AN EMPIRICAL ASSESSMENT OF PAKISTAN'S DISCRETIONARY MONETARY POLICY STRATEGY USING NOVEL DISCRETION AND INFLATION BIAS INDICATORS

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ABSTRACT

Although price and output stability have been the major goals of monetary policy, contention remained over their mutual compatibility and substitution for one another. It is challenging for monetary policy makers to maintain a balance between the price and growth objectives. The pursuit of a balance historically has led monetary policy to evolve under many guises. Discretion and commitment are the two popular monetary policy guises advocated for achievement of the twin objectives of inflation and growth. Under commitment, the long-term growth stability is assumed to be achieved via price stability, and therefore the overriding focus is the inflation objective. Under discretion, the achievement of the dual objectives requires sufficient flexibility with the central banker to adjust monetary policy as and when necessary, and as frequently as desired, to maximize monetary policy benefits. This thesis seeks to empirically investigate to what extent Pakistan's typical discretionary monetary policy strategy has benefited the economy both in terms of achievement of inflation and growth objectives as well as maintaining a balance between them for a 50-year timeframe. Using a novel discretion assessment approach, new inflation bias indicators and its determinants as well as a new discretion indicator, the thesis demonstrates that Pakistan's discretionary monetary policy strategy failed to deliver on its core mandate. Instead, the policy proved to be self-defeating as it produced results contrary to its *very purpose*. On one side, the State Bank of Pakistan (SBP) exercising its discretion, induced long-term excessive inflationary pressures in the economy and on the other side hindered the real growth than potentially would have been. This failure of the discretionary monetary policy on both the counts of inflation and growth objectives cast nontrivial doubts on its efficacy to fully reap the benefits of price and growth stability. The major findings of the study call for a reorientation of the focus of the SBP towards the inflation objective as against the growth objective. For this transformation to occur, monetary policy must change from the existing discretionary set-up to a commitment-based policy framework. Under such a framework, the SBP will have to commit to a certain low level of inflation and should not renege upon it to help build its credibility and capability to effectively anchor inflation expectations to ensure price stability, and hence growth-stability.

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LIST OF ABBREVIATIONS

ADF	-	Augmented Dicky-Fuller
AIC	-	Akaike information criterion
ARDL	-	Autoregressive distributed lag
ARMA	-	Autoregressive moving average
ARIMA	-	Autoregressive integrated moving average
CB	-	Central bank
CPI	-	Consumer price index
CUSUM	-	Cumulative sum of squares of residuals
CUSUMQ	-	Cumulative sum of squares of recursive residuals
C.V	-	Critical value
DF-GLS	-	Dicky-Fuller generalized least squares
DW	-	Durbin Watson
ECB	-	European central bank
ECM	-	Error correction model
e.g.	-	Exempli Gratia (for example)
i.e.	-	Id Est (that is)
FDI	-	Foreign direct investment
FIML	-	Full information maximum likelihood
GARCH	-	Generalized autoregressive conditional heteroskedasticity
GDP	-	Gross domestic product
GNP	-	Gross national product
GMM		Generalized method of moments
HP		Hodrick and Prescott

LIST OF ABBREVIATIONS

HQC	-	Hannan and Quinn criterion
LSM	-	Large scale manufacturing
MLE	-	Maximum likelihood estimation
NLLS	-	Non-linear least squares
OECD	-	Organization of economic cooperation and development
OLS	-	Ordinary least squares
PP	-	Phillips Perron
RPI	-	Retail price index
RPIX	-	Retail price index (excluding mortgage interest payment)
SBC	-	Schwarz Bayesian criterion
SBP	-	State bank of Pakistan
SPI	-	Sensitive price index
SUR	-	Seemingly unrelated regressions
U.S	-	United States
U.K	-	United Kingdom
VECM	-	Vector error correction model
WDI	-	World development indicators
WPI	-	Wholesale price index
2SLS	-	Two-stage least squares

CHAPTER 1
INTRODUCTION AND OVERVIEW

The monetary policy literature widely recognizes price stability as monetary policy's primary goal, particularly in the long-run. Price stability helps an economic system to operate more efficiently while producing higher levels of output and rapid economic growth (Mishkin, 1997). Conversely, the absence of price stability generates high costs to society. These costs may be diverse, ranging from the 'shoe leather' costs (Bailey, 1956) to the loss of output (Groshen and Schweitzer, 1996).[1] Considerable work of both theoretical and empirical nature has been done either to justify the importance of price stability, or to highlight the costs associated with price instability (see Fischer and Modigliani, 1975; Fischer, 1981; Briault, 1995; Hatch *et al.,* 1998 and Mishkin, 2006).

Historically, global performance in terms of price stability in the three decades of the 1960s, 1970s and 1980s was relatively poor in comparison to the recent decades of the 1990s and 2000s. One of the reasons for this was the pursuit of monetary activism, the active use of money supply to increase the output through exploitation of the Philips curve (inflation output trade-off) – as advocated by Samuelson and Solow (1960). Nevertheless, monetary activism lost its popularity mainly due to three strong arguments against it. First, the existence of long and variable lags in the effects of monetary policy (Friedman, 1968). Second, the absence of a long-term trade-off between inflation and output (Friedman, 1968; Lucas, 1973), and third is the time inconsistency argument put forth by Kydland and Prescott (1977). This argument asserts that the conduct of monetary policy in a

[1] Also see English (1996) for the shift of resources from productive use to non-productive use due to inflation.

discretionary manner to boost output above its natural level results in excess inflation (inflation bias) without any gain on the output front.[2]

The theory of time inconsistency of monetary policy gained significant attention in the 1980s. Subsequently numerous studies presented models where the inflation bias problem of discretionary monetary policy can potentially be mitigated.[3] A popular outcome of this line of research has been the delegation of monetary policy authority to a central banker who gives more weight to inflation objective as compared to the output objective. In the practical world of central banking, New Zealand, in order to resolve the problem of excess inflation, took the lead in delegating authority to a central banker with price stability as the overriding objective of monetary policy in the 1990s.

Technically, the institutional arrangement of the central bank was changed from monetary targeting to inflation targeting framework, where the former policy targets monetary aggregates in order to achieve price stability while the latter policy directly and explicitly targets inflation. Following New Zealand's lead, a number of developed and emerging market countries concerned about inflation adopted inflation targeting. They have been successful in bringing down their rates of inflation close to levels that can be termed as price stability.[4] However, in contrast to the countries that recognize low and stable inflation as one of the determinants of sustainable economic growth, the State Bank of Pakistan (SBP) did not reorient its focus towards the attainment of price stability. Instead

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[2] For details on inflation bias see Chapter 2 and Chapter 4.

[3] These include *punishment equilibria* such as discussed in Barro and Gordon (1983) and Rogoff (1987), *incentive contract as* are covered in Canzoneri (1985), Garfinkle and Oh (1993), Persson and Tabellini (1993) and Walsh (1993 b, 1995b) and delegation of monetary policy Rogoff (1985).

[4] It is pertinent to mention that some of the advanced countries did not formally adopt inflation targeting such as USA but it does recognize price stability as the prime objective of monetary policy. Further, the central banker does not exercise the discretion to increase the output beyond its potential (Blinder, 1998).

the SBP continued to stick to the discretionary regime while essentially trying to exploit the inflation output trade-off.[5]

Against this backdrop, how has the discretionary monetary policy strategy of Pakistan performed over the past half a century time period? To what extent has this policy yielded the desired outcomes in terms of achievement of its core objectives of inflation and real growth to warrant its continuation? These are the broader questions that this thesis attempts to explore. To serve the purpose, the format of the thesis is designed as follows:

Chapter 2 critically reviews the literature to develop a broader understanding of the underlying issues of discretion and the resultant inflation bias. Although not the main focus of this study, it also discusses the evolution of the recommended remedial framework of inflation targeting, its preconditions and operational issues, its actual performance and the skepticism that surrounds it.[6] This chapter goes a step further to highlight the key features of Pakistan's monetary policy that make it a typical case of discretion, and brings out the country-specific literature to discuss the case for and against the continuation of the contemporary discretionary monetary policy strategy.

Chapter 3 of the thesis proposes a framework to uniquely evaluate the historical performance of the discretionary monetary policy strategy of Pakistan. It rationalizes three scenarios of optimal, desirable, and threshold inflation-growth nexus rates reflecting states of a balanced monetary policy and considers them as benchmarks for evaluation. These benchmarks are estimated using a long-term dynamic, stable and robust baseline real

[5] This phenomenon has led to high and volatile inflation rates. The average inflation for example for the last 4 decades (1971-2010) is 9.39% with a variance of 29.98%.

[6] It is pertinent to mention that this particular section that relates to inflation targeting is reviewed to help develop an overall understanding of the potential practicable solution to the focal problem of discretion and the resultant inflation bias–the main focus of the current study. The inflation targeting section is not meant to motivate the questions such as feasibility of inflation targeting in Pakistan and so forth as that kind of work is beyond the scope of this thesis.

growth model. The evaluation of the policy against the estimated benchmarks presents a dismal picture for Pakistan, as the discretionary monetary policy strategy has failed to stabilize inflation around the optimal, desirable and threshold levels.[7] In other words, discretion has harmed real growth 62% of the time in the last 50 years, hence it has contributed to the deterioration rather than enhancement of welfare of the Pakistani society.

Since the intention of a discretionary central banker to accept excessive inflation (inflation bias) is either to stabilize real growth or to accelerate it beyond its natural rate; the empirical investigation to ascertain the extent of the effectiveness of inflation bias per se in realizing this intention is inevitable. This is important because it would help determine the scope of monetary policy as an inflation or growth-stabilizer. As no inflation bias indicators exist to carry out appropriate empirical analysis, Chapter 4 of the thesis proposes a framework to generate novel indicators of inflation bias for the discretionary monetary policy strategy of Pakistan. While using the estimated benchmarks in Chapter 3, the inflation bias indicators are generated to estimate their long-term cointegrating relationship with real growth. The results of this chapter show that in the long-run inflation bias does not help boost real growth, rather it affects it adversely. This chapter, thus consistent with the conclusion in Chapter 3 suggests that inflation-stabilization should be the prime objective of Pakistan’s central bank because inflation bias yields a negative, rather than the presumed positive effect on real growth. This implies that commitment should be preferred over discretion as it helps better anchor inflation expectations.

Chapter 5 empirically examines the relevance and relative-robustness of stabilization and non-stabilization sources of inflation bias per se (generated in Chapter 4)

[7] The optimal, desirable and threshold inflation rates estimated by the study are 1%, 2%-3% and 5%, respectively (see Chapter 3 for details).

for the discretionary monetary policy strategy of Pakistan. The chapter conducts rigorous robustness tests in bivariate and multivariate settings to ascertain the relative-robustness and fragility of the determinants of inflation bias. This determination is fundamental in containing inflation bias by furthering the understanding of discretionary central bankers towards its root-causes. The chapter finds that stabilization sources of inflation bias such as the central banker's motivation to exploit inflation-output trade-off and its concern for growth-stabilization are the most relevant and robust determinants of inflation bias as compared to the non-stabilization sources. In the set of non-stabilization sources, surprise monetary expansion and openness are partially relevant but fragile. The findings of this chapter are also consistent with the findings of Chapters 3 and Chapter 4, endorsing the discontinuation of the discretionary monetary policy practices in Pakistan.

The last analytical Chapter 6 posits that the use of discretion in conduct of monetary policy entails a trade-off between output-stabilization and a suboptimal inflation. Empirical determination of the extent of such a trade-off is important to assess the benefit of the use of discretion for output-stabilization purposes. This requires quantification of the discretionary behavior of the central banker and the corresponding causal behaviors in its objective function – inflation and output objectives. This chapter generates new indicators of discretion, inflation and output for the typical discretionary monetary policy strategy of Pakistan in order to explore their interrelationships. While using a cointegrating approach, the long and short-run parameters are obtained. The findings suggest that discretion is significantly biased towards inflation both in the long and short-run. It is ineffective in stabilizing output in the long-run; however, it does help create short-run growth spurts in the economy. Nevertheless, the gains in terms of these spurts are too small to offset the discretion-induced losses. This finding is also consistent with the findings of the previous chapters suggesting that the continuation of the discretion is not warranted, as it has caused damage to the economy both in terms of high inflation and attaining lower than potential growth over the long-term.

Finally, Chapter 7 concludes the thesis. A straightforward implication of the thesis based on the consistent evidence from all the analytical chapters is that pursuit of the discretionary monetary policy set-up in Pakistan has induced losses to the populace in the past 50 years. Discretion is primarily granted to central bankers to conduct monetary policy in the best possible manner. By that token, through exercising its discretion, the SBP needs to maintain price-stability along with output stabilization and should strike a favorable balance in case of a conflict between the two in the long-run.

However, by exercising its discretion, Pakistan’s central banker has compromised both its core objectives. On one hand the inflation rates have been excessive, and on the other hand the real growth rates have negatively been affected, hence causing twofold losses to the society for decades. Had price stability been the focus of the SBP, as in most of the advanced countries, the outcomes would have been positive. The thesis therefore, suggests dismantling of the existing discretionary monetary policy set-up in Pakistan in favor of a commitment-based framework with price stability as the prime objective. The most practicable solution to the problem of discretion is the adoption of inflation targeting as this has a well-proven track record of inflation-contained growth.

CHAPTER 2

LITERATURE REVIEW: THE INFLATION BIAS PROBLEM OF DISCRETIONARY MONETARY POLICY STRATEGY, INFLATION TARGETING (AS ITS REMEDY) AND KEY FEATURES OF PAKISTAN'S MONETARY POLICY STRATEGY

2.1 INTRODUCTION

As indicated in chapter 1 that higher average inflation rates have been the hall mark of Pakistan's economic history during the last four decades. Persistently high average inflation rates have inimical consequences of political and socio-economic nature. Given the importance of low and stable prices (maintaining the inflation within 1%-3% range) a considerable number of countries made price stability as the primary objective of monetary policy since 1990s through adoption of inflation targeting framework.

The framework holds central bankers accountable for the non-achievement of assigned inflation targets. The main reason for the accountability of monetary policy makers is the widely accepted notion that in the long-run inflation is a *monetary phenomenon* and that sustainable economic growth can be achieved through low and stable inflation (Dotsey, 2008). Therefore, unequivocally price stability/instability is closely linked to underlying monetary policy strategies in the sense that it shapes motivation and hence behavior of central bankers.

The task of monetary policy makers is complicated and becomes particularly challenging when inflation goes beyond certain desirable levels as is the case in Pakistan.[8]

[8] Price stability generally implies inflation in the range of 1%-3% and is considered favorable for real growth; however, inflation beyond this level may not be conducive. Consistent with the accepted standards, inflation

Thus the core issue is not inflation rather the 'excess of inflation'. The focus of this chapter is to extensively explore 'excess inflation' and solution thereof in light of the world's experiences. The concept of 'excess inflation' in the jargon of economic literature is known as 'inflation bias'. This bias is argued to be the outcome of the discretionary behavior of a monetary policy maker, which essentially emanates from the long-term pursuit of the dual objectives of inflation and output, especially the output beyond its natural rate.

A practical and workable solution for the mitigation of this problem is the delegation of authority of conduct of monetary policy to a conservative central banker – a central banker who assigns more weight to inflation objective instead of output objective. This implies institutional change from an activist monetary policy strategy (with dual or multiple objectives) to a conservative monetary policy framework (inflation targeting) with inflation being the prime objective/target.

Therefore the literature is critically reviewed under three broader sections: inflation bias (Section 2.1), inflation targeting (Section 2.2) and Pakistan's monetary policy (Section 2.3). These broader sections are further divided into subsections and the research gaps are identified at the end of the subsections where appropriate – based on the reviewed literature. The purpose is to be able to develop a thorough understanding of the fundamental theoretical and empirical underpinnings and to prepare grounds for sound empirical analysis of discretion and the resultant inflation bias per se in Pakistan.

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in Pakistan in the range from 1% to 3% has a positive and statistically significant effect on the real growth whereas inflation beyond 5% is harmful (see Chapter 3 for details).

2.2 THE PROBLEM OF INFLATION BIAS

There has been a long standing debate on the nature of conduct of monetary policy, the debate of rules versus discretion[9]. Although the arguments of this debate can be traced back to the 1920s (Hetzel, 1985) and 1940s (see Simons, 1936), it has been extensively researched after the influential work of Kydland and Prescott (1977) and Barro and Gordon (1983). It is well established both in theoretical and empirical literature that discretionary monetary policy frameworks are inflationary as they create excess inflation (a concept known as inflation bias) in the economy. The use of the terms 'discretion' and 'inflation bias' have become increasingly popular after the seminal work of Kydland and Prescott (1977).

They theorized that discretionary monetary policy makers tend to produce higher than optimal inflation due to the problem of dynamic/time inconsistency of monetary policy.[10] Since the world was experiencing inflationary trends in the 1970s and 1980s, Kydland and Prescott (1977) asserted that the conduct of monetary policy in a discretionary manner generates excess inflation, when the monetary authority targets an output rate higher than the natural rate.

A substantial theoretical and lately empirical literature has emerged covering various dimensions of discretionary and commitment based monetary policy frameworks (see Gartner, 1994-2000; Al-Nowaihi and Garratt, 1998; Garratt, 1998; Persson and Tabellini, 1999). However, this study focuses on the literature specifically pertaining to the

[9] For some relevant discussions and reviews see Kydland and Prescott (1977), Barro and Gordon (1983a, b), Fischer (1988), Carlson (1988), Lear (2000), Drazen (2000), McCallum (2000), Dennis (2010) and Alesina and Stella (2010).

[10] For an illustration and discussion on time/dynamic inconsistency see Romer (2006) and Mankiw (2009).

inflation bias resulting from the discretionary monetary policy – the core problem in Pakistan (see Chapter 3 for the historical performance of the discretionary monetary policy strategy of Pakistan, which is indicative of inflation bias). The primary intent henceforth is to investigate this problem of inflation bias and to suggest a workable solution based on the literature.

Several authors have either implicitly assumed or explicitly defined 'inflationary bias', sometimes with slight distinctions as per the requirement and the objectives of their studies. The central theme however, is the generation of a relatively higher inflation than some unknown but desirable rate of inflation. Ruge-Murcia and Francisco J (2001, p. 5) defined it as "the systematic difference between equilibrium and optimal inflation". Romer (2006) conceptualized it as the tendency of the discretionary monetary policy to produce higher rates of inflation than optimal over extended periods. Gartner (2000) referred to the inflation bias as the tendency of the central banks with representative preferences (preferences for employment and inflation) to generate inefficiently high inflation rates without gaining the benefit of output beyond the potential output.

Broadly, two theories have been developed over time, providing different lines of reasoning for the creation of inflation bias. First, conventional or standard theory of Kydland and Prescott (1977) and second is the Cukierman's (2000) new inflation bias. The latter emerged largely in response to the criticism by the academicians and practitioners on the grounds of realism (Cukierman and Gaerlach, 2003). These theories of inflation bias and its solutions are discussed subsequently as follows.

2.2.1 The conventional theory of discretion and its inflationary bias

The conventional theory of inflation bias came to the limelight with the pioneering work of Kydland and Prescott (1977). The authors built their argument of inflation bias of a discretionary central banker on the premise that reneging on its commitment (using its discretion) to a low level of inflation leads to excessive inflation – inflation bias. This may happen as when the expected inflation is low, the marginal cost of additional inflation is low. The central banker is therefore tempted to raise the level of output above its natural rate while using its discretion. Since the economic agents are rational, they understand this incentive of a discretionary central banker and adjust their expectations accordingly. This phenomenon results in a high average inflation without output gains.

Barro and Gordon (1983a, 1983b) elaborated on the pioneering work of Kydland and Prescott (1977). They explained the mechanism that how monetary authority creates excess inflation while exercising its discretion in the conduct of monetary policy. Barro and Gordon argued that enforcement of commitment for monetary behavior can lead to improvement. The monetary authority while using its discretion may create surprise inflation by printing more money in anticipation of the benefits of expansion of economic activity and to reduce the nominal liabilities of government.[11]

Following Kydland-Prescott and Barro-Gordon, a number of other studies have modeled inflationary bias while introducing changes to the assumptions and scenarios. For example, Guender and McCaw (1999), Ruge-Murcia and Francisco J (2001), Tambakis

[11] Another benefit arising from creation of surprise inflation to the government is the increase in inflationary finance (government revenue). The government may resort to such sources of revenue when the other popular sources of revenues such as taxation may create distortions to the economy.

(2004), Yuan and Miller (2010), are few among others. However, due to the lack of their direct relevance to the purpose of the study, these are not covered in the current review.

2.2.2 Theory and empirics of discretion and inflation bias – the research gap

The prime objective of the previous descriptive synthesis was to develop a broader outlook of the problem of discretion and the resultant inflation bias. Nonetheless, this subsection is devoted to draw attention to a subtle but important distinction between the underlying theoretical argument of inflation bias and the efficacy of its empirical treatment. The purpose is not to challenge the accuracy of the existing empirical literature but to minimize the extent of type B error in order to be able to appropriately examine the core problem of inflation bias in Pakistan.[12] In order to understand the underlying theoretical concept of inflation bias, some of the theoretical and empirical literature is discussed.

Gartner (2000) illustrated the theoretical concept of inflation bias through the typical standard aggregate supply function as:

$$y_t = \pi_t - \pi_{e(t-1)} + \varepsilon_t \qquad (2.1)$$

where, the aggregate supply 'y_t' is the logarithm of income in period 't' determined by the difference between inflation 'π_t' in period 't' and expected inflation 'π_e' in period '$t-1$'. 'ε_t' is the supply shock in period 't', which is independently and identically distributed with zero mean and finite variance. This is important to mention that the supply function is standard in pertinent work and assumes price or wage stickiness. Typically, based on

[12] Birks (2014) discussed the logical gaps in economics and highlighted three types of logical errors (type A, B and C). "Type B error arise when the empirical formulation do not accurately reflect the underlying theory" (Birks, 2014, p. 4). Klamer (2007, p.106) also pointed to a similar problem that the "Gaps between the theoretical and empirical arguments have not been bridged".

expected inflation, nominal wages are set at the beginning of a period. The monetary policy is implemented after the expectations are formed and subsequently inflation and output are determined through the given aggregate supply function.

Utility of the society in period 't' is determined both by income and inflation following the standard functional form of Barro and Gordon (1983), which has subsequently been used by a number of studies in related work (Gartner, 2000).

$$U_t = -\frac{1}{2}\pi_t^2 + \xi y_t \tag{2.2}$$

where $\xi > 0$ and its magnitude indicates the weight the society assign to the income gains relative to the reduction in inflation. The aforementioned utility function (2.2) characterizes asymmetric treatment of inflation and income.[13] Due to an implicit desired inflation rate of zero, a movement towards price stability results in a decreasing marginal utility of reduction in inflation. The desired level of income is infinitely large and its marginal utility is constant at 'ξ'.

Assuming rational expectations and that the monetary authority can directly control inflation, the results of the conduct of monetary policy under pre-commitment and discretion would be different. In case of pre-commitment the inflation bias is eliminated whereas in case of discretion it arises.

In case of pre-commitment, where the policy maker sticks to its commitment, the actual inflation 'π' is equal to the expected inflation 'π_e' implying a one-to-one correspondence between income 'y_t' and supply shock 'ε_t'. Therefore, '$y_t = \varepsilon_t$'.

[13] It may be noted that the same function can be motivated as a loss function with opposite signs to be minimized by society without affecting the results (Gartner, 2000).

Substituting '$y_t = \varepsilon_t$' into Equation 2.2 and maximization with respect to inflation 'π' yields $\pi = 0$. Thus the possibility of pre-commitment eliminates inflation bias. It may be noted that under the current linear utility function, the monetary authority does not try to stabilize supply shocks because it is presumed that the society does not want the shocks to be stabilized at the expense of higher inflation.

In case of discretion while treating expected inflation as given, substitution of Equation 2.1 into Equation 2.2 and maximization with respect to inflation yields $\pi_t = \xi$. Under rational expectations, '$\pi_{e(t-1)} = \xi$, which leads to '$y_t = \varepsilon_t$'. Therefore, the use of discretion in the conduct of monetary policy tempted by the desire for temporary gain in income generates inflation bias 'ξ' without an increase in output.[14]

Thus the point this study focuses on for further discussion is that the theoretical underpinnings of the concept of inflation bias distinguishes it from the forthright use of inflation as is common in the empirical literature. Few studies have attempted to show evidence of inflation bias empirically. Although those studies have their own focus, one of their common features is that they recognize inflation bias as the core issue, nevertheless in their empirical analysis they use inflation as a proxy of inflation bias – hence ignoring the conceptual distinction between them. Some of the examples such as Romer (1993); Ireland (1999); Ruge-Mercia and Francisco J (2001); Cukierman and Gerlach (2003) and Berlemann 2005) are subsequently discussed as follows.

Romer (1993) attempted to test the prediction of the theoretical models of monetary policy without pre-commitment that excessive inflation (inflation bias) is inversely related

[14] Rogoff (1985) recommended delegation of the authority to a weight conservative central banker from the government (presumably representing society's preferences) characterized by ξ=0. This implies the elimination of the bias due to the absence of the role for stabilization of shocks.

to openness.[15] The basic argument is that a surprise increase in money supply depreciates the real exchange rate and therefore reduces the incentives to expand money supply. Vaubel (1990) also made similar argument. The proxy for empirical investigation used by the study is inflation rather than some measure of inflation bias.

Similarly, Ireland (1999) argued that the model of Barro and Gordon can potentially explain the rise in inflation up till 1980s and a subsequent decline afterwards in the United States. He empirically tested the hypothesis that the underlying problem of the behavior of inflation is the problem of dynamic inconsistency of monetary policy. The author, therefore, derived some restrictions from Barro and Gordon's model and tested those statistically using quarterly data for unemployment and inflation. He derived long and short-run restrictions from the Barro and Gordon's model. In the former case, in statistical terms, both inflation and unemployment should be non-stationary but cointegrated. The results of the study were found to be consistent with the theory as inflation and unemployment were cointegrated. This study also used inflation instead of some plausible measure of inflation bias.

Ruge-Mercia and Francisco J (2001) predicted that inflation bias may arise in the presence of asymmetric preferences even if the central banker targeted the natural rate of unemployment.[16] Specifically, they predicted that the bias is proportional to the conditional variance of unemployment while using the following model for their empirical estimation.

$$\pi_t = \alpha + b\sigma_{u,t}^2 + \epsilon_t, \tag{2.3}$$

[15] The source model for the work of Romer is Rogoff (1985b), which has extended the basic model of dynamic consistency and monetary policy to open economy settings.
[16] Asymmetric preferences refer to the relative weight the policy maker assigns to the positive or negative deviations from natural rate of unemployment in their loss function.

where, 'b' is the parameter of interest. A positive 'b' indicates that the monetary policy maker gives higher weight to the positive than negative deviations from the natural rate of unemployment. They found results consistent with the view that central bankers have given more importance to the positive unemployment deviations than the negative. Thus they have also tried to ascertain the intention of the monetary policy makers from the given data set from an observed series of inflation.

Moreover, Cukierman and Gerlach (2003) gave a new explanation of the mechanism of inflation bias in response to the critique by McCallum (1995) and Blinder (1998). The authors' main argument was that given the expectations from the central banks to stabilize output, uncertainty about future macroeconomic conditions and asymmetric concerns to positive or negative supply shocks (output gaps) generate inflation bias. They demonstrated theoretically while using expectations-augmented Phillips curve that inflationary bias may arise based on the presumptions of uncertainty about the future state of economy. Nevertheless, in their empirical analysis they regressed average inflation (instead inflation bias, which is conceptually distinct from inflation) on the standard deviation of real GDP growth rates for OECD countries such that:

$$\bar{\pi}_i = \emptyset_0 + \emptyset_1 \hat{\sigma}_i + \eta_i \qquad (2.4).$$

Where, $\bar{\pi}_i$ is the average inflation, $\hat{\sigma}_i$ is the standard deviation of real GDP growth and η_i is the residual.

Similarly, Berlemann (2005) tested the existence of inflationary bias as envisaged by Barro and Gordon's model and found the evidence of its existence from six countries based on polling data. Berlemann argued that the relative importance of inflation or output determines the extent of inflationary bias and estimated the following model in order to establish the evidence of the presence of inflationary bias.

$$\pi_t^i = \eta^i + \gamma(L)\pi_t^i + \lambda^i . \frac{\beta_{t-x}^i}{\alpha_{t-x}^i} + \epsilon_t^i \tag{2.5}$$

where 'π_t^i' is inflation, 't' denotes time and 'i' is the country index, '$\gamma(L)$' is a polynomial in the lag operator, 'β_{t-x}^i' represents public preferences for employment and 'α_{t-x}^i' the public preferences for inflation. 'x' is the time lag and the coefficient 'λ^i' shows the relative weight put on the goal of employment. Thus a significantly positive coefficient would mean more weight on employment leading to an increase in inflationary bias.

However, an exception is the paper of Garman and Richards (1989) who gave importance to the distinctive treatment of inflation bias and inflation in their empirical analysis. They tried to establish its evidence rather indirectly in their models by showing that the central banker puts relatively higher weight on output stabilization. While presenting a simple theoretical model, they illustrated that strict policy rules limits inflation bias but increases output variability. Based on their model they constructed a political popularity function and estimated it empirically. Output variance and inflationary bias were incorporated as the key arguments to the function, which is given as follows:

$$PF_t = X_t b + \alpha_1(\sqrt{Q})GA_t^2 + \alpha_2(\sqrt{Q})BI_t^2 + \eta_t, \tag{2.6}$$

where 'PF_t' is the political popularity function, 'GA_t^2' is the weighted average of variance of output around the mean.[17] This is adjusted by multiplying with the square root of the number of quarters the administration held the office '$(\sqrt{Q})$' with 'α_1' as the coefficient.

Similarly, 'BI_t^2' is the weighted average of variance of inflation around the society's preferred rate of inflation being adjusted by multiplying with the square root of the number of quarters the administration held the office '$(\sqrt{Q})$' with 'α_2' as the coefficient.[18] '$X_t b$' capture the intangibles and special factors such as personality of each president, Watergate and Vietnam war. Nonlinear maximum-likelihood estimation technique was employed to estimate all the unknown parameters. The value estimated for the optimal rate of inflation was 0.2 indicating the existence of an inflationary bias (4.7 percentage points) as the average inflation for the sample period was 4.93 %.

From the aforementioned discussion in this sub-section it is clear that theoretically, inflation bias is the difference between observed/actual inflation and societies' preferred, desirable or some optimal inflation rate (Garman and Richards, 1989; Ruge-Mercia and Francisco J, 2001). The relevant empirical studies, however, have established its evidence indirectly through stylized models by focusing on one particular explanation of inflation bias. For example, Richard and Garman (1989) used voter's preferences; Ireland (1999) focused on the relationship of employment and inflation, Ruge-Mercia and Francisco J,

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[17] $GA_t^2 = 100 \left[\sum_{k=0}^{31} \delta^k (y_{t-k} - \bar{y}_{t-k})^2 \cdot D_{t,t-k}\right] \Big/ \left[\sum_{k=0}^{31} \delta^k D_{t,t-k}\right]$, where y and $\bar{y}$ are the logs of actual and natural output. The length of voter's memories is denoted by delta δ. $D_{t,t-k}$ indicates a dummy variable, which takes the value 1, if the administration in power in period 't' was also in power in period '$t - k$'.

[18] $BI_t^2 = 100 \left[\sum_{k=0}^{31} \delta^k (\pi_{t-k} - \pi^*)^2 \cdot D_{t,t-k}\right] \Big/ \left[\sum_{k=0}^{31} \delta^k D_{t,t-k}\right]$, where inflation is denoted by π, which is the quarterly change in the log of GNP deflator expressed as an annual percentage rate. π^* is the society's preferred rate.

(2001) used the conditional variance of output and Berlemann (2005) used the symmetry in the employment inflation trade-off.

Importantly, the studies such as Romer, 1993; Ireland 1999; Ruge-Mercia and Francisco J, 2001 and Cukierman and Gerlach, 2003 have used inflation as a proxy for inflation bias while assigning least importance to the treatment of *conceptual distinction* between them in their empirical analysis. Thus, the common feature in all these empirical studies is the strong implicit assumption of the synonymous treatment of inflation bias and inflation. Moreover, the aforementioned studies have largely focused on establishing the evidence of the intent of the central banker that they have given relative preference to output or inflation. For theory of inflationary bias and empirical evidence to be consistent, the use of an appropriate proxy for inflation bias in empirical work may be more meaningful. Similarly, another striking feature of both the aforementioned theoretical and empirical literature is that the discretionary behavior of monetary authority does not enter the models directly.[19] It may be due to the absence of known discretion indicators that may appropriately represent the discretionary behavior of monetary authority per se, which can particularly be used in empirical investigations.

To bridge these gaps, the current study generates novel indicators of (i) inflation bias and (ii) discretion and empirically examine their relationships with the real growth at length in Chapter 4 and Chapter 6. This investigation is important because discretionary central banker either through exercise of discretion or acceptance of inflation bias contemplates output gains that may potentially offset (more than offset) discretion induced

[19] The recent papers of Bodenstein et al. (2010) and Dennis (2014) are an exception as they modelled the discretionary behaviour, however, the current study aims to quantify discretion historically that may be used as a right hand side variable to analyse its long-term effects.

losses. Empirical exploration to the extent of such trade-offs therefore could be more insightful and may illuminate the understanding of typical discretionary central bankers – who uses discretion on long-term basis to spur the growth beyond its potential.

2.2.3 Solution to time inconsistency problem of discretionary monetary policy

Kydland-Prescott and Barro-Gordon shows that the exercise of discretion in the conduct of monetary policy results in inefficiently high inflation due to the problem of dynamic/time inconsistency.[20] A straight forward answer to the problem of dynamic inconsistency is the determination of monetary policy by rules rather than discretion. However, Romer (2006) emphasized that the rules must be binding. If for example, a policy maker announces to follow a constant money growth rate rule, this may lead to time inconsistency problem if monetary authority still has the ability to renege after expectations have been formed. This is because the public would know that the monetary authority has the discretion and will exercise it for optimal gains.

Addressing the underlying problem using binding rules has two associated limitations: normative and positive (Romer, 2006). The former refers to the inability of binding rules to anticipate and respond to unexpected circumstances that may have severe impacts on the economy; the latter is the observance of low inflation in many situations even without binding rules.

Other than binding rules, theories (models) dealing with the problem of dynamic inconsistency in order to reduce the inflation bias can broadly be classified into four categories. First, *punishment equilibria* such as discussed in Barro and Gordon (1983) and

[20] For an illustration and discussion on time/dynamic inconsistency see Romer (2006) and Mankiw (2009).

Rogoff (1987). In these models sustainability of inflation at low levels is ensured in a way that if the central banker chooses a high level of inflation in one period, the public will punish the policy maker in the form of higher inflation expectations in the next period.

Second, is the *incentive contract* – an arrangement between the government and the central banker.[21] Under such arrangements the policy maker is given a target rate of inflation and is rewarded or punished on the basis of its achievement/non-achievement. The third solution is the *enhancement in reputation*. Barro and Gordon (1983a) considered reputation as a remedy in order to overcome the problem of dynamic inconsistency. In the presence of repeated interaction between the policy maker and private agents, reputation can substitute for formal rules.

Following Kreps and Wilson (1982a, 1982b) and Milgrom and Roberts (1982a, 1982b), most of the studies have adopted a game theoretic (game theory) approach to analyze the discretionary behavior of monetary policy.[22] Kazuo and Shunichi (1990) note that in these models incomplete information arises when the public is not certain about the true character of a policy maker. This uncertainty creates room for reputational considerations for the central bank. Thus the lower the inflation today, the lower would be the expectations for future inflation and the higher the incentive for the central bank to stick to the low inflation.

Fourth and the most important in terms of practicality is the delegation of the conduct of monetary policy to a weight-conservative central banker (central bank

[21] Incentive contracts are covered in Canzoneri (1985), Garfinkle and Oh (1993), Persson and Tabellini (1993) and Walsh (1993 b, 1995b).
[22] It includes the seminal papers of Backus and Driffill (1985a, 1985b) and Barro (1986). Other examples are Canzoneri (1985) and Vickers (1986). Rogoff (1987) and Driffill (1988) provide a related survey.

independence). Rogoff (1985) proposed delegation of monetary policy authority to an independent central banker who is inflation-averse. This will restore the credibility although at the expense of optimal output stabilization. Such a central banker puts more weight on inflation and less on output resulting in lower inflation bias but the output variability may increase especially when the supply shocks are large.

Several studies extended the idea of delegation including Flood and Isard (1989); Person and Tabellini (1990, 1993); Alesina and Grilli (1991); Lohman (1992); Cukierman (1992) and Svensson (1997a). Romer and Romer (1997) added that the conduct of monetary policy should be delegated to knowledgeable persons who are adept in the evaluation and maximization of social welfare. Such experts can better and faster incorporate the advances in knowledge in the monetary policy decision making process.

2.2.4 Critique of the conventional theory of inflation bias

In view of Barro and Gordon (1983a), the model presented by Kydland and Prescott (1977) is a valuable contribution giving significant insights to the monetary policy phenomena. Taylor (1983) on the other hand argued that the tendency of monetary policy makers to systematically increase output beyond potential is eliminated by institutions and/or mechanisms in other contexts.

Among others, McCallum (1995), Blinder (1998) and Vickers (1998) have criticized the conventional theory of inflation bias. McCallum (1995) took issue with the standard interpretation in the literature in two ways: first, the underestimation of the likelihood of a good policy performance by an independent central bank; second, the overestimation of the likelihood of beneficial effects generating from central bank contracts with the government. Essentially the study criticized the basic assumption of the theory of dynamic inconsistency and argued that the central bank will not necessarily behave in a discretionary manner if there is no pre-commitment.

Similarly, Blinder (1998) questioned rather strongly, the justification of the dynamic inconsistency theory on the basis of its ideal assumptions and its closeness to the real world central banking practices. He argued that the academic literature has misdirected its focus to either the wrong problem or a non-problem because the central banker does not try to maintain employment above its natural level. Moreover, the proposal of a variety of solutions (reputation, principal agent contracts and conservative central banker) make little sense in the real world with the only exception of conservative central banker because this solution to him seemed relatively realistic.

2.2.5 New inflation bias (non-conventional explanation)

The Kydland-Prescott and Barro-Gordon inflationary bias is based on the presumption that the central banker aims at employment above potential. This is questioned strongly both by the academics and practitioners for its practicality as discussed above. In response, Cukierman (2000) came up with a new version of explanation of inflation bias referred to as the ‘new inflation bias’. He argued that even if the central bank targets potential output, still inflation bias may arise. This is due to the presence of uncertainty and asymmetries about the future state of the economy. The new theory builds on the premise that the central banks are willing to tolerate some higher level of inflation in order to reduce the risk of the economy plunging into deep recession. Thus unlike the conventional theory of inflation bias, the origin of the new inflation bias lies in the precautionary behavior of the monetary authority.

Cukierman and Gerlach (2003) extended and empirically tested the theory of new inflation bias. They theorized that a bias will still arise when the policy maker targets normal level of employment. This bias is sensitive to employment below rather than the above normal level of employment in the presence of uncertainty about economic conditions. The study based its inflation bias mechanism on two presumptions. First, at the time the current monetary policy is chosen the policy maker is unsure of the real state of the economy when the planned policy is expected to take effect. Second, the policy maker is more concerned about the downward deviations of employment from the normal compared to the upward deviations. This view of the inflation bias implies inflation and the variance of inflation shock are positively correlated. The study tested this theory empirically for OECD countries and found supporting evidence.

2.2.6 Determinants of inflation bias – the research gap

In this sub-section an attempt is made to deduce and specify the key determinants (implicit or explicit) of inflation bias from the pertinent theory, empirical work and subsequent explanations – while paying attention that less theoretical essence (logic) is compromised when moving from theory to empirical work. The underlying idea in the theory of dynamic inconsistency is that if a monetary policy maker is allowed discretion, a natural outcome is the generation of inflation bias. Since the monetary policy maker announces a certain low rate of inflation in order to anchor expectations and when the expectations have been formed – the central banker is tempted to inflate in order to spur the growth believing that the marginal cost of additional inflation is low. In this scenario the monetary policy maker, tempted by the incentive to exploit the Philips curve, increases money supply in order to achieve growth in output beyond its potential level. However, this incentive cannot materialize as the public are rational and understand this incentive of the monetary policy maker thereby making such a policy time inconsistent.

Therefore, the benefits of the increase in money supply do not accrue systematically and leads to higher inflation without increasing the output and this resultant higher (excess) inflation is in fact the inflation bias. Such an excess inflation essentially results from a particular behavior of the monetary policy maker. The pioneering theory of Kydland and Prescott 1977) explains this behavior in the context of the available discretion to central banker along with the temptation to increase the real output in the long-run.

One can think of many other facets that can trigger the same behavior on the part of the monetary policy maker, for example, the theory of new inflation bias. Therefore it is possible to link the outcome of excess inflation to a number of explicit and implicit determinants (explanations) that are assumed in subsequent works (see previous sub-sections of this chapter). Therefore, for the purpose of identification and pooling of determinants of inflation bias, any other explanations are considered along with the pioneering theory that can somehow be empirically proxied.[23] This pooling of determinants would facilitate sound and appropriate empirical investigation of the underlying inflation bias problem in Pakistan.

[23] For details of various proxy indicators see Chapter 5 as these determinants are reproduced in a more succinct form along with exact details for the convenience of the reader.

2.2.6.1 Inflation-output trade-off

The view point of most of the theoretical literature on inflation bias with respect to output broadly, covers two main sets of arguments. The first set of arguments pertains to the conventional explanation of inflation bias and the second to the new inflation bias. A distinction between them may help mitigate the risk of compromise in the process of transition from theory to empirical investigation.

First and the foremost is the pioneering argument of Kydland and Prescott (1977) that the monetary policy maker tries to achieve higher than natural rate of output. Indeed this presumed intention of the monetary policy maker does not materialize because in the long-run Philips curve is vertical.[24] Technically, for the theoretical explanation of the theory to hold true one would expect the ratio of inflation to real growth ($\frac{\pi_t}{\widehat{GDP}_t}$, where π is inflation and $\widehat{GDP}$ is real growth of GDP) to increase each time the monetary policy maker attempt to increase surprise inflation in order to increase output in two ways. Firstly, an increase in inflation without a corresponding increase in real growth. Secondly, a disproportionately higher increase in inflation than real growth (assuming that monetary policy actions bear a short-run impact on growth).[25]

The ratio also implies a trade-off between the change in prices and the change in output as both the nominator and the denominator are growth variables. Moreover, the argument made by Berlemann (2005) that inflationary bias is determined crucially by the

[24] A wide range of the theoretical and empirical literature has covered this issue with a general consensus since the pioneering work of Friedman, (1968) and Lucas, (1973).

[25] This outcome can be understood with the help of the Mundell-Fleming model [$M/P = L(r, Y)$] of money markets as explained in Mankiw (2009). It states that the supply of real balances (M/P) equals the demand $L(r, Y)$. The demand for real balances is related negatively to the interest rates and positively to the output. Ignoring the 'r' for simplicity and rewriting the equation takes the form $M = P/Y$. In order to compensate any change in M requires either a change in prices or output or both.

relative importance the central banker assign to the goals of high output or stable prices. It is also envisaged by Rogoff (1985) that if the inflation and output are determined only by the monetary policy in the economy, in a particular period t, the $\frac{\pi_t}{\widehat{GDP}_t}$ is equal to 1 would imply that the monetary authority gave equal weight to both the objectives. If the $\frac{\pi_t}{\widehat{GDP}_t}$ is greater than 1, implies that the monetary authority gave more weight to the output objective as compared to the inflation objective and vice versa if $\frac{\pi_t}{\widehat{GDP}_t}$ is less than 1. Thus an increase in the ratio indicates that the central bank is giving more importance to the output objective compared to the inflation objective with the implicit assumption that inflation and real output are determined by the monetary policy alone.

Therefore, in part the extent of the relative change in the ratio would determine the level of excess inflation in the economy. The study thus uses $\frac{\pi_t}{\widehat{GDP}_t}$ as a proxy of (i) inflation-real growth trade-off and (ii) as a proxy of the central banker relative preferences to the objectives of inflation and real growth (for detailed empirical analysis see Chapter 5). The, inflation bias (IB), therefore, can be represented as a function of $(\frac{\pi_t}{\widehat{GDP}_t})$ as:

$$IB = f\left(\frac{\pi_t}{\widehat{GDP}_t}\right) \quad (2.7)$$

There should be a positive relationship between IB and $\frac{\pi_t}{\widehat{GDP}_t}$ for the theoretical arguments to hold true empirically.

2.2.6.2 Output variability

The second explanation is provided by the new inflation bias theory as proposed by Cukierman (2000). According to this view the monetary policy makers are more sensitive to the ‘below than the above’ natural rate of output. Cukierman and Gerlach (2003) tested this explanation by looking at the relationship between inflation and the variance of growth. The use of the variance of growth may not appropriately capture their theoretical explanation because it assumes constant trend. This increases the likeliness of introducing bias into the estimates particularly in time series data.[26]

This study, instead of using variance of growth generates the series of interest (see analytical Chapter 5 and Chapter 6) representing the fluctuations about the long-term growth path (natural rate) of real growth using Hodrick and Prescott (HP) filter.[27] Such fluctuations characterize time-varying volatility of real growth as it’s the period-by-period deviation of real growth about its long-term growth path. The use of the HP filter allows introducing a natural time-varying component to the variance of growth. Therefore, the inflatin bias can be written as a function of:

$$IB = f(GDPT_t) \tag{2.8}$$

[26] The bias may be both upward and down ward depending on the existing level of the trend growth in the economy. In a particular point in time, if the trend growth is satisfactorily high, the monetary policy maker’s response may be moderate to the changes in growth and vice versa.

[27] Hodrick-Prescott (HP) filter is a widely used filter, which decomposes the time series of an observed variable into a permanent (a secular trend that is slowly evolved) and a transitory deviation (for details see Hodrick and Prescott, 1997). Other techniques used for such purposes are Baxter King, Wavelets and exponential smoothing, Kalman filter, production function and SVAR but there is no consensus in the literature over the use of one of them in any particular situation. The dynamic theory provides no guidance as to what type of economic trend a particular series should display (Canova, 1998), therefore there is much scope for the researcher to use judgement as per the specific needs of the research. This study choses HP filter because not only does it give maximum smoothing (Neumann and Greiber, 2004), but it also allows the trend to change over time. Orphanides and Nordon (1999) concluded that preference should be given to models with time varying trend rates. Combination of both these features makes the technique ideal to capture the deviations from the trend over time with varying magnitude that may better represent the policy actions of monetary policy maker. Its important to mention that the end point problem associated with the HP filter is relatively relevant in models meant for forecasting.

Where, $GDPT_t$ represents the deviations of real growth $\widehat{GDP}_t$ about its long-term growth path $\widehat{GDPP}_t$. The expected relationship between the inflation bias IB and the real growth volatility indicator $GDPT_t$ would be positive.

2.2.6.3 Money growth

It may also be deduced from the pertinent literature that the driving force behind the inflation bias is the surprise increase in inflation originating from the surprise increase in money supply (see Barro and Gordon, 1983b; Barro, 1986; Berlemann, 2005 and Romer, 2006). Generally, in the empirical studies an indicator in the form of broad money ($M2$) or its growth is used as a proxy for the money supply. However, a slight distinction needs to be made in the context of inflationary bias. For example, it is not the routinely targeted expansion in money supply that the monetary policy makers would use to be able to push the real output beyond its potential. Instead, implicit in the theories explaining inflation bias, is the element of surprise increase in the money supply growth (see Rogoff, 1985b; Romer, 1993; Berlemann, 2005; Romer 2006), which can appropriately be captured by the expansion in money supply growth beyond/below its long-term growth path. This surprise expansion/contraction of the growth in money supply to some extent can reflect the use of discretion by the monetary policy maker, which is more consistent with the pertinent theoretical underpinnings.

Historically, the monetary policy maker in Pakistan has followed a regime of targeting monetary aggregates (Khan, 2009) and is given annual indicative targets for inflation and real growth by the government. The monetary policy maker using Fischer's equation of exchange decides on the target for broad money ($M2$) growth for achievement of the assigned goals of inflation and growth while implicitly assuming constant velocity.[28] For example, if the target for real growth is 8% and that of inflation is 5%, the target $M2$ growth would work out to be 13% (Qayyum, 2008). Thus, this $M2$ growth is implicitly assumed to be the necessary growth rate in $M2$ for the long-term achievement of the goals of inflation and real growth. Given the aforementioned information, in order to keep the economy on indicative targets for growth and inflation, the monetary policy maker would possibly make short-term adjustments by increasing/decreasing growth in $M2$ about its long-term growth path.[29]

Therefore, it can roughly be conceived that part of these fluctuations about the long-term growth path of money supply ($M2$) represent the use of discretion by the monetary policy maker. Pursuing this line of logical reasoning, the monetary policy maker's discretionary behavior over time can be generated from growth in $M2$ using Hodrick and Prescott filter. The HP filter facilitate the decomposition of the observed growth series of $M2$ over time denoted by '$\widehat{GM2}_t$' into its long-term growth path '$GM2P_t$' and the fluctuations about it '$GM2T_t$' such that

$$\widehat{GM2}_t = GM2P_t + GM2T_t \qquad \text{for } t = 1, \ldots \ldots, T. \tag{2.9}$$

This decomposition makes appropriate empirical analysis of the individaul effects of both the fluctuations of money growth about its long-term growth path ($GM2T_t$) and the core money growth (long-term growth path of broad money growth – $GM2P_t$).[30] Some

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[28] Akhtar (2006) documented that the central bank of the country use M2 growth as an intermediate target to achieve the inflation objective.

[29] This is consistent with Lucas (1980) that the aggregate economic variable (in the underlying case $M2$) experiences repeated fluctuations about their long-term growth paths.

[30] Friedman and Schwartz (1991) recommend modelling of the trend and cycle jointly and the use of annual data in the analysis.

recent studies such as Gerlach (2003-2004); Neumann and Greiber (2004) and Carstensen (2007) identified the core money growth as a significant and stable explanatory variable of the movements in inflation in the Euro area. The core money growth essentially characterizes the long-term behavior of the target growth rates of $M2$, the policy maker sets and deem necessary for the long-term achievement of the desirable combination of the dual objectives of growth and inflation.

The core money growth is another potential source of inflation bias particularly, in monetary targeting policy regimes. The reason is that the appropriate amount of growth in money supply for the achievement of the desirable (target) combination of inflation and real growth in a particular period is not known, and the chances of error are likely. If in a particular time period the targets for the money growth are set higher than the optimal necessary lubrication needed for growth, the natural outcome will be inflation bias. The severity of this problem may be directly proportional to the target misses (over hitting the set target for M2 growth). The discussion above reveals that the empirical analysis of the effects of the core money growth in explaining inflation bias in Pakistan is crucial. Therefore, it follows that the inflation bias can be represented as a function of growth in money supply as:

$$IB = f\left(\widehat{GM2}_t\right) \tag{2.10}$$

where, $\widehat{GM2}_t = GM2P_t + GM2T_t$

The expected association between $GM2P_t$ and IB is positive and that of $GM2T_t$ and IB is likely to be inverse as when the excess inflation in the economy is low, the monetary policy maker would try to increase the money supply growth to achieve its other objective of real growth and when the excess inflation is high, it will decrease the money growth to bring the inflation down to certain minimum acceptable levels.

2.2.6.4 Expectations

One of the main assumptions of the theory of dynamic inconsistency of discretionary monetary policy is rational expectations. Because the public are rational and their understanding of the incentive of the monetary policy maker to try to increase output beyond its natural rate renders their policy move ineffective hence leading to inflation bias. Another view point is that it is the previous experiences of the public regarding the conduct of monetary policy on the basis of which they form expectations about future conduct of the monetary policy maker. For example, in their model of reputation as a remedy for inflation bias, Barro and Gordon (1983a) argued that reputation may possibly substitute for formal rule because the people's expectations for future policy in some way depends on the past performance of the central banker. However, it is difficult to formalize the linkages between past actions and expectations about future behavior (Barro and Gordon, 1986). Therefore, it can be discerned that inflation bias may be determined both by rational and adaptive nature of expectations.

In this study, the lagged inflationary bias is used as a proxy to capture the adaptive expectations (see Chapter 5 for details). The rational expectations indicator (generally prepared through surveys by the central banks) may not be used in empirical investigations due to the non-availability of data. It is pertinent to mention that this indicator of lagged inflation bias is slightly different both in its construct and interpretation from that of the lagged inflation (which is generally used as a proxy for adaptive expectations) in two ways:

first, it is the lag of the inflationary bias $IB_t = (\pi_t - \pi_{opt})_{t-1}$ instead of $\pi_t = \pi_{t-1}$ and second, it represents the expectations of the public about the reputation of the monetary policy maker consistent with the Barro and Gordon (1983) explanations. Where IB_t is the inflation bias in period t, π_t is the observed inflation is period t and π_{opt} is the desired/optimal inflation rate and $t-1$ denotes the lag period (see Chapter 3 for details on optimal, desirable and threshold inflation rates). Thus inflation bias can be represented as:

$$IB = f(IB_{t-1}) \tag{2.11}$$

Where the expected association between IB_t in period t is positive with its lag value $t-1$.

2.2.6.5 Equilibrium in balance of payment and openness

Guender and McCaw (1999) showed that for a small open economy with discretionary monetary policy, the inflation bias is inversely related to the elasticity of output supplied with respect to the real exchange rate. Similarly, Mendonca (2005) while appraising the conventional and the new inflation bias theories identified the lack of equilibrium in the balance of payments as a source of inflation bias especially, in the case of developing economies.

In order to correct for the disequilibrium in the balance of payments, the currency is devalued to encourage exports and discourage imports resulting in an increase in inflation. This explanation is different from that of the standard explanations and emerges from the real problem of deficits in the balance of payments. Romer (1993) on the other hand carried out detailed empirical analysis and found a strong negative link between inflation and openness. His results confirmed the basic prediction of Rogoff (1985b) who extended the dynamic inconsistency model to an open economy setting and noted that the surprise monetary expansion leads to the depreciation of real exchange rate and hence reduce incentives to expand money supply.

Therefore, it can also be deduced from the literature that inflation bias may be determined by the disequilibrium in the balance of payments and the level of integration (openness) of the economy. Thus the inflation bias may be expressed as a function of:

$$IB = f(BOP, OPEN) \tag{2.12}$$

Where, BOP is the balance of payment and $OPEN$ is the openness.

2.2.6.6 Fiscal dominance

In broader terms, fiscal dominance can be viewed as a determinant of inflation bias. Fiscal dominance may refer to the submissiveness of monetary policy to fiscal policy. It can be linked to a number of theoretical explanations pertaining to inflation bias. This may include the government's use of the monetary policy to serve its objectives which may not necessarily increase the long-run welfare of the society (Fratianni *et al.,* 1997; Piga, 2004).

The flip side of the argument of political involvement reflects the lack of independence of the central bank. Increased involvement of the government in the conduct of monetary policy through any channel may affect the performance of the monetary policy in terms of inflation. Cukierman *et al.* (1992) found that lower central bank independence is related to higher inflation rates.[31] The concept of central banker's independence is closely connected to Rogoff (1985) as he suggests delegation of authority of monetary policy to an independent central banker who puts more weight on inflation compared to output.

[31] Grilli *et al*. (1991) and Alesina and Summers (1993) also reached similar conclusions.

For the purpose of empirical investigations fiscal deficit can be used as a proxy for fiscal dominance. However, fiscal deficit may be due to an increase in government spending or decrease in taxes. This again may derive its motivation from the theories that the political governments might want to raise the employment and gain some popularity in order to be elected for the second term. Nordhaus (1975), Alesina and Jeffry (1988), Rogoff and Sibert (1987), Garman and Richards (1989), Gartner (1994 and 2000) and Fratianni *et al.* (1997) provides some of the relevant literature and surveys in this respect.

Essentially, there could be two main sources to finance fiscal deficit i.e. internal and external (Agha and Saleem, 2006). The internal sources may be through seigniorage and increase in the stock of government outstanding debt. Barro and Gordon (1983) discussed the links of seigniorage and government debt leading to inflation bias. Therefore, changes both in seigniorage and government debt represent fiscal dominance and hence are the potential determinants of inflation bias that can empirically be investigated. Thus inflation bias can be expressed as a function of

$$IB = f(SEIN, GDEBT) \tag{2.13}$$

Where, $SEIN$ is the seigniorage and $GDEBT$ denotes the government debt.

From the discussion above in this subsection, it is clear that the conventional and new inflation bias theories as well as subsequent explanations/interpretations by different studies essentially provide the basis for potential determinants of inflation bias. A number of such determinants have been identified and appropriate proxies thereof (where appropriate) that can be used in empirical analysis are proposed (see Chapter 5 for specific details of the proxies). Broadly, these include inflation and output trade-off, output variability, money supply growth, balance of payment, openness and fiscal dominance.

Although, these identified determinants of inflation bias are discussed and explored individually/separately in the theoretical and empirical literature from different perspectives as potential sources of inflation bias. Nevertheless, to the best of author's knowledge they have not been identified and pooled up as a set of determinants to empirically examine their effects on inflation bias.[32] This study bridges this gap by empirically exploring the effects of the identified set of determinants of inflation bias in Pakistan (see Chapter 5).

[32] The empirical studies as shown in the previous sub-section have tested some of its aspects only by using inflation rather than inflation bias.

2.3 INFLATION TARGETING AS A REMEDY FOR INFLATION BIAS AND KEY LESSONS

2.3.1 Inflation targeting in theory

The theoretical foundations of the dynamic inconsistency of low inflation laid down by Kydland and Prescott (1977) and Barro and Gordon (1983) attracted considerable research and has been widely debated. The essence of the theory is the well-known outcome of inflation bias, which results from the conduct of monetary policy in a discretionary manner. This inflation bias is not desirable hence most of the literature focuses on ways of the conduct of monetary policy/institutional arrangement that may either eliminate or reduce it.

Broadly, five solutions to the problem of inflation bias were suggested in the literature; binding rules, punishment equilibria, incentive contracts, reputation and delegation. The last two gained relatively more popularity, in particular the delegation. The influential work of Rogoff (1985) suggested the delegation of the conduct of monetary authority to a central banker who is independent and gives more importance to the inflation objective rather than the output objective. Theoretically, the delegation of monetary policy to such a central banker reduces inflation bias but increases output variability to the level, which is not optimal.

In subsequent research, the delegation of monetary policy to an independent central banker is emphasized largely under two main arrangements. First, is the implementation of performance contracts and second, the implementation of inflation targets. Person and

Tabellini (1993) and Walsh (1995a) theorized/modeled the performance contracts with the presumption that the central banks have both instrument as well as goal independence.[33]

On the other hand, Svensson (1995) examined the performance of inflation targeting regime to address the problem of inflation bias. The study interpreted inflation targeting as the delegation of authority to a policy maker with a set of three main responsibilities comprising an explicit inflation target, implicit output target and an implicit weight on output stabilization. In addition, Svensson's study while following Rogoff's terminology showed that an inflation target can achieve the second best equilibrium.[34] The study suggested the delegation of monetary policy to a policy maker with a low inflation target and a relatively more importance given to inflation stabilization. Technically, the band of the inflation target should be relatively narrow as the width of the band represents an implicit consideration for output stabilization. Thus the broader the band width of the inflation target, the more would be the scope for inflation bias.

Similarly, Herrendorf (1998) concluded that inflation targeting under instrument independence mitigates the inflation bias. Although, it does not fully eliminate it because the government still has the discretion to revise the target (goal independence).

After discussing the evolution of inflation targeting strategy as a remedy for inflation bias in the literature, I now turn to the evolution, performance, pre-requisites, operational issues

[33] Under the arrangement of instrument independence, the central bank can chose its policy without government interference and under the arrangement of goal independence the central bank can also chose the policy goal (Beetsma and Jensen, 1998).

[34] In the second best equilibrium the natural level of output is lower than the socially desired in an optimal rule under commitment.

pertaining to the inflation targeting in the real world and synthesis of the specific literature in Pakistan.

2.3.2 Inflation targeting in practice

The absence of a long-term trade-off between inflation and output, lags in the effects of monetary policy and dynamic inconsistency are the main arguments in the literature against the pursuit of an activist monetary policy (the use of expansionary monetary policy to reduce unemployment). Lucas (1973), for example, found on the basis of his empirical study of eighteen countries for the period 1951-67 that there existed a natural rate of output (an absence of a positive relationship between the changes in average inflation rates and average output). Similarly, Friedman (1968) asserted that there are lags in effects of monetary policy, which may differ both in magnitude and length with varied circumstances. Further, the intellectual development of the theory of dynamic inconsistency of Kydland and Prescott (1977) as discussed in Section 2.1 raised questions about the continuation of the use of expansionary monetary policy for the purpose of raising output beyond its potential level.

In practice, central banks use various monetary policy strategies to achieve the goal of price stability. These strategies include exchange rate pegging, monetary targeting, 'just do it' and inflation targeting (Mishkin, 1997).[35] Each one of these strategies has its own advantages and disadvantages. The focus of the literature review of the section under

[35] Just do it monetary policy strategy refers to the conduct of monetary policy in a pre-emptive manner without having an explicit nominal anchor. There is no unique definition of inflation targeting however Leiderman and Svensson (1995) and Bernanke *et al.* (1999) provides some related discussion on the framework.

discussion is to encompass the implications of these strategies for inflation bias and output stabilization.

The strategy of exchange rate pegging does not allow the discretion to pursue expansionary monetary policy to reap the gains from output, hence limits the scope for the creation of inflation bias. Monetary targeting on the other hand possesses a considerable scope to create inflation bias. Bernanke and Mishkin (1992) are of the view that central banks have hardly been able to adhere to strict rules for monetary expansion. In fact in order to meet the short-term objectives such as real output growth and exchange rate stabilization, the central banks using the monetary targeting strategy to control inflation often deviate from their targets.[36]

Similarly, the 'just do it' strategy, although forward looking, offers the monetary policy maker untamed discretion to deal with the unforeseen shocks to the economy. This discretion may potentially create inflation bias. Inflation targeting, however, is a framework, which is best described as 'constrained discretion'. An explicit inflation target makes the central bank accountable for its policy actions but at the same time allows flexibility with the policy maker to deal with supply shocks. For example, the band of the inflation target provides flexibility to the policy maker to adjust to supply shocks. Yet another source of flexibility with inflation targeting central bank is its accountability in terms of core inflation, which is an indicator of inflation adjusted for supply shocks.

[36] Also see Mishkin and Posen, (1997) and Clarida and Gertler, (1997). See Table 2.2 in Section 2.3 as evidence to this effect from Pakistan. Moreover, the Goohart's (1975) law seems to be applicable to monetary targeting. According to the law an economic indicator loses its information content once it is made a target for conducting economic policy.

Both inflation targeting and 'just do it' strategies of monetary policy are prone to create inflation bias via the political pressures. However, the former is immune in the sense of being accountable and hence cannot use its discretion to systematically raise the level of output. Moreover, transparency is another distinguishing feature that places inflation targeting above the 'just do it' strategy (Mishkin, 1997).

McCallum (1996) concluded in his study that inflation targeting is generally attractive as compared to other discretionary modes of monetary policy strategies and is likely to yield superior results in the long-run on average. Inflation targeting derives its superiority from the fact that other discretionary modes of monetary policy lead into inflation bias that results from the pressures on the central bank emanating from pursuit of short-term gains.

Thus from the above literature it may be inferred that inflation targeting is no panacea but it is the best available framework among the alternatives. The framework constrains discretion only to the short-run and enhances long-term commitment to the inflation objective, hence mitigating the inflation bias problem of a discretionary monetary policy strategy.

2.3.3 Skepticism/critique of inflation targeting

Since the adoption of inflation targeting by New Zealand in 1990, there has been skepticism about the performance and implications of the strategy. The main concern emanates from theoretical argument (see for example Rogoff, 1985; Herrendorf, 1998) that under inflation targeting, the central banker will put more weight on inflation stabilization compared to output stabilization, which in turn will increase output variability. Truman

(2003) noted that the views of the skeptics broadly falls under three categories. First, the belief that inflation targeting is too hard. Second, the opinion that inflation targeting is too soft and third is the view that inflation targeting would not work.

Inflation targeting has been perceived to be only focusing on inflation objective thereby unnecessarily increasing the variability of growth (Friedman and Kuttner, 1996; Blanchard, 2003). Debelle (1999) while exploring the question that 'does inflation targeting pay sufficient attention to output stabilization?' concluded that even in the case of strict inflation targeting, the output considerations are important due to their crucial role in the determination of future inflation.

A contrasting but unpopular view is that the inflation targeting is too soft (Genberg, 2002; Kumhof, 2002), particularly compared to the exchange rate regime. The discretion allowed to central banks in the form of target ranges for inflation weakens the strength of the target as an anchor of inflation expectations.

Truman (2003) noted that the view point that inflation targeting would not work is primarily based on the argument that inflation targeting is too demanding and due to the absence of technical and institutional preconditions, the strategy may not be implemented successfully. However, this view no longer seems to be important because so many countries have adopted inflation targeting as of date and have remained successful in the achievement of their primary objective of price stability (see Table 2.1). The on-going debate, however, is mainly focused on reaching a consensus about the growth performance of the inflation targeting framework.

Table 2.1: Inflation Targeting (IT) Countries

Nature of countries	Countries (in order of adoption)	IT adoption date	Inflation rate at start of IT	Average inflation rate (2009)	Current annual inflation target	Policy instrument (official)
Emerging and Developing Countries (19)	Israel	1997Q2	8.5	3.3	2 +/- 1	O/N rate
	Czech Republic	1998Q1	13.1	1.0	3 +/- 1	2-week repo
	Poland	1998Q4	9.9	3.8	2.5 +/- 1	28-day intervention
	Brazil	1999Q2	3.3	4.9	4.5 +/- 2	Selic O/N rate
	Chile	1999Q3	2.9	1.5	3 +/- 1	O/N rate
	Colombia	1999Q3	9.3	4.2	2 - 4	Repo
	South Africa	2000Q1	2.3	7.1	3 - 6	n.a
	Thailand	2000Q2	1.7	-0.9	0.5 - 3	14-day repo
	Korea	2001Q1	3.2	2.8	3 +/- 1	O/N call rate
	Mexico	2001Q1	8.1	5.3	3 +/- 1	91- day cetes
	Hungary	2001Q2	10.5	4.2	3 +/- 1	2-week deposit
	Peru	2002Q1	-0.8	2.9	2 +/- 1	n.a
	The Philippinse	2002Q1	3.8	1.6	4.5 +/- 1	Reverse repo
	Slovak Republic	2005Q1	3.2	n.a	n.a	n.a
	Indonesia	2005Q3	7.8	4.6	4 - 6	1-month SBI
	Romania	2005Q3	8.8	5.6	3.5 +/- 1	n.a
	Turkey*	2006Q1	7.8	6.3	6.5 +/- 1	CB O/N rate
	Turkey**	2001Q2	8.2	6.3	6.5 +/- 1	CB net domestic
	Guatemala	2005	9.2	1.8	5 +/- 1	n.a
	Serbia	2006	10.8	7.8	4 - 8	n.a
	Ghana	2007	10.5	19.3	14.5 +/- 1	n.a
Industrial Countries (7)	New Zealand	1990Q1	7.0	0.8	1 - 3	Cash rate
	Canada	1991Q1	6.2	0.3	2 +/- 1	O/N rate
	United Kingdom	1992Q4	3.6	2.2	2 +/- 1	Repo
	Sweden	1993Q1	4.8	-0.3	2 +/- 1	Repo
	Australia	1993Q2	1.9	1.9	2 - 3	Cash rate
	Iceland	2001Q1	3.9	12	1.5	n.a
	Norway	2001Q1	3.7	3.6	2.5 +/- 1	n.a
Candidate countries	Costarica, Egypt, Ukraine	(1-2 yrs)				
	Albania, Armenia, Botswana, Dominican Republic, Gautemala, Mauritius, Uganda, Angola, Azerbaijian, Georgia, Moldova, Serbia, Srilanka, Vietnam, Zambia	Medium term (3-5 yrs)				
	Belarus, China, Kenya, Kyrgyz Republic, Moldova, Serbia, Sri Lanka, Vietnam, Zambia, Bolivia, Honduras, Nigeria, Papua New Guinea, Sudan, Tunisia, Uruguay, Venezuela	Long-term (> 5 yrs)				

Source: Author's tabulation based on Roger (2010) and Chowdhury and Islam (2011). Notes: *Official adoption date for Turkey. **Turkish CB declared 'distinguished inflation targeting' in the aftermath of 2001 February crisis. O/N, over-night interest rate; CB, Central bank; SBI, 1-month Bank of Indonesia certificates; n.a., not available.

Another dimension of the skepticism pertains to the developing countries, particularly, in terms of lack of expertise and inadequate status of the preconditions of inflation targeting (Masson *et al.,* 1997; Calvo and Mishkin, 2003), which may affect credibility thereby resulting in poor macroeconomic outcomes in these countries.

However, on the other hand, Svensson (1997), Bernanke *et al*. (1999) and Mishkin (1999) believe that the adoption of inflation targeting will lead to better macroeconomic outcomes because the initial credibility in these countries is low and hence the scope for improvement is greater.

Recently, Epstein and Yeldan (2010) while avoiding the one size fits all policy approach of Washington Consensus (of which inflation targeting has become an important part) developed country specific alternatives to inflation targeting.[37] Although they believed that inflation should be controlled, however, did not agree with the prescription of inflation in 2-4 percent band. Moreover, they argued for broadening the responsibilities of the central banks to include real variables such as investment allocation or real exchange rate that directly impact on poverty, employment and economic growth.

Similarly, Chowdhury and Islam (2011) argued that inflation targeting being an important component of IMF's macroeconomic policy advice has proven to be a hindrance in the way of achieving the Millennium Development Goals particularly, poverty reduction. Too much focus on price stability causes output variability and hence lower economic growth especially in the developing economies, which are prone to supply shocks.

[37] The term Washington Consensus was introduced by Williamson (1990) and contains a set of reforms (10 key points) for economic development.

The recent financial crises lead several economists to question the role of monetary policy in combating financial crisis that may emanate from any source. For example, Blanchard *et al.* (2010) argued that the scope for monetary policy to respond to shocks at lower inflation is limited. Similarly, Aydin and Volkan (2011) argued that in conventional inflation targeting framework, the monetary policy does not respond to the shocks of financial nature as long as its effects becomes visible in inflation and output. Further, such a framework does not respond to shocks pre-emptively instead with a lag if it does. Therefore, the paper proposed alternative inflation targeting rules where the central bank monitors additional indicators of financial sector.

On the contrary several economists have come up with contrasting findings and arguments with respect to the financial crisis. For example, Filho (2010) concluded that inflation targeting framework has suitably dealt with the crisis. On average, inflation targeting countries have effectively managed the crisis, particularly; they were able to reduce nominal policy rates more than the non-targeting countries. They also found some evidence that the inflation targeting countries not only performed well on unemployment front but the advanced inflation targeting countries, particularly, done well by showing relatively higher industrial production and output growth rates.

Svenson (2009) argued that conditions that led to the crisis are largely associated with failures on supervisory and regulatory front rather than monetary policy. He concluded inflation targeting as the best monetary policy among alternatives in the wake of financial crisis. However, he emphasized further work on an understanding of the financial sector, particularly in the transmission mechanism as indicators of inflation and output in the future. Similarly, Dale (2009) argued that the characteristics of inflation targeting in the form of low stable inflation and transparency have proven helpful in combating the crisis and stresses the need to consider asset prices while conducting monetary policy as it may hinder the achievement of inflation target.

There also exists a strand of theoretical literature that emphasize on other nominal variables to be used as nominal anchors for the conduct of monetary policy such as nominal income targeting or price-level targeting. Nominal income targeting approach to monetary policy has been explored since 1980s by a number of economists including Tobin (1980), Bean (1983), Gordon (1985), McCallum (1985,1988), Taylor (1985), Hall and Mankiw (1994), Cecchetti (1996), Guender (1998), McCallum and Nelson (1998), Kim and Henderson (2005) and Wang (2007). Similarly, Fisher (1995), Svensson (1999), Berg and Jonung (1999) and Guender and Oh (2006) are some of the notable contributions in respect of the price-level targeting.

Detailed discussion on the two approaches is avoided in this literature review because the purpose of the proposed study is not to assess the alternative approaches to inflation targeting instead to find a practical solution to the problem of inflation bias. This solution as is as envisaged both by theory and practice is the adoption of a commitment based monetary policy approach for which a close and a practical world example is inflation targeting.

2.3.4 Inflation targeting performance

Since the adoption of inflation targeting by New Zealand in 1990 there has been skepticism about the effectiveness of inflation targeting in terms of its macroeconomic performance. Several studies (to be discussed subsequently) have attempted over the period to explore the performance and effectiveness of inflation targeting largely against (i) best non-inflation targeters and (ii) the period prior to the adoption of inflation targeting. They have reached some conclusions because of the lapse of considerable time for the assessment of the performance of inflation targeting countries.

The best criterion for the judgment of the effective performance of the inflation targeting is price stability, both in terms of (i) bringing down inflation from undesirably higher levels to desirable lower levels and (ii) sustaining the prices at the desirable level from medium to long-term with a decreasing variability. Nevertheless, economists and non-inflation targeting central bankers at large have also been skeptical about its performance in terms of output stabilization, exchange rate fluctuations and interest rates variability. Considerable research has been done in order to empirically explore answers to such skepticism about the performance of inflation targeting. The following section throws some light on the success of inflation targeting framework on the basis of macroeconomic indicators mentioned above in terms of empirical findings in the literature.

2.3.4.1 Inflation performance of inflation targeting

An important criterion to judge the performance of inflation targeting strategy could be the performance in terms of inflation, as price stability is the overriding objective. Being fully aware of the importance of price stability, not only developed but also developing countries adopted the strategy of inflation targeting (see Table 2.1) and many others are planning to do so – largely motivated by the framework's effective performance and the higher rates of inflation in these countries (Mishkin and Schmidt-Hebbel, 2007; Walsh, 2009).[38]

For the purpose of assessment, studies have used various dimensions of the inflation performance including average inflation, inflation persistence, inflation variability and inflation expectations.[39] While assessing inflation targeting, Corbo *et al.* (2001) attempted to answer the question whether the inflation targeters have successfully reduced inflation rates and found that on average inflation targeters to have met the targets for inflation.[40] They reported that the average deviation from its target of the inflation targeters was merely 12 basis points. Peturson (2005), however, documented that the deviation from the target approach is too narrow a perspective for the assessment of inflation targeting. Peturson, therefore, used the average inflation both before and after the adoption of inflation targeting by the inflation targeters. The sample in the study constituted 21 inflation targeters and six non-targeting industrial countries. The findings of the study revealed that inflation was successfully reduced in the last five years prior to the adoption of inflation targeting from over 30% to 4.5% in the inflation targeters, whereas in non-targeting industrial countries the inflation subdued from 5% to 2.5%.

Several studies (Vega and Winkelried, 2005; Batini and Laxton, 2006) while including developing countries in their samples have found inflation targeting beneficial in terms of lowering inflation not only in developed but also in developing economies. Vega

[38] Roger and Stone (2005) noted that despite frequent target misses no country has left inflation targeting strategy due to its flexibility, lack of realistic alternatives and high standards of transparency and accountability.

[39] See Fuhrer, (2009) for definition and measurement of inflation persistence.

[40] Haldane (1995), Bernanke *et al.* (1999), Cecchetti and Ehrmann, (1999) and Neumann and Von Hagen, (2002) are some of the other studies with similar findings of bringing inflation down after the adoption of inflation targeting.

and Winkelried (2005) while controlling for the level of inflation prior to the adoption found that adoption of inflation targeting decreased average levels of inflation both in developed and developing countries, particularly with a strong effect for the latter.

Inflation persistence is yet another dimension of inflation in the empirical literature through which the performance of inflation targeting has been assessed. For instance, Siklos (1999) found a significant reduction in inflation persistence after the adoption of inflation targeting for a subset of countries including New Zealand, Canada, Spain, Finland, United Kingdom and Sweden. A number of other studies have also reached similar conclusions such as Kuttner and Posen (1999, 2001), King (2002), Levin *et al.* (2004) and Petursson (2005).

Inflation performance of the inflation targeting regime has also been gauged by inflation variability. Levin *et al.* (2004) for example, found that the overall inflation variance in both the inflation targeters and non-inflation targeters in their sample is roughly similar. However, the author further argued that the shocks to inflation in the inflation targeting countries under the sample period have been larger compared to the non-inflation targeting countries, which shows their better performance. Peturson (2005) also found that the inflation variability (using standard deviations) have reduced after the adoption of inflation targeting by the inflation targeters. Similarly, Lin and Ye (2009) while exploring if inflation targeting makes a difference in developing countries found that thirteen developing countries in their sample who have adopted the strategy successfully lowered their inflation and inflation variability on average.

Lastly, inflation expectations are an important dimension to assess the inflation performance of the inflation targeting strategy. Johnson (2002) analyzed the change in the behavior of expected inflation for a set of 11 countries. The panel included five inflation targeting countries (New Zealand, Australia, Canada, Sweden and United Kingdom) and six non-targeting industrial countries (Germany, Netherland, France, Italy, United States and Japan). The study concluded with a strong evidence of a large reduction in expected inflation after the announcement of the inflation targets.[41] Similarly, Gavin (2003) concluded that the inflation targeting central banks by announcing their objectives effectively anchor expectations. This in turn makes it easier for them to achieve the objective of price stability. Moreover, Levin *et al.* (2004) also reached similar conclusions that inflation targeting has played an important role in anchoring long-run expectations.

2.3.4.2 Output performance of inflation targeting

Like other monetary policy strategies, inflation targeting has also been subject to criticism, in particular the concern for output stabilization. Inflation targeting is sometimes perceived as 'inflation only' targeting perhaps with no flexibility or consideration for output and employment[42]. However, a number of studies have argued that inflation targeting allow reasonable flexibility with the central banker to deal with the output shocks. Debelle (1999) therefore deems this kind of criticism to be misplaced. The author argued

[41] It is however pertinent to mention that the previous literature including Laidler and Robson (1993), Bowen (1995) and Bernanke *et al.* (1999) did not find satisfactory evidence of the impact of inflation targets on inflation expectations. The apparent reasons for the lack of such evidence are the limitations in terms of the short time period of inflation targeting and only analyzing the unconditional impact of inflation targets on expected inflation (Johnson, 2003).

[42] Bryant (1996) and Rivlin (2002) for example, view inflation targeting as the choice of a trade-off between inflation and output (Philips curve) and inflation variability and output variability (Taylor curve).

that the framework is sufficiently flexible while deriving its flexibility from the targeting bands and policy horizons[43].

Truman (2003) in collaboration with Hu (2003a, 2003b) found that inflation targeting has resulted in a significant positive relationship with growth and a significant negative relationship with inflation. Levin *et al.* (2004) documented that inflation targeting has improved the trade-off between inflation and output volatility in the inflation targeting countries. Corbo *et al.* (2001), Neuman and Von Hagen (2002) and Peturson (2005), among others, have also come up with similar conclusions.

Concalves and Salles (2008) explored the question if inflation targeting matters for developing countries while employing Ball and Sheridans' (2005) methodology. The overall number of countries analyzed was 36 out of which 13 were the countries that had already adopted inflation targeting. They found that inflation targeting countries witnessed significant decreases in inflation and output variability as compared to the rest with alternative monetary policy regimes. A similar finding was reached by Roger (2010) in his analysis.

Brito and Bystedt (2010), however, came up with partially contrasting results from Concalves and Salles (2008). The paper re-evaluated the performance of 36 developing countries and concluded that although the inflation targeting countries have lowered their inflation rates but while accounting for inflation-output trade-off, there is no significant indication of improvement.

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[43] In practice short-run inflation variability is allowed to a certain degree thereby leaving some room for output variability at low levels in order to maintain medium term price stability.

2.3.4.3 Exchange rate Performance of inflation targeting

Kutner and Posen (2000) while seeking answer to the question in the context of G3 countries (Germany, Japan and United States) found that there is an inverse relationship between monetary policy transparency and exchange rate volatility. The authors argued that an increased transparency in monetary policy implies a movement away from discretion, which helps to anchor inflation expectations and decreases the need to be aggressive against inflation shocks.

Similarly, Peturson (2005) found results consistent with the theoretical arguments that price stability at lower levels is positively related to exchange rate stability. He concluded that inflation targeting has decreased exchange rate volatility on average, specifically in countries with a floating exchange rate regime before they adopted the inflation target. Peturson, however, argued that the increased volatility in the exchange rate in some of the inflation targeting countries is due to the fact that prior to inflation targeting those countries practiced a fixed exchange rate regime.

Lin (2010) extended the analysis of Lin and Ye (2009) to see the effects of inflation targeting on exchange rate volatility and international reserves while using the propensity score matching methods. The study found significantly different impacts on developing and developed countries. The former showed significant improvements in nominal/real exchange rates and international reserves stability while such significant improvements were lacking in the latter.

2.3.4.4 Interest rate performance of inflation targeting

Interest rates are the primary policy instruments used by central bankers in the conduct of monetary policy (Sellon and Weiner, 1996). Several studies have used interest rates in order to assess the performance of inflation targeting strategy. Kahn and Parrish (1998), for instance, observed that short-term nominal interest rates are lower and less volatile in the post-adoption period compared to the pre-adoption period in inflation targeting countries. With respect to the real interest rates the study observed that the inflation targeting countries have witnessed an increase in the real interest rates reflecting tight monetary policy.

A similar finding was reached by Neumann and Hagen (2002) that on average short-term interest rates and volatility have fallen in inflation targeting countries after the adoption of inflation target. Ball and Sheridan (2003) on the contrary found no significant evidence for inflation targeting on long and short-term interest rates variability. However, Peturson (2005) found results consistent with the findings of Kahn and Parrish (1998) and Neumann and Hagen (2002) while comparing the variability in short-term interest rates before and after the adoption of inflation targeting and found a decrease in general in the variability after the adoption.

2.3.5 Inflation targeting preconditions

In principle any monetary policy strategy whether it is monetary targeting, exchange rate pegging, ‘just do it’ or inflation targeting requires certain preconditions to be in place for its successful implementation and effective performance. For inflation targeting, these preconditions have been evolved and identified with the increasing experience of the framework over time. Several authors have built up their arguments for and against the adoption of inflation targeting framework on the basis of such preconditions; particularly, in the context of emerging market economies. The more these preconditions exist, the more successful would be the implementation of the inflation targeting framework and vice versa.[44] Some of the key preconditions such as central bank independence and accountability, price stability as the overriding objective, ability to forecast inflation and healthy financial system are reviewed as follows.

2.3.5.1 Central bank independence and accountability

The independence of the central bank is a particularly important pre-requisite for the successful implementation of the inflation targeting framework.[45] The degree of independence however, may vary from country to country. The concept of central bank independence can better be understood as goal independence and instrument independence. Goal independence means that the central bank has the authority to set the goal itself rather than the government or any other entity. Instrument independence means that the central bank can choose the appropriate instrument or set of instruments for the achievement of its goal/s. It is instrument independence rather than goal independence, which is desirable for the appropriate conduct of monetary policy (Blinder, 1998; Masson *et al.,* 1997 and Amato and Gerlach, 2002).

Fiscal dominance can be regarded as closely linked to central bank independence. The literature however, discusses fiscal dominance separately as a pre-requisite of

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[44] Although this assertion is implicitly assumed in the preconditions literature yet Amato and Gerlach (2002) found that the inflation targeting has successfully been implemented without the preconditions being in place.

[45] Central bank independence is equally desirable and important for the implementation of other monetary policy strategies as well (Amato and Gerlach, 2002).

successful implementation of the inflation targeting framework (see for discussion on fiscal dominance Debelle, 1998; Carare *et al.*, 2002; Amato and Gerlach, 2002 among others). Fiscal dominance may largely result from the continuous higher budget deficits, which force the government to fulfill the need of its finances through seigniorage, and borrowing from the banking sector and the public. This tendency blurs the central bank pursuit of an independent monetary policy steered towards medium term and long-term objectives of price stability. Moreover, the erratic behavior in the government expenditures can potentially lead to disproportionate inflation by triggering high inflation expectations (Mishkin and Schmidt-Hebbel, 2000).

Carare *et al.* (2002) argued that accountability of the central bank for the achievement of the objective (target) of price stability is another precondition that can help in the successful implementation of inflation targeting. This is an essential feature in the sense that it keeps the policy maker focused on the target and provides insulation from political pressures. Further, they are of the view that accountability in the inflation targeting framework is ensured through increased transparency and communication with the public.

2.3.5.2 Price stability as the over-riding objective of monetary policy

In the inflation targeting setting, price stability is the overriding objective of monetary policy (Mishkin, 2004). Clear inflation targets either in the form of a point or a range is set and the monetary policy is geared to achieve those targets. This, however, does not necessarily mean that price stability is the only objective. The experience with the inflation targeters shows that they may pursue other macroeconomic objectives as long as these objectives remain consistent with the inflation target (Debelle, 1998). In the cases of conflict with the other objectives, more weight is given to price stability. In short, there remains a clear institutional commitment to the price stability rather than other nominal anchors (Mishkin and Schmidt-Hebbel, 2000; Jonas and Mishkin, 2003).

2.3.5.3 Forecasting inflation

Ability to forecast inflation has been identified as another pre-requisite for successful implementation of inflation targeting (Debelle, 1998; Carare *et al.,* 2002; Jonas and Mishkin, 2003; Batini and Laxton, 2006). The inflation targeting monetary policy regime is forward looking by nature and therefore inflation forecasts are needed to act pre-emptively before inflation begins to rise (Debelle, 1998). The capabilities of inflation forecasting, however, vary with the time and the level of development of the inflation targeters. For example, in the initial stages of adoption of inflation targeting the central banks may rely on simple models and simultaneously devote resources for its development (Batini and Laxton, 2006). Countries like Brazil, Czech Republic and Israel use simple three or four equation models for the purpose of forecasting (Carare *et al.,* 2002). On the other hand, developed countries like New Zealand and Canada use more sophisticated models for forecasting (Drew and Hunt, 1998). Batini and Laxton (2006), however, found that most of the inflation targeters had little or no forecasting capability at the time of adoption of inflation targeting. In practice, the central banks along with other qualitative relevant information and judgment adopt a certain monetary policy stance supported by the forecasts of inflation (Carare *et al.,* 2002).

2.3.5.4 Healthy financial system

The literature related to the preconditions of inflation targeting suggests that financial system should be sufficiently sound to allow for effective transmission mechanisms for monetary policy instruments (Jonas and Mishkin, 2003). Financial stability relieves central bankers from the concerns of health of financial sector as it may be in conflict with inflation targets – thus helping to anchor inflation expectations (Carare *et al.*, 2002). Given the preconditions, as reviewed above, an important question arises that if these preconditions are not met, can the inflation targeting still be adopted? The discussion in the next section is devoted to this particular question.

2.3.6 Can inflation targeting be adopted if the preconditions are not met?

This sub-section discusses the literature dealing with the inevitability of the preconditions for adoption of inflation targeting, particularly in the context of developing countries. Although the literature dealing with the adoption of inflation targeting by the developing countries is relatively scanty, a few studies provide some relevant discussion. Masson *et al.* (1997), while assessing the scope for inflation targeting concluded that developing countries can choose inflation targeting provided two prerequisites are satisfied. First, is the central bank's independence in terms of fiscal dominance. Second, is the absence of any other nominal anchor rather than inflation such as exchange rate and output-stabilization. The paper argued that developing countries are plagued either by fiscal dominance (seigniorage is an important source of financing) or low inflation is not the overriding objective of monetary policy. Inflation forecasting capability is yet another prerequisite where the developing countries are lagging behind.

Debelle (1998) however does not regard it compulsory for all the prerequisites to be in place at the same time in the case of developing countries. Debelle, for instance, argued that it may not necessarily be the case that inflation target is inconsistent with other goals such as output stabilization. Nevertheless, when a conflict arises, central bank should give priority to inflation target instead of other objectives. Similarly, he argued that complete reliance on a model-based forecast of inflation is not the practice even in industrial countries, rather, the decisions regarding the monetary policy stance are taken on the basis of other information and judgment supported by forecasts. Therefore, such models can be developed over time and should not be treated as a hindrance in the way of adopting inflation targeting framework by the developing countries.

Batini and Laxton (2006), in order to assess the role of preconditions for the adoption of inflation targeting, conducted a survey of 21 inflation targeting and 10 non-targeting central banks in emerging markets. They found that although the industrial inflation targeters as compared to emerging market inflation targeters were better in some dimensions, all the preconditions were not in place before adopting inflation targeting in any of these countries. Further, the study found that no precondition significantly explained the improvement in macroeconomic performance after the adoption of inflation targeting.

2.3.7 Key operational issues in effective implementation of inflation targeting

Apart from the preconditions, several authors have identified a number of practical operational/technical issues of economic nature associated with the adoption of inflation targeting as a monetary policy framework. The capability of the inflation targeters to deal with such issues may vary from country to country, largely based on the preparedness and the initial macroeconomic conditions of the economy. Some of the relevant literature is reviewed below with a particular emphasis on the important operational issues.

2.3.7.1 The choice of an appropriate price index

The consumer price index (CPI) is the most popular and widely used index by inflation targeting countries (Haldane, 1995; Debelle, 1998; Schaechter *et al.*, 2000). An alternative measure is the GDP deflator which has a wide coverage; however, it is not used by the inflation targeters because it is not readily available and is subject to frequent revisions (Debelle, 1998; Schaechter *et al.,* 2000). Most of the inflation targeters use either CPI or some variant of CPI commonly referred to as 'core inflation' or 'underlying inflation'.[46] The use of core inflation as a target allows central banks some flexibility to deal with supply shocks.[47] The purpose of using core inflation is that the CPI is sensitive to supply side shocks. A movement in CPI may be the result of supply side factors over which the central bank has no control (Haldane, 1995; Debelle, 1998; Amato and Gerlach, 2002). Core inflation measures may also be used as an operational guide by the monetary authorities for analytical and forecasting purposes for the achievement of the target. One of the purposes of the use of the core inflation measures is to guide and keep the monetary policy focused in an appropriate direction (Cutler, 2001).

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[46] There is no unique definition of core inflation. Various authors however have defined it in the context of their own studies. For example, Eckstein, (1981) defined it as "the trend increase in the cost of the factors of production", Blinder, (1997) defines it as a "persistence part of aggregate inflation", Bryan and Cecchetti, (1994) defines it as a measure that is the most correlated with the money growth and Bryan *et al.* (1997) as the measure the more correlated with a smoothed trend inflation rate. Quah and Vahey, (1995) give its definition in terms of an inflation having no long-run impact on output, estimating it through VAR system. Cogley (2002) defines CI as a response to changes in mean inflation and Smith (2004) defines it as the best forecaster of inflation.
[47] It is also qualified with certain exemptions or escape clauses that also allow some flexibility to the central bank (Haldane, 1995).

The use of core inflation thus helps fix the responsibility of the central bank for the price movements over which it has control. Moreover, these measures direct and help the monetary policy makers focus on the demand driven price movements. Research has developed and devised various techniques for the computation and evaluation of core inflation measures. Broadly, core inflation measures are computed through the exclusion approach, limited influence estimators (trimmed mean and median) and the model-based techniques.[48] The most widely used approach for the computation of core inflation is the exclusion approach (Wynne, 1999) practiced since the 1970s (Vega and Wynne, 2001). Silver (2007) argues that countries often use the exclusion-based methods when they first instigate inflation targets because they are timely, easy to understand and transparent in that the user can replicate the measure.

Given the importance of the core inflation measures as discussed above, it is inevitable to have an appropriate core inflation measure to be used as an inflation target. It is important to mention that Pakistan's central bank has been using various core inflation indicators since the early last decade of 2000s.[49]

2.3.7.2 Specification of the inflation target (point or band)

Specification of the inflation target for operational purposes in an inflation targeting framework is a technical part of the adoption of inflation targeting process. Generally the targets are specified either as a point or a band using a headline or a core inflation measure.

[48] The concept of limited influence estimators (trimmed mean and median) was first proposed by Bryan and Pike (1991) and Bryan and Cechetti (1994). Subsequently, the methods have been used in various studies and practically numerous central banks estimate such measures for their use. Whereas Quah and Vahey (1995) brought a new multivariate approach to the core inflation measurement while bringing in some economic theory to distinguish between core and non-core inflation.

[49] See for example, Tahir (2006) and Riazuddin *et al.* (2013) among others.

Practice varies across inflation targeting countries. For example, Australia, Brazil, Chile, Finland, Sweden and U.K. have point targets whereas Canada, Czech Republic, Israel and New Zealand have bands for inflation targets (Haldane, 2000). There are advantages and disadvantages of both the point and band targets and the choice between them involves a trade-off between stronger commitment to the inflation target and a necessary flexibility with the monetary policy makers (Debelle, 1998).[50]

Haldane (2000), while discussing the reasons why the U.K. chose a point inflation target, highlighted three main relative advantages. First, it provides a clear point of referral for the monetary policy makers thereby keeping them focused and ensure transparency. Second, it helps in anchoring the inflation expectations of the private sector agents and third, it enables the conduct of monetary policy in a symmetric way particularly, when the inflation is on its long-term target. A point target however, has the disadvantage of increasing the variability in output and has the potential to induce instrument instability of monetary policy (Debelle, 1998).[51] Moreover, point targets have been observed to be missed more often, which potentially creates the problem of credibility and reputation.

Dennis (1997) noted that although in theory, the literature distinguishes between the point and band target/s, however, it does not provide a basis for the choice of an appropriate bandwidth. Empirical literature, on the other hand, tries to address the problem of optimal bandwidth using the criterion that 95 % of the inflation observations should fall within the target range.[52] He therefore, argued that the bands produced by these studies are appropriate

[50] There is a slight distinction between a point inflation targeting and band inflation targeting frameworks. In the former the centre of the band target band is explicitly mentioned (Dennis, 1997).
[51] In the case of instrument instability the economy experiences excessive swings in the monetary policy instruments when the central banks try to hit the inflation target.
[52] See for example Debelle and Stevens, (1995), Fillion and Tetlow, (1993) and Turner, (1996).

for the central bank's accountability purposes but are less suited to reflect on the economic costs of inflation.

Therefore there is a need to bridge this gap by estimating a point/band that may serve twofold purposes. First, it can be used for accountability of the central bank and second, it will help the inflation targets to be set in a range, which is beneficial to real growth. This study seeks to suggest appropriate inflation rates for Pakistan in Chapter 3 at length by estimating optimal, desirable and threshold levels of inflation in Pakistan.

2.3.7.3 Costs of disinflation

One of the widely discussed operational issues in the literature, related to inflation targeting is the cost associated with disinflation (King, 1996; Mishkin and Schmidt-Hebbel, 2001). This is particularly important for the countries where the inflation rates are reasonably high (in double digits, for example) before the adoption of inflation targeting. King (1996) argued that the costs of disinflation increase more than proportionately with the increasing speed of disinflation if the countries have long experienced high inflation rates because it takes time for the private sector to adjust expectations. Similarly, Mishkin and Schmidt-Hebbel (2001) argued that due to the imperfect credibility of the central banks and because of the past higher inflation, inflation inertia is larger. This makes a quicker disinflation potentially more costly. Sargent (1986), on the other hand, preferred a sharp decrease in inflation because expectations adjust quickly.

Practical experiences may vary from country to country in the speed of bringing down inflation to the desired level that can be regarded as price stability. Canada, for example, attempted to bring down inflation from around 6 % to a band of 1-3 % in four years and New Zealand, on the other hand, aimed to bring down inflation into the band of 0-2 % rather quickly (King, 1996). Emerging market economies dealt with the problem of disinflation by phasing inflation targeting gradually from informal to formal with the increasing success in lowering inflation (Mishkin and Savastano, 2000; Mishkin, 2000b; Mishkin and Schmidt-Hebbel, 2001). There is, however, no consensus in the literature over a particular speed of disinflation to be optimal.

Broadly, there are two approaches in the literature towards the appropriate speed of disinflation – gradualism (Taylor, 1983), and cold turkey (Sargent, 1983). The former view devotes a gradual approach to the disinflation so that wages and prices adjust smoothly to the tight monetary policy due to the presence of inertia. The latter prefers a rather quicker disinflation because inflation expectations adjust sharply and is supported by empirical studies, which found lower sacrifice ratio such as Ball (1993) and Zhang (2001).

The essence of this issue hinges on the relationship between inflation and real growth. Such relationships are explored in Chapters 3, 4 and 6 for the underlying case of Pakistan. The analysis provides a clear evidence if Pakistan is likely to gain or lose from disinflation.

2.4 PAKISTAN'S DISCRETIONARY MONETARY POLICY STRATEGY AND THE CASE FOR INFLATION TARGETING

2.4.1 Pakistan's monetary policy – a typical case of discretion

In Pakistan, it is the statutory obligation of the State Bank of Pakistan (SBP) to conduct monetary policy in a manner consistent with the federal government targets for real growth and inflation (SBP Act, 1956).[53] The SBP regulate monetary and credit system with a view to secure monetary stability and fuller utilization of the country's productive resources. The core functions of the SBP are: (i) the regulation of liquidity, (ii) ensuring the soundness of the financial system, (iii) exchange rate management and balance of payments and (iv) to enhance development. The basic objective underlying these functions is the maintenance of monetary stability thereby leading towards the stability in the domestic prices as well as the promotion of economic growth. A reserve money management program has been developed under which the intermediate target of (M2) is achieved by observing the desired path of the reserve money (operating target).

In the 1990s SBP was made autonomous through an amendment to the Act thereby making monetary policy the sole responsibility of central bank and hence it can decline to the government any borrowing exceeding the limit (Hanif and Arby, 2003; Arif, 2011). Khan and Schimmelpenning (2006) noted that SBP is fully capable of implementing its own independent monetary policy and the best policy contribution for the achievement of growth on sustainable basis would be to maintain price stability.

[53] Bec *et al.* (2002) noted that inflation bias – the key characteristic of a discretionary monetary policy strategy arises due to two features of monetary policy behavior, first, twofold objectives of inflation and output and second, targeting output beyond the potential level of the economy. This is in contrast to the inflation targeting frameworks where the central bank is given inflation target and is held accountable for its achievement. In Pakistan, there is no explicit mechanism of central bank's accountability for non-achievement of the targets.

The Federal Government decides targets for growth and inflation[54] while SBP, in response to the government's targets for inflation and growth sets its targets for broad money (M2) growth accordingly.[55] Qayyum (2008) explains this mechanism of setting M2 growth targets. Suppose, if the government's targets for inflation and growth are 5% and 8%, respectively. The $M2$ growth target would work out to be the sum total of both inflation and growth targets i.e. 13%. The Figure 2.1 depicts that the government targets for inflation and growth over time are inconsistent. Specifically, they are not consistent with the standard theory that low and stable inflation is inevitable for a sustained growth. Instead, it appears that government sets the annual inflation and growth targets on two highly unrealistic presumptions. First, the effects of monetary policy are realized contemporaneously without any lag and second, the monetary policy can be adjusted on a year-by-year basis for the achievement of inconsistent inflation and growth targets.

Figure 2.1 also shows that growth targets are overly ambitious and much beyond than that of the potential growth rate of the economy.[56] This feature of pursuit of higher than potential output is central to a discretionary monetary policy strategy as was highlighted by Kydland and Prescott (1977). Since Pakistan's monetary policy fulfills both the central features of being discretionary i.e. duality of objectives and pursuit of higher than potential rate of the economy, it is ideal to examine this typical case for the problems associated with discretion.

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[54] The target for inflation is initially set by the Planning Commission and is discussed in the Fiscal and Monetary Policies Cordination Board and is finally approved by the National Economic Council with overall Annual Development Plan (Viqar and Amjad, 1984; Moinuddin, 2009).

[55] Akhtar (2006), the then governor of the central bank documented that the central bank of the country uses M2 growth as an intermediate target to achieve its objective.

[56] The potential real growth rate of the economy is estimated through Hodrick and Prescott (HP) filter while using the recommended level of the penalty parameter of $\lambda = 100$ for annual data (Mise *et al.*, 2005).

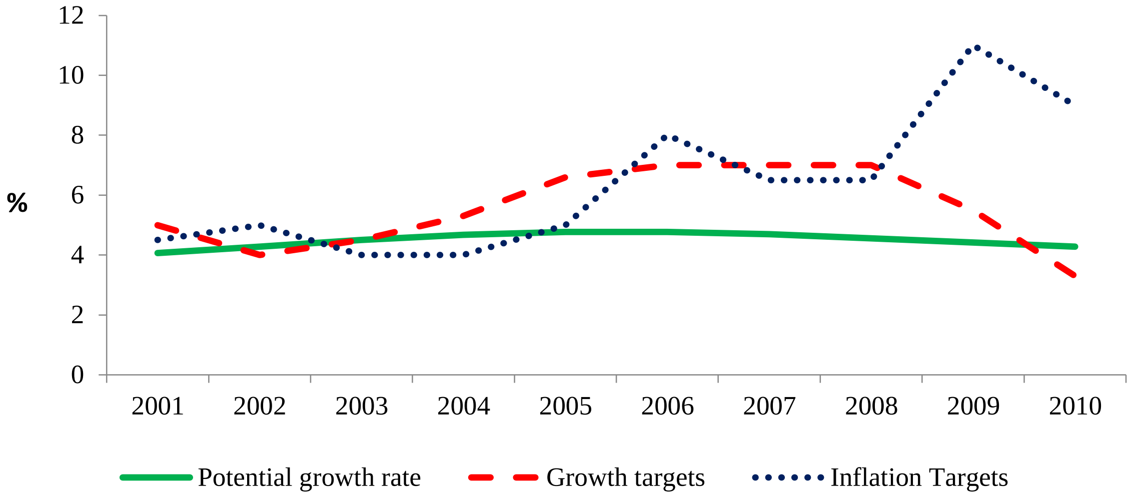

Figure 2.1: Growth capacity of the economy and inconsistent inflation and growth targets for Pakistan

2.4.2 The case for inflation targeting – money demand stability and growth skepticism

The pursuit of higher than the potential growth rate of the economy in Pakistan – a key feature of discretion, has led to the frequent overshooting of the $M2$ growth targets by the central bank (see Table 2.2). The Table shows that although the targets for inflation are critically high as compared to the world's standard practice of a 3% rate, they are hardly achieved. Similarly, M2 targets were overshot (by 75 % of the time) despite the fact that these targets were already ambitious. This suggests inherent flaws in the system as the policy seems to be conducted extremely on ad hoc basis hence leading to an inefficient performance.

Table 2.2: Growth in M2 and inflation (targets and actual)

Fiscal Year	Annual M2 growth (in percentage)			Annual Inflation (in percentage)		
	Target	Actual	Difference	Target	Actual	Difference
1975	11.2	6	-5.2	n.a	26.8	n.a
1976	11.3	20.3	9	n.a	11.6	n.a
1977	13.6	19.7	6.1	n.a	11.8	n.a
1978	10.6	19.3	8.7	n.a	7.3	n.a
1979	12	20.3	8.3	n.a	7.1	n.a
1980	13.7	15.7	2	n.a	10.7	n.a
1981	10.3	12	1.7	n.a	12.4	n.a
1982	13.8	10.4	-3.4	n.a	11.1	n.a
1983	13.9	23.4	9.5	n.a	4.7	n.a
1984	12.3	11.1	-1.2	n.a	7.3	n.a
1985	10.4	11.9	1.5	n.a	5.7	n.a
1986	9.4	14.1	4.7	n.a	4.4	n.a
1987	11.3	13.1	1.8	n.a	3.6	n.a
1988	11.7	11.8	0.1	n.a	6.3	n.a
1989	11.2	7.5	-3.7	n.a	10.4	n.a
1990	10.3	16.9	6.6	n.a	6.1	n.a
1991	9.7	16.9	7.2	7	12.6	5.6
1992	11.1	25.6	14.5	8.5	10.6	2.1
1993	9.2	17.4	8.2	8	9.8	1.8
1994	13.1	17.9	4.8	8	11.3	3.3
1995	10.7	17	6.3	7	13	6
1996	12	13.7	1.7	9.5	10.8	1.3
1997	12.2	12.1	-0.1	8.5	11.8	3.3
1998	14.1	14.4	0.3	9	7.8	-1.2
1999	13.5	6.1	-7.4	8	5.7	-2.3
2000	9.4	9.3	-0.1	6	3.6	-2.4
2001	10.4	8.9	-1.5	4.5	4.4	-0.1
2002	9.5	15.3	5.8	5	3.5	-1.5
2003	10.7	17.9	7.2	4	3.1	-0.9
2004	11	19.5	8.5	3.9	4.6	0.7
2005	11.2	19.2	8	5	9.3	4.3
2006	12.8	14.8	2	8	7.9	-0.1

Source: Omer and Saqib (2009). n.a, not available.

Due to inherent problems with current monetary policy strategy of monetary targeting, several studies have suggested either to rethink the current monetary policy strategy or to adopt inflation targeting (see Omer and Saqib, 2009; Moinuddin, 2009; Saleem, 2010). One of the dimensions of the critique against the existing monetary targeting set-up is the instability of money demand function. For example, a number of empirical studies have found that money demand function is unstable and the velocity of circulation of money is not constant (see Ahmed and Khan, 1990; Qayyum, 2006; Omer and Saqib, 2009; Moinuddin, 2009). Nevertheless, there exist a literature that concludes to the contrary such as Khan (1994) and Azim *et al.* (2010).

Although the empirical literature in Pakistan seem to be agreeing that inflation is mainly a monetary phenomenon (see Table 2.3) but it is far from being conclusive based on the evidence of money demand stability if the monetary targeting should be discontinued – as at best the literature examining the money demand function is mixed (see Table 2.4).

Another dimension relates to the studies that have explored inflation targeting as a potential alternative monetary policy strategy to the contemporary monetary policy of aggregates targeting. These studies may broadly be classified as the opponents and proponents of the adoption of inflation targeting as a monetary policy strategy in Pakistan.

The opponents of adoption of inflation targeting (Chaudhry and Choudhry, 2006; Akbari and Rankaduwa, 2006; Felipe, 2009; Naqvi and Rizvi, 2010) largely base their argument on their findings that the adoption of the strategy may hurt economic growth and/or the pre-requisites for inflation targeting in Pakistan are not in place. Chaudhry and Choudhry (2006) for example, concluded that money supply has no effect on inflation both in the long and short-run and that there exists a proportionate long-run relationship between money supply and output growth. Moreover, they found that the growth rate of import prices is the most important determinant of inflation in Pakistan and any attempt by the central bank to reduce inflation through monetary policy will plunge the economy into severe recession.

Table 2.3: Selected empirical literature on determinants of inflation in Pakistan

Authors	Estimation technique	Dependent variable/s	Independent variables	Sample period	Frequency	Key findings
Saleem (2010)	VAR	CPI inflation , Call money rate and output gap	CPI inflation and its lag , Call money rate and its lag and output gap and its lag	1970-2009	Annual	Interest rate and output gap are negatively related to inflation and hence inflation targeting is suggested
Serfraz and Anwar (2009)	Johansen Cointegration Test, VAR	CPI inflation	M2, internal borrowings and external borrowings	1976-2007	Annual	M2 and fiscal deficit are positively and significantly related to the inflation in the long-run.
Khan and Saqib (2007)	GMM	CPI inflation	M2, Private sector credit, Fiscal balance, lagged inflation, agriculture output, per capita GDP, Oil price, Trade share, Dummies representing political scenario	1951-2007	Annual	Inflation and political instability are positively associated
Omer and Saqib (2009)	OLS, Granger Causality test and ARDL	CPI inflation	M2 and real GDP	1975-2006	Annual	One-on-one relationship between M2 and inflation does not hold
Haider and Khan (2007)	GARCH, ARDL Bounds Testing Approach	CPI inflation	Volatility in government borrowing from central bank (GBCB)	1992:7-2007:6	Monthly	Inflation and volatility in government borrowing from central bank are related both in the long and short-run
Khan and Gill (2007)	OLS	CPI inflation food, CPI inflation general, WPI inflation, SPI inflation and GDP deflator	M1, M2 and M3	1975-2007	Annual	All the dependent inflation indicators are positively associated the three monetary indicators (M1, M2 and M3)

Table2.3 Continued……... Selected empirical literature on determinants of inflation in Pakistan

Authors	Estimation technique	Dependent variable/s	Independent variables	Sample period	Frequency	Key findings
Hanif and Batool (2006)	OLS, Heteroscedasticity and Autocorrelation Consistent (HAC) estimator	CPI inflation	Reserve money, real GDP, ONIR, wheat support price, openness indicator (growth in trade to GDP ratio)	1973-2005	Annual	Significant negative relationship between inflation and openness
Agha and Khan (2006)	Johansen Cointegration, VECM	CPI inflation	Fiscal deficit, Overall bank borrowing	1973-2003	Annual	Inflation is cointegrated with fiscal deficit and bank borrowing
Chaudhry and Choudhary (2006)	ARDL	GDP deflator	Import prices, M2 and real GDP	1972-2004	Annual	M2 does not significantly explain inflation in the long-run
Qayyum (2006)	ARDL	CPI inflation	M2, GDP, Income velocity of money	1960-2005	Annual	M2 is a significant contributor to inflation. M2 affects growth in the first round and inflation in the second round.
Khan and Schimmelpfennig (2006)	Johansen Cointegration, VECM	CPI inflation	M2, Private sector credit, 6-month treasury bill rate, Large-scale manufacturing (LSM) Index, Exchange rate, GDP	1998:1-2005:6	Monthly	Monetary factors (M2 and private sector credit) dominantly explain inflation in the long-run whereas wheat support prices have a short-run impact only.
Kemal (2006)	Johansen Cointegration, VECM	CPI inflation	M2, GDP	1975:1-2003:4	Quarterly	M2 is a long-run determinant of inflation whereas in the short-run it affects the inflation with a lag of three quarters.
Bokil and Schimmelpfennig (2005)	OLS, ARIMA, VAR	CPI inflation	Lagged inflation, M2, M0, Private sector credit, 6-month treasury bill rate, Large-scale manufacturing (LSM) Index, Output gap	1998:06-2004:12 and 1975-2004	Monthly and Annual	Pakistan's data permits quantitative forecasts for inflation and leading indicators approach is best suited for inflation forecasting. M2 and private sector credit provides the leading explanation for inflation.

Table 2.3 Continued……….. Selected empirical literature on determinants of inflation in Pakistan

Authors	Estimation technique	Dependent variable/s	Independent variables	Sample period	Frequency	Key findings
Hyder and Shah (2004)	Recursive VAR	CPI inflation, WPI inflation	Exchange rate, M2, Oil prices and large scale manufacturing (LSM) Index	1988:1-2003:9	Monthly	Moderate exchange rate pass through to CPI
Choudhri and Khan (2002)	VAR	CPI inflation, WPI inflation	Exchange rate, Foreign price Index	1982:1-2001:2	Quarterly	No significant evidence of rupee depreciation pass through to CPI in the short-run
Ahmad and Ali (1999a)	OLS, Engel Granger Cointegration Test, 2SLS	CPI inflation, Exchange rate	Exchange rate, Import prices, Export prices, Money supply, Real GDP, World prices and Foreign exchange reserves	1982:2 to 1996: 4	Quarterly	The speed of adjustment in price level and exchange rate to domestic and external shocks is slow and gradual.
Price and Nasim (1999)	VECM, SUR	CPI inflation, Exchange rate	M2, GDP, Deposit rate, M2, world prices	1974-1994	Annual	Money demand and purchasing power parity acts as attractors of prices.
Chaudhary and Ahmad (1996)	OLS	CPI inflation	GDP, M2, Public debt, Import prices and share of service sector	1972-1992	Annual	Inflation is determined by M2, GDP growth, import prices, public debt and share of service sector
Ahmad and Ram(1991)	OLS	CPI inflation, WPI inflation, GNP deflator, Implicit GNP price deflator	M1, M2, lagged inflation, Real GNP, Unit value of imports	1960-1988	Annual	The growth in import prices, monetary expansion and inflation in the past are the major causes of inflation
Jones and Khilji (1988)	Granger Causality test	CPI inflation, WPI inflation	M1 and M2	1973-1985	Annual	M1 and M2 granger causes WPI inflation but not CPI inflation.

Table 2.4: Selected empirical literature on monetary policy in Pakistan

Authors	Estimation technique	Dependent variables	Independent variables	Sample period	Frequency	Key findings
Anwar and Asghar (2012)	ARDL	Real (M1 and M2)	GDP deflator, real GDP and exchange rate	1975-2009	Annual	A stable cointegrating relationship exists between M2 and its determinants as compared to the unstable cointegrating relationship in case of M1.
Azim *et al*. (2010)	ARDL	M1 and M2	Inflation, income and exchange rate	1973-2007	Annual	Money demand functions are stable both for M1 and M2 measures.
Omer (2010)	ARDL	Velocity of money (Vo, V1 and V2)	Real permanent and transitory incomes, real interest rate, inflation	1975-2006	Annual	Vo and V2 are independent of interest rate whereas V1 is dependent on it.
Moinuddin (2009)		Real M2	Real GDP, real call money rate	1974-2006	Annual	The money demand function is unstable and therefore, the monetary aggregates targeting monetary policy strategy is not appropriate.
Chaudhary *et al*.(2005)	Johansen Cointegration	Real GDP, M1, GDP deflator and call money rate	Real GDP, M1, GDP deflator and Call money rate	1953-2004	Annual	In the long-run the variation in output growth are the more explained by the inflation shocks than the money growth or interest rate changes.
Qayyum (2001)	OLS and Johansen Cointegration analysis, Stability tests	Real M2 (aggregate, business and household)	Call money rate, CPI, WPI, GNP, sales (wholesale and retail trade), interest rate on bank advances, private business sector deposits and personal sector deposits	1959:3-1985:2	Quarterly	Long-run relationship exists between money demand and its determinants. Real income elasticity of money by personal sector is less than the business sector. Inflation is important in determination of money demand function.

Table 2.4 Continued………. Selected empirical literature on monetary policy in Pakistan

Authors	Estimation technique	Dependent variable	Independent variables	Sample period	Frequency	Key findings
Ahmad and Munirs (2000)	OLS, ARMA and cointegration analysis	M1, M2	CPI inflation, lag dependent variable, industrial production index, interbank call money rate and dummies to capture the effect of financial reforms	1972:2-1996:1	Quarterly	As compared to nominal interest rate, inflation is the more relevant determinant of money demand. In the short-run money demand is not sensitive to shocks.
Tariq and Matthews (1997)	VAR, cointegration analysis	M1, M2, divisia M1 and divisia M2	Real GNP, opportunity cost indicator	1974:4-1992:4	Quarterly	The long-run income elasticity of money is greater than unity and short-run parameters of money demand model are stable.
Hossain (1994)	Johansen cointegration	Real (M1 and M2)	Real GDP, CPI inflation and Opportunity cost variables (yield on government bonds, market call rate)	1951-1991	Annual	Narrow money demand function is more stable than the broad money demand function.
Khan (1994)	Engel Granger cointegration test	M1 and M2	CPI inflation, real income, short and medium-term (real and nominal) interest rates	1971:3-1993:2	Quarterly	The relationship between the dependent and independent variables in the long-run is stable and the financial liberalization has not destabilized this relationship as the liberalization program has been implemented gradually.
Ahmad and Khan (1990)	Maximum Likelihood (Cooley and Prescott, 1976 varying coefficients technique)	M1 and M2	GNP, opportunity cost variables (time deposit rate and inter-bank call rate)	1959-1987	Annual	Money demand function is stable from 1959-1981 and unstable thereafter and multiple interest rates are the preferred determinants
Burney and Akmal (1990)	NLLS	Real M2	Real GNP, GNP deflator, inflation volatility	1959-1989	Annual	The adjustment to the desired level of money stock is instantaneous and the expected inflation rate is inversely related to the real money demand.

Similarly, Akbari and Rankaduwa (2006) while assessing the feasibility of inflation targeting found that only the lack of exchange rate pass through favors the adoption of the strategy. However, a relatively lower impact of money supply on inflation, importance of lag adjustments in price level and the likeliness of a considerable loss in output due to the high sacrifice ratio weaken the case for adoption of inflation targeting.

Felipe (2009) considered broader implications of monetary policy regime shift to inflation targeting while highlighting the theoretical foundations. He argued that although Pakistan meets basic technical requirements to implement inflation targeting-lite yet issues like the lack of overwhelming empirical evidence of the inverse relationship between inflation and short-term interest rates should be considered before any final decision is made. Moreover, he suggested that SBP should target full employment subject to constraint on inflation.

Naqvi and Rizvi (2010) concluded from their study that inflation cannot be the only objective of the State Bank of Pakistan and is not yet ready to adopt inflation targeting framework. They evaluated the preconditions of inflation targeting qualitatively in Pakistan and argued that most of the preconditions are not in place. Moreover, they empirically explored the relationship between short-term interest rates and inflation and found that the former does not affect the latter directly but through money supply channel, therefore the case for the adoption of inflation targeting is not warranted.

The proponents of adoption of inflation targeting (Khalid, 2006; Zaidi, 2006; Moinuddin, 2009; Saleem, 2010; Zaidi and Zaidi, 2011) either base their arguments on the instability of money demand function that makes continuation with monetary targeting less favorable or believe that inflation targeting has performed well in emerging market countries and therefore it is appropriate to move towards inflation targeting.

Khalid (2006) for example, argued that despite the fact that all the preconditions were not met in some of the emerging economies, adoption of inflation targeting benefited them in terms of price and macroeconomic stability. Moreover, improved macroeconomic conditions in the country make it a good time to consider inflation targeting as a monetary policy strategy.

Zaidi (2006) argued that adoption of inflation targeting in Pakistan will help anchor inflation expectations and reduce surprise inflation (and its associated costs) emanating from fluctuations in output. Saleem (2010) recommended the adoption of flexible inflation targeting largely based on two major findings. First, the paper found evidence of the existence of the interest rate channel for price stability and second, GDP growth and inflation were found to be negatively related in Pakistan. Zaidi and Zaidi (2011) emphasized the need for developing forecasting capabilities and enhancing the level of transparency.

On the other hand, Moinuddin (2009) argued that success of monetary targeting depends on a stable and predictable relationship between monetary aggregates. This relationship has significantly weakened due to financial innovation and increased application of technology in the financial sector of Pakistan. Alternatively, he suggested inflation targeting-lite as a monetary policy strategy due to its superior qualities (flexibility, transparency, easy to understand target and accountability) and improvements needed in terms of central bank independence, fiscal prudence, appropriate measure of inflation, training of staff and legislative support.

2.5 SUMMARY AND CONCLUSION

The literature reviewed highlights the issue of discretion and its inflation bias outcome. The main sources of inflation bias are the exercise of discretion by monetary policy makers either to achieve higher than natural rate of the economy or its fear not to allow inflation to fall below a certain level as the economy may plunge into recession. Binding rules, incentive contracts, punishment equilibria, reputation and delegation are some of the potential solutions presented to overcome the issue of inflation bias. The pertinent empirical literature does not clearly distinguish between inflation and inflation bias per se. Moreover, the discretion is rather descriptively discussed and there is lack of its quantitative proxies to use in empirical analysis.

The synthesis of the literature indicates that in the set of monetary policy strategies being practiced; inflation targeting is the best available strategy, which reduces the problem of inflation bias. Although there remains some skepticism and uncertainty regarding inflation targeting in the sense that inflation targeting is rigid and may affect growth and other macroeconomic indicators adversely, however, no study to the best of author's knowledge has been able to produce substantive evidence to this effect. Analysis of the relevant empirical literature shows that there is sufficient evidence that inflation targeting has performed satisfactorily well not only for the developed countries but also for the developing countries. It has improved the effectiveness of monetary policy, which is evident from the improved macroeconomic indicators by and large as compared to other monetary policy regimes.

The literature, however, has identified some preconditions, which arguably are important but not strictly necessary for the successful implementation of the inflation targeting monetary policy framework. Nonetheless, the availability of core inflation measures, the potential costs of disinflation, and determination of appropriate targets of inflation are some of the technical aspects that are considered important for the effective performance of inflation targeting.

Owing to the unsatisfactory performance of monetary targeting in Pakistan (also see Chapter 3 to this effect for a thorough analysis), a few studies have suggested adoption of inflation targeting framework. Nevertheless, some others have expressed their reservations especially in terms of the potential growth losses and inadequacy of preconditions. As mentioned earlier, preconditions may not necessarily and strictly be in place before adoption of inflation targeting. The current study, however analyses the validity of growth skepticism (potential growth losses) in Pakistan by ascertaining the extent of the growth benefit from discretion in Chapter 3, Chapter 4 and Chapter 6 covering its various dimensions.

CHAPTER 3
EVALUATING THE PERFORMANCE OF THE TYPICAL DISCRETIONARY MONETARY POLICY STRATEGY OF PAKISTAN: A WELL-BALANCED MONETARY POLICY APPROACH

3.1 INTRODUCTION

Since, there is no standard monetary policy evaluation framework that specifically and uniquely assesses a typical discretionary monetary policy strategy; this chapter proposes a new discretion-assessment approach to evaluate Pakistan's monetary policy. Pakistan's monetary policy characterizes the salient features of a typical case of discretion as theorized by the influential work of Kydland and Prescott (1977) and Barro and Gordon (1983). The country's central bank targets monetary aggregates for the achievement of its statutory twofold objectives of inflation and growth (SBP Act, 1956) and tries to achieve a higher than natural growth level of the economy (see Figure 2.1).

Given the crucial role of monetary policy, the need to evaluate the performance of monetary policy is both widely recognized and increasingly practiced. It helps motivate central banks to vigilantly achieve its objectives and develop its capability to conduct monetary policy in the best possible manner. The performance of monetary policy is broadly evaluated on ex post, ex ante and comparative basis.[57] Monetary policy evaluation on a comparative basis has attracted much of the academic research that may fall into three main areas.

Firstly, models that compare the actual performance of monetary policy with hypothetical performances of alternative monetary policies (see for example, Taylor, 1979; McCallum, 1988; and Ireland, 1997). Secondly, a variety of models depending on the size, level of integration (openness) and the nature of policy (backward-looking or

[57] See Svensson (2009) for discussion on ex post and ex ante monetary policy evaluation approaches.

forward-looking) have been developed primarily to assess the policy rules consistent with inflation targeting (see Rudebusch and Svensson, 1998; Clarida *et al.*, 1999; Moron and Winkelried, 2005). Lastly, the assessment of commitment versus discretion as modeled by Kydland and Prescott (1977) and Barro and Gordon (1983) and subsequently researched by hundreds of studies (see for example, the survey of Gartner, 2000). However, empirically the relevance of commitment versus discretion is recently evaluated by Givens (2012) using a forward-looking New Keynesian model of output and inflation for the U.S. economy. He estimated the model representing discretion, then simulated it to produce counterfactual estimates for commitment, and then systematically compared their effects.

Nevertheless, the current study asserts that such a comparative approach for the evaluation of discretion may not be self-fulfilling. As noted by Dennis (2005), counterfactual simulations are model dependent, and as such they may not necessarily have the correct structure and therefore may be misleading by themselves. Moreover, *the divergence in the responsibilities of the monetary policy makers both under commitment and discretion* does not allow a common yardstick for comparative evaluation. For example, under the former, the main objective of the central bank is price stability, whereas under the latter there are at-least two objectives, namely inflation and growth.[58] Therefore, it is hard to quantify the true preferences (weights) of central bankers in such models. Generally, under commitment the central banker is inflation averse, and gives less importance to the output-stabilization. Whereas the converse may be true for discretion.

As a starting point, a reasonable assessment-approach then is to evaluate the monetary policy on the basis of its objectives. This may be quite straightforward for

[58] As mentioned and showed earlier, Pakistan's monetary policy is one such unique example.

commitment- based monetary policy frameworks as they can be evaluated on the basis of the assigned inflation targets. However, such a straightforward evaluation of a discretionary monetary policy can be misleading, particularly in the short-term, as the achievement of the inflation and output objectives may be conflicting with each other.[59]

The current study posits that in the long-run, a discretionary central banker may justifiably be expected to achieve a reasonable balance between the inflation and growth stabilization objectives to enhance the social welfare. After all, the primary purpose of allowing discretion to the central banker is to seek a reasonable balance between inflation and growth, which is beneficial for the economy. Svensson (2009, p. 3) highlights the achievement of such a 'balanced' state in the context of inflation targeting as "a well-balanced monetary policy". He expressed it by noting that "the central bank choses an instrument rate path that the forecast of inflation and resource utilization "looks good"…To be more precise, it means a forecast for inflation and resource utilization that as effectively as possible stabilizes inflation around the inflation target and resource utilization around its normal level and, in the event of conflicting objectives, achieves a reasonable compromise between inflation stability and resource utilization".

The extent of achievement of such a balance by the discretionary central banker provides a natural yardstick for the evaluation of discretion. This study borrows the notion of a well-balanced monetary policy and extends it into a framework for ex-post evaluation of the typical discretionary monetary policy strategy of Pakistan. The study

[59] It may be noted that Svensson (2009) argued that evaluation solely on the basis of assigned inflation targets may not be the best way to evaluate and that it may lead to wrong conclusions due to the lags involved in monetary policy transmission as well as the unanticipated shocks to the economy that affect the outcomes. Moreover, the inflation targets by themselves may be non-sensical as is the case in Pakistan (see Figure 2.1). The targets for inflation seem to be naïve and it is hard to find a valid economic theory or a standard prevailing practice that may explain that high real growth levels are achievable by critically high and erratic inflation targets on period by period basis. Thus evaluation, for example, on the basis of such inflation targets may not be a useful practice.

builds on the premise that the balance between inflation and growth (inflation-growth nexus) may be categorized into three empirically identifiable scenarios.

The first scenario is to stabilize inflation around an optimal level, which is defined for the purposes of this study as a unique low rate of inflation that exerts a significantly positive long-run effect on real growth and stands highest in terms of magnitude as compared to any other inflation rates.[60] The second is to stabilize inflation around a desirable level, which is defined as a rate or rates of inflation that exerts a significantly positive effect on the real output but its quantitative effect is less than that of an optimal rate.[61] Finally, to stabilize inflation around a threshold level, which is defined as a unique rate of inflation beyond which the effects of inflation on real growth turns negative.[62]

While setting these three scenarios as benchmarks for the evaluation of the discretionary monetary policy strategy of Pakistan, the objectives of this study are as follows. The first is to investigate the long-term nexus between inflation and real growth to identify and estimate the benchmark inflation rates. Secondly, to evaluate the actual performance of Pakistan's discretionary monetary policy strategy against the estimated benchmarks for a 50-year time period. Since, evaluation of this nature has

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[60] There is no specific and well established definition of 'optimal' rate of inflation in the literature. For example Friedman (1969) argued that a negative inflation rate is optimal. Billi and Kahn (2008) perceive it as a rate that maximizes the economic well-being of the public. Juhasz (2008) views optimal inflation as the rate at which the costs and benefits of inflation balance out. Nonetheless, in some of the monetary models the optimal rate is the outcome when the nominal interest rate is zero (Billi and Kahn, 2008). Bernanke (2004) stressed the need for more research for the determination of optimal long-term inflation rate due to the implicit or explicit crucial nature of such approximations in policy making.

[61] This definition is consistent with the argument of Garman and Richard (1989) that from a society's point of view, any change in inflation may be desirable that leads the economy towards the optimum.

[62] The threshold level of inflation is the rate beyond which the effects of inflation on growth turn harmful (see Sarel, 1996 and Bruno and Easterly, 1998).

never been done for Pakistan thus far, the current research may aid to institutional accountability mechanisms to ensure robust monetary evaluation processes.[63]

Auto Regressive Distributed Lag (ARDL) bounds testing and estimation approach of Pesaran *et al.* (2001) is used to explore the long-run nexus between inflation and real growth. The results indicate that 1% inflation rate is optimal. The inflation from 2% to 3% is desirable whereas 5% is the threshold inflation rate. The actual performance of the discretionary monetary policy strategy of Pakistan presents a dismal picture when evaluated against the benchmark optimal, desirable and threshold values. For example, over the 50-year time frame from 1960 to 2010, using discretion, the observed inflation could be stabilized around the optimal, desirable and threshold benchmark levels only at 8%, 18% and 38% of the time, respectively. This implies that the observed inflation has remained in detrimental range (where its observed effects on growth are negative) for 62% of the 50-year time period.

The rest of the chapter is organized as follows: Section 3.2 briefly discusses the inflation-growth nexus and elucidate on the distinction among optimal, desirable and threshold inflation rates. Section 3.3 highlights the methodological framework, estimation strategy and specifies the baseline growth model. Section 3.4 discusses the data and conducts the unit root tests. Section 3.5 present and draw on the results while the concluding remarks are given in the last Section 3.6.

[63] A brief review of the monetary policy literature in Pakistan reveals that the determination of money demand stability has remained the focus of most of the researchers (see Table 2.4). Recently, Hasan and Shahzad (2011) constructed a monetary sector model to evaluate monetary policy responses. They used their model to assess the impact of alternative monetary policy instruments under rules and discretion. Nevertheless, their objectives, methodology, sample size and data are different from the current study.

3.2 THE INFLATION-GROWTH NEXUS AND THE DISTINCTION AMONG OPTIMAL, DESIRABLE AND THRESHOLD INFLATION RATES

Historically, the empirical evidence about the long-term relationship between inflation and growth has varied over time. In the 1960s the advent of the Phillips curve and its subsequent popularization by economists such as Paul Samuelson and Robert Solow brought into limelight the positive relationship between inflation and growth. There was a widespread belief that monetary policy maker could reduce unemployment by accepting high levels of inflation. Nevertheless, the proceeding stagflation of the 1970s led to the emergence of the popular work of Milton Friedman and Robert E. Lucas who criticized the Phillips curve relationship. Friedman argued that the positive relationship between inflation and output is a short-run phenomenon.

The research of Kydland and Prescott (1977) furthered the literature on the way the monetary policy should be conducted based on the insignificant relationship between inflation and growth. They maintained that with the help of activist monetary policy output cannot be pushed beyond its natural rate in the long-run. This line of research led to the emergence of commitment based monetary policy frameworks (inflation targeting), which assume a negative relationship between inflation and growth (see for example Dotsey, 2008). Several empirical studies such as De Gregario (1992-93), Barro (1995), Bullard and Keating (1995) and Wilson, 2006 validated the negative relationship between inflation and growth.

Another strand of empirical research found the evidence of a non-linear relationship between inflation and growth (see for example the pioneering study of Fischer, 1993). Sarel

(1996) and Khan and Senhadji (2001) are the key studies extending this line of research with their prime focus on identification of the threshold levels of inflation (inflection points) for a cross section of countries using a similar framework but different econometric approaches.[64] Their and the findings of other studies are mixed. For example, Sarel (1996) found 8% inflation as threshold; Khan and Senhadji (2001) found 12% for developing countries and 3% for developed countries. Ghosh and Phillips (1998) found the threshold at 2.5% for a sample larger than Sarel's. Drukker *et al.* (2005) and Pollin and Zhu (2006) found high threshold levels at around 19% and 18%, respectively. Recently, Lopez-Villavicencio and Mignon (2011) found 17.5% as inflation threshold for developing countries compared to the 2.7% threshold for industrial countries. Burdekin *et al.* (2004) however, arrived at a threshold of 3% for developing countries. Although in part, the methodological differences and selection of time periods may have led to diversity in the findings, the literature is yet to be furthered in explaining such differences in threshold estimates between developed and developing countries.

Indeed, driven by the mixed nature of findings for a cross section of countries, a number of case studies have been undertaken to analyze country-specific data. For example, Kannan and Joshi (1998), Samantaraya and Prasad (2001), Singh and Kalirajan (2003) and Mohanty *et al.* (2011) investigated the issue of non-linearity and threshold levels for India, Hayat and Kalirajan (2009) for Bangladesh, Munir and Mansur (2009) for Malaysia, Lee and Wong (2005) for Taiwan and Japan and Salami and Kelikume (2010) for Nigeria.

[64] Sarel (1996) used ordinary least squares (OLS) whereas Khan and Senhadji (2001) used nonlinear least squares (NLLS).

Similarly, in the case of Pakistan, the studies that attempted to explore the issue of nonlinearity mainly focused on investigating the threshold levels of inflation. For example, Mubarak (2005) found 9% as the threshold, Hussain (2005) suggested 6% inflation as threshold, Nawaz and Iqbal (2010) concluded at two threshold levels of 6% and 11%, whereas Akmal (2011) found 4% as the inflection point.

It is pertinent to discuss that some of the recent studies (see for example, Seleteng, 2005; Juhasz, 2008 and Ahortor *et al*, 2012) treat ‘threshold’ and ‘optimal’ rate of inflation synonymously and indistinctly. The distinction between the two is important for appropriate empirical investigations and for laying down a sound basis for research. The threshold level of inflation is the rate beyond which the effects of inflation on growth turn harmful (see Sarel, 1996 and Bruno and Easterly, 1998). A threshold inflation rate may not necessarily be optimal or desirable rather this study argues that such inflation rates may be treated distinctively in empirical investigations.

This distinction can be brought out by considering a hypothetical example. Assuming if there is only one threshold (reflection point) in the data identified through a growth model, which occurs say at the 7 % inflation rate, this would imply that the signs of the coefficients of individual inflation rates beyond 7% are expected to be negative and they may or may not be statistically significant. Similarly, the coefficients of each individual inflation rate ranging from 1% to 7% should be positive, irrespective of its statistical significance. Nevertheless, it is likely that some of them may be statistically significant and others may not. All the statistically significant inflation rates below the threshold level may be deemed as ‘desirable’ as they roughly approximate improvement in well-being of the society because they are causing the economy to grow. This proposition is consistent with the argument of Garman and Richard (1989) that from a society's point of view, any change in inflation may be desirable that leads the economy towards the optimum. In, the set of 'desirable' inflation rates, the 'optimal' inflation rate would be the one with relatively larger coefficient size and high statistical significance. Such a particular inflation rate is unique in the sense that it ensures the maximum growth of the economy and hence the maximum welfare gains to the society.

3.3 METHODOLOGY

3.3.1 Framework for estimation of optimal, desirable and threshold inflation rates

Both Sarel (1996) and Khan and Senhadji (2001) are important studies that estimated the threshold effects of inflation on growth. Whereas both use the same framework, Khan and Senhadji opted for NLLS as opposed to the OLS estimation technique applied in Sarel's work. The use of the NLLS, which assumes asymptotically normal distribution, was primarily motivated to determine if the threshold effect was statistically significant. The focus of the current study, however, is to examine the magnitude and direction of effects of individual inflation rates on real growth for a range of observed inflation rates, primarily to identify estimate the optimal, desirable and threshold inflation rates.

This study uses a similar framework to that of Sarel (1996) for the estimation of the effects of various arbitrary values of observed inflation on output (see Section 3.3).[65] The framework suggests simulation of the variable expressed as $D_t.(\pi_t^0 - \pi_a)$ through a

[65] The econometric technique and the model used here are more advanced. In contrast to the static baseline model of Sarel (1996), this study uses a dynamic model to account for the lag effects of the dependent and independent variables, tests and estimates the cointegrating relationship through ARDL. Moreover, the simulation is carried out on a stable and robust baseline growth model.

baseline growth model. Where, π_t^0 is observed inflation rate and π_a is the arbitrary value of inflation rate at which the structural break might occur. D_t takes the value 1, if $\pi_t^0 > \pi_a$ and 0, if $\pi_t^0 \leq \pi_a$. The expression $D_t.(\pi_t^0 - \pi_a)$ captures the difference in the effects of inflation on growth between the two sides of the structural break.

3.3.2 Specification of the baseline growth model

The empirical analysis of the effects of individual inflation rates on growth requires specification of a baseline growth model to simulate the variable $D_t(\pi_t^o - \pi_a)$ for various arbitrary rates of inflation. Although research has identified a range of growth determinants (Levine and Renelt, 1991 provides a summary of such variables) but all of them have not been found robust except investment (see Levine and Renelt, 1992). This study specifies a model consistent with popular growth studies such as Barro (1990); Romer (1989); Romer (1990b); Barro (1991); Barro and Sala-i-Martin (1992); Levine and Renelt (1992); Barro (1995); Barro and Sala-i-Martin (1995); Sarel (1996) and Khan and Senhadji (2001).

The error correction version of the specified ARDL baseline growth model for testing the long-term equilibrium relationship is given as:

$$\Delta\widehat{GDP}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta\widehat{GDP}_{t-i} + \sum_{j=0}^{q1} \alpha_j^{\pi} \Delta\pi_{t-j} + \sum_{k=0}^{q2} \alpha_k^{POP} \Delta\,\widehat{POP}_{t-k} + \sum_{l=0}^{q3} \alpha_l^{INV} \Delta\,\widehat{INV}_{t-l} ..$$

$$+ \sum_{0}^{q4} \alpha_m^{FDI} \Delta\left(\frac{FDI_{t-m}}{GDP_{t-m}}\right) + \beta_0 \widehat{GDP}_{t-1} + \beta_1 \pi_{t-1} + \beta_2 \widehat{POP}_{t-1} + \beta_3 \widehat{INV}_{t-1} ..$$

$$+\beta_4 \left(\frac{FDI_{t-1}}{GDP_{t-1}}\right) + \epsilon_t \qquad (3.1)$$

Where, $\widehat{GDP}$ is the growth rate of real GDP and Δ denotes the first difference operator. The π is the annual inflation rate based on consumer price index (CPI). The $\widehat{POP}$ represents population growth rate, $\widehat{INV}$ is the investment indicator showing the growth rate of gross fixed capital formation, $\left(\frac{FDI}{GDP}\right)$ is the ratio of foreign direct investment to the real GDP and finally ϵ is the error term.

3.3.3 The choice of estimation strategy

In contrast to the Sarel's simple OLS estimation, this study estimated cointegrating relationships as it is the most appropriate way to avoid spurious regression (in a time series data) and account for dynamics. The Autoregressive Distributed Lag (ARDL) approach of Pesaran *et al.* (2001) is used for estimation purposes. None of the studies reviewed in the previous section used the cointegration approach in their estimation, which is particularly important for the country case studies as they use time series data for their analysis.

In the class of dynamic models, cointegration techniques are the most appropriate options to explore long-run relationships. In econometric jargon, the time series of variables are said to be cointegarated if there is a long-run equilibrium relationship between them or that they trend together (Koop, 2009). Broadly, three econometric techniques are employed to estimate and test the long and short-run relationships between variables while assuming stationary processes in the underlying time series.[66] First, is the traditional two-step

[66] The use of time series data in empirical investigations implicitly assumes the data to be stationary (Gujarati and Porter, 2009). The key characteristics of a stochastic stationary process is that of constancy of mean, variance and the dependence of its covariance on time between lagged observations only (Watshman and Parramore, 1997; Gujarati and Porter 2009). If the time series data is non-stationary (absence of any of the characteristics), it leads to the problem of *spurious or nonsense* regression (Granger and Newbold 1974; Phillips, 1987; Koop, 2009 and Gujarati and Porter 2009). The spurious results imply that the conventional statistics such as R-Square, T-test and Durbin-Watson statistics are unreliable and the estimates are biased (Escudero, 2000).

residual-based approach introduced by Engel and Granger (1987). Second, is the system based reduced rank approach of Johansen Cointegration and VECM framework (Johansen and Juselius, 1990 and Johansen, 1991-1995a). Third, is the relatively new Auto Regressive Distributive Lag (ARDL) bounds testing and estimation approach to cointegration proposed by Pesaran and Shin (1999) and Pesaran *et al.* (2001).

The first two approaches strictly requires the variables to be integrated of order I(1). If the variables are not I(1) or even near integrated, their estimates may not be reliable (Hjalmarsson and Osterholm, 2007). There is also a chance of incorrect determination of order of integration of underlying series. The Augmented Dicky Fuller (ADF) or Phillips Perron (PP) tests in small to moderate samples suffer from low size and power properties (Enders, 1995).

However, the ARDL does not require pre-testing of order of integration. It may be applied to variables integrated of order I(0), I(1) or both and allows to capture optimal lag effects of dependent and independent variables. The estimators of the ARDL are superconsistent for long-run coefficients and it performs particularly well in small samples without losing long-run information. Further, the presence of cointegration facilitates the analysis of short-run dynamics using ECM framework (Rushdi *et al*., 2012).

The ARDL approach allows the selection of optimal dynamic models. For example, the model is selected with optimal lags for the regressand and regressors using a certain model selection criterion. These criteria are the Akike Information Criterion (AIC) proposed by Akaike (1973-1974), Schwarz Bayesian Criterion (SBC) proposed by Schwarz (1978), and Hannan and Quinn criterion (HQC) proposed by Hannan and Quinn (1979).

These criteria are particularly helpful when the true orders of lags are not known in theory and reliable empirical estimates of transmission time are not available. Among the set of these selection criteria, the researchers may decide on the appropriateness of any particular criterion on the basis of their characteristics. For example, AIC selects the least parsimonious model (a model with the maximum number of freely estimated parameters) as against the SBC, which selects the most parsimonious model (with the least number of freely estimated parameters). Pesaran and Pesaran (1997) noted that the HQC lies somewhere between the SBC and AIC. Pesaran and Shin (1999) reported that SBC is a consistent model selection criterion compared to the AIC, specifically, in small samples and that it selects a relatively more parsimonious model (Enders, 1995). The ARDL works even in the presence of endogenous regressors irrespective of the order of integration I(1) and I(0) of explanatory variables (Pesaran and Pesaran, 1997; Pesaran and Shin 1999).

This study therefore, uses the ARDL bounds testing and estimation approach of Pesaran *et al.* (2001) for empirical analysis.[67] Operationally, the ARDL is a two-stage procedure. The first stage is to test for the existence of the cointegrating relationship by computing the F-statistic. Since the asymptotic distribution of this F-statistic is non-standard, Pesaran *et al.* (2001) tabulated two sets of appropriate critical values for I(0) or I(1), for different numbers of regressors (k) with and without intercept and trend. If the computed F-statistic falls outside the band for respective critical values of I(0) or I(1), cointegration exists and if it falls within that band, then the result of the inference is inconclusive. In the second stage, long and short-run coefficients are obtained provided the cointegration is established in the first stage.

[67] It is pertinent to mention that the ARDL testing and estimation approach is used hence forth for testing and estimation purposes of all the required models in Chapters 4, 5 and 6.

Another added advantage of the ARDL approach is that it allows testing for the stability of the relationships. The stability of the long and short-run coefficients is important because the existence of a long-run relationship does not necessarily imply the relationship is stable (Bahmani-Oskooee and Bhol 2000; Bahmani-Oskooee, 2001). The regression analyses of time series data assume that the regression relationship is constant over time; however, it is desirable to examine its validity (Brown *et al.,* 1975). The stability of long and short-run coefficients depends on the stability of the auxiliary optimal models selected through the model selection criteria. The stability tests such as cumulative sum of *squares of residuals (CUSUM)* and the cumulative sum of *squares of recursive residuals (CUSUMQ)* proposed by Brown *et al.* (1975) would be used in this chapter as well as in Chapter 4, 5 and 6 with a view to make sure that the final estimates are derived from stable regression functions, where the regression coefficients do not exhibit systematic changes and sudden departures of constancy.

3.4 DATA AND VARIABLE'S STATIONARITY PROPERTIES

Annual time series data for the period 1961-2010 obtained from the World Bank Development Indicators (WDI) and State Bank of Pakistan (SBP) have been used for the purpose of empirical investigation. Although, the data sources are quite reliable the possibility of errors and omissions may not be precluded. Nevertheless, its identification and correction is beyond the scope of this study. This study uses an extended data set as compared to the studies that deals specifically with the estimation of the threshold level of inflation in Pakistan, namely Mubarik (2005); Hussain (2005) and Nawaz and Iqbal (2010). Those studies used comparatively shorter annual time series from 1973-2000, 1973-2005 and 1961-2008, respectively.

In order to justify the choice of the ARDL approach instead of the traditional cointegration techniques, the stationarity properties of the underlying variables are tested through three popular unit root tests, which yields inconsistent results for some of the variables (Table 3.1). For example, population growth indicator $\widehat{POP}$ is I(1) as Per ADF, both I(0) and I(1) as per DF-GLS and even I(2) as per the PP tests (see Table 3.1 for unit root tests results).[68] In such a case, where the order of integration of variables cannot be determined for sure, the use of traditional cointegration techniques, which requires the variables to be integrated of order I(1) may lead to unreliable results. The stationarity properties of the variables show that they are a mixture of both I(0) and I(1), which reinforces the choice of the use of ARDL approach for testing and estimation purposes.

3.5 RESULTS AND DISCUSSION

3.5.1 Baseline growth model

In the first step the long-run estimates of the baseline growth model specified in Section 3.2 were obtained using the ARDL testing and estimation strategy of Pesaran *et al.* (2001). It is pertinent to mention that numerous potential variables were tried for inclusion in the baseline model such as government debt to GDP ratio, export to GDP ratio, import to GDP ratio, export plus import to GDP ratio, exchange rate, trade balance, $M2$ to GDP ratio and various proxies for human capital.[69]

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[68] Trying all the available specifications of no intercept, intercept, intercept and trend, the null hypothesis that the POP has a unit root could not be rejected both in level and in first difference. The null could be rejected in the second difference [with a P-value at 0.03]; however, this result may still not be reliable due to the presence of autocorrelation given the DW statistic as 0.25.

[69] For a review of the empirical growth literature, see Levine and Renelt (1991). They surveyed 41 growth studies out of which 33 included investment, 29 included population growth, 18 included measures of initial income and 13 included measures of human capital.

Table 3.1: Stationarity properties of the variables

	ADF		DF-GLS		PP	
Variables	**Level**	**First difference**	**Level**	**First difference**	**Level**	**First difference**
π	[0.03]**	[0.00]***	[-2.69]***	[-6.66]***	[0.03]**	[0.00]***
(DW)	1.76	2.00	1.78	1.98	1.76	2.00
$\widehat{POP}$	[0.70]	[0.07]*	[-1.28]*	[-1.65]*	[0.91]	[0.19]
(DW)	2.25	2.16	2.25	2.17	0.17	0.42
$\widehat{GDP}$	[0.00]***		[-5.76]***		[0.00]***	
(DW)	2.03		2.03		2.03	
$\widehat{INV}$	[0.00]***		[-0.54]	[-0.92]	[0.00]***	
(DW)	2.10		2.18	2.18	2.10	
$\frac{FDI}{GDP}$	[0.98]	[0.00]***	[-0.71]	[-5.50]	[0.93]	[0.05]*
(DW)	1.94	1.93	1.92	1.84	1.05	1.10

This Table reports the P-values of the Augmented Dicky Fuller (ADF) and Phillips Perron (PP) tests and the t-statistics of the Elliott-Rotenberg-Stock DF-GLS in brackets. The Durbin Watson (DW) statistic is also reported to show that (i) different tests may yield varied results and (ii) stationarity was achieved while the residuals were uncorrelated. ***, ** and * indicates that the series are stationary at 1%, 5% and 10% level of significance, respectively.

These variables were dropped subsequently, because either they were (i) insignificant, (ii) non-cointegrated or (iii) the estimated models (while retaining these indicators) could not pass the key diagnostic tests (for normality, serial correlation, functional form and heteroscedasticity) and stability tests such as *CUSUM* and *CUSUMQ*.[70] Thus, consistent with Levine and Renelt (1992) approach, the specified model is robust in the sense that the relatively fragile variables have been dropped. The sub-period robustness check is conducted in the next sub-section.

As in practice the 'true' orders of the ARDL (p, q) model are rarely known a priori, the model was selected through the SBC. This is a relatively consistent model selection criterion in small samples that leads to the selection of most parsimonious model with the least number of freely estimated parameters (Enders, 1995; Pesaran and Pesaran, 1997). To allow a reasonable transmission time for both dependent and independent variables, a maximum lag length of 3 was imposed as the data used is annual, for which 2 to 3 years is deemed appropriate. The order of the model specified by the SBC is ARDL (0,2,1,0,1). The error correction term $ECM(-1)$ may not be obtained because the SBC did not select lag dependent variable as optimal.[71] The null hypothesis of no cointegration, $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ against the alternative $H_0: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$ was tested using the F-test.

[70]The diagnostic and stability tests are particularly important to guard against the impact of potential structural breaks in the economy during the sample period. In order to capture the effect of the well-known shocks in inflation (1973, 1974 and 1975) in the aftermath of war with India in 1971 and the impact of international oil shocks in 1973, a dummy variable was introduced into the model but it was dropped due to its insignificance. This decision was further supported by the joint test of zero restrictions on the coefficient of the deleted variable. The P-values of the LM, LR and F-test are 0.74, 0.74 and 0.77, respectively.

[71] Technically, this is the case with ARDL models to reduce to Dynamic Distributed Lag models if the model selection criterion does not identify any lag of the regressand as optimal.

Since the computed F-statistic (7.34) is greater than the asymptotic upper critical value bound (4.68) at 1 % level, the existence of the long-term cointegrating relationship is confirmed. It is important to mention that the baseline growth model is sound as it did not present any diagnostic issue. The hypothesis of residual serial correlation, functional form misspecification, normality of residuals and heteroscedasticity were tested (Table 3.2).[72]

Moreover, cumulative sum of *squares of residuals* ($CUSUM$) and the cumulative sum of *squares of recursive residuals* ($CUSUMQ$) tests proposed by Brown *et al.* (1975) were used to make sure that the long-run estimates are derived from stable regression function (Figure 3.1). This ensures that the regression coefficients do not exhibit systematic changes and sudden departures of constancy.

The results (Table 3.2) show that in the long-run, inflation affects real growth adversely. This finding is consistent with the viewpoint advocated by a wide range of theoretical and empirical literature (see, for example Kydland and Prescott, 1977; Barro and Gordon, 1983; De Gregario, 1992-93; Barro, 1995; Bullard and Keating, 1995 and Wilson, 2006). It confirms that in the long-run the monetary policy activism is detrimental to the real economy. The effects of investment on real growth are positive and highly significant. This finding endorses the robust positive relationship between investment and output.[73]

[72] The F-stat is also greater than the upper bound at 1 % for the upper critical bound value (5.874) computed by Narayan (2005) for the small sample sizes. The values reported in Pesaran and Pesaran (1997) and Pesaran *et al.* (2001) are generated using relatively larger samples.
[73] See for example, Levine and Renelt (1992) for finding the robustness of investment as a determinant of output and references therein.

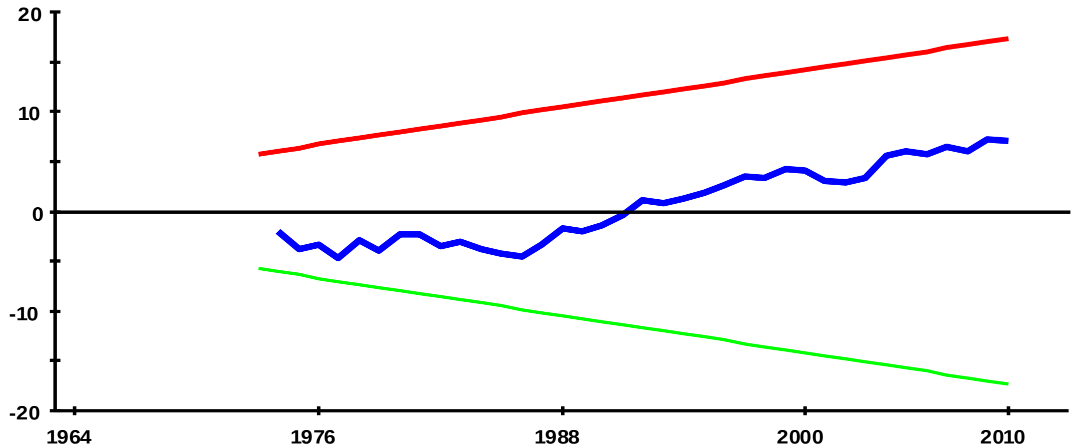
Table 3.2: Long-term estimates of the baseline growth model - dependent variable $\widehat{GDP}$

Models /Variables	Variables					Fit of the models and the diagnostic tests				
	π	$\widehat{POP}$	$\widehat{INV}$	$\frac{FDI}{GDP}$	α	R^2	AUTO	SPEC	NORM	HETR
	-0.24**	0.95	0.16***	23.78	4.20					
Baseline Model (1961-2010)	(0.08)	(0.74)	(0.04)	(27.78)	(2.11)	0.46	[0.96]	[0.22]	[0.16]	[0.85]
	[0.01]	[0.21]	[0.00]	[0.39]	[0.05]					
	-0.27***	0.99	0.14***	22.97	4.48					
Baseline Model (1973-2010)	(0.09)	(0.64)	(0.05)	(24.26)	(2.14)	0.50	[0.36]	[0.66]	[0.61]	[0.65]
	[0.00]	[0.13]	[0.00]	[0.35]	[0.05]					

This Table reports the full and sub-period long-term estimates of the baseline growth model. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test – Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

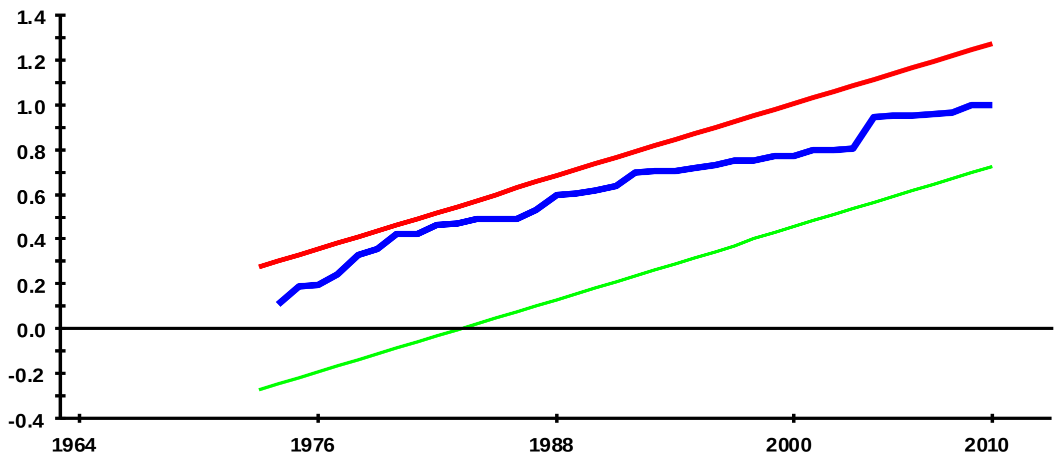
Figure 3.1: Stability tests

Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level

Although the long-run effects of population and foreign direct investment on real growth are statistically insignificant they yield the correct sign. Nevertheless, these variables were retained in the model despite their insignificance as their deletion on the basis of their long-run insignificance is not supported by the joint test of zero restrictions on the coefficients of the deleted variables – hence indicating that the variables add significantly to the model. For example, the P-values of the Langrange Multiplier Statistics, Likelihood Ratio Statistics and F-Statistics for the deletion of population and foreign direct investment jointly the respective P-values are 0.02, 0.01 and 0.03, respectively.

3.5.2 Robustness check of the baseline growth model

In order to ascertain the robustness of the baseline growth model, a check was conducted through the regression of the sub-sample period from 1973-2010. Since the overall sample (50 observations) is not sufficiently large to split into two equal parts, only the activist monetary policy period from 1971-2010 was considered. In this period, the average inflation, M2 and real growth rates are 9.39%, 15.45%, and 4.9% as compared to 3.51%, 11.33% and 7.24% in 1961-1970, respectively, which clearly indicates monetary activism. The initial two years of 1971 and 1972 were dropped from estimation to eliminate the potential effects of Pakistan's war with India in 1971.[74]

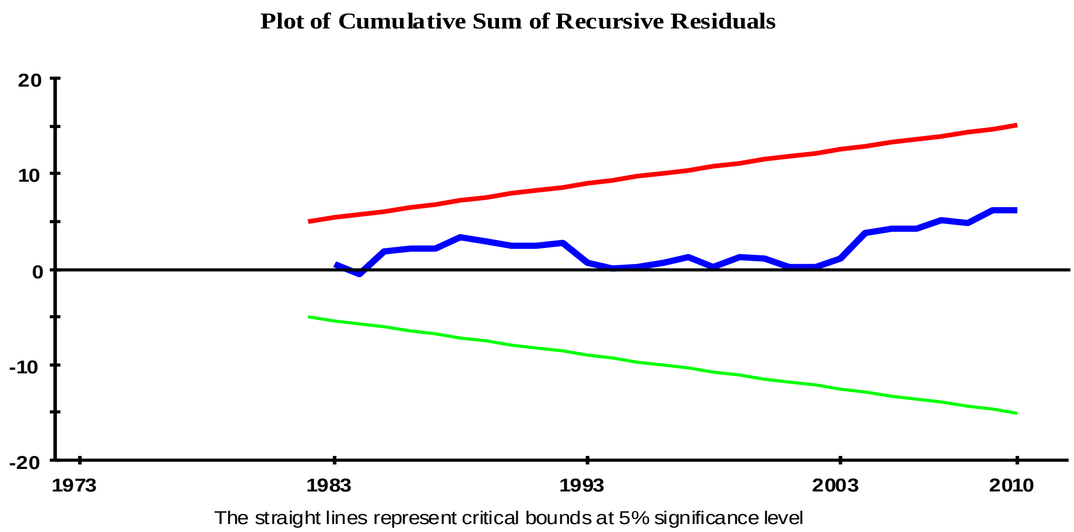
Again, the null hypothesis of no cointegration, $H_0\colon \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ against the alternative $H_0\colon \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$ was tested using the F-test. The computed F-Statistic (8.26) is greater than the asymptotic upper critical value bound (5.06) at 1 % level, which confirms the existence of the long-term cointegrating relationship. The order of the model specified by the SBC is the same as in the full-sample, i.e. ARDL (0, 2, 1, 0, 1). Moreover, the diagnostic tests did not indicate any potential problem. The stability of the model was confirmed through the $CUSUM$ and $CUSUMQ$ (Figure 3.2).

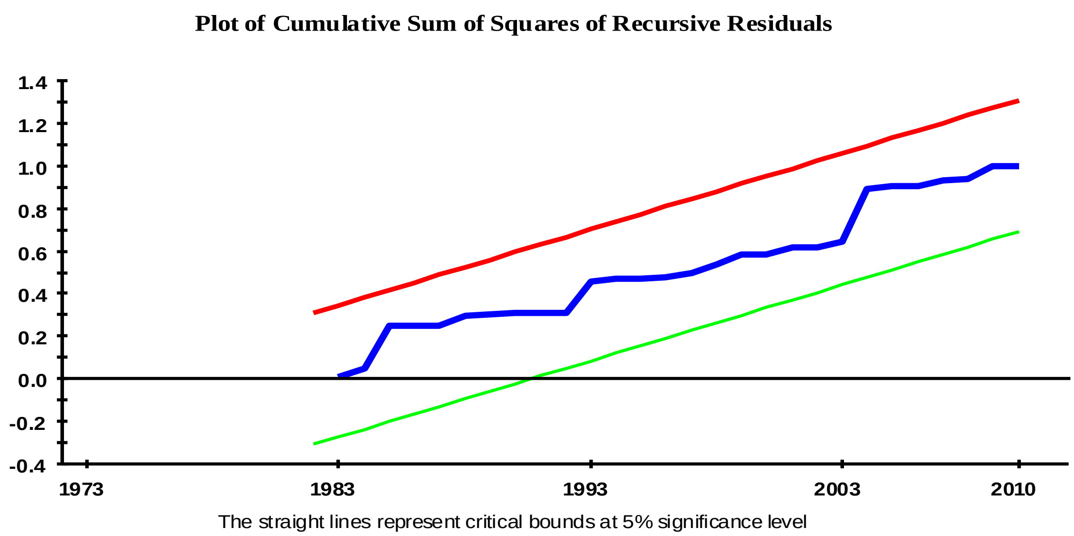
The results of the sub-period also present similar findings as the full-sample (Table 3). For example, inflation and investment are statistically significant variables and bears

[74] This war badly affected the real growth rates in Pakistan as on average a growth rate of 0.64% was witnessed for the years 1971 and 1972.

negative and positive effects on real growth, respectively. The adverse effect of inflation on the real growth is even more pronounced as compared to the full-sample both in terms of significance and quantum. This might be due the high average inflation rates of 9.31% in 1971-2010 as compared to 3.51% in 1961-1970 on the back of active use of money supply to achieve ambitious growth levels.

Figure 3.2: Stability tests





3.5.3 Simulation results

The baseline growth model was estimated without the variable $D_t.(\pi_t^0 - \pi_a)$. Since the prime objective of this research was to identify the effects of the range of observed inflation rates on real growth, the expression $D_t.(\pi_t^0 - \pi_a)$ was simulated through the baseline growth model for varying values of π_a from 1% to 26%. The choice of this range of values of π_a was motivated by the fact that the observed inflation during the 50 years sample period of the study remained between this band.[75]

When $D_t.(\pi_t^0 - \pi_a)$ was simulated for $\pi_a = 1\%$, the results (see Table 4 for simulation results) show that ignoring the existence of the structural break makes a huge difference to the long-run estimated effects of overall inflation on growth. In the baseline growth model, the estimated effect of inflation on growth was -0.23, whereas, after the simulation, it increased to -4.63 (see Model 1, Table 3.3). This implies that if the break is ignored, the effects of inflation on growth may be underestimated.

Technically, this downward bias is due to the fact that the baseline growth model estimates the effect of inflation on growth conditional on this effect being the same throughout the inflation spectrum. This finding is consistent both with the literature and the popular belief that low and stable inflation is crucial for long-term sustainable economic growth (see for example, Mishkin, 2006).

[75] Negative inflation was recorded in 1962. It may be noted that the inflation numbers were rounded off to the nearest percentage point {1, 2, 3…26} because assuming continuity is overwhelmingly challenging and has no direct policy relevance.

Table 3.3: Long-term parameter estimates of the baseline growth model and simulation results

Models /Variables	Variables						Fit of the models and the diagnostic tests							
	π	$\widehat{POP}$	$\widehat{INV}$	$\frac{FDI}{GDP}$	$DUMM$	α	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 1 (INF=1)	-4.63*	1.32*	0.17***	28.05	4.46*	6.75								
	(2.61)	(0.73)	(0.04)	(27.55)	(2.62)	(3.09)	0.44	0,2,0,0,1	6.42	1%	[0.81]	[0.01]	[0.95]	[0.34]
	[0.08]	[0.07]	[0.00]	[0.31]	[0.09]	[0.04]								
Model 2 (INF=2)	-2.19*	1.32*	0.17***	28.05	2.02*	6.33								
	(1.18)	(0.72)	(0.04)	(27.55)	(1.18)	(2.92)	0.44	0,2,0,0,1	6.37	1%	[0.81]	[0.01]	[0.95]	[0.34]
	[0.07]	[0.07]	[0.00]	[0.31]	[0.09]	[0.04]								
Model 3 (INF=3)	-1.48*	1.33*	0.17***	28.31	1.31*	6.17								
	(0.76)	(0.72)	(0.04)	(27.57)	(0.76)	(2.85)	0.44	0,2,0,0,1	6.35	1%	[0.83]	[0.01]	[0.96]	[0.34]
	[0.06]	[0.07]	[0.00]	[0.31]	[0.09]	[0.04]								
Model 4 (INF=4)	-0.79	1.10	0.17***	28.47	0.58	5.73								
	(0.53)	(0.75)	(0.04)	(27.41)	(0.55)	(2.57)	0.47	0,2,1,0,1	6.17	1%	[0.83]	[0.09]	[0.34]	[0.56]
	[0.14]	[0.15]	[0.00]	[0.31]	[0.30]	[0.03]								
Model 5 (INF=5)	-0.45	1.05	0.16***	26.70	0.23	4.80								
	(0.39)	(0.76)	(0.04)	(27.41)	(0.40)	(2.39)	0.46	0,2,1,0,1	6.27	1%	[0.89]	[0.16]	[0.26]	[0.73]
	[0.25]	[0.18]	[0.00]	[0.34]	[0.58]	[0.05]								
Model 6 (INF=6)	-0.19	0.92	0.15***	22.98	-0.05	4.06								
	(0.28)	(0.76)	(0.04)	(27.41)	(0.31)	(2.58)	0.46	0,2,1,0,1	6.13	1%	[0.96]	[0.24]	[0.15]	[0.86]
	[0.50]	[0.23]	[0.00]	[0.41]	[0.87]	[0.08]								

This Table reports the cointegrating relationship of the real GDP with its potential determinants in a multivariate setting. DUMM is the interactive dummy $(D_t.(\pi_t^0 - \pi_a)$. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. The upper critical value bound of Pesaran *et al.* (2001) for k=6 at 1% level is 4.43. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test – Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Table 3.3 Continued ……….. Long-term parameter estimates of the baseline growth model and simulation results

Models /Variables	Variables						Fit of the models and the diagnostic tests							
	π	$\widehat{POP}$	$\widehat{INV}$	$\frac{FDI}{GDP}$	$DUMM$	α	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 7 (INF=7)	-0.10	0.88	0.15***	21.68	-0.18	3.68								
	(0.22)	(0.74)	(0.04)	(27.43)	(0.49)	(2.25)	0.47	0,2,1,0,1	6.06	1%	[0.94]	[0.22]	[0.14]	[0.88]
	[0.66]	[0.24]	[0.00]	[0.43]	[0.49]	[0.25]								
Model 8 (INF=8)	-0.11	0.88	0.15***	21.47	-0.18	3.67								
	(0.18)	(0.74)	(0.04)	(27.32)	(0.22)	(2.21)	0.47	0,2,1,0,1	6.05	1%	[0.91]	[0.20]	[0.13]	[0.90]
	[0.56]	[0.24]	[0.00]	[0.43]	[0.41]	[0.10]								
Model 9 (INF=9)	-0.11	0.88	0.15***	21.15	-0.18	3.70								
	(0.17)	(0.74)	(0.04)	(27.32)	(0.22)	(2.21)	0.47	0,2,1,0,1	6.11	1%	[0.91]	[0.17]	[0.13]	[0.87]
	[0.45]	[0.24]	[0.00]	[0.44]	[0.34]	[0.09]								
Model 10 (INF=10)	-0.13	0.88	0.15***	20.98	-0.19	3.78								
	(0.13)	(0.73)	(0.04)	(27.25)	(0.19)	(2.16)	0.47	0,2,1,0,1	6.14	1%	[0.92]	[0.16]	[0.13]	[0.83]
	[0.32]	[0.24]	[0.00]	[0.44]	[0.34]	[0.08]								
Model 11 (INF=11)	-0.14	0.87	0.15***	19.82	-0.19	3.84								
	(0.12)	(0.73)	(0.04)	(27.31)	(0.18)	(2.13)	0.47	0,2,1,0,1	6.13	1%	[0.95]	[0.15]	[0.13]	[0.78]
	[0.26]	[0.24]	[0.00]	[0.47]	[0.30]	[0.08]								
Model 12 (INF=12)	-0.14	0.85	0.15***	18.06	-0.21	3.90								
	(0.11)	(0.73)	(0.04)	(27.40)	(0.18)	(2.11)	0.48	0,2,1,0,1	6.11	1%	[0.97]	[0.14]	[0.13]	[0.75]
	[0.21]	[0.25]	[0.00]	[0.51]	[0.25]	[0.07]								
Model 13 (INF=13)	-0.15	0.85	0.15***	15.63	-0.23	3.92								
	(0.11)	(0.73)	(0.04)	(27.83)	(0.19)	(2.11)	0.48	0,2,1,0,1	6.11	1%	[0.98]	[0.15]	[0.13]	[0.75]
	[0.20]	[0.25]	[0.00]	[0.57]	[0.25]	[0.07]								

This Table reports the cointegrating relationship of the real GDP with its potential determinants in a multivariate setting. DUMM is the interactive dummy $(D_t.(\pi_t^0 - \pi_a)$. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. The upper critical value bound of Pesaran *et al.* (2001) for k=6 at 1% level is 4.43. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test – Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Table 3.3 Continued ……….. Long-term parameter estimates of the baseline growth model and simulation results

Models /Variables	Variables						Fit of the models and the diagnostic tests							
	π	$\widehat{POP}$	$\widehat{INV}$	$\frac{FDI}{GDP}$	$DUMM$	α	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 14 (INF=14)	-0.14	0.83	0.15***	12.74	-0.26	3.95								
	(0.11)	(0.73)	(0.04)	(28.41)	(0.21)	(2.11)	0.48	0,2,1,0,1	6.12	1%	[0.99]	[0.15]	[0.12]	[0.75]
	[0.20]	[0.26]	[0.00]	[0.65]	[0.23]	[0.06]								
Model 15 (INF=15)	-0.14	0.83	0.15***	12.23	-0.30	3.96								
	(0.11)	(0.73)	(0.04)	(28.47)	(0.24)	(2.10)	0.48	0,2,1,0,1	6.13	1%	[0.99]	[0.16]	[0.11]	[0.76]
	[0.20]	[0.26]	[0.00]	[0.67]	[0.22]	[0.06]								
Model 16 (INF=16)	-0.17	0.83	0.15***	11.59	-0.24	4.19								
	(0.10)	(0.75)	(0.04)	(30.67)	(0.27)	(2.11)	0.47	0,2,1,0,1	6.02	1%	[0.87]	[0.18]	[0.12]	[0.79]
	[0.12]	[0.27]	[0.00]	[0.70]	[0.39]	[0.05]								
Model 17 (INF=17)	-0.17	0.82	0.15***	11.05	-0.29	4.19								
	(0.11)	(0.75)	(0.04)	(30.44)	(0.31)	(2.11)	0.47	0,2,1,0,1	6.07	1%	[0.88]	[0.18]	[0.11]	[0.80]
	[0.11]	[0.28]	[0.00]	[0.71]	[0.36]	[0.05]								
Model 18 (INF=18)	-0.17	0.82	0.15***	11.04	-0.28	4.19								
	(0.10)	(0.75)	(0.04)	(30.44)	(0.31)	(2.11)	0.47	0,2,1,0,1	6.12	1%	[0.90]	[0.18]	[0.09]	[0.80]
	[0.11]	[0.28]	[0.00]	[0.72]	[0.36]	[0.05]								
Model 19 (INF=19)	-0.17*	0.82	0.15***	10.62	-0.35	4.19								
	(0.10)	(0.74)	(0.04)	(30.11)	(0.28)	(2.11)	0.48	0,2,1,0,1	6.15	1%	[0.93]	[0.19]	[0.08]	[0.82]
	[0.11]	[0.27]	[0.00]	[0.72]	[0.32]	[0.35]								
Model 20 (INF=20)	-0.17*	0.82	0.15***	10.58	-0.43	4.19								
	(0.10)	(0.74)	(0.04)	(29.64)	(0.40)	(2.10)	0.48	0,2,1,0,1	6.15	1%	[0.96]	[0.20]	[0.06]	[0.83]
	[0.09]	[0.27]	[0.00]	[0.72]	[0.28]	[0.05]								

This Table reports the cointegrating relationship of the real GDP with its potential determinants in a multivariate setting. DUMM is the interactive dummy $(D_t.(\pi_t^0 - \pi_a)$. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. The upper critical value bound of Pesaran *et al.* (2001) for k=6 at 1% level is 4.43. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test–Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

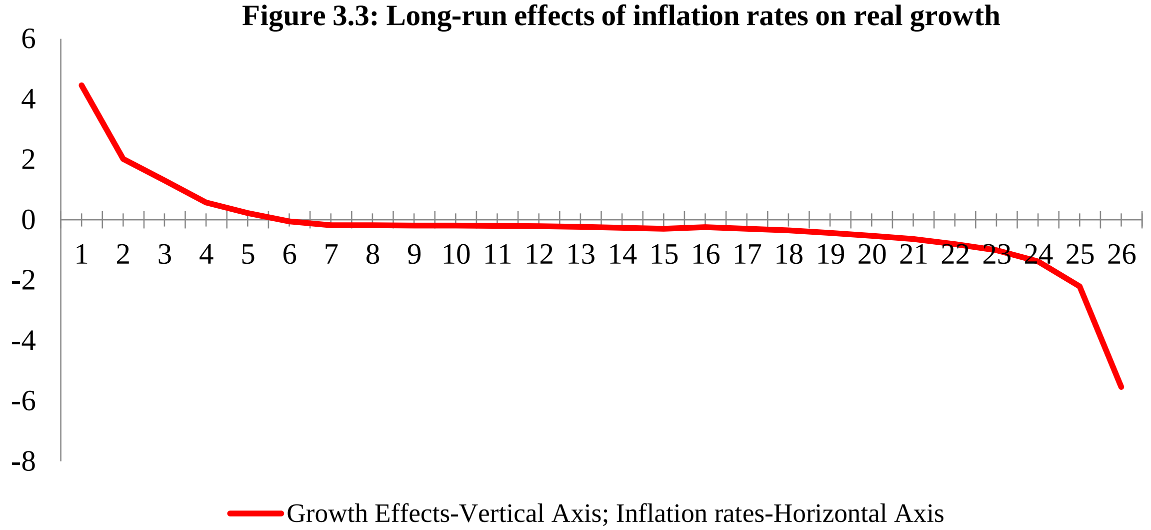
Table 3.3 Continued ……….. Long-term parameter estimates of the baseline growth model and simulation results

	Variables						Fit of the models and the diagnostic tests							
Models /Variables	π	$\widehat{POP}$	$\widehat{INV}$	$\frac{FDI}{GDP}$	$DUMM$	α	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 21 (INF=21)	-0.18*	0.84	0.15***	11.35	-0.53	4.19								
	(0.09)	(0.73)	(0.04)	(28.98)	(0.45)	(2.10)	0.48	0,2,1,0,1	6.11	1%	[0.99]	[0.22]	[0.05]	[0.86]
	[0.07]	[0.26]	[0.00]	[0.69]	[0.25]	[0.05]								
Model 22 (INF=22)	-0.19**	0.86	0.15***	13.19	-0.63	4.18								
	(0.09)	(0.73)	(0.04)	(28.23)	(0.51)	(2.09)	0.48	0,2,1,0,1	6.05	1%	[0.94]	[0.21]	[0.05]	[0.87]
	[0.04]	[0.24]	[0.00]	[0.64]	[0.2]	[0.05]								
Model 23 (INF=23)	-0.18**	0.86	0.15***	13.15	-0.80	4.19								
	(0.08)	(0.73)	(0.04)	(28.05)	(0.61)	(2.09)	0.48	0,2,1,0,1	5.91	1%	[0.85]	[0.22]	[0.04]	[0.90]
	[0.04]	[0.24]	[0.00]	[0.64]	[0.20]	[0.05]								
Model 24 (INF=24)	-0.19**	0.87	0.15***	14.09	-1.01	4.19								
	(0.08)	(0.73)	(0.04)	(27.75)	(0.75)	(2.09)	0.48	0,2,1,0,1	5.90	1%	[0.84]	[0.22]	[0.04]	[0.90]
	[0.02]	[0.24]	[0.00]	[0.61]	[0.19]	[0.05]								
Model 25 (INF=25)	-0.19**	0.87	0.14***	14.23	-1.37	4.19								
	(0.08)	(0.73)	(0.04)	(27.73)	(1.02)	(2.09)	0.48	0,2,1,0,1	5.90	1%	[0.84]	[0.22]	[0.04]	[0.90]
	[0.02]	[0.24]	[0.00]	[0.61]	[0.19]	[0.05]								
Model 26 (INF=26)	-0.19**	0.87	0.15***	14.23	-2.20	4.19								
	(0.08)	(0.73)	(0.04)	(27.73)	(1.64)	(2.09)	0.48	0,2,1,0,1	5.90	1%	[0.84]	[0.22]	[0.04]	[0.90]
	[0.02]	[0.24]	[0.00]	[0.61]	[0.19]	[0.05]								

This Table reports the cointegrating relationship of the real GDP with its potential determinants in a multivariate setting. DUMM is the interactive dummy $(D_t.(\pi_t^0 - \pi_a)$. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. The upper critical value bound of Pesaran *et al.* (2001) for k=6 at 1% level is 4.43. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test – Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM,which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Overall, the simulation results show that lower inflation is associated with higher growth unless it crosses the 5% inflation rate. This finding is also consistent with the lately emerged literature on the non-linear effects of inflation on growth that emerged in 1990s, such as Fischer (1993), Sarel (1996) and Khan and Senhadji (2001) as the inflation exhibits a turning point when it reaches 5% level. High inflation rates beyond 5% are associated with low growth (Figure 3.3). The break occurs at 6% inflation rate beyond which moderate increases in inflation affect growth with moderately increasing intensity till 17% rate and beyond 17% the intensity of the negative effect increases markedly.

Figure 3.3: Long-run effects of inflation rates on real growth



Although statistically insignificant, 5 % inflation rate is the threshold because the effects of inflation on real growth turn negative at 6% inflation. This result is consistent with the findings of Hussain (2005), Nawaz and Iqbal (2010) and Akmal (2011) who concluded 6%, 6% and 4% respectively as threshold levels of inflation in Pakistan.

Inflation from 1% to 3% is desirable because their effects on real growth are positive and statistically significant (see column 6, Model 1-Model 3). Among the desirable range of inflation from 1% to 3%, the 1% inflation is optimal because inflation at this particular rate exerts the maximum boosting effect on the real growth as compared to the 2% and 3% inflation rates. For example, the effect of 1% inflation rate on the real growth is 4.4% and that of 2% and 3% inflation rates is 2.02% and 1.31%, respectively. This finding of optimality of 1% inflation rate is consistent with Garman and Richards (1989) and Billi (2010), who found 0.2% and 0.2%-0.9%, respectively as optimal rates of inflation for the U.S. economy.[76]

Overall these findings are consistent with standard practices of maintaining inflation somewhere around 2% and 3% both by inflation targeting and even non-targeting advanced countries. The SBP in order to maintain a balance in monetary policy may focus on the desirable range of inflation from 1% to 3% to maximize gains from the monetary policy. This range of inflation may also be used as inflation targets in case of adoption of the framework.

3.5.4 Monetary policy performance evaluation against the estimated benchmarks

As emphasized earlier, the purpose of granting discretion to the monetary policy maker is to allow sufficient flexibility in adjusting monetary policy as frequently as desired to help achieve inflation and growth stabilization objectives, and to ensure a reasonable compromise between the two in case of conflict. To gauge the extent to which discretionary monetary policy in Pakistan achieved this very objective, three possible cases of the nexus between inflation and real growth are identified and used as benchmarks for evaluation. These are optimal, desirable and threshold yardsticks as presented in Table 3.4.

[76] It is pertinent to mention that although 1% inflation may be optimal but not feasible as there is always a dilemma between first- and second-best solutions. This rate might not be practicable due to the illusionary fear of deflation and the issue of zero lower bound.

In the case of Pakistan, when the actual performance of monetary policy maker is evaluated against these benchmarks, the outcome is dismal. Discretionary monetary policy strategy by and large fails to stabilize inflation around the optimal, the desirable or the threshold levels. In other words, discretion has harmed real growth 62% of the time in the last 50 years, hence contributes to the deterioration rather than the enhancement of economic welfare.

Table 3.4: Proximity of observed inflation rates with the estimated benchmarks in the 50 years' time period

	Optimal yardstick	**Desirable yardstick**	**Threshold yardstick**
	INF<2%	**INF <4%**	**INF<6%**
Optimal performance	4 (8% of 50 years)		
Desirable performance		9 (18% of 50 years)	
Threshold performance			19 (38% of the 50 years)
Non performance	46 (92% of 50 years)	41 (82% of 50 years)	31 62% of the 50 years)

3.6 CONCLUSION

This study contributes by developing a framework that uniquely evaluates the performance of discretionary monetary policy strategy in Pakistan. The framework requires identification and estimation of the benchmarks – optimal, desirable and threshold inflation rates. These benchmark inflation rates reflect the three cases of a balance between inflation and real growth, and are obtained using a baseline growth model. The model is dynamic, stable and robust. The long-run estimates are obtained through the ARDL bounds testing and estimation strategy of Pesaran *et al.* (2001).

The optimal, desirable, and threshold inflation rates are 1%, 2%-3% and 5%, respectively. The ex-post evaluation of the actual performance of the discretionary monetary policy of Pakistan against these benchmarks presents a picture that deserves attention as 62% of the time in the last 50 years, monetary policy has harmed real growth by keeping inflation at levels, which are detrimental to the economy. These findings suggest that allowing discretion in the conduct of monetary policy for the purposes of the dual objectives of inflation and growth stabilization has backfired. Instead, it has destabilized inflation and adversely affected the real growth.

The results clearly indicate that Pakistan needs a monetary policy framework that can stabilize inflation at low levels to bring real output growth towards its potential path rather than affecting it adversely. A change in the institutional setup of monetary policy from discretion to commitment (inflation targeting), is therefore a natural recommendation.[77] Inflation targeting provides a framework, where the SBP may stabilize inflation between optimal and desirable levels of 1% to 3%. This, would ensure fully reap the gains from price stability as well as help avoid the growth-impairment that discretion has induced over the last 50 years in Pakistan.

[77] As there is almost a consensus on the inflation performance of inflation targeting. See for example, Haldane (1995), Bernanke *et al.* (1999), Cecchetti and Ehrmann (1999), Siklos (1999) Kuttner and Posen (1999, 2001), King (2002), Corbo et al. (2001), Neumann and Von Hagen (2002), Gavin (2003) Levin *et al.* (2004), Petursson (2005), Vega and Winkelried (2005), Batini and Laxton (2006), Mishkin and Schmidt-Hebbel (2007), Walsh (2009) and Lin and Ye (2009) among others that establishes this evidence.

CHAPTER 4

ON THE EFFECTIVENESS OF INFLATIONARY BIAS OF THE DISCRETIONARY MONETARY POLICY STRATEGY OF PAKISTAN

4.1 INTRODUCTION

There is a consensus that vesting unconstrained discretion with central bankers to achieve twofold objectives of inflation and growth and the pursuit of higher than natural rate of the economy leads to excess inflation (inflation bias). Such a central banker is tempted to compromise on inflation objective by accommodating excess inflation to spur growth beyond its potential (Kydland and Prescott, 1977; Barro and Gordon, 1983). As a remedy, to contain this temptation and the resultant inflation bias, several countries either evolved mechanisms to overcome the time inconsistency problem (Berleman, 2005) or adopted commitment-based monetary policy frameworks (inflation targeting). Inflation targeting countries performed markedly well in achieving their prime objective of price stability.[78] Steady long-term growth, under this framework is deemed to be the by-product of low and stable inflation (Dotsey, 2008). The growth performance of inflation targeting countries is also commendable (Concalves and Salles, 2008 and Roger, 2010) as this framework allows sufficient flexibility for short-run growth-stabilization (Haldane, 1995 and Debelle, 1998).

It is quite puzzling that despite a dismal performance, Pakistan's monetary policy continues to be a typical case of discretion (see Section 3.1) instead of adopting inflation targeting. One of the potential reasons of strict adherence to the discretionary monetary

[78]See for example, Haldane (1995); Bernanke *et al.* (1999); Cecchetti and Ehrmann, (1999); Corbo *et al.* (2001); Neumann and Von Hagen, (2002); Levin *et al.* (2004); Peturson (2005); Vega and Winkelried (2005); Batini and Laxton, (2006); Lin and Ye (2009); Roger (2010) and Brito and Bystedt (2010).

policy strategy is the consideration either for growth-stabilization or the ambition to attain of high growth rates. For example, Chaudhry and Chowdhry (2006), Akbari and Rankaduwa (2006), Felipe (2009) and Naqvi and Rizvi (2010) argued against the adoption of inflation targeting, largely on the basis that it may negatively affect growth.[79]

This growth-skepticism against inflation targeting is predominantly motivated by the implicit assumption of a positive relationship between inflation and growth. However, the relationship between inflation and growth is far from straightforward. For example, up till the mid-1970s, the Phillips curve (positive relationship between inflation and growth) was popular, while the empirical evidence in the 1990s suggests a negative relationship (see for example, De Gregario, 1992-93; Barro, 1995; and Ireland, 1999). One of the aspects of empirical evidence, in the 1990s and 2000s suggest a nonlinear relationship between

[79] This growth-skepticism is not only a Pakistan-specific phenomenon rather some of the studies such as Ball and Sheridan (2005), Brito and Bystedt (2010) and Chowdhry and Islam (2011) are skeptical of the output performance of inflation targeting and others including Bryant (1996) and Rivlin (2002) views inflation targeting as the choice of a trade-off between inflation and output (Philips curve) and inflation variability and output variability (Taylor curve). Inflation targeting is also sometimes perceived as 'inflation only' targeting with no flexibility or consideration for output and employment. Nevertheless, a number of studies have argued to the contrary that inflation targeting allow reasonable flexibility with the central banker to deal with the output shocks. For example, Debelle (1999) argued that the framework is sufficiently flexible while deriving its flexibility from the targeting bands and policy horizons. Moreover, several studies have found evidence that inflation targeting has resulted in a significant positive relationship with growth and that it has improved the trade-off between inflation and output volatility in the inflation targeting countries (see for example, Corbo *et al.*, 2001; Neuman and Von Hagen, 2002; Truman, 2003; Hu, 2003a-b; Levin *et al.* 2004; Peturson, 2005; Concalves and Salles, 2008; and Roger, 2010).

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inflation and growth (see for example, Fischer, 1993; Sarel, 1996 and Khan and Senhadji, 2001).

Its implications for the findings of the previous empirical research are rather serious. It means that previous studies either overestimated or underestimated the effects of inflation on growth. Divergence in the long and short-term effects of inflation on real growth is yet another dimension. For example, in the long-term inflation is believed to be negatively affecting growth, however, in the short-run monetary policy can be used to stabilize growth, which suggests a short-term positive relationship between the two.

Despite all this complexity about the relationship of inflation and growth amidst variety in evidence and viewpoints, there exists one common point of agreement. The economists, irrespective of whether they are proponents of discretion or commitment, agree that an unknown but a certain low and steady rate of inflation is crucial for real growth. This implies that the core contention between them is the excess inflation per se – the inflation exceeding that unknown but low and steady rate. This excess inflation in the literature has been termed as inflation bias. The pervasive explanation for inflation bias is the central banker's exercise of its discretion in pursuit of twofold objectives of inflation and growth, specifically, its temptation to raise the latter beyond its potential (Kydland and Prescott, 1977; Barro and Gordon, 1983).

The role of a discretionary central banker in contrast to a central banker with commitment (inflation targeting) is more challenging. The former has both inflation and growth-stabilization objectives, whereas the latter primarily stabilizes inflation. A discretionary central banker accepts inflation bias to stimulate growth. However, thus far to the best of author's knowledge, the literature has not been furthered to empirically investigate the crucial questions that (i) is the inflation bias (per se) effective in stimulating real growth in the long-run and (ii) is the extent of such stimulation sufficient enough to justify the grant of discretion permanently to the central banker.[80]

Indeed, the empirical research could not be furthered to specifically explore these dimensions due to the non-existence of inflation bias indicators per se (see Table 4.1 for a brief survey) that can be used to conduct appropriate empirical investigation – as was recently concluded by Surico (2008 p. 35) that "measuring and disentangling the inflation bias remains a challenging topic for future research".

This study thus contributes to further the literature by proposing a framework to generate the time series of various measures of inflation bias (inflation bias indicators) for Pakistan and uses these indicators to ascertain the extent of its effectiveness to stabilize the real growth.[81] These indicators are generated using the benchmark optimal, desirable and threshold inflation-growth nexus rates (see Section 3.3 and Section 3.5). The long-term parameters of the proposed indicators were then estimated from the baseline growth model using the ARDL bounds testing and estimation approach of Pesaran *et al.* (2001) to avoid spurious regression and endogeneity problems.

Consistent with the theory of commitment against discretion, the results show that all the indicators of inflation bias affect the real growth adversely in the long-run. This

[80] This investigation is particularly important: first, in determining the scope of the role of monetary policy in stabilizing inflation or growth and second, in assessing if discretion should be preferred over commitment for the achievement of the dual objectives of inflation and growth-stabilization.

[81] It is pertinent to mention that Garman and Richards (1989) and Surico (2008) obtained point estimates of the average inflation bias for the U.S. whereas the current study proposes a framework for generation of time series of inflation bias indicators based on plausible definitions. These indicators are meant to be used as individual variables in empirical investigation.

relationship is robust both to the generated indicators of inflation bias and to the sub-period analysis. The findings suggest that inflation-stabilization should be the prime objective of monetary policy to avoid (i) the negative effects accruing directly from inflation bias per se and (ii) its significant adverse effects on the real growth.

The remainder of the chapter is organized as follows. Section 4.2 briefly reviews the literature to highlight the issue of the synonymous treatment of inflation and inflation bias in the empirical literature. Section 4.3 proposes the methodological framework for generation of the inflation bias indicators and specifies the models. Section 4.4 analyses the long-term relationships between the real growth and the proposed inflation bias indicators, highlights the data and reports the stationarity properties of the variables. Section 4.5 presents and analyses the results and conduct the robustness checks while Section 4.6 concludes the chapter.

Table 4.1: Selected empirical studies on central bank's preferences and inflation bias

Authors	Estimation technique/s	Dependent variable	Independent variables	Sample period	Frequency	Country	Key findings
Kobbi (2013)	ARCH, GARCH	CPI inflation	Output gap (computed from Industrial Production Index), inflation variance and variance of output	1993:1-2010:1	Quarterly	Tunisia	Inflation is determined by output gap and conditional variance of inflation. There is an evidence of central bank's asymmetric preference.
Doyle and Falk (2010)	Johansen Cointegration, Monte Carlo Methods	Inflation rate	Conditional variance of inflation and employment	Mid 1960-Late 2004	Quarterly	Australia, Austria, Canada, Denmark, Finland, Germany, Italy, Japan, Norway, Sweden, U.K, and U.S.	Time inconsistency, asymmetric preferences and time varying variances of output shocks does not explain the rise and fall of inflation in OECD countries.
Sweidan (2009)	OLS, GARCH,	Inflation rate	Inflation variance, Output variance	1992:1-2007:1	Quarterly	Jordan	Inflation rate is determined by variances of inflation and variances output.
Aguiar and Martins (2008)	GMM	GDP deflator	short-interest rate (Euribor), proxy for exogenous supply shock, output gap	1995:1-2005:2	Quarterly	Euro Area	Significant evidence that Euro Area central bank had a precautionary demand for price stability during 1995-2005.
Surico (2008)	GMM	Inflation (annualized change in the log of GDP chain-weighted price index	output gap, real GDP	1960:1-2005:2	Quarterly	U.S.	Inflation bias in the U.S was 1% before 1979 due to the large preference for output and asymmetric preferences, while it disappeared over the last two decades.

Table 4.1 Continued……….. Selected empirical studies on central bank's preferences and inflation bias

Authors	Estimation technique/s	Dependent variable	Independent variables	Sample period	Frequency	Country	Key findings
Surico (2007)	GMM	Federal Funds rate	Inflation (Personal consumption expenditure deflator), Output gap and GDP deflator	1960:1-2003:2	Quarterly	U.S.	Asymmetry induced average inflation bias is 1.5%, which accounts for a sizable fraction of the decline in inflation mean.
Berlemann (2005)	OLS	inflation indicator (Country's CPI-G7 countries CPI)	Absolute preference indicator for inflation and unemployment (voter's preferences), unemployment	1974: 2001	Monthly	Austria, Australia, Denmark, Germany, U.K and the U.S.	The study finds the influence of voter's preferences on inflation in case of U.K, U.S and Denmark whereas it does not find evidence of support of time inconsistency problem in case of Austria, Australia and Germany.
Ruge-Murcia (2004)	ARCH, GARCH, ML	GDP deflator	average civilian unemployment rate,	1960:1-1999:2	Quarterly	U.S, U.K, France, Canada, Italy	Conditional variance of unemployment and inflation rate are related.
Dolado *et al.* (2004)	GMM, OLS, ARCH and GARCH	Federal Funds rate	CPI inflation and Implicit GDP deflator, Output gap computed from Industrial production Index (IPI).	1970:1-2000:12	Monthly, Quarterly	U.S.	The U.S. monetary policy after 1983 can be characterised by a nonlinear rule but not prior to 1979.
Ruge-Murcia (2003a)	FIML, GMM	CPI, Core CPI, RPIX and RPI	inflation variance and rates of unemployment	1992:12-2006:6	Monthly	Canada, Sweden and U.K.	Results support asymmetric preferences rather than symmetric preferences.

Table 4.1 Continued………. Selected empirical studies on central bank's preferences and inflation bias

Authors	Estimation technique/s	Dependent variable	Independent variables	Sample period	Frequency	Country	Key findings
Ruge-Murcia (2003b)	ARCH, GARCH, FIML	GDP deflator	Unemployment rate, conditional variance of unemployment	1960:1-1999:4	Quarterly	U.S.	The Federal Reserve gives more importance to the positive unemployment deviations from expected natural rate than the negative deviations.
Cukierman and Gerlach (2003)	OLS	GDP deflator	Standard deviation of real GDP growth	1971-2000	Annual	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the U.K and the U.S.	There is a positive association between inflation and the variance of output
Ireland (1999)	Phillips and Ouliaris (1990) test; Johansen (1988) test	GDP implicit price deflator	Civilian unemployment rate	1960:1-1997:2	Quarterly	U.S.	Inflation and unemployment are cointegrated implying that the theory explains the initial rise and subsequent fall in the U.S inflation for the sample period.
Richard and Garman (1989)	Nonlinear MLE	Political popularity	BIAS (indicator showing inflation concerns of rational public), GAP (Indicator showing output concerns of rational public), Dummies	1961:1-1986:2	Quarterly	U.S.	Flexibility granted to the central bank has produced inflation bias at an average rate of about 4.95%. Optimal inflation rate is 0.2%, which is not significantly different than zero.

4.2 THE DISTINCTION BETWEEN INFLATION AND INFLATION BIAS

There is no exact definition of inflation bias. Generally theoretical studies have presented it as the difference between observed and a target or a desirable rate of inflation. The central theme, however, is the end product of an excess inflation than some unknown but a desirable level. For example, Ruge-Murcia and Francisco J. (2001, p. 5) put it as “the systematic difference between equilibrium and optimal inflation”. Romer (2006) conceptualized it as the tendency of monetary policy to produce higher rate of inflation than optimal inflation over extended periods. Gartner (2000) viewed it as the tendency of the central banks with representational preferences (preferences for employment and inflation) to generate inefficiently high inflation rates without gaining the benefit of output beyond the potential output.

Broadly, two aspects of the notion emerge. First, is the tendency or temptation of central banker to accelerate growth because it is one of its main objectives and it has discretion to adjust monetary policy for its achievement. Second is the difference in the probable inflation outcomes, as excess inflation results primarily from the use of discretion for the achievement of growth. If discretion is not used to achieve higher than potential growth, the inflation may not necessarily surpass the desired levels.

From inflation outcome point of view, although the inflation bias is the difference between observed inflation and society’s preferred inflation (Garman and Richards, 1989; Ruge-Mercia and Francisco J, 2004), the empirical studies have established its evidence rather indirectly. They have used stylized models and have focused on one particular explanation of inflation bias rather than the outcome per se. For example, Richard and Garman (1989) used voter’s preferences, Romer (1993) focused on the relationship between openness and inflation, Ireland (1999) examined the cointegrating relationship between inflation and unemployment, Cukierman and Gerlach (2003) estimated the relationship between output volatility and inflation, Ruge-Mercia and Francisco J. (2004) explored the relationship of inflation and conditional variance of unemployment while Berlemann (2005) used the symmetry in the employment inflation trade-off.

A common feature of all these empirical studies is that they have used inflation as a proxy for inflation bias while assigning less importance to the treatment of the conceptual distinction between them. This implicit assumption of the synonymous treatment of inflation bias and inflation in empirical analysis is rather strong. An obvious reason for this is the unavailability of directly observable indicators of inflation bias. The study, to steer the literature in this direction, proposes a framework to generate indicators of inflation bias.

The main problem in generating inflation bias indicators hinges on identification and estimation of the society's preferred rates of inflation. This problem is dealt with in detail in Chapter 3 where three acceptable scenarios of the inflation rates viz. optimal, desirable and threshold were discussed and estimated, which are to be used in generation of inflation bias indicators. To the best of author's knowledge, no such attempt has been made to use inflation bias indicators in empirical analysis in case of Pakistan. These studies mainly used CPI inflation, WPI inflation or GDP deflator (see Table 2.3 for a brief survey) with their own specific objectives mainly exploring the causality and the long and short-term determinants of inflation.

4.3 PROPOSED FRAMEWORK FOR GENERATION OF INFLATION BIAS INDICATORS AND MODELS SPECIFICATION

As highlighted in the previous sub-sections neither inflation bias is clearly defined nor there exist a guideline that can be followed to generate inflation bias indicators. As a starting point, it is important to clearly define inflation bias for working purposes. Consistent with the essence of inflation bias, this study defines inflation bias as 'the positive difference of the benchmark (optimal, desirable and threshold) inflation-growth nexus rates from observed inflation weighted by the estimated coefficients of the respective benchmark rates'.[82] Based on this working definition, the proposition for inflation bias indicators takes the following forms:

$$IB1 = \left(\pi_t^o - \pi_1^{opt}\right) * \beta_{opt1} \tag{4.1}$$

$$IB2 = (\pi_t^o - \pi_2^{des}) * \beta_{des2} \tag{4.2}$$

$$IB3 = (\pi_t^o - \pi_3^{des}) * \beta_{des3} \tag{4.3}$$

$$IB4 = (\pi_t^o - \pi_5^{thr}) * \beta_{thr5} \tag{4.4}$$

Where $IB1$, $IB2$, $IB3$ and $IB4$ are the inflation bias indicators generated on the basis of π_1^{opt}, π_2^{des}, π_3^{des} and π_5^{thr}, which are the benchmark optimal, desirable and threshold inflation-growth nexus rates. These rates are 1%, 2%, 3% and 5%, respectively (see Section 3.5 for details). π_t^o is the observed inflation in period t and β_{opt1}, β_{des2}, β_{des3}

[82] The benchmark rates are the unique inflation rates at which the nexus between inflation and real growth reflects desirable states of a 'balanced monetary policy'. For example, a low inflation rate that positively and significantly effects the real growth is desirable. Optimal inflation rate is the unique rate that enhances the real growth both positively and significantly but with the largest possible magnitude. Threshold inflation rate is the one beyond which the effects of inflation on real growth turn from positive to negative (for details see Chapter 3).

and β_{thr5} are the estimated coefficients of long-term effects of the benchmark inflation-growth nexus rates.

It is worth mentioning that a simple un-weighted difference of the observed and benchmark inflation-growth nexus rates poses three main problems. First, a straight forward difference is rather mechanical, which potentially renders the individual regression estimates meaningless for each inflation bias indicator. In such a case, the differences among the indicators of inflation bias when regressed would only be captured by intercept term and parameter estimates would remain unchanged.

Second, the differences in the magnitudes of the effects of the individual benchmark inflation-growth nexus rates on real growth by definition are different and need to be accounted for a meaningful analysis. Third, a simple difference of optimal, desirable and threshold inflation-growth nexus rates (π_1^{opt} , π_2^{des}, π_3^{des} and π_5^{thr}) from the observed inflation (π_t^o) may result in values less than zero. For example, if in a particular period t, the $\pi_t^o < \pi_1^{opt}$, π_2^{des}, π_3^{des} and π_5^{thr}, which is not desirable because by definition the inflation bias indicators $IB1$, $IB2$, $IB3$ and $IB4 \geq 0$. Acquiring a zero value means no inflation bias in that specific period for any particular specification of $IB1$, $IB2$, $IB3$ and $IB4$. The negative values would instead mean deflation bias. Since the objective is to generate inflation bias indicators, the negative values were restricted to '0' assuming the absence of inflation bias in that particular period.

The prime objective of all this exercise of generation of inflation bias indicators was to explore the long-term effects of inflation bias on real growth. These indicators are substituted for π in the baseline growth model (see Equation 3.1), which yield the models with the following four specifications:

$$\Delta\widehat{GDP}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta\widehat{GDP}_{t-i} + \sum_{j=0}^{q1} \alpha_j^{IB1} \Delta IB1_{t-j} + \sum_{k=0}^{q2} \alpha_k^{POP} \Delta\, \widehat{POP}_{t-k} + \cdots + \sum_{l=0}^{q3} \alpha_l^{INV} \Delta\, \widehat{INV}_{t-l} + \sum_{0}^{q4} \alpha_m^{FDI} \Delta\left(\frac{FDI_{t-m}}{GDP_{t-m}}\right) + \beta_0 \widehat{GDP}_{t-1} + \beta_1 IB1_{t-1} + \beta_2 \widehat{POP}_{t-1} + \beta_3 I\widehat{N}V_{t-1} + \beta_4 \left(\frac{FDI_{t-1}}{GDP_{t-1}}\right) + \epsilon_t \tag{4.5}$$

$$\Delta\widehat{GDP}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta\widehat{GDP}_{t-i} + \sum_{j=0}^{q1} \alpha_j^{IB2} \Delta IB2_{t-j} + \sum_{k=0}^{q2} \alpha_k^{POP} \Delta\, \widehat{POP}_{t-k} + \cdots + \sum_{l=0}^{q3} \alpha_l^{INV} \Delta\, \widehat{INV}_{t-l} + \sum_{0}^{q4} \alpha_m^{FDI} \Delta\left(\frac{FDI_{t-m}}{GDP_{t-m}}\right) + \beta_0 \widehat{GDP}_{t-1} + \beta_1 IB2_{t-1} + \beta_2 \widehat{POP}_{t-1} + \beta_3 I\widehat{N}V_{t-1} + \beta_4 \left(\frac{FDI_{t-1}}{GDP_{t-1}}\right) + \epsilon_t \tag{4.6}$$

$$\Delta\widehat{GDP}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta\widehat{GDP}_{t-i} + \sum_{j=0}^{q1} \alpha_j^{IB3} \Delta IB3_{t-j} + \sum_{k=0}^{q2} \alpha_k^{POP} \Delta\, \widehat{POP}_{t-k} + \cdots + \sum_{l=0}^{q3} \alpha_l^{INV} \Delta\, \widehat{INV}_{t-l} + \sum_{0}^{q4} \alpha_m^{FDI} \Delta\left(\frac{FDI_{t-m}}{GDP_{t-m}}\right) + \beta_0 \widehat{GDP}_{t-1} + \beta_1 IB3_{t-1} + \beta_2 \widehat{POP}_{t-1} + \beta_3 I\widehat{N}V_{t-1} + \beta_4 \left(\frac{FDI_{t-1}}{GDP_{t-1}}\right) + \epsilon_t \tag{4.7}$$

$$\Delta\widehat{GDP}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta\widehat{GDP}_{t-i} + \sum_{j=0}^{q1} \alpha_j^{IB4} \Delta IB4_{t-j} + \sum_{k=0}^{q2} \alpha_k^{POP} \Delta\, \widehat{POP}_{t-k} + \cdots + \sum_{l=0}^{q3} \alpha_l^{INV} \Delta\, \widehat{INV}_{t-l} + \sum_{0}^{q4} \alpha_m^{FDI} \Delta\left(\frac{FDI_{t-m}}{GDP_{t-m}}\right) + \beta_0 \widehat{GDP}_{t-1} + \beta_1 IB4_{t-1} + \beta_2 \widehat{POP}_{t-1} + \beta_3 I\widehat{N}V_{t-1} + \beta_4 \left(\frac{FDI_{t-1}}{GDP_{t-1}}\right) + \epsilon_t \tag{4.8}$$

Where, $\widehat{GDP}$ is the growth rate of real GDP and Δ denotes the first difference operator. The $IB1$, $IB2$, $IB3$ and $IB4$ are the generated annual series of inflation bias indicators from Equation (4.1) through Equation 4.4, respectively. The $\widehat{POP}$ represents population growth rate, $\widehat{INV}$ is the investment indicator showing the growth rate of gross fixed capital formation, $\left(\frac{FDI}{GDP}\right)$ is the ratio of foreign direct investment to the real GDP and finally ϵ is the error term.

4.4 DATA, ITS STATIONARITY PROPERTIES AND SOME RELATIONSHIPS

The specified model was estimated using annual time series data obtained from the World Bank Development Indicators (WDI) and the State Bank of Pakistan (SBP). The time span of the data is from 1961 to 2010, which is dictated by data availability at the time of analysis. Figure 4.1 depicts the relationship between the smoothed series of the real GDP and the smoothed series of the generated inflation bias indicators.[83] $IB1P$, $IB2P$, $IB3P$ and $IB4P$ are the permanent components of the proposed indicators. The relationship of the trend in real GDP ($GDPP$) with the trends in the proposed inflation bias indicators largely depict a negative correlation over time.

In order to reinforce the choice of the ARDL testing and estimation strategy compared to the conventional cointegration techniques, the stationarity properties of the variables were examined through the Augmented Dicky Fuller (ADF) unit root test.[84] The P-values of the unit root tests along with the Durbin Watson statistics are summarized in

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[83] These series were smoothed using the HP filter in order to obtain their readily observable long-term trends while using $\lambda = 100$ (as recommended by Mise *et al.*, 2005).
[84] For a detailed two-stage operational procedure and justification of the ARDL bounds testing and estimation strategy see Section 3.3.

Table 4.2, to show that the stationary series have no autocorrelation problem hence confirming its reliability.

Figure 4.1: Time plot of trends in inflation bias and real growth

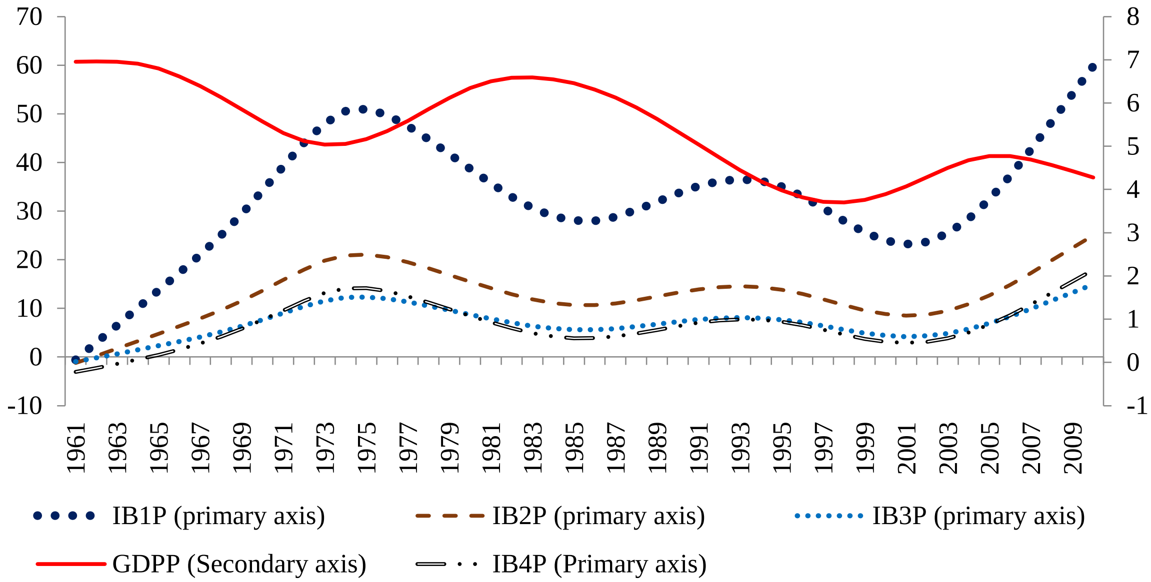


Table 4.2: Stationarity properties of the variables

Variables	Intercept	Trend and Intercept	First Difference
$\boldsymbol{IB1}$	[0.03]** 1.75	[0.10]* 1.74	[0.00]*** 2.00
$\boldsymbol{IB2}$	[0.03]** 1.74	[0.10]* 1.74	[0.00]*** 2.00
$\boldsymbol{IB3}$	[0.03]** 1.74	[0.10]* 1.73	[0.00]*** 2.00
$\boldsymbol{IB4}$	[0.02]** 1.74	[0.08]* 1.74	[0.00]*** 2.01
$\widehat{\boldsymbol{GDP}}$	[0.00]*** 2.09		
$\widehat{\boldsymbol{POP}}$	[0.99] 0.17	[0.84] 0.22	[0.00]*** 0.86
$\widehat{\boldsymbol{INV}}$	[0.00]*** 2.09		
$\frac{\boldsymbol{FDI}}{\boldsymbol{GDP}}$	[0.96] 1.05	[0.94] 1.07	[0.00]*** 1.93

This Table reports the P-values in brackets along the Durbin Watson statistic to show that stationarity was achieved while the residuals were uncorrelated. ***, ** and * indicates that the series are stationary at 1%, 5% and 10% level of significance, respectively.

The results of the ADF tests show that investment and real output growth are integrated of order I(0), whereas, all the other variables are integrated of order I(1). This validates the preference of this study for the ARDL testing and estimation strategy over the conventional techniques.

4.5 RESULTS AND ROBUSTNESS CHECK

4.5.1 Results

In order to test for the existence of a long-term cointegrating relationship, the null and alternative hypothesis were defined as $H_0\colon \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ against $H_1\colon \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$ for each model from Equation 4.5 to Equation 4.8. SBC was used as the model selection criterion. Table 4.3 summarizes the ARDL (p, q) orders and the bounds test results for all the four specifications of the proposed inflation bias indicators (from Equation 4.1 to Equation 4.4).

Table 4.3: ARDL Bound's test results

		ARDL Order	**Pesaran *et al.* (2001)***		**Narayan (2005)***		**Cointegration outcome**
Model	Computed F-Statistics	SBC Criterion	Lower Bound at 1%	Upper Bound at 1%	Lower Bound at 1%	Upper Bound at 1%	F-Statistics > Critical Value Bounds
Model 1	7.42	0,2,1,0,1	3.41	4.68	3.95	5.58	1%
Model 2	7.41	0,2,1,0,1	3.41	4.68	3.95	5.58	1%
Model 3	8.39	0,0,0,0,0	3.41	4.68	3.95	5.58	1%
Model 4	8.29	0,0,0,0,0	3.41	4.68	3.95	5.58	1%

* Critical value bounds at K=5 with unrestricted intercept and no trend.

The test results suggest the existence of cointegrating relationships. This long-term equilibrium relationship is highly significant at the 1 % level both for the asymptotic critical values of Pesaran *et al.* (2001) and Narayan (2005). Since the cointegrating relationship was established, the long-term parameter estimates were obtained subsequently while making sure that the models were stable (Figure 4.2).[85]

As expected, the estimated long-term coefficients of all the proposed inflation bias indicators show that inflation bias is significantly detrimental to real growth (Table 4.4). This finding supports the influential theoretical contribution of Kydland and Prescott (1977) and Barro and Gordon (1983) – to the extent that inflation bias does not help achieve higher than potential growth in the long-run. Instead, the results show that increased average inflation bias destabilizes the real growth. This finding essentially calls for Rogoff (1985)'s proposition of delegation of authority to an inflation averse central banker, who puts 'too large' but not an 'infinite' weight on inflation stabilization as a solution to the underlying problem of inflation bias.

Among the four proposed indicators of inflation bias, $IB1$ and $IB2$ provide a better explanation in terms of fit of the data and their respective models passes all the key diagnostic tests. The adverse effects of $IB1$ and $IB2$ on real growth are significant at the 1% level. The models with $IB3$ and $IB4$ provide a relatively lower explanation for the real growth in terms of fit of the data and their respective models do not pass the specification test. Moreover, their effects on the real growth are statistically insignificant. One of the plausible explanations for this finding is that inflation exceeding the 2% level constitutes

[85] The P-values of the diagnostic tests are presented along with the main results in Table 4.4. The hypothesis of residual serial correlation, functional form misspecification, normality of residuals and heteroscedasticity were tested.

inflation bias. This 2% level is consistent with the practices of most of the advanced countries' central banks as generally they have been setting their inflation targets around 2% (Romer and Romer, 2002). This rate allows a sufficient cushion to trivialize the zero lower bound in a world of small shocks (Blanchard *et al.* 2010).[86] Moreover, the European Central Bank (ECB) tries to maintain an inflation rate below but close to 2% over the medium term to fully reap the benefits of price stability.

Surico (2008) noted that for the U.S the inflation bias disappears when the inflation target is close to 2% and have estimated a bias of 1% for pre-1979 policy regime. The average inflation bias in Pakistan has been critically high at 8.87% for the period 1961-2010, which is 8 times higher than the 1% level in the U.S.[87] This rather huge difference reveals a critical gap in the central banker's seriousness and hence the tolerance levels of the two countries for inflation bias. Even in the U.S, a 1% inflation bias is not tolerable and has been eliminated subsequently as is noted by Surico (2008). Whereas in Pakistan inflation bias as high as 8.87% is no big deal to warrant institutional changes from discretionary to a more conservative commitment based monetary policy.[88]

[86] Zero lower bound is typically considered a low inflation situation in the economy where the nominal interest rates reach the zero level. In such cases the conventional monetary policy no longer works as a further reduction in nominal interest rates to stimulate growth particularly in case of shocks to the economy is not possible (Billi and Kahn, 2008).

[87] The average is obtained for the 1961-2010 period after excluding the observed inflation rates equal to or below than 2% level. There could be supply side factors that may have contributed to part of the high average inflation bias; however, disentangling its impact from the overall bias is beyond the scope of this study.

[88] This naivety may in part be due to the resource gap and the level of focused monetary policy research in both countries at the academic level and at the respective central banks. Nevertheless, the consequences of this naivety of Pakistan's central bank have been grave as the economy has been deteriorated in terms of the real growth for the past 5 decades due to high average inflation bias.

Figure 4.2: Stability tests

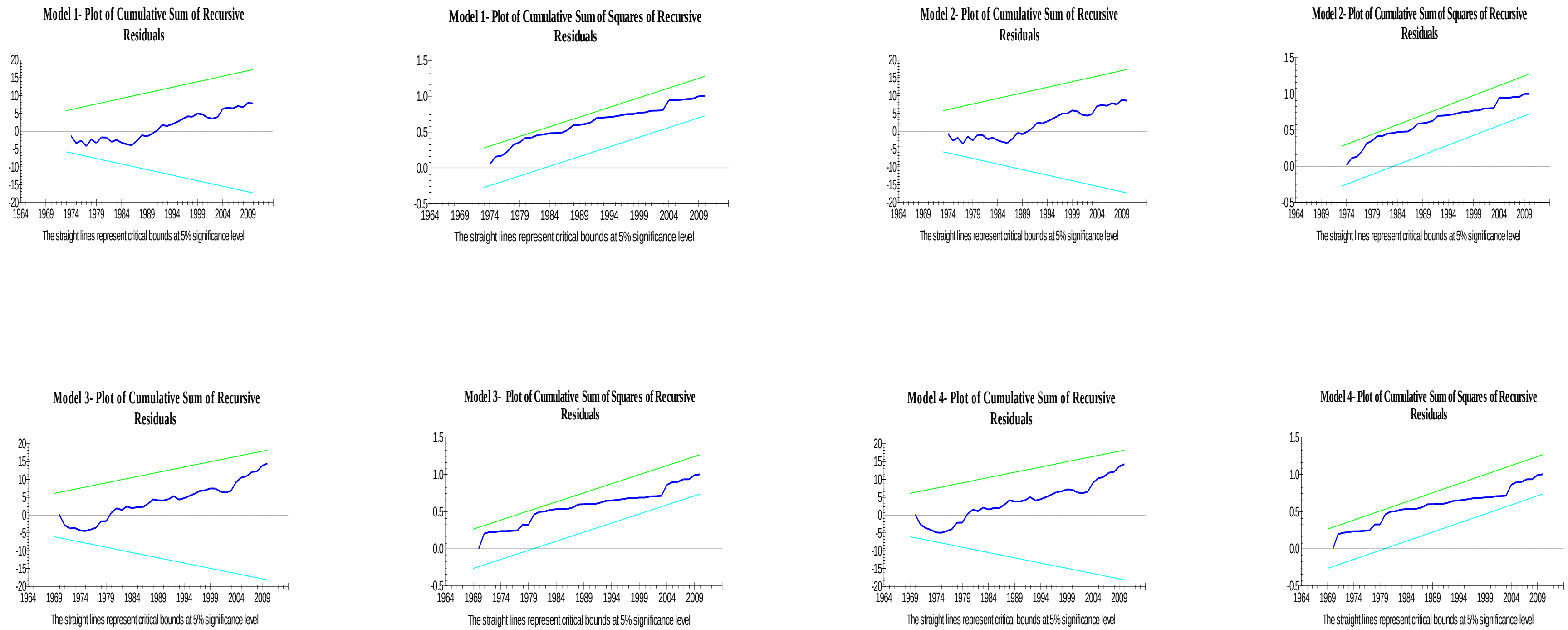


Table 4.4: Long-term parameter estimates of the proposed inflation bias indicators (1961-2010)

Models /Variables	Variables								Fit of the models and the diagnostic tests				
	$IB1$	$IB2$	$IB3$	$IB4$	$\widehat{POP}$	$\widehat{INV}$	$\frac{FDI}{GDP}$	α	R^2	AUTO	SPEC	NORM	HETR
Model 1 (IB1)	-0.05** (0.02) [0.01]				0.94 (0.74) [0.21]	0.16*** (0.04) [0.00]	23.75 (27.10) [0.38]	4.02* (2.11) [0.06]	0.46	[0.93]	[0.20]	[0.15]	[0.85]
Model 2 (IB2)		-0.12** (0.04) [0.01]			0.92 (0.74) [0.22]	0.16*** (0.04) [0.00]	23.60 (27.20) [0.39]	3.84 (2.11) [0.07]	0.45	[0.92]	[0.18]	[0.16]	[0.87]
Model 3 (IB3)			-0.02 (0.05) [0.64]		0.62 (0.77) [0.42]	0.13*** (0.04) [0.00]	-12.12 (27.10) [0.65]	3.44 (2.21) [0.12]	0.24	[0.40]	[0.01]	[0.68]	[0.67]
Model 4 (IB4)				-0.15 (0.30) [0.61]	0.61 (0.77) [0.43]	0.13*** (0.04) [0.00]	12.09 (26.84) [0.65]	3.43 (2.21) [0.12]	0.24	[0.40]	[0.01]	[0.68]	[0.69]

This Table reports the cointegrating relationship of the real GDP with inflation bias indicators. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test – Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

This naivety may in part be due to the resource gap and the level of focused monetary policy research in both countries at the academic level and at the respective central banks. Nevertheless, the consequences of this naivety of Pakistan's central bank have been grave as the economy has been deteriorated in terms of the real growth for the past 5 decades due to high average inflation bias.

A straightforward policy implication of these findings for Pakistan's monetary policy is that in the long-run it should primarily focus on inflation to contain inflation bias and to provide a conducive environment to help flourish the real economic activity. This would work like a double razor edge; as on one side the price stability would be restored and on the other, the real growth would be stabilized through low and stable inflation.

The results pertaining to other control variables are also consistent with a wide range of theoretical and empirical literature whilst investment is the most significant accelerator of real growth at 1% level. The long-run effects of population and foreign direct investment on real growth are statistically insignificant. The deletion of the population and foreign direct investment (Model 1 and Model 2) on the basis of their long-run insignificance is not supported by the joint test of zero restrictions on the coefficients of the deleted variables.[89] The P-values of the LM test for the deletion of population and FDI jointly for the four regressions of $IB1$, $IB2$, $IB3$ and $IB4$ are 0.016, 0.015, 0.319 and 0.327, respectively. The LM test individually for population and FDI also reflects the same results. For example, the P-values of the test for population in case of $IB1$, $IB2$, $IB3$ and

[89] In ARDL cointegration analysis, this may be the case as the variables, which are not supported by the variable deletion test might be significant in the short-run as compared to being insignificant in the long-run. The short-run coefficients in this particular estimation, however, may not be obtained because the SBC did not pick the lag dependent variable as optimal. In such a case the error correction term may not be obtained either.

$IB4$ are 0.015, 0.015, 0.400 and 0.634, respectively. Similarly, the P-values of the test for FDI are 0.052, 0.050, 0.637 and 0.634 for the cases of $IB1$, $IB2$, $IB3$ and $IB4$, respectively.

4.5.2 Robustness checks

This section conducts the robustness check of the relationship between inflation bias indicators and the real growth. The conduct of this exercise in a conventional way of bifurcating the sample in this particular case does not seem appropriate. The sample size is not sufficiently large to split into two equal parts while allowing the dynamics to be sufficiently accounted for up to 3 lags. To overcome this issue, only the activist monetary policy period, which spreads over the larger part of the data (from 1971 till 2010) was examined.

Pakistan's monetary policy can be divided into two main phases: the first phase from 1960-1970 can be characterized as a moderate monetary policy and the second, from 1971-2010 as monetary activism. In the first phase, the monetary policy remained moderate as the average M2 growth stood at 11.33% (Table 4.5). The overall economic performance in this decade was commendable. The average real growth rate remained high whilst the average inflation remained low and stable. The second phase started after the 1971, where there is a shift in the monetary policy approach from moderate to monetary activism. On average, the M2 growth rates for this period have been raised to 15.45%, resulting in high inflation and relatively lower average real growth rates.

Table 4.5: Monetary policy shift in Pakistan from moderate to monetary activism

Period	M2 growth	Inflation	Real growth
1961-1970	11.33	3.51	7.24
1971-1980	16.98	12.42	4.72
1981-1990	13.29	6.98	6.29
1991-2000	16.18	9.25	3.96
2001-2010	15.34	8.92	4.63
1971-2010	15.45	9.39	4.90

Source: World Development Indicators (WDI) and author's calculations

The initial two years of 1971 and 1972 were excluded from the analysis to eliminate the potential effect of Pakistan's war with India in 1971. This war badly affected the real growth rates in Pakistan as on average a growth rate of 0.64% was witnessed for the years 1971 and 1972. The country also experienced an all-time high average inflation rate of around 24% from 1973 to 1975, due to international oil price shocks and domestic floods in that period.[90]

To test for the existence of cointegration, the null and alternative hypotheses were formulated as $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ against the alternative $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$. The SBC model selection criterion was used for the selection of optimal lags by imposing a maximum lag of 3. The F-stat for the four regressions on the basis of $IB1$, $IB2$, $IB3$ and $IB4$ are 8.24, 8.46, 8.22 and 7.71, respectively. All these F-statistics are greater than the corresponding asymptotic critical values at the 1% level both for Pesaran *et al.* (2001) and Narayan (2005). This confirmed the presence of cointegration

[90] To account for the potential impact of this period, a dummy variable was included, which was dropped subsequently due to its insignificance. The joint test of zero restrictions on the coefficient of this variable also revealed that it should be dropped from all the individual models containing the proposed inflation bias indicators. For example, the P-values of the LM test for the dummies in the models with $IB1$, $IB2$, $IB3$ and $IB4$ are 0.624, 0.624, 0.621 and 0.805, respectively.

and hence the long-term parameter estimates were obtained. Before obtaining the long-term estimates, it was nevertheless made sure that the models are stable (Figure 4.3).

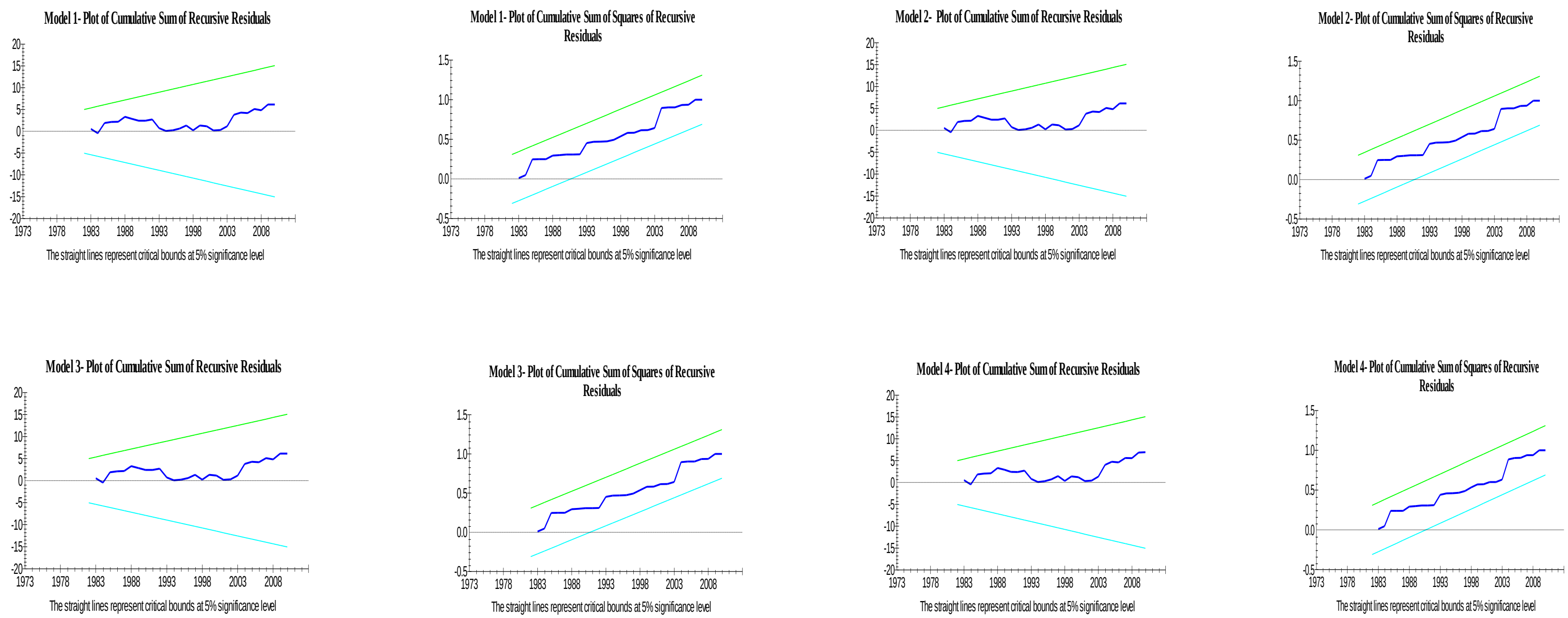
The results (Table 4.6) for the sub-period 1973-2010 confirm a significant long-term negative relationship between all the inflation bias indicators and the real growth at the 1% level of statistical significance. For this period, the inflation bias indicators ($IB3$ and $IB4$) are also significant and their effect is quantitatively larger as compared to the effect of the $IB1$ and $IB2$. This implies that the severity of the adverse effects of inflation bias on real growth increases, the more the inflation departs from the optimal and desirable levels. For example, for $IB1$, a 1% increase in inflation bias reduces the real growth by 0.05%, whereas for $IB4$ the corresponding reversal in the real growth is 1.21%. This result also suggests that the higher the average inflation bias the higher are the adverse effects on the real growth. For example, the average inflation bias computed from the observed inflation i.e. $\pi > 2\%$ is 8.87% and for $\pi > 5\%$ is 10.27%. For this period the fit of the data for all the models have also improved and all of them pass the diagnostic and stability tests.

Table 4.6: Long-term parameter estimates of the proposed inflation bias indicators (1973-2010)

Models /Variables	Variables								Fit of the models and the diagnostic tests				
	$IB1$	$IB2$	$IB3$	$IB4$	$\widehat{POP}$	$\widehat{INV}$	$\frac{FDI}{GDP}$	α	R^2	AUTO	SPEC	NORM	HETR
Model 1 (IB1)	-0.06***				0.99	0.14***	23.00	4.21					
	(0.01)				(0.64)	(0.05)	(24.26)	(2.10)	0.50	[0.36]	[0.66]	[0.61]	[0.65]
	[0.00]				[0.13]	[0.00]	[0.35]	[0.05]					
Model 2 (IB2)		-0.13***			0.99	0.14***	22.99	3.95					
		(0.04)			(0.64)	(0.05)	(24.26)	(2.08)	0.50	[0.35]	[0.66]	[0.61]	[0.65]
		[0.00]			[0.13]	[0.00]	[0.35]	[0.06]					
Model 3 (IB3)			-0.20***		0.99	0.14***	22.95	3.69					
			(0.06)		(0.64)	(0.05)	(24.25)	(2.06)	0.49	[0.35]	[0.66]	[0.61]	[0.65]
			[0.00]		[0.13]	[0.00]	[0.35]	[0.08]					
Model 4 (IB4)				-1.21***	0.80	0.14**	18.22	3.87					
				(0.39)	(0.65)	(0.05)	(24.41)	(2.08)	0.48	[0.48]	[0.72]	[0.58]	[0.67]
				[0.00]	[0.22]	[0.01]	[0.46]	[0.07]					

This Table reports the cointegrating relationship of the real GDP with inflation bias indicators for the sub period. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test – Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Figure 4.3: Stability tests



4.6 CONCLUSION

This study posits that empirical investigation into the extent of the effectiveness of inflation bias per se to stabilize the real growth is crucial for two reasons. First, it may help determine the scope of monetary policy as an inflation or growth-stabilizer. Second, it may augment the decision in favor of or against discretion compared to commitment as an inflation or growth-stabilizer. Nevertheless, probe into the extent of the effectiveness of inflation bias, in the first place, requires the generation of its indicators. This study proposes a framework for generation of inflation bias indicators for the discretionary monetary policy strategy of Pakistan – an ideal case for the analysis of inflation bias. These indicators have been then used to empirically investigate the extent of the long-term effectiveness of inflation bias in enhancing the real growth through ARDL approach while using asymptotic critical values both from Pesaran *et al.* (2001) and Narayan (2005).

The estimates show that inflation bias is significantly detrimental to the real growth in the long-run. The higher the average inflation bias the higher are its adverse effects on the real growth. These results are consistent with Kydland and Prescott (1977) and Barro and Gordon (1983) as it confirms that in the long-run, the inflation bias does not help boost the real activity. It is also unveiled that not only inflation bias is ineffective in boosting the real growth in the long-run but it is significantly detrimental to it. In the short-run the inflation bias may or may not have a positive effect on the real growth, however, to be certain about it and to ascertain its magnitude requires separate research, which is beyond the scope of this study.

These results imply that the scope of discretion in enhancing the real growth in the long-run is not only limited but counterproductive, particularly, in terms of its very objectives to stabilize inflation and real growth. Therefore, discretion may not be preferred over commitment as an inflation or growth-stabilizer because it accommodates inflation bias to stabilize the real growth, but inflation bias instead destabilizes it.

CHAPTER 5

ON THE RELEVANCE AND RELATIVE-ROBUSTNESS OF STABILIZATION AND NON-STABILIZATION SOURCES OF INFLATION BIAS

5.1 INTRODUCTION

Discretionary monetary policy has been critiqued since 1970s, when Kydland and Prescott (1977) theorized that in the long-run it creates excessive inflation – a phenomenon commonly referred to in the literature as inflation bias.[91] The core concern is that inflation bias is costly in the long-run as it does not guarantee long-run output gains rather affect it adversely (see Chapter 4 for empirical evidence). Several researchers have highlighted the potential sources that may determine inflation bias directly or indirectly. These can broadly be classified as stabilization and non-stabilization sources.

The stabilization sources may include the conventional inflation bias theory pioneered by Kydland and Prescott (1977) and the new inflation bias proposition put forth by Cukierman (2000). Under the conventional scheme, a discretionary central banker exploits inflation-output trade-off to spur output above its natural rate. Whereas, the notion of new inflation bias proposes that such a central banker is more concerned about the economy being plunged into recession. Therefore, its asymmetric preference in favor of output-stabilization leads to an inefficiently high inflation. The non-stabilization sources may include a number of factors other than the stabilization-sources. For example, the first is the fiscal dominance in terms of using seigniorage

[91] To recall from Section 4.5, there is no exact definition of inflation bias. Few studies have put it with slight differences, the central theme; however, is the end product of an excess inflation than some unknown but a desirable level. For example, Ruge-Murcia and Francisco J. (2001) put it as "the systematic difference between equilibrium and optimal inflation" (pp. 5). Romer (2006) conceptualized it as the tendency of monetary policy to produce higher rate of inflation than optimal inflation over extended periods. Gartner (2000) viewed it as the tendency of the central banks with representational preferences (preferences for employment and inflation) to generate inefficiently high inflation rates without gaining the benefit of output beyond the potential output.

money for its purposes (see Barro, 1983b) and lack of central bank independence (see Cukierman *et al.*, 1992). Second is the rationality assumption per se that economic agents are rational (see Kydland and Prescott, 1977; Barro and Gordon, 1983) while understanding the motivation of a discretionary central banker to inflate for temporary output gains, they adjust their expectations accordingly – implying that actual inflation cannot systematically be higher or lower than the expected inflation. Third is the openness channel as investigated by Romer (1993) in the context of time inconsistency problem of monetary policy and fourth is the balance of payments as is emphasized by Mendonca (2005). Last is the notion of surprise inflation and high average monetary expansion as is predicted by Barro and Gordon (1983b).

Although, theoretically literature has highlighted an array of the sources of inflation bias, empirical literature is sparse (Berlemann, 2005) while its focus remains: first, on validating the evidence of the predictions of theory; second on estimating the extent of inflation bias and third to seek evidence of central banker's asymmetric preferences to explain inflation rather than inflation bias. For example, Ireland (1999) and Ruge-Murcia (2003a) examined validity of the predictions of Barro and Gordon (1983)'s model. Cukierman and Gerlach (2003) conducted a preliminary test to support their new inflation bias proposition. Garman and Richards (1989) and Surico (2008) estimated the extent of inflation bias. Ruge-Murcia (2003b), Sweidan (2009) and Kobbi (2013) investigated the relevance of central banker's asymmetric preferences in explaining inflation.

This gap between theoretical and empirical literature on the sources of inflation bias can partially be due to the non-existence of inflation bias indicators and appropriate proxies of its determinants. As is evident from (Table 4.1), empirical studies have used inflation rather than inflation bias indicators per se as left hand side variables. Whereas, the right hand side variables are mainly confined to inflation, inflation variance, output, output variance and output gap as against an array of stabilization and non-stabilization sources of inflation bias.

To fill this gap, the current study contributes in three ways. First, it gleans potential stabilization and non-stabilization sources of inflation bias from the literature and constructs their proxy variables in case of absence of appropriate indicators for empirical investigation. Second, to ascertain their long-term relevance and relative-robustness (defined in Section 5.3), it systematically examines their cointegrating relationship with inflation bias indicators per se in bivariate and multivariate settings.[92] This evidence is particularly important in guiding the central bankers' focus towards the most relevant and robust sources of inflation bias to help contain it more effectively. Third, in contrast to the previous studies that have mainly focused on advanced countries (see Table 4.1), this analysis is conducted for a typical case of the discretionary monetary policy strategy of Pakistan. This country's central bank has not only dual objectives of inflation and growth (SBP Act, 1956) but also targets a growth level above the natural rate of the economy (see Figure 2.1). These two monetary policy features make it ideal for such analysis.[93]

Autoregressive Distributed Lag (ARDL) bounds testing and estimation strategy of Pesaran *et al.* (2001) is applied to test for the existence of cointegrating relationships (see Section 3.3.3 for details). Findings of this study suggest that the stabilization-sources of inflation bias as advocated by the conventional theory and the new inflation bias proposition are highly significant and robust determinants of inflation bias as

[92] To the best of author's knowledge, this is the first study that uses inflation bias indicators per se in empirical investigation to explore the long-term relative-robustness of its stabilization and non-stabilization sources.

[93] To recall that Bec *et al*. (2002) noted that inflation bias arises due to two features of monetary policy. First, dual objectives of inflation and output and second, targeting an output level above the natural rate of the economy.

compared to the non-stabilization sources. The stabilization sources withstand the relative-robustness criterion chalked out by the study. The temptation to exploit inflation-output trade-off and the effort to maintain the real growth at its natural rate provide strong evidence to explain inflation bias in Pakistan. Surprise monetary expansion and openness are partially relevant but fragile non-stabilization sources of inflation bias. The surprise monetary expansion is marginally significant only in bivariate and sub-period analysis. It fails to withstand the relative-robustness check in the mainstream multivariate analysis by losing its significance. Openness indicator is relevant but a fragile source of inflation bias as it fails to pass the relative-robustness check in the full sample cointegration analysis while its coefficient changes sign in the sub-period.

The remainder of the chapter is organized as follows. Section 5.2 discusses and deduces the determinants of inflation bias from the literature broadly under the stabilization and non-stabilization sources. Section 5.3 highlights estimation strategy and enunciates the specific methodological framework of the analysis. Section 5.4 introduces the data sources, constructs the proxy indicators for stabilization and non-stabilization sources and conducts their unit root tests. Section 5.5 presents the results while Section 5.6 concludes the chapter.

5.2 STABILIZATION AND NON-STABILIZATION SOURCES OF INFLATION BIAS

5.2.1 Stabilization sources

This study posits that stabilization sources pertain mainly to the core arguments in the conventional theory of inflation bias and the new inflation bias proposition. Under the conventional scheme a discretionary central banker tries to exploit inflation-output trade-off to spur the output above its natural rate. Under the new inflation bias argument, such a central banker is more concerned about below than above natural rate of economy.

The underlying motivation for exercise of discretion is the incentive in exploitation of the Phillips Curve that unemployment can be reduced by accepting a slightly higher inflation than otherwise would be (Gordon, 2011). Kydland and Prescott (1977) and Barro and Gordon (1983), however, argued that the realization of such exploitation is not possible as the public are rational and form their expectations in view of their understanding of the incentive of the central banker to inflate. Resultantly, in the long-run exploitation of inflation-output trade-off leads to an excess in inflation. In contrast to Kydland and Prescott (1977) and Barro and Gordon (1983), Cukierman (2000) proposed that inflation bias may arise due to the precautionary motives of a discretionary central banker. As per this proposition, central bank is more sensitive to below than above natural rate of the economy.

The empirical literature on validating the relevance of both the conventional inflation bias theory and the new inflation bias proposition as compared to the large theoretical literature is limited (Ruje-Murcia, 2003). For example, Ireland (1999) examined the prediction of the conventional theory of inflation bias by estimating the cointegrating relationship between civilian unemployment rate and GDP implicit price deflator. He concluded on the basis of his estimation that the theory explains the initial rise and subsequent fall of inflation in the U.S. Ruje-Murcia (2003a) examined the prediction of the conventional theory by applying FIML methodology and using GDP deflator, unemployment rate and the conditional variance of unemployment. He, however, could not find support for the conventional theory in case of the U.S. Similarly, Cukierman and Gerlach (2003) tested the new inflation bias proposition by examining the relationship between inflation and variance of growth for selected OECD countries and found a positive relationship between output variability and inflation. Ruje-Murcia (2003a) also examined its relevance and concluded that the U.S. data supports the new inflation bias view point. Although the analysis in these studies to test for the predictions of the conventional and new inflation bias viewpoints has their own specific objectives, the conduct of empirical analysis using appropriate proxies of inflation bias per se, inflation output trade-off and output volatility for a typical case of discretion may extend this literature.

5.2.2 Non-stabilization sources of inflation bias

These are the sources of inflation bias other than the core arguments – often highlighted in the literature with relatively less emphasis. Some of these sources can be investigated empirically and may include the following.

5.2.2.1 Monetary surprises and the core money growth

It may be gleaned from the literature that surprise increase in inflation (stemming from monetary surprises) leads to inflation bias (Barro and Gordon, 1983b; Barro, 1986; Berlemann, 2005 and Romer, 2006). In the pertinent empirical literature however, by and large the role of money seems to be ignored (Soderstrom, 2001).[94] Although, in standard empirical literature narrow and broad measures of money supply such as M1, M2 and M3 are generally used, its application in the context of inflationary bias requires a slight distinction. Particularly, in case of Pakistan where the central bank targets the M2 for achievement of its objectives. One may ask that is it the long-term expansion (contraction) in M2 or the core money growth that the central banker would use to push the real output beyond or maintain at its natural rate.[95]

Implicit in the theories explaining inflation bias, is the element of monetary surprises (see Rogoff, 1985b; Romer, 1993; Berlemann, 2005; Romer 2006) that can appropriately be captured by expansion (contraction) in money supply growth above (below) its long-term growth path. This surprise expansion or contraction of growth in money can reflect the extent of use of discretion in the short-term by the central banker. Nevertheless, in the long-run the core money growth can be source of inflation bias as Barro and Gordon (1983b) also predicted high average monetary growth as the outcome of a discretionry monetary policy.

Technically, it can be thought of as a long-term growth path of money supply. The central banker of Pakistan exercise discretion in determining the long-term growth path of money supply that can help achieve the combination of the indicative targets for inflation and growth for a particular year. Recently, some studies such as Gerlach (2003-2004); Neumann and Greiber (2004) and Carstensen (2007) identified core money growth as a

[94] Interest rate indicators also represent monetary policy maker’s actions but their use seems more relevant in the analysis of commitment based frameworks where money growth is generally assumed to be determined endogenously – as compared to its exogenous determination in case of monetary aggregates targeting.

[95] One may expect the natural rate of monetary aggregates (also known as core money growth) to approximate the central banker’s targets for monetary aggregates in a monetary targeting monetary policy strategy.

significant and stable explanatory variable of movements in inflation in the Euro area. The core money growth essentially characterizes long-term behavior of target growth rates of money supply, which a discretionary central banker deem necessary for the long-term achievement of its objectives.

Therefore, core money growth is another potential source of inflation bias, particularly, in typical monetary targeting policy frameworks. Since an appropriate amount of growth in money supply for achievement of desirable combination of inflation and real growth in a particular period is not known, the chances of error in the specification of its optimal level are high. For example, if in a particular time period, targets for money growth are set higher than optimal; the natural outcome would be excessive inflation. Therefore, this study considers both monetary surprises and core money growth as sources of inflation bias.[96]

5.2.2.2 Expectations

One of the main assumptions of the theory of dynamic inconsistency of discretionary monetary policy is rational expectations (Kydland and Prescott, 1977). Under this scheme the public is rational and understand the incentive of a discretionary central banker to increase output growth beyond its natural rate.[97] Such a policy is time inconsistent and hence leads to inflation bias without long-term output gain as the public form their expectations accordingly.

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[96] Friedman and Schwartz (1991) recommended modeling of the trend and cycle jointly and the use of annual data in the analysis.

[97] Kydland and Prescott (1977, pp. 474) put it as “current decisions of economic agents depend in part upon their expectations of future policy actions.”

Another viewpoint is that it is the previous experiences of the public regarding the conduct of monetary policy on the basis of which they form expectations about the conduct of monetary policy in future. For example, in their model of reputation as a remedy for inflation bias, Barro and Gordon (1983a) argued that reputation may possibly substitute for formal rules because people's expectations for future policy in some way depend on past performance of central banker. However, it is difficult to formalize the linkages between past actions and expectations of future behavior (Barro, 1986). Therefore, it can be discerned that inflation bias may be determined both by rational and adaptive nature of expectations.

5.2.2.3 Openness and equilibrium in balance of payments

Romer (1993) carried out detailed empirical analysis and found a robust negative link between inflation and openness. His results confirmed the basic prediction of Rogoff (1985b) who extended the dynamic inconsistency model to an open economy setting and noted that surprise monetary expansion leads to depreciation of real exchange rate, and hence reduces the incentive to expand money supply. Therefore, inflation bias may be determined by the level of integration (openness) of economy. The more integrated the economy is, the more is the likeliness of inflation bias with an increase in monetary expansion.

Guender and McCaw (1999) showed that for a small open economy with discretionary monetary policy, inflation bias is inversely related to the elasticity of output supplied with respect to real exchange rate. Similarly, Mendonca (2005) while appraising conventional and new inflation bias arguments identified the lack of equilibrium in balance of payments as a source of inflation bias especially, in case of developing economies. In order to correct for disequilibrium in balance of payments, currency is devalued to encourage exports and discourage imports resulting in an increase in inflation. This explanation is different from that of standard explanations and emerges from the problem of deficit in balance of payments.

5.2.2.4 Fiscal dominance

Fiscal dominance may refer to the submissiveness of monetary policy to the fiscal policy. It can be linked to a number of theoretical explanations pertaining to inflation bias. This may include the government's use of monetary policy to serve its objectives, which may not necessarily increase the long-term welfare of society (see Fratianni *et al.,* 1997; Piga, 2004). One of the motivations of government's involvement in central bank affairs may come through printing more money. For example, Barro (1983) argued that the government may choose to inflate through seigniorage by printing more money to benefit from expansion in economic activity and reduction in real value of its nominal liabilities. Such benefits, however, do not arise systematically in equilibrium as people adjust their expectations accordingly, which implies high rates of inflation and monetary growth than otherwise. Therefore, inflation bias may be represented as a function of seigniorage.

The flip side of this argument of political involvement reflects the lack of independence of central bank. The increased involvement of government in conduct of monetary policy affects its inflation-performance. Rogoff (1985) suggested delegation of the conduct of monetary policy to a conservative and an independent central bank to contain inflation bias. Several empirical studies since then have found evidence of a negative correlation between central bank independence and inflation such as Alesina (1988), Grilli *et al*. (1991), Cukierman *et al*. (1992) and Alesina and Summers (1993). Therefore, inflation bias may also be expressed as a function of central bank's independence.

5.3 METHODOLOGICAL FRAMEWORK

To examine the relevance and robustness of the specified inflation bias determinants, this study uses a combination of relative-robustness (consistent with Levine and Renelt, 1992) and the standard sub-period robustness checks. The relative-robustness is defined as if an independent variable significantly enters into the model with other explanatory variables in a significant cointegrating-relationship after qualifying (i) the variable addition test (VAT) and (ii) without losing its significance is a relatively-robust determinant.[98] This combination of both the relative and sub-period robustness checks together forms a relatively stringent robustness criterion.

Since there is no standard theoretical framework to guide empirical work on inflation bias, this study applies specific to general approach as it allows determination of right hand side variables sequentially in two rounds. In the first round, bivariate cointegration analysis is conducted to identify the core-variables that form a baseline model. The core-variables are the variables that qualify an ad hoc criterion that – such a variable significantly enters into a significant cointegrating relationship with the dependent variable without the problems of autocorrelation and functional form. In time series analysis, the presence of autocorrelation and misspecification of the model are considered more serious problems than the normality

[98] VAT is the joint F-test of zero restrictions on the coefficients of additional variables.

of residuals and heteroscedasticity.[99] This does not mean that the assumptions of normality and heteroscedasticity are trivial but practically it's hard to get normally distributed residuals and the heteroscedasticity is more of a serious problem in cross-section data.

In the second round, multivariate cointegration analysis is conducted. The remaining explanatory non-core variables are tested through VAT for its potential introduction into the baseline model. While conducting multivariate analysis, insignificant variables are dropped from the model only if the variable deletion test (VDT) supports its exclusion.[100] This ad hoc operational mechanism is particularly helpful to make the analysis more objective by containing the elements of subjectivity and discretion in obtaining the final results.

Since, the study estimates a number of ARDL models in bivariate and multivariate settings, specific models may not be specified here, however, a general specification of the error correction versions of the ARDL models to test for the existence of cointegration for the four inflation bias indicators is given as:

$$\Delta IB1_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta IB1_{t-i} + \sum_{j=0}^{q} \alpha_j^X \Delta X_{t-j} + \beta_0 IB1_{t-1} + \beta_1 X_{t-1} + \epsilon_t \qquad (5.1)$$

$$\Delta IB2_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta IB2_{t-i} + \sum_{j=0}^{q} \alpha_j^X \Delta X_{t-j} + \beta_0 IB2_{t-1} + \beta_1 X_{t-1} + \epsilon_t \qquad (5.2)$$

$$\Delta IB3_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta IB3_{t-i} + \sum_{j=0}^{q} \alpha_j^X \Delta X_{t-j} + \beta_0 IB3_{t-1} + \beta_1 X_{t-1} + \epsilon_t \qquad (5.3)$$

[99] In ARDL bounds testing methodology of Pesaran *et al*. (2001) serial independence of the errors is a key assumption.
[100] VDT is the joint F-test of zero restrictions on the coefficients of deleted variables.

$$\Delta IB4_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta IB4_{t-i} + \sum_{j=0}^{q} \alpha_j^X \Delta X_{t-j} + \beta_0 IB4_{t-1} + \beta_1 X_{t-1} + \epsilon_t \quad (5.4)$$

Where, X_t is the vector of explanatory variables. $IB1$, $IB2$, $IB3$ and $IB4$ denotes the inflation bias indicators (see Chapter 4 for details of the inflation bias indicators).

5.4 DATA SOURCES, VARIABLES CONSTRUCTION AND UNIT ROOT TESTS

5.4.1 Data sources and variables construction

Annual time-series data is obtained from World Bank Development Indicators (WDI) and the State Bank of Pakistan (SBP) for time period spanning from 1961 to 2010. The stabilization variables used in the empirical analysis are $IOTO$ and $GDPT$ representing inflation-output trade-off and volatility of output, respectively. The non-stabilization determinants used in the empirical investigation are monetary surprises ($GM2T$), core money growth ($GM2P$), overall seigniorage ($SEIN$), seigniorage generated by the State Bank of Pakistan ($SSBP$), central bank independence ($CIND$), nominal openness ($OPEN$) and real openness ($OPER$).

$IOTO$ is measured as the ratio of inflation rate to the real GDP growth rate. For the conventional explanation of inflation bias to hold true, one would expect the ratio of inflation to real growth ($\frac{\pi}{\widehat{GDP}}$, where π is inflation and $\widehat{GDP}$ is the real growth) to increase each time when central banker attempts to increase surprise inflation in order to increase output.[101] This may occur in two ways: first, an increase in π without a proportionate increase in $\widehat{GDP}$ or a decrease in $\widehat{GDP}$ second, a decrease in π such that $\Delta\pi < \Delta\widehat{GDP}$.

[101] The ratio implies a trade-off between the change in prices and the change in output as both numerator and denominator are growth variables.

This ratio may also imply central banker's symmetric preference, if in a particular period t, $\frac{\pi}{\widehat{GDP}} = 1$, which indicates that central bank gives equal weight to both inflation and output objectives in that particular period, subject to the condition that both $\pi > 0$ and $\widehat{GDP} > 0$. If $\frac{\pi}{\widehat{GDP}} > 1$, the central banker has given more weight to the growth objective rather than inflation objective, and vice versa, if $\frac{\pi}{\widehat{GDP}} < 1$. Thus an increase in the ratio indicates that the central bank is giving more importance to the output objective compared to the inflation objective with the implicit assumption that inflation and growth are determined by the monetary policy. Therefore, in part the extent of change in the ratio would determine the level of excess inflation in the economy by capturing inflation-output trade-off and the level of central banker's preference either for inflation or output in a particular period.

$GDPT$ is the transitory component (output gap) extracted from real GDP growth data using the HP filter. As discussed in Chapter 2, the HP filter decomposes the time series of an observed variable into a permanent component (a secular trend that is slowly evolved) and a transitory component (for details see Hodrick and Prescott, 1997). This study choses HP filter because it gives maximum smoothing (Neumann and Greiber, 2004) and allows the trend to vary over time. Orphanides and Nordon (1999) noted that preference should be given to models with time varying trend rates. Combination of both these features make the technique ideal to capture the deviations from the trend over time with varying magnitude that may better represent the policy actions of monetary policy maker.[102]

[102] This will also help minimize the extent of potential bias inherent in the use of simple variance as is used by Cukierman and Gerlach (2003). The use of variance of growth may not appropriately capture their theoretical explanation for a single country time-series analysis, because it assumes a constant mean. This potentially increases the chances of introducing bias into estimates, particularly, in time-series data. Such a bias may

$GM2T$ and $GM2P$ are also obtained through the HP filter based on the justification that the filter allows time varying trend and hence shocks with varying magnitudes. The trend component (proxy of core money growth) needs to be time varying as Pakistan's central bank set a target for $M2$ monetary aggregate each year that may not be constant as it depends on the indicative targets for inflation and real growth. The filter capture deviations from trend, which this study relates to monetary surprises and the intensity and magnitude of such surprises, would vary depending on the contemporary levels of inflation and growth and the central banker's aggressiveness for any particular objective.

$SEIN$ and $SSBP$ represent the two specifications of seigniorage. Seigniorage is generally defined in two ways: first, as the opportunity cost of holding money and second, the amount of real resources obtained by the government through injection of new base money. The latter definition is widely used to motivate the measurement of seigniorage as it is hard to identify the 'true' interest rate as is required by the opportunity cost definition. Since, it is convenient to use the monetary definition to generate seigniorage; this study uses an approach consistent with Baltensperger and Jordan (1997) for the measurement of seigniorage.[103] Firstly, the overall seigniorage is obtained as $SEIN = \frac{\Delta M}{P}$, where ΔM is the change in the broad money ($M2$) and P is the price index. This measure represent the real

either be upward or downward depending on the existing level of actual trend of growth (natural rate) in the economy. For example, if at a particular point in time, the trend of growth is high, the central banker's response may not be aggressive to shocks to growth and vice versa.

[103] The monetary approach is based on strong assumptions and the seigniorage may be overestimated if these are not met (see Auerenheimer, 1974). Nevertheless, determination of the validity of such assumptions is beyond the scope of this analysis.

value of money issued in a given time period (Arby, 2006). Secondly, the central bank seigniorage is obtained as $SSBP = \frac{\Delta H}{P}$, where ΔH is the change in high-power money.[104] The central bank's independence indicator denoted by $CIND$ is measured as the ratio of the government's domestic outstanding debt to the real GDP. Consistent with Grilli *et al*. (1991) and Neyapti (2003), this indicator mainly represents the financial dimension of the central bank independence.[105]

Although, there is no consensus on any particular ratio or index to be used as a universally accepted measure (David, 2007) of openness, the current study choses to employ the most widely used measures. $OPEN$ and $OPER$ are the nominal and real ratios of exports plus imports to the GDP. These ratios are largely considered as measures of the country's size and integration into the international markets rather than trade policy orientation, which is the main objective of the study to account for. This study takes a precautionary approach and uses the two alternative measure of openness – both nominal and real as Alcala and Ciccone (2004) argue that the real measure of openness should be preferred over the nominal.

It is important to mention that although rational expectations and balance of payment are important determinants of inflation bias (see Section 5.2.2.2 and Section 5.2.2.3), their indicators are not included in the analysis as explanatory variables due to

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[104] Arby (2006) used similar methodology to obtain seigniorage for Pakistan for a relatively shorter time period from 1972-2005 as compared to the current study.

[105] Since the central bank independence indices are highly subjective (Mangano, 1998; Ahsan *et al*. 2006) and non-robust (Arnone *et al*. 2006). The current study mainly relies on a financial indicator for which consistent data is available for the underlying sample period. This may appropriately proxy central bank's independence as Rao (2011) noted that in Pakistan the revenue deficit is often financed by the government through borrowing. Recently the SBP reported in its annual report (2012-13) that government has breached its borrowing limit (and has reached 59% of M2). This level of government borrowing in SBP's viewpoint impairs financial intermediation and complicates liquidity and debt management. Moreover, construction of a comprehensive index–representing legal, political, objective and policy dimensions of central bank independence requires separate research, which is beyond the scope of the present analysis.

non-availability of data.[106] As an alternative, the study considered conducting a test suggested by Griffiths *et al*. (1993) to explore if adaptive expectations approximate rational expectations.[107] Although, the results of the test confirmed that adaptive expectations approximate rational expectations, the indicator of the adaptive expectations (lag of inflation) was dropped from estimations because of its high correlation with inflation bias indicators.

5.4.3 Stationarity properties

In order to rationalize the suitability of the application of ARDL approach, the stationarity properties of the underlying variables were tested through three popular unit root tests. The tests yielded inconsistent results for some of the variables. For example, $SSBP$ is I(1) as per ADF and DF-GLS but I(0) as per the PP tests (see Table 5.1 for unit root tests results). Again, $GM2P$ as per ADF is I(0) and as per PP it is I(1) but the latter may not be reliable due to the presence of autocorrelation problem as is suggested by the DW=0.31. ADF also shows that the $GM2P$ is stationary at second difference as the P-value in that case is [0.03] and DW is 1.92.

Thus the ADF test shows stationarity for $GM2P$ both in level and second difference instead of the first difference. As per the DF-GLS, the $GM2P$ is neither I(0) nor I(1). It is not even stationary at the second difference. The t-stat of the DF-GLS test for the second difference is -1.93 against the C.V of -2.89 for a 10% level. The DW at second difference is 1.91. In such a case, where the order of integration of variables cannot be determined for

[106] There is no consistent data both for balance of payment and rational expectations. For the latter the central bank of Pakistan has recently started collecting survey data since January, 2012 and its preliminary analysis by the SBP indicate that the trend in actual inflation follows the trend in expected inflation (SBP annual report, 2012-13). Another way is to infer expectations from existing data, for example, through yield curve on government bonds, however, government bonds in Pakistan are not indexed (SBP annual report, 2012-13).
[107] For an illustration of the test see p.147-148 of their book.

sure as no single test can be reliable, the use of traditional cointegration techniques, which requires the variables to be integrated of order I(1) may lead to unreliable results.

Moreover, the stationarity properties of the variables show that they are a mixture of both I(0) and I(1), which suggest ARDL as the best available approach for testing and estimation purposes.

Table 5.1: Stationarity properties of the variables

	ADF		DF-GLS		PP	
Variables	**Level**	**First difference**	**Level**	**First difference**	**Level**	**First difference**
$IB1$	[0.03]**	[0.00]***	[-2.68]***	[-6.92]***	[0.03]**	[0.00]***
(DW)	1.76	2.00	1.78	2.00	1.76	2.01
$IB2$	[0.03]**	[0.00]***	[-2.72]***	[-6.95]***	[0.03]**	[0.00]***
(DW)	1.75	2.01	1.77	2.01	1.75	2.01
$IB3$	[0.03]**	[0.00]***	[-2.83]***	[-6.94]***	[0.02]**	[0.00]***
(DW)	1.74	2.01	1.76	2.01	1.74	2.01
$IB4$	[0.02]**	[0.00]***	[-3.13]***	[-7.05]***	[0.02]**	[0.00]***
(DW)	1.75	2.01	1.75	2.01	1.75	2.01
IOTO	[0.00]***		[-4.93]***		[0.00]***	
(DW)	2.04		2.07		2.04	
OPEN	[0.21]	[0.00]***	[-0.20]	[-7.19]***	[0.17]	[0.00]***
(DW)	2.23	1.99	1.95	1.99	2.23	1.99
RGAP	[0.00]***		[-7.52]***		[0.00]***	
(DW)	2.03		2.00		2.03	
OPER	[0.27]	[0.00]***	[-0.20]	[-7.12]***	[0.35]	[0.00]***
(DW)	2.25	1.86	2.25	1.86	2.25	2.09
SSBP	[0.78]	[0.00]***	[-0.47]	[-10.33]***	[0.00]***	[0.00]***
(DW)	2.18	2.23	2.16	2.22	2.37	2.54
SEIN	[0.76]	[0.00]***	[-0.55]	[-10.97]***	[0.46]	[0.00]***
(DW)	2.1	2.15	2.09	2.13	2.6	2.15
GM2P	[0.06]*	[0.25]	[-0.93]	[-0.45]	[0.00]	[0.07]*
(DW)	1.92	1.92	1.95	1.98	0.15	0.31
GM2T	[0.00]***		[-4.21]***		[0.00]***	
(DW)	1.95		1.99		1.95	
CIND	[1.00]	[0.71]	[1.38]	[-1.26]	[1.00]	[0.93]
(DW)	2.25	2.06	1.84	2.08	0.76	2.38

This Table reports the P-values of the Augmented Dicky Fuller (ADF) and Phillips Perron (PP) tests and the t-statistics of the Elliott-Rotenberg-Stock DF-GLS in brackets. The Durbin Watson (DW) statistic is also reported to show that (i) different tests may yield varied results and (ii) stationarity was achieved while the residuals were uncorrelated. ***, ** and * indicates that the series are stationary at 1%, 5% and 10% level of significance, respectively.

5.5 RESULTS

5.5.1 Relative-robustness check

In the first step bivariate cointegration analysis was conducted for the four inflation bias indicators with a purpose to identify the 'core variables' that determine inflation bias. Each inflation bias indicator was regressed on the stabilization and non-stabilization variables one by one. The ARDL models were selected through the Schwarz Bayesian Criterion (SBC) as it is a consistent model selection criterion and that is selects the most parsimonious model (Enders, 1995) – a model with the least number of freely estimated parameters. [108] A maximum lag of 3 years was imposed to allow for a sufficient transmission-time and to avoid omitted variable bias problem that might emerge due to the omission of a significant lag. The null and alternative hypothesis to test for the existence of a level relationship can be expressed as $H_0: \beta_1 = \beta_2 \ldots\ldots = \beta_n = 0$ against $H_1: \beta_1 \neq \beta_2 \ldots\ldots \neq \beta_n \neq 0$ where rejection of H_0 implies that a long-run relationship exists.

The results of the bivariate cointegration analysis and error correction models are presented in Tables 5.2-5.5 along with the corresponding goodness-of-fit and the outcomes of diagnostic tests. These results show that all the specified stabilization and non-stabilization determinants are highly cointegrated with inflation bias indicators while showing the expected signs but not all of them are significantly relevant (see the column with COIN in Tables 5.2-5.5). For example on the basis of the first round bivariate cointegration analysis, only $IOTO$ and $GM2T$ and $OPEN$ are statistically significant. Out of them only the first two meet the ad hoc criterion for a core variable as they entered into a significant cointegrating relationship with the inflation bias indicators without the problems

[108] See Section 3.3 for justification and the two-stage procedure of the ARDL testing and estimation strategy.

of serial correlation of residuals or misspecification of the models (see the P-values of diagnostic tests for Model 1 and Model 3 in Tables 5.2-5.5). These bivariate models pass the required diagnostic tests consistently for almost all the indicators of inflation bias as compared to the rest of the models. For example, in case of Model 1, the null of no serial correlation and no misspecification could not be rejected. Whereas, in case of Model 3, the null of no serial correlation, no misspecification, normality of residuals and homoscedasticity could not be rejected. These models show a significant error correction term as is denoted by the $ECM(-1)$ with varying degrees of convergence to the long-run.

Since qualification as a core or non-core variable on the basis of the first round bivariate cointegration analysis lends support to the long-term relevance of a particular variable but may not determine its relative-robustness against other competing variables. Therefore, in the second round multivariate cointegration analysis was conducted to ascertain both the relevance and relative-robustness of stabilization and non-stabilization sources of inflation bias. In this round, the non-core variables were sequentially introduced into the baseline inflation bias models with $IB1$, $IB2$, $IB3$ and $IB4$. Each non-core variable was subjected to the VAT one by one for a potential inclusion into the baseline inflation bias models. As can be seen from VAT1 in Tables 5.6-5.9, only $GDPT$ could pass the VAT to be included with the core variables in the regression.

The ARDL results after inclusion of the $RGAP$ show that all the variables are statistically significant (see Model 2, Tables 5.6-5.9). This ARDL model; however, may not be relied on as it fails to pass the cointegration test because the respective computed F-statistic falls within the lower and upper critical value bound hence rendering the inference about the long-term level relationship as ‘inconclusive’ (see column with COIN, Model 2 in

Tables 5.6-5.9). Further, the null of no serial correlation and no misspecification was rejected for all the four specifications of inflation bias models. To correct for these problems VAT was conducted to examine if any of the remaining variables can significantly enter the model; however, none of these variables could pass the VAT (see VAT2 in Tables 5.6-5.9).

Alternatively, a dummy ($SHOK$) was introduced to control for the potential effects of the 1973 international oil price shock and the floods that significantly affected the prices in Pakistan.[109] The $SHOK$ takes the value '1' for the period 1973 to 1975 and '0' otherwise. Re-estimation along with the $SHOK$ corrects for the problems of cointegration, misspecification as well as normality problems (see Model 3 in Tables 5.6-5.9). The $SHOK$ is highly statistically significant and exerts a quantitatively large effect but the results of this Model 3 are also not reliable as the null of no serial correlation is rejected hence violating one of the key assumption of ARDL as is given by Pesaran *et al.* (2001). To fix the serial correlation problem in the Model 3 and to explore if any of the remaining variables may qualify for a meaningful introduction to the Model 3 all the rest of the variables were once again subjected to the VAT. $OPER$, $OPEN$ and $SSBP$ qualified the VAT but only the $OPER$ (i) fixed the problem of serial correlation without inducing any other diagnostic problems and (ii) enhanced the fit of the data (see the results for Model 4 in Tables 5.6-5.9).[110] The final Model 4 passes all the diagnostic as well as the stability tests. The outcome of the stability tests such as cumulative *sum of recursive residuals* ($CUSUM$) and the cumulative *sum of squares of recursive residuals* ($CUSUMQ$) are

[109] In this period Pakistan experienced an all-time high average inflation rate of around 24% from 1973 to 1975.

[110] Although SSBP and OPEN passed the VAT but they further aggravated the diagnostic problems as it instigated the problem of specification on top of the existing problem of serial correlation.

presented in Figure 5.1 and Figure 5.2, which indicates that the estimated relationships are stable.

The conduct of multivariate cointegration analysis as a check of relative-robustness of the inflation bias determinants suggests that both the stabilization-sources of inflation bias are relatively-robust. For example, $IOTO$ and $GDPT$ as advocated by the conventional theory of inflation bias of Kydland and Prescott (1977) and Barro and Gordon (1983) and the new inflation bias proposition of Cukierman (2000) withstand the relative-robustness check without losing the high levels of significance and cointegration. This finding implies that in the long-run the central bank of Pakistan tries to exploit inflation output trade-off and does not allow the output to fall below its natural rate even at the expense of high inflation.

The former evidence related to the exploitation of inflation output trade-off for the achievement of higher than natural rate of the economy is in sharp contrast to the Blinder's viewpoint. Blinder (1998) argues that practically the central bankers target the expected rate of inflation. The latter evidence of concern for output stabilization supports the assertion of Blinder (1998, p. 19-20) that "in most situations the central bank will take far more political heat when it tightens pre-emptively to avoid higher inflation than when it eases pre-emptively to avoid higher unemployment".

From within the two stabilization-sources of inflation bias $IOTO$ and $GDPT$, the former is more consistent as: firstly, in the initial bivariate cointegration analysis it qualified as a core variable and secondly, its significance remained unaffected under the second round relative-robustness multivariate cointegration analysis. The latter, however, could not qualify as a core variable but withstood the relative robustness checks consistently. $IOTO$ is not only thoroughly consistent in explaining inflation bias with a relatively high goodness of fit and significance but its effect is quantitatively large as compared to the $RGAP$.[111] This suggests that the conventional theory of inflation bias as put forth by Kydland and Prescott (1977) and Barro and Gordon (1983) is the core cause of inflation bias followed by Blinder's (1998) claim and the new inflation bias proposition.

All the non-stabilization sources such as $GM2T$, $OPEN$, $OPER$, $GM2P$, $SEIN$, $SSBP$ and $CIND$ are both fragile and insignificant in the long-run. They might be significant in the short-run; however, its investigation is beyond the scope of the current analysis. On the basis of the multivariate relative-robustness the non-stabilization sources of inflation bias are fragile as they failed to significantly enter the models at various stages such as $SEIN$, $SSBP$, $OPEN$, $CIND$ and $GM2P$. $GM2T$ remained in the multivariate models at various stages but lost its significance. The $OPER$ is fragile because it could significantly enter only into the final model and is only marginally significant at 10%.

In normative terms, these findings have nontrivial implications for the design and conduct of monetary policy in Pakistan. In this country, the monetary policy is conducted in sharp contrast to the widely accepted monetary policy beliefs and practices that in the long-run inflation output trade-off cannot be exploited and that inflation rather than output should be the primary objective of the central bank. A natural recommendation therefore would be the move towards a monetary policy strategy more oriented towards price stability rather than growth stability.

[111] This result holds even when the coefficients of the two variables are standardized for the purpose of comparison. For example, the respective standardized coefficients for IOTO and RGAP in case of IB1 (as dependent variable) are 0.67 and 0.40, respectively.

Table 5.2: ARDL long-term estimates of bivariate analysis – dependent variable $IB1$

Models /Variables	**Variables**											**Fit of the data and econometric tests**							
	$GM2T$	$GM2P$	$IOTO$	$OPEN$	$OPER$	$SEIN$	$SSBP$	$GDPT$	$CIND$	α	$ECM(-1)$	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 1	-2.67*									36.61	-0.37								
	(1.43)									(7.16)	(0.11)	0.46	1,0	6.39	1%	[0.13]	[0.18]	[0.00]	[0.92]
	[0.07]									[0.00]	[0.00]								
Model 2		3.53								-16.96	-0.41								
		(5.00)								(75.56)	(0.13)	0.40	1,0	5.36	5%	[0.08]	[0.83]	[0.00]	[0.39]
		[0.48]								[0.82]	[0.00]								
Model 3			7.85***							15.19	-0.72								
			(1.63)							(4.97)	(0.13)	0.64	2,2	15.19	1%	[0.75]	[0.45]	[0.16]	[0.23]
			[0.00]							[0.004]	[0.00]								
Model 4				-1.82*						32.33	-0.58								
				(0.99)						(5.32)	(0.11)	0.6	1,2	12.13	1%	[0.23]	[0.07]	[0.01]	[0.59]
				[0.08]						[0.00]	[0.00]								
Model 5					22.38					29.49	-0.40								
					(113.33)					(27.48)	(0.12)	0.5	1,1	6.38	1%	[0.59]	[0.50]	[0.00]	[0.03]
					[0.84]					[0.29]	[0.00]								
Model 6						0.56				30.69	-0.35								
						(0.65)				(11.40)	(0.11)	0.50	1,1	5.68	2.5%	[0.08]	[0.16]	[0.00]	[0.38]
						[0.39]				[0.01]	[0.00]								
Model 7							0.58			33.58	-0.38								
							(0.17)			(10.86)	(0.12)	0.39	1,0	5.42	5%	[0.19]	[0.79]	[0.00]	[0.49]
							[0.74]			[0.00]	[0.00]								
Model 8								0.54		36.28	-0.38								
								(3.65)		(7.45)	(0.12)	0.4	1,0	5.34	5%	[0.18]	[0.87]	[0.00]	[0.46]
								[0.88]		[0.00]	[0.00]								
Model 9									18.10	34.03	-0.38								
									(56.49)	(10.10)	(0.12)	0.4	1,0	5.30	5%	[0.18]	[0.79]	[0.00]	[0.47]
									[0.75]	[0.00]	[0.00]								

This Table reports the cointegrating relationship of the IB1 with its potential determinants in a bivariate setting. ECM is the error correction model showing the speed of convergence into the long-term is computed as $ECM = y - \beta_c * C - \beta_x * X$, where for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β_x is its coefficient. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=2 with intercept and no trend at 10%, 5%, 2.5% and 1% are [3.17 – 4.14], [3.79 – 4.85], [4.41 – 5.52] and [5.15 – 6.36], respectively. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form – Ramsey regression equation specification error test (RESET) using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Table 5.3: ARDL long-term estimates of bivariate analysis – dependent variable $IB2$

Models /Variables	Variables											Fit of the data and econometric tests							
	$GM2T$	$GM2P$	$IOTO$	$OPEN$	$OPER$	$SEIN$	$SSBP$	$GDPT$	$CIND$	α	$ECM(-1)$	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 1	-1.22*									14.57	-0.37								
	(0.65)									(3.24)	(0.11)	0.46	1,0	6.21	5%	[0.13]	[0.19]	[0.00]	[0.93]
	[0.07									[0.00]	[0.00]								
Model 2		1.59								-9.59	-0.41								
		(2.26)								(34.18)	(0.13)	0.40	1,0	5.27	5%	[0.08]	[0.87]	[0.00]	[0.38]
		[0.49]								[0.78]	[0.00]								
Model 3			3.52***							4.99	-0.72								
			(0.73)							(2.24)	(0.13)	0.64	2,2	15.20	1%	[0.70]	[0.46]	[0.11]	[0.25]
			[0.00]							[0.03]	[0.00]								
Model 4				-0.82*						12.59	-0.58								
				(0.45)						(2.38)	(0.12)	0.58	1,2	12.31	1%	[0.20]	[0.08]	[0.00]	[0.61]
				[0.07]						[0.00]	[0.00]								
Model 5					10.54					11.25	-0.39								
					(51.25)					(12.43)	(0.12)	0.45	1,1	6.27	3%	[0.59]	[0.54]	[0.00]	[0.04]
					[0.84]					[0.37]	[0.00]								
Model 6						0.25				11.88	-0.37								
						(0.30)				(5.18)	(0.11)	0.50	1,1	5.59	3%	[0.07]	[0.16]	[0.00]	[0.37]
						[0.39]				[0.03]	[0.00]								
Model 7							0.25			13.25	-0.38								
							(0.78)			(4.92)	(0.12)	0.40	1,0	5.34	5%	[0.19]	[0.82]	[0.00]	[0.48]
							[0.74]			[0.01]	[0.00]								
Model 8								0.28		14.4	-0.37								
								(1.66)		(3.38)	(0.12)	0.4	1,0	5.27	5%	[0.18]	[0.91]	[0.00]	[0.45]
								[0.87]		[0.00]	[0.00]								
Model 9									8.18	13.41	-0.38								
									(25.61)	(4.58)	(0.12)	0.40	1,0	5.21	5%	[0.17]	[0.83]	[0.00]	[0.46]
									[0.75]	[0.01]	[0.00]								

This Table reports the cointegrating relationship of the IB2 with its potential determinants in a bivariate setting. ECM is the error correction model showing the speed of convergence into the long-term is computed as $ECM = y - \beta_c * C - \beta_x * X$, where for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β_x is its coefficient. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=2 with intercept and no trend at 10%, 5%, 2.5% and 1% are [3.17 – 4.14], [3.79 – 4.85], [4.41 – 5.52] and [5.15 – 6.36], respectively. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form – Ramsey regression equation specification error test (RESET) using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Table 5.4: ARDL long-term estimates of bivariate analysis – dependent variable $IB3$

Models	Variables											Fit of the data and econometric tests							
/Variables	$GM2T$	$GM2P$	$IOTO$	$OPEN$	$OPER$	$SEIN$	$SSBP$	$GDPT$	$CIND$	α	$ECM(-1)$	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 1	-0.81*									8.13	-0.36								
	(0.43)									(2.11)	(0.11)	0.46	1,0	5.99	10%	[0.14]	[0.20]	[0.00]	[0.95]
	[0.07]									[0.00]	[0.00]								
Model 2		1.07								-8.10	-0.41								
		(1.46)								(22.00)	(0.13)	0.40	1,0	5.18	10%	[0.07]	[0.91]	[0.00]	[0.38]
		[0.47]								[0.72]	[0.00]								
Model 3			2.27***							1.99	-0.72								
			(0.47)							(1.45)	(0.13)	0.65	2,2	15.15	1%	[0.63]	[0.46]	[0.08]	[0.29]
			[0.00]							[0.18]	[0.00]								
Model 4				-0.54*						6.84	-0.57								
				(0.29)						(1.53)	(0.12)	0.59	1,2	12.47	1%	[0.20]	[0.12]	[0.00]	[0.64]
				[0.06]						[0.00]	[0.00]								
Model 5					6.36					6.09	-0.57								
					(33.11)					(8.04)	(0.12)	0.45	1,2	6.12	1%	[0.59]	[0.57]	[0.00]	[0.03]
					[0.84]					[0.45]	[0.00]								
Model 6						0.17				6.35	-0.34								
						(0.20)				(3.38)	(0.11)	0.50	1,1	5.37	5%	[0.07]	[0.16]	[0.00]	[0.36]
						[0.38]				[0.06]	[0.00]								
Model 7							0.16			7.28	-0.37								
							(0.51)			(3.20)	(0.12)	0.50	1,0	5.23	5%	[0.18]	[0.84]	[0.00]	[0.45]
							[0.75]			[0.03]	[0.00]								
Model 8								0.28		8.03	-0.37								
								(1.08)		(2.19)	(0.12)	0.4	1,0	5.18	10%	[0.17]	[0.93]	[0.00]	[0.45]
								[0.85]		[0.00]	[0.00]								
Model 9									5.47	7.36	-0.38								
									(16.65)	(2.97)	(0.11)	0.40	1,0	5.1	10%	[0.17]	[0.85]	[0.00]	[0.46]
									[0.74]	[0.02]	[0.00]								

This Table reports the cointegrating relationship of the IB3 with its potential determinants in a bivariate setting. ECM is the error correction model showing the speed of convergence into the long-term is computed as $ECM = y - \beta_c * C - \beta_x * X$, where for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β_x is its coefficient. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=2 with intercept and no trend at 10%, 5%, 2.5% and 1% are [3.17 – 4.14], [3.79 – 4.85], [4.41 – 5.52] and [5.15 – 6.36], respectively. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form – Ramsey regression equation specification error test (RESET) using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Table 5.5: ARDL long-term estimates of bivariate analysis – dependent variable $IB4$

Models /Variables	Variables											Fit of the data and econometric tests							
	$GM2T$	$GM2P$	$IOTO$	$OPEN$	$OPER$	$SEIN$	$SSBP$	$GDPT$	$CIND$	α	$ECM(-1)$	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 1	-0.14*									1.01	-0.38								
	(0.72)									(0.34)	(0.11)	0.45	1,0	5.91	10%	[0.19]	[0.11]	[0.00]	[0.93]
	[0.05]									[0.00]	[0.00]								
Model 2		0.18								-1.69	-0.43								
		(0.24)								(3.54)	(0.13)	0.37	1,0	5.46	10%	[0.08]	[0.70]	[0.00]	[0.33]
		[0.45]								[0.64]	[0.00]								
Model 3			0.38***							0.01	-0.76								
			(0.07)							(0.23)	(0.13)	0.65	2,2	17.44	1%	[0.45]	[0.36]	[0.03]	[0.33]
			[0.00]							[0.98]	[0.00]								
Model 4				-0.09*						0.81	-0.61								
				(0.04)						(0.24)	(0.12)	0.59	1,2	14.33	1%	[0.27]	[0.06]	[0.00]	[0.66]
				[0.04]						[0.00]	[0.00]								
Model 5					1.09					0.59	-0.48								
					(4.44)					(1.09)	(0.12)	0.48	1,2	8.52	1%	[0.13]	[0.06]	[0.00]	[0.25]
					[0.81]					[0.59]	[0.00]								
Model 6						0.27				0.74	-0.35								
						(0.32)				(0.56)	(0.11)	0.48	1,1	5.40	5%	[0.06]	[0.08]	[0.00]	[0.31]
						[0.41]				[0.19]	[0.00]								
Model 7							0.28			0.87	-0.39								
							(0.82)			(0.52)	(0.12)	0.37	1,0	6.97	5%	[0.18]	[0.55]	[0.00]	[0.42]
							[0.73]			[0.10]	[0.00]								
Model 8								-0.02		0.99	-0.40								
								(0.17)		(0.35)	(0.12)	0.36	1,0	5.47	10%	[0.17]	[0.61]	[0.00]	[0.41]
								[0.92]		[0.00]	[0.00]								
Model 9									1.13	0.86	-0.40								
									(2.68)	(0.48)	(0.12)	0.37	1,0	5.10	10%	[0.16]	[0.56]	[0.00]	[0.41]
									[0.67]	[0.08]	[0.00]								

This Table reports the cointegrating relationship of the IB4 with its potential determinants in a bivariate setting. ECM is the error correction model showing the speed of convergence into the long-term is computed as $ECM = y - \beta_c * C - \beta_x * X$, where for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β_x is its coefficient. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=2 with intercept and no trend at 10%, 5%, 2.5% and 1% are [3.17 – 4.14], [3.79 – 4.85], [4.41 – 5.52] and [5.15 – 6.36], respectively. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form – Ramsey regression equation specification error test (RESET) using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Table 5.6: ARDL long-term estimates of multivariate analysis – dependent variable $IB1$

	Variables												Fit of the data and econometric tests							
Models	$IOTO$	$GM2P$	$OPER$	$GM2T$	$OPEN$	$SEIN$	$SSBP$	$GDPT$	$CIND$	$SHOK$	α	$ECM(-1)$	R^2	**ARDL**	**FSTS**	**COIN**	**AUTO**	**SPEC**	**NORM**	**HETR**
Model 1	6.19***			-1.55							20.37	-0.47								
	(1.99)			(0.94)							(6.95)	(0.11)	0.56	1,0,0	4.19	10%	[0.23]	[0.13]	[0.00]	[0.87]
	[0.00]			[0.11]							[0.00]	[0.00]								
VAT1		[0.69]	[0.43]		[0.32]	[0.66]	[0.55]	[0.00]	[0.86]											
Model 2	10.29***			-1.59*				9.52***			9.64	-0.49								
	(2.36)			(0.79)				(3.07)			(7.12)	(0.09)	0.67	1,0,0,0	3.15	INCN	[0.35]	[0.08]	[0.00]	[0.68]
	[0.00]			[0.05]				[0.00]			[0.18]	[0.00]								
VAT2		[0.41]	[0.67]		[0.22]	[0.94]	[0.54]		[0.69]											
Model 3	6.14***			0.21				5.55***		68.28***	14.93	-0.65								
	(1.31)			(0.58)				(1.71)		(11.71)	(4.01)	(0.08)	0.82	1,0,1,0	8.27	1%	[0.04]	[0.39]	[0.65]	[0.50]
	[0.00]			[0.73]				[0.00]		[0.00]	[0.00]	[0.00]								
VAT3			[0.05]																	
Model 4	5.84***		-83.80**	-0.01				4.72***		93.95***	-35.91	-0.62								
	(1.19)		(37.19)	(0.55)				(1.46)		(17.43)	(9.51)	(0.08)	0.88	1,0,3,0,0	5.86	1%	[0.48]	[0.16]	[0.77]	[0.71]
	[0.00]		[0.03]	[0.99]				[0.00]		[0.00]	[0.00]	[0.00]								

This Table reports the cointegrating relationship of the IB1 with its potential determinants in a multivariate setting. ECM is the error correction model showing the speed of convergence into the long-term is computed as $ECM = y - \beta_c * C - \beta_1 * X_1 - \cdots \beta_n * X_n$, where for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β is its coefficient. VAT stands for the variable addition test, which is a joint (LM) test of zero restrictions on the coefficients of additional variables, whereas variable deletion tests (VDT) is the joint (LM) test of zero restrictions on the coefficients of deleted variables. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. INCN shows that the cointegration is inconclusive. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=4 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.45 – 3.52], [2.86 – 4.01], [3.25 – 4.49] and [3.74 – 5.06], respectively. Similarly the critical lower and upper value bounds of Pesaran *et al*. (2001) for k=5 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.26 – 3.35], [2.62 – 3.79], [2.96 – 4.18] and [3.41 – 4.68], respectively. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test–Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of Skewness and Kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Table 5.7: ARDL long-term estimates of multivariate analysis – dependent variable $IB2$

Models	Variables												Fit of the data and econometric tests							
	$IOTO$	$GM2P$	$OPER$	$GM2T$	$OPEN$	$SEIN$	$SSBP$	$GDPT$	$CIND$	$SHOK$	α	$ECM(-1)$	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 1	2.80***			-0.71							7.23	-0.47								
	(0.91)			(0.43)							(3.15)	(0.10)	0.56	1,0,0	4.07	10%	[0.23]	[0.13]	[0.00]	[0.88]
	[0.00]			[0.10]							[0.03]	[0.00]								
VAT1		[0.70]	[0.44]		[0.32]	[0.66]	[0.56]	[0.00]	[0.86]											
Model 2	10.29***			-1.59*				9.52***			9.64	-0.49								
	(2.36)			(0.79)				(3.07)			(7.12)	(0.09)	0.67	1,0,0,0	3.15	INCN	[0.35]	[0.08]	[0.00]	[0.68]
	[0.00]			[0.05]				[0.00]			[0.18]	[0.00]								
VAT2		[0.41]	[0.67]		[0.22]	[0.94]	[0.54]		[0.69]											
Model 4	2.79***			0.07				2.53***		30.77***	4.78	-0.65								
	(0.59)			(0.26)				(0.77)		(5.24)	(1.80)	(0.08)	0.82	1,0,1,0	8.23	1%	[0.03]	[0.37]	[0.63]	[0.39]
	[0.00]			[0.79]				[0.00]		[0.00]	[0.01]	[0.00]								
VAT4			[0.05]																	
Model 5	2.67***		-36.64**	-0.03				1.97***		42.65***	-13.96	-0.61								
	(0.54)		(16.77)	(0.25)				(0.71)		(7.88)	(4.29)	(0.08)	0.88	1,0,3,1,0	5.84	1%	[0.44]	[0.16]	[0.85]	[0.35]
	[0.00]		[0.04]	[0.89]				[0.01]		[0.00]	[0.00]	[0.00]								

This Table reports the cointegrating relationship of the IB2 with its potential determinants in a multivariate setting. ECM is the error correction model showing the speed of convergence into the long-term is computed as $ECM = y - \beta_c * C - \beta_1 * X_1 - \cdots \beta_n * X_n$, where for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β is its coefficient. VAT stands for the variable addition test, which is a joint (LM) test of zero restrictions on the coefficients of additional variables, whereas variable deletion tests (VDT) is the joint (LM) test of zero restrictions on the coefficients of deleted variables. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. INCN shows that the cointegration is inconclusive. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=4 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.45 – 3.52], [2.86 – 4.01], [3.25 – 4.49] and [3.74 – 5.06], respectively. Similarly the critical lower and upper value bounds of Pesaran *et al*. (2001) for k=5 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.26 – 3.35], [2.62 – 3.79], [2.96 – 4.18] and [3.41 – 4.68], respectively. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test–Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of Skewness and Kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Table 5.8: ARDL long-term estimates of multivariate analysis – dependent variable $IB3$

Models	Variables												Fit of the data and econometric tests							
	$IOTO$	$GM2P$	$OPER$	$GM2T$	$OPEN$	$SEIN$	$SSBP$	$GDPT$	$CIND$	$SHOK$	α	$ECM(-1)$	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
Model 1	1.82***			-0.47							3.38	-0.47								
	(0.59)			(0.28)							(2.06)	(0.11)	0.57	1,0,0	3.93	10%	[0.25]	[0.13]	[0.00]	[0.91]
	[0.00]			[0.09]							[0.11]	[0.00]								
VAT1		[0.69]	[0.44]		[0.31]	[0.65]	[0.56]	[0.00]	[0.86]											
Model 2	3.06***			-0.49*				2.87***			0.14	-0.49								
	(0.70)			(0.24)				(0.91)			(2.11)	(0.09)	0.67	1,0,0,0	2.99	INCN	[0.28]	[0.09]	[0.00]	[0.74]
	[0.00]			[0.05]				[0.00]			[0.95]	[0.00]								
VAT2		[0.69]	[0.43]		[0.23]	[0.94]	[0.55]		[0.68]											
Model 4	1.81***			0.03				1.66***		19.83***	1.81	-0.65								
	(0.38)			(0.16)				(0.50)		(3.36)	(1.16)	(0.08)	0.82	1,0,1,0	8.12	1%	[0.03]	[0.36]	[0.65]	[0.46]
	[0.00]			[0.87]				[0.00]		[0.00]	[0.13]	[0.00]								
VAT4			[0.06]																	
Model 5	1.75***		-23.24**	-0.04				1.30***		27.72***	7.61	-0.60								
	(0.35)		(10.85)	(0.16)				(0.46)		(5.11)	(2.77)	(0.08)	0.88	1,0,3,1,0	5.79	1%	[0.41]	[0.17]	[0.92]	[0.36]
	[0.00]		[0.04]	[0.79]				[0.00]		[0.00]	[0.00]	[0.00]								

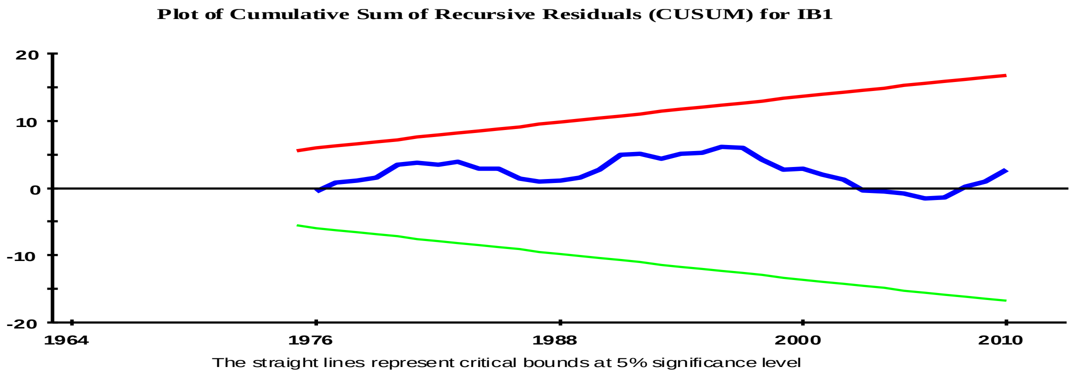
This Table reports the cointegrating relationship of the IB3 with its potential determinants in a multivariate setting. ECM is the error correction model showing the speed of convergence into the long-term is computed as $ECM = y - \beta_c * C - \beta_1 * X_1 - \cdots \beta_n * X_n$, where for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β is its coefficient. VAT stands for the variable addition test, which is a joint (LM) test of zero restrictions on the coefficients of additional variables, whereas variable deletion tests (VDT) is the joint (LM) test of zero restrictions on the coefficients of deleted variables. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. INCN shows that the cointegration is inconclusive. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=4 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.45 – 3.52], [2.86 – 4.01], [3.25 – 4.49] and [3.74 – 5.06], respectively. Similarly the critical lower and upper value bounds of Pesaran *et al*. (2001) for k=5 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.26 – 3.35], [2.62 – 3.79], [2.96 – 4.18] and [3.41 – 4.68], respectively. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test–Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of Skewness and Kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

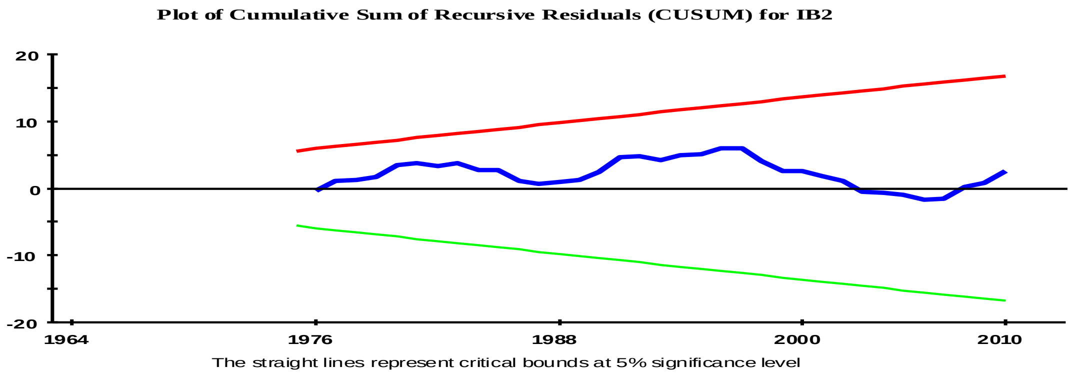
Table 5.9: ARDL long-term estimates of multivariate analysis – dependent variable $IB4$

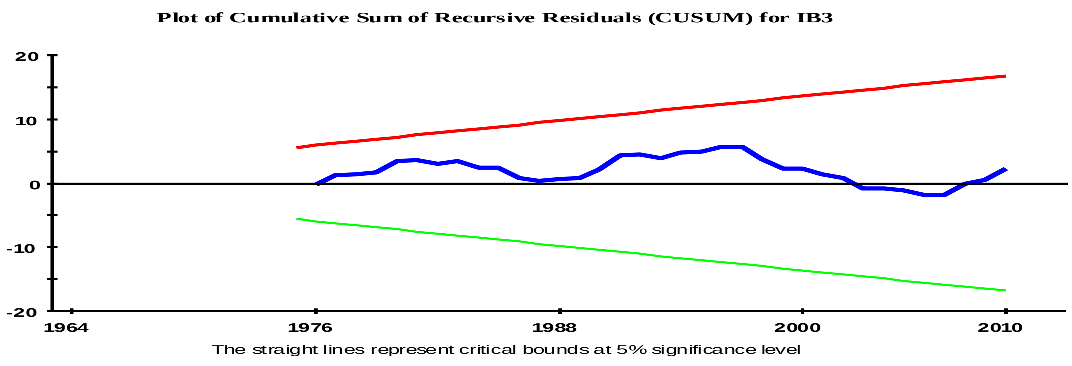
	Variables												Fit of the data and econometric tests							
Models	$IOTO$	$GM2P$	$OPER$	$GM2T$	$OPEN$	$SEIN$	$SSBP$	$GDPT$	$CIND$	$SHOK$	α	$ECM(-1)$	R^2	**ARDL**	**FSTS**	**COIN**	**AUTO**	**SPEC**	**NORM**	**HETR**
Model 1	0.30***			-0.09							0.23	-0.48								
	(0.09)			(0.05)							(0.34)	(0.11)	0.56	1,0,0	3.89	10%	[0.28]	[0.07]	[0.00]	[0.90]
	[0.00]			[0.07]							[0.50]	[0.00]								
VAT1		[0.67]	[0.38]		[0.30]	[0.63]	[0.51]	[0.00]	[0.94]											
Model 2	0.47***			-0.06*				-0.04***			0.20	-0.55								
	(0.09)			(0.03)				(0.18)			(0.30)	(0.09)	0.71	1,0,0,2	3.70	INCN	[0.11]	[0.01]	[0.38]	[0.20]
	[0.00]			[0.06]				[0.83]			[0.50]	[0.00]								
VAT2		[0.87]	[0.76]		[0.35]	[0.84]	[0.48]		[0.58]											
Model 4	0.28***			0.03				0.23***		3.08***	0.05	-0.73								
	(0.06)			(0.02)				(0.07)		(0.49)	(0.18)	(0.08)	0.80	1,0,0,0	12.60	1%	[0.01]	[0.37]	[0.92]	[0.34]
	[0.00]			[0.11]				[0.00]		[0.00]	[0.79]	[0.00]								
VAT4			[0.06]																	
Model 5	0.27***		-3.65**	-0.04				0.17***		4.47***	0.96	-0.65								
	(0.06)		(1.71)	(0.02)				(0.07)		(0.79)	(0.44)	(0.08)	0.87	1,0,3,0,0	7.72	1%	[0.27]	[0.01]	[0.97]	[0.50]
	[0.00]		[0.04]	[0.04]				[0.02]		[0.00]	[0.04]	[0.00]								

This Table reports the cointegrating relationship of the IB4 with its potential determinants in a multivariate setting. ECM is the error correction model showing the speed of convergence into the long-term is computed as $ECM = y - \beta_c * C - \beta_1 * X_1 - \cdots \beta_n * X_n$, where for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β is its coefficient. VAT stands for the variable addition test, which is a joint (LM) test of zero restrictions on the coefficients of additional variables, whereas variable deletion tests (VDT) is the joint (LM) test of zero restrictions on the coefficients of deleted variables. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. INCN shows that the cointegration is inconclusive. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=4 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.45 – 3.52], [2.86 – 4.01], [3.25 – 4.49] and [3.74 – 5.06], respectively. Similarly the critical lower and upper value bounds of Pesaran *et al*. (2001) for k=5 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.26 – 3.35], [2.62 – 3.79], [2.96 – 4.18] and [3.41 – 4.68], respectively. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test–Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of Skewness and Kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

Figure 5.1: Stability tests







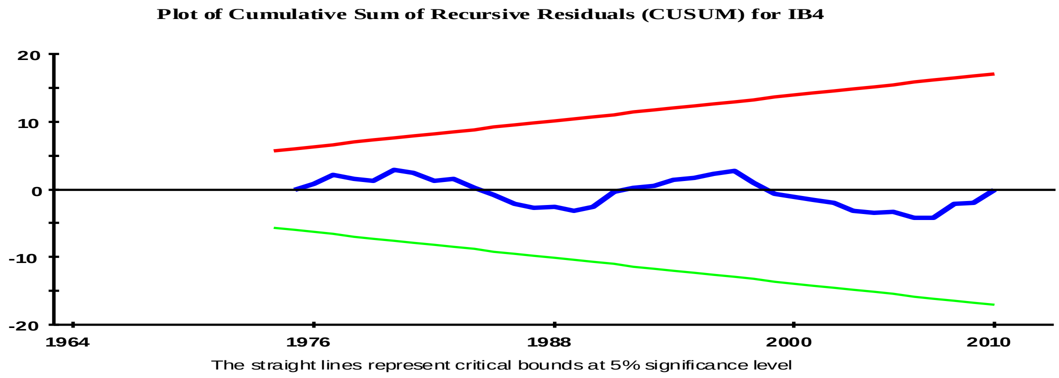
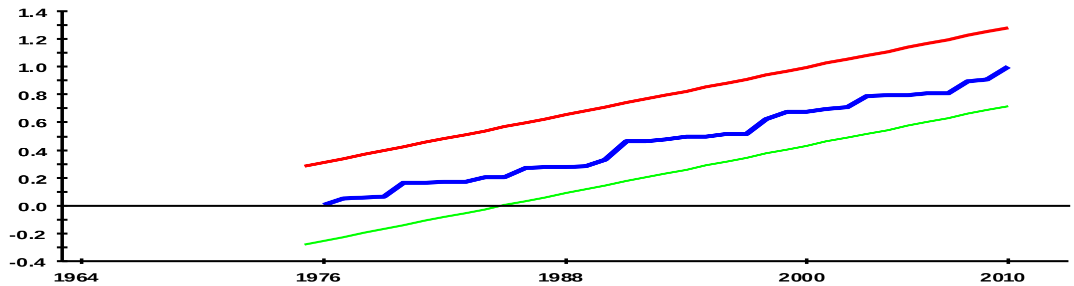


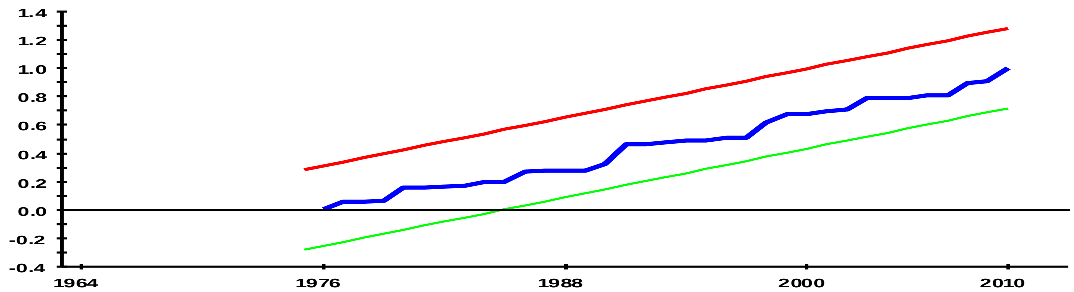
Figure 5.2: Stability tests

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) for IB1



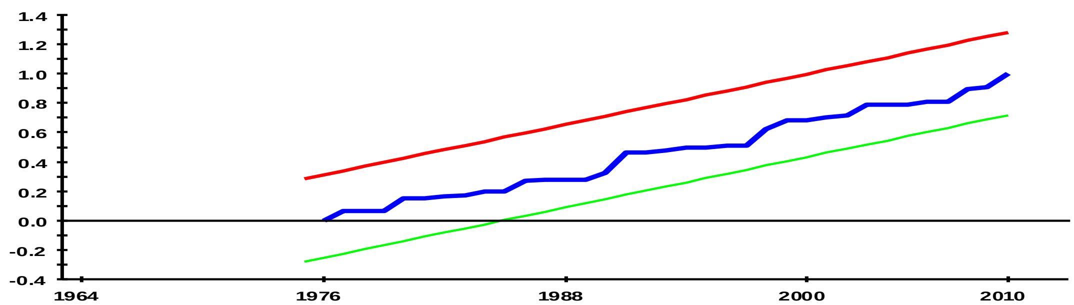
The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) for IB2



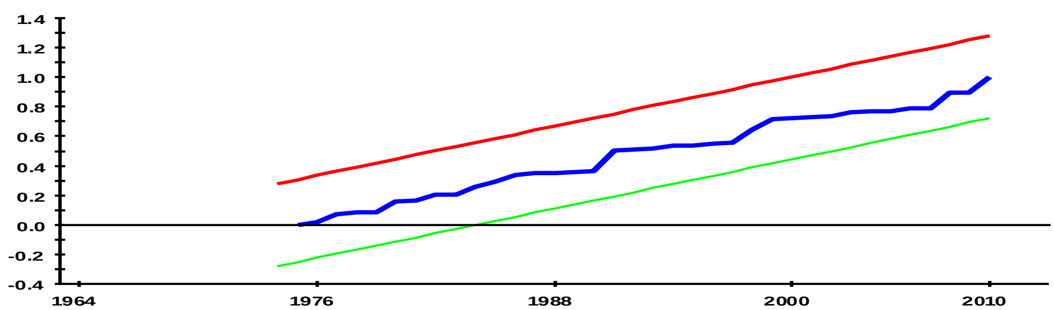
The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) for IB3



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) for IB4



The straight lines represent critical bounds at 5% significance level

5.5.2 Robustness check

In order to confirm the robustness of the final Model 4, the cointegration tests were conducted for a sub-sample from 1973-2010.[112] Since the overall sample (50 observations) is not sufficiently large to split into two equal parts, only the activist monetary policy period from 1971-2010 was considered. As mentioned in (Section 4.5.2), in this period, the average inflation, $M2$ and real growth rates are 9.39%, 15.45%, and 4.9% as compared to 3.51%, 11.33% and 7.24% in 1961-1970, respectively. This clearly indicates the pursuit of activist's monetary policy where money supply is actively used to reduce the unemployment. The initial two years of 1971 and 1972 were dropped from estimation to eliminate the potential effects of Pakistan's war with India in 1971.

The sub-period analysis as a check of the robustness of the final Model 4 confirms the results obtained from the full-sample. The null of the existence of a level relationship among the variables could not be rejected as the computed F-stat is greater than the critical value bound at 1% level for all the inflation bias indicators except $IB4$ (see Table 10).[113] The Models passes all the key diagnostic and stability tests as are presented in Table 5.10, Figure 5.3 and Figure 5.4.

The results of this sub-period relative-robustness check confirm the robustness of the stabilization sources in explaining inflation bias in Pakistan. Both conventional and new inflation bias arguments stand valid and play a non-trivial role in determining inflation bias

[112] It is important to mention that the study conducted rolling window robustness check for a 40 years' time frame starting from 1961 and finishing at 2001 and so on from 1970 till 2010. The results of the robustness strongly support the findings of the study. These results, however, are not reproduced to save space and they are available on demand from the author.

[113] This may indicate that IB4 does not appropriately capture the inflation bias. Similar findings were observed in Chapter 3 and Chapter 4 as in these cases the results of IB4 were not consistent with IB1, IB2 and IB3.

as compared to the non-stabilization sources. The non-stabilization sources are fragile as the coefficient of $OPER$ changed sign and the $GM2T$ is only marginally significant at 10%. This gain in the significance of the $GM2T$ in the sub-period can be explained by the increased monetary activism by the discretionary central banker of Pakistan as the average $M2$ growth rates increased from 11.33% in the excluded period to 15.45% in the sub-sample period. The evidence about the fragility of $OPER$ is supportive of the inflation-openness puzzle. The evidence of the cointegrating relationship between openness and inflation bias is both mixed (negative and positive) and fragile contrary to the finding of the negative robust relationship by Romer (1993).[114]

[114] Lane (1997) also found a significant inverse relationship between inflation and openness. Nevertheless, there are other studies who could not find a robust significant relationship between inflation and openness such as Terra (1998) and Temple (2002).

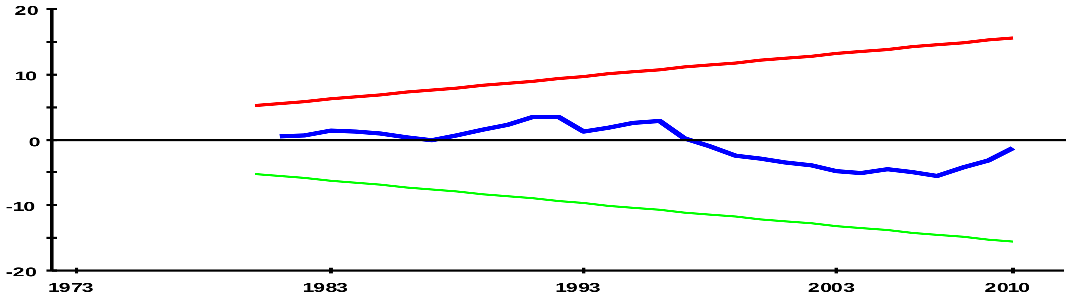
Table 5.10: ARDL long-term estimates – dependent variables, $IB1$, $IB2$, $IB3$ and $IB4$ (1973-2010)

Models /Variables	Variables							Fit of the data and econometric tests								
	$IOTO$	$OPER$	$GM2T$	$GDPT$	$SHOK$	α	$ECM(-1)$	R^2	ARDL	FSTS	COIN	AUTO	SPEC	NORM	HETR
	6.12***	240.33**	-0.63*	5.23***	46.82***	-30.19	-0.80								
Model 1 ($IB1$)	(1.08)	(111.18)	(0.36)	(1.60)	(7.91)	(22.07)	(0.08)	0.88	1,0,0,0,0	10.34	1%	[0.11]	[0.29]	[0.89]	[0.83]
	[0.00]	[0.04]	[0.09]	[0.00]	[0.00]	[0.18]	[0.00]								
	2.77***	108.85**	-0.29*	2.37***	21.21***	-15.69	-0.80								
Model 2 ($IB2$)	(0.49)	(50.36)	(0.16)	(0.73)	(3.58)	(9.99)	(0.08)	0.88	1,0,0,0,0	10.35	1%	[0.11]	[0.29]	[0.89]	[0.85]
	[0.00]	[0.04]	[0.09]	[0.00]	[0.00]	[0.13]	[0.00]								
	1.79***	70.39**	-0.19*	1.53***	13.76***	-11.43	-0.80								
Model 3 ($IB3$)	(0.32)	(32.60)	(0.11)	(0.47)	(2.32)	(6.47)	(0.08)	0.88	1,0,0,0,0	10.36	1%	[0.11]	[0.30]	[0.89]	[0.87]
	[0.00]	[0.04]	[0.36]	[0.00]	[0.00]	[0.08]	[0.00]								
	0.29***	9.60*	-0.03*	0.22***	2.45***	-1.78	-0.84								
Model 4 (*IB4*)	(0.05)	(5.19)	(0.02)	(0.07)	(0.37)	(1.03)	(0.08)	0.88	1,0,0,0,0	11.25	1%	[0.08]	[0.54]	[0.94]	[0.85]
	[0.00]	[0.07]	[0.09]	[0.00]	[0.00]	[0.09]	[0.00]								

This Table reports the cointegrating relationship of the IB1 with its potential determinants in a multivariate setting. ECM is the error correction model computed as $ECM = y - \beta_c * C - \beta_1 * X_1 - \cdots \beta_n * X_n$, where, for any particular model, y is the dependent variable, C is constant term and β_c is its estimated coefficient, X is explanatory variable and β is its coefficient. VAT stands for the variable addition test, which is a joint test (LM) of zero restrictions on the coefficients of additional variables, whereas variable deletion tests (VDT) is the joint test (LM) of zero restrictions on the coefficients of deleted variables. ARDL represents the lag order of the variables as is selected by the SBC. FSTS shows the computed F-statistics to test for the existence of a cointegrating relationship. If the FSTS is greater than the upper critical value bound, the null hypothesis of no level effect is rejected. The critical lower and upper value bounds of Pesaran *et al*. (2001) for k=4 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.45 – 3.52], [2.86 – 4.01], [3.25 – 4.49] and [3.74 – 5.06], respectively. Similarly the critical lower and upper value bounds of Pesaran *et al*. (2001) for k=5 with intercept and no trend at 10%, 5%, 2.5% and 1% are [2.26 – 3.35], [2.62 – 3.79], [2.96 – 4.18] and [3.41 – 4.68], respectively. COIN indicates the cointegration at a certain level of confidence. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test–Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets and the values in parentheses are the standard errors. The significance level of the coefficients at 1%, 5% and 10% are indicated by ***, ** and *, respectively.

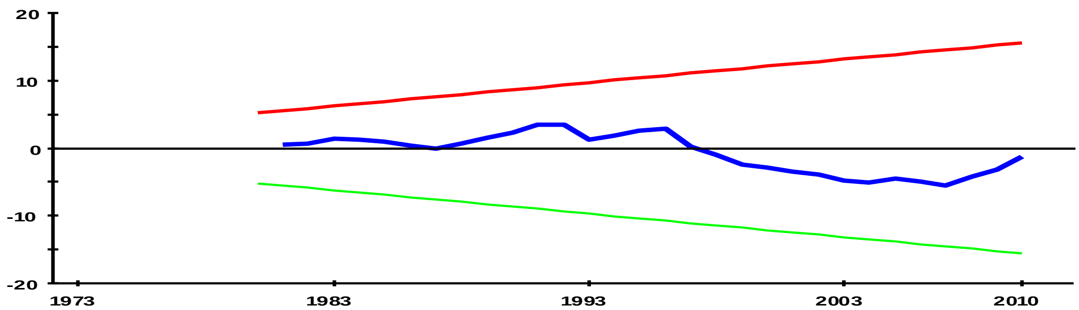
Figure 5.3: Stability tests

Plot of Cumulative Sum of Recursive Residuals (CUSUM) for IB1: 1973-2010



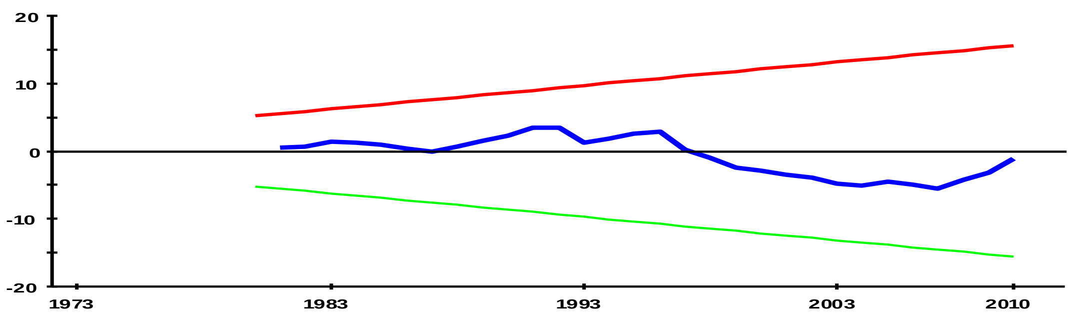
The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Recursive Residuals (CUSUM) for IB2: 1973-2010



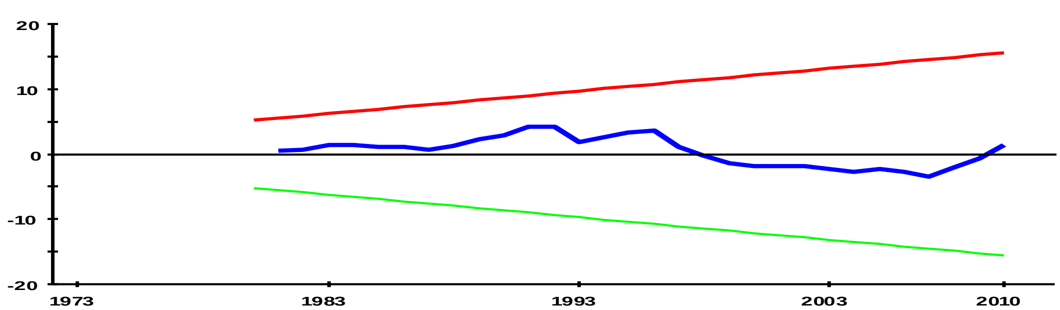
The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Recursive Residuals (CUSUM) for IB3: 1973-2010



The straight lines represent critical bounds at 5% significance level

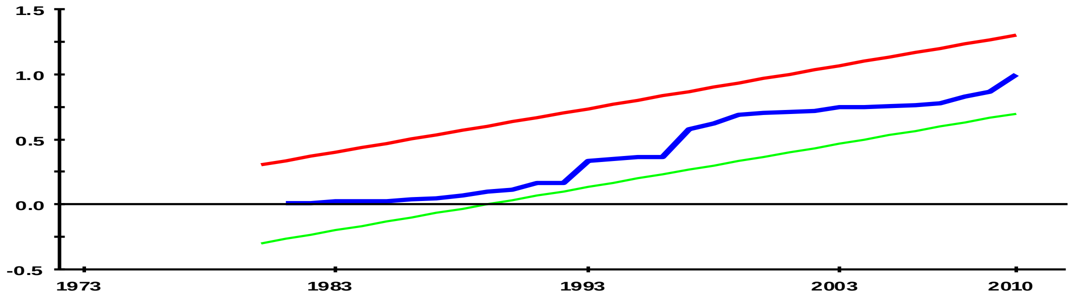
Plot of Cumulative Sum of Recursive Residuals (CUSUM) for IB4: 1973-2010



The straight lines represent critical bounds at 5% significance level

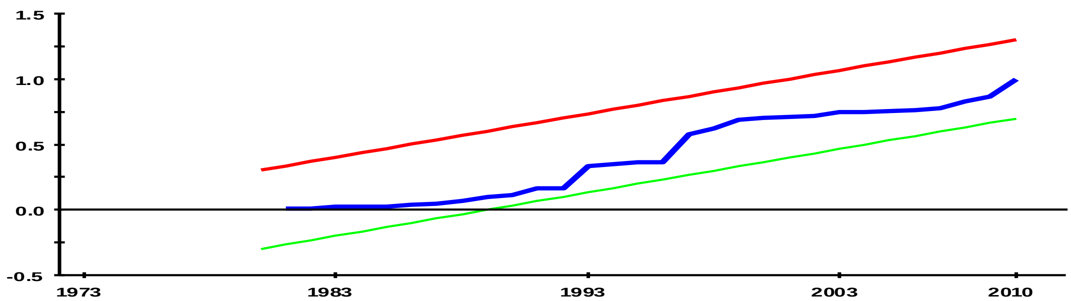
Figure 5.4: Stability tests

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) for IB1: 1973-2010



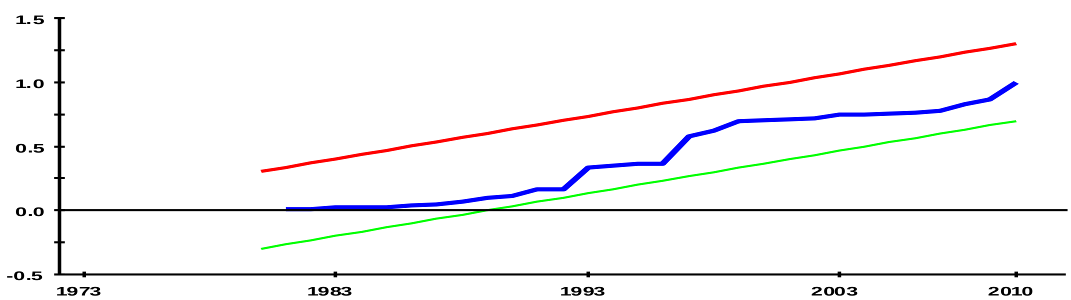
The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) for IB2: 1973-2010



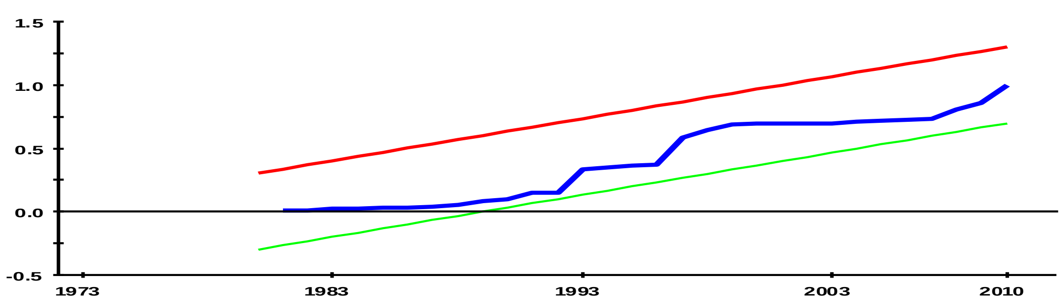
The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) for IB3: 1973-2010



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) for IB4: 1973-2010



The straight lines represent critical bounds at 5% significance level

5.6 CONCLUSION

The study posits that inflation bias emerging from the exercise of discretion by central banker for temporary output-gains is a non-trivial source of concern. There is almost a consensus in the literature that acceptance of inflation bias in the long-run is costly because it does not guarantee a significant trade-off in terms of real growth gains to the extent to more than offset the losses accruing in terms of excessive inflation. Theoretically, the literature is quite rich in identifying and discussing an array of the sources of inflation bias but the empirical literature is sparse in examining the long-term relevance and relative-robustness of such sources. This may be due to the non-availability of both the inflation bias indicators as well as appropriate proxies of its determinants.

Since the inflation bias indicators are generated in Section 4.3, this chapter bridges the latter gap by deducing and classifying the potential determinants of inflation bias as stabilization and non-stabilization sources and constructs their proxy variables – in case of absence of appropriate proxies for empirical investigation.

The long-term relevance and relative-robustness of stabilization and non-stabilization sources of inflation bias is ascertained for the typical discretionary monetary policy strategy of Pakistan. The findings of the study suggest that stabilization sources of inflation bias as advocated by the conventional theory put forth by Kydland and Prescott (1977) and Barro and Gordon (1983) and the new inflation bias proposition of Cukierman (2000) are consistently robust determinants of inflation bias. Whereas, the non-stabilization sources are fragile as they do not withstand the relative-robustness checks and loses their significance. In normative terms, these findings have nontrivial implications both for the design and conduct of monetary policy in Pakistan. A monetary policy framework is needed where the central banker is bound to limit the exercise of discretion for output gains while place a higher weight on the inflation objective.

CHAPTER 6

IS DISCRETION BENEFICIAL? EVIDENCE FROM THE TYPICAL DISCRETIONARY MONETARY POLICY STRATEGY OF PAKISTAN

6.1 INTRODUCTION

This chapter contributes to the literature by quantifying the discretionary behavior of Pakistan's central banker – a typical case of discretion, over the last 50 years timeframe.[115] The behavior of this new indicator conforms to all the three major explanations of exercise of discretion as given by the seminal paper of Kydland and Prescott (1977), the new inflation bias proposition of Cukierman (2000) and central banker's asymmetric preferences (for details see next Section). For example, when inflation is low, Pakistan's central banker exercises its discretion to expand the real output beyond its potential consistent with what was argued by Kydland and Prescott (1977). The central banker in Pakistan does not allow the inflation to fall below a certain level to avoid recession – a point central to the new inflation bias proposition of Cukierman (2000). Further, consistent with the central bankers asymmetric preferences literature, the central banker's preferences keeps shifting between inflation and output objectives depending on the state of the business cycle. [116]

The study also generates indicators of the corresponding discretion induced behaviors in inflation and growth variables. This is consistent with Uhlig (2005) who noted

[115] To recapitulate that Pakistan's monetary policy is a typical example of discretion as it (i) is responsible for the achievement of the twofold objectives of inflation and growth (SBP Act, 1956) and (ii) explicitly targets a higher than natural growth rate of the economy (see Figure 2.1).

[116] Moreover, as was argued by Kydland and Prescott (1977), this indicator is significantly biased towards inflation in the long-run without any significant gain in output. The indicator is also consistent with the findings of Ireland (1999) that discretion leads to excess inflation even in the short-run.

that variations in monetary policy account only for a small portion of the variation in the variables such as inflation and real growth.[117]

Although not the direct focus, the study also adds to the literature on the monetary neutrality as the central banker in Pakistan exercises its discretion for the achievement of its growth and inflation objectives by targeting monetary aggregates. The framework of the study for generation of discretion, inflation and growth indicators corresponds to a mechanism that serves the 'suggestion' given by James Bullard to test for the long-term monetary neutrality. Bullard (1999 p. 60) noted that "To study long-run neutrality more directly, the time series evidence on inflation and monetary growth for individual countries needs to be considered. Can we isolate, permanent or at-least highly persistent changes in the money stock (or the money growth rate), which are then correlated with persistent changes in the price level (or the rate of inflation) and simultaneously are uncorrelated with permanent movements in important real variables? That is the challenge of testing monetary neutrality propositions".

Nevertheless, the prime objective of the current chapter is to explore the relevance of the Kydland and Prescott (1977) intellectual contribution rather directly using discretion indicator per se that; is discretion significantly biased towards inflation without output gains in the long-run. The study goes a step further to investigate into the short-term validity of the theory. The purpose of this whole exercise is to gauge the extent of both the long and short-run discretion induced gains and losses over the fifty years' time for Pakistan. This essentially provides a sound basis for an objective assessment of the existing

[117] The study finds evidence of the flow of causality from discretion indicator to the inflation and growth indicators. As was expected, this causality is strong for inflation indicator instead of the growth indicator (see Section 5 for details).

discretionary monetary policy strategy. Particularly, from the perspective if the continuation of discretion is warranted or a reorientation in the focus of the central bank from growth to price stability is expedient.[118]

Autoregressive distributed lag (ARDL) bounds testing and estimation approach of Pesaran *et al.* (2001) was employed to test and estimate the long and short-run parameters (see Section 3.3.3 for details of the ARDL approach). The findings of the study reveal that discretion is significantly biased towards inflation not only in the long-run but also in the short-run. In the long-run discretion is ineffective to bring any significant gain in terms of real output as was claimed by Kydland and Prescott (1977). However, it successfully creates short-term growth spurts in the economy. Nevertheless, these growth spurts are quantitatively small and cannot even off-set the corresponding short-term discretion induced indicative losses.

Overall the results are in strong conformity with Kydland and Prescott's argument and the long-run monetary neutrality proposition and leads to important implications for the continuation of discretion. The findings envisage a reorientation in the focus of Pakistan's central bank – from the useless pursuit of growth to a low and stable inflation. This in turn requires transformation from discretion to a commitment based monetary policy strategy with the primary focus on price stability – to help build credibility and hence capability to effectively anchor inflation expectations.

[118] This assessment is particularly important: first, to define the scope of a discretionary monetary policy in stabilizing inflation or growth. Second, to ascertain the effectiveness of discretion for achievement of the twofold objectives of inflation and growth-stabilization and third to assess the degree of the potential benefits/losses that may accrue from discretion. Garman and Richards (1989, p. 420) indicated the need for research on these lines as "since we have not quantified the potential stabilizing role of policy, we cannot draw airtight policy conclusions from the evidence…… stabilization policy must achieve to warrant granting officials discretion. On this point it appears that unless discretionary policy has been more effective than is typically claimed, voters would not deem its benefits to be worth its inflationary cost".

The remainder of the chapter is organized as follows. Section 6.2 briefly discusses the conceptual framework of the study and the framework for generation of discretion, inflation and real growth indicators. Section 6.3 enunciates the testing and estimation strategy and specifies the models. Section 6.4 analyses the long-term relationships among the generated indicators. Section 6.5 presents and analyses the results and Section 6.6 concludes the chapter.

6.2 FRAMEWORKS AND IDENTIFICATION CHECKS

6.2.1 Conceptual framework of the study

As there is no exact definition of discretion in the literature, consistent with the theory, this study defines discretion for its working purposes as 'the deliberate and persistent policy stance of a central bank executed via long-term monetary stabilization for the achievement of its long-term inflation and growth-stabilization objectives'. Before discussing the framework for generation of discretion indicator, it is important to shed some light on crucial theoretical explanations of discretion and their practical implications for a potential discretion indicator.

The pioneering theory of Kydland and Prescott (1977) and Barro and Gordon (1983 a,b) argued that when inflation is low, the marginal cost of additional inflation is low and hence central banker is tempted to increase the real growth beyond its natural rate. The central bank exercises its discretion to adopt an expansionary stance to serve its temptation. This strategy, however, does not work because the public is rational. For this argument to hold true, one would expect any potential discretion indicator to exhibit the behavior that when inflation is low, the central banker would adopt an expansionary monetary policy over a certain horizon to accelerate growth.

The critique of this theory on realism basis by Blinder (1998) led Cukierman (2000) to propose that discretion may lead to inflation bias even if the central bank targets the expected natural growth rate of the economy. Blinder (1998, p. 19 – 20) noted that “in most cases the central bank will take far more political heat when it tightens pre-emptively to avoid higher inflation than when it eases pre-emptively to avoid higher inflation”.[119] Cukierman argued that central bank is more concerned about the economy may not plunge into recession. From this theoretical explanation, it follows that a discretionary central bank would not allow inflation to fall below a certain level, to avoid deflation. Practically, this would mean that when inflation reaches a certain minimum level, central banker would adopt expansionary monetary policy to escape recessionary pressures. Thus one would also expect the discretion indicator to reflect this behavior, if Cukierman’s explanation of exercise of discretion holds.

Another explanation of discretion is the central bank’s asymmetric preferences, which means that at a certain point or over a horizon, central banker gives preference either to inflation or output objective. Essentially, there is a trade-off involved between the achievement of the two objectives of inflation and growth. For example, Rogoff (1985) noted that assigning a relatively large importance to inflation objective instead of output

[119] This critique is crucial because, it led to the emergence of the proposition of new inflation bias and subsequently to the literature on central bank’s asymmetric preferences (see for example, Cukierman, 2000; Ruje-Murcia, 2003 and Goodhart, 1998). This strand of literature emerged in late 1990s in response to the previous literature that mainly focused on a quadratic loss function, which assume that the preferences of central bankers are symmetric (Kobbi, 2013). These propositions and their practical relevance for the exercise of discretion in conduct of monetary policy is crucial.

objective, the variability of the latter is raised sub-optimally when the supply shocks are large.[120] The central banker's decision in favor of either would depend on the preference of central banker. For example, a conservative central banker will care much about inflation even at the expense of lost output-gain. Similarly, if the central banker is non-conservative, it will exercise its discretion to stabilize growth at the cost of an increased inflation. To operationalize its preference, say for growth objective, the discretionary central banker will adopt an expansionary monetary policy. Similarly, central banker would adopt a contractionary monetary policy, if its preference shifts to the inflation objective.

Practically, this will mean the conduct of monetary policy in phases or cycles of expansion and contraction. The length of these phases of expansion and contraction is likely to depend on the acceptability of a certain maximum and a minimum level of inflation. For example, from a central banker's viewpoint, inflation beyond the maximum level would be undesirable to the extent to warrant a reversal in monetary policy stance from pro-cyclical to counter-cyclical. As a result of the counter-cyclical monetary policy, when inflation would reach the minimum level, the central bank is likely to adopt a pro-cyclical monetary policy as in its viewpoint the inflation at the minimum level is likely to induce recessionary pressures in the economy. Therefore, one would expect phases of central banker's asymmetric preferences in discretion indicator.

These phases representing the discretionary behavior of central banker are likely to induce trends in inflation and growth cycles. The trends in inflation cycles are more likely to be consistent with that of discretion as inflation in the long-term is a monetary

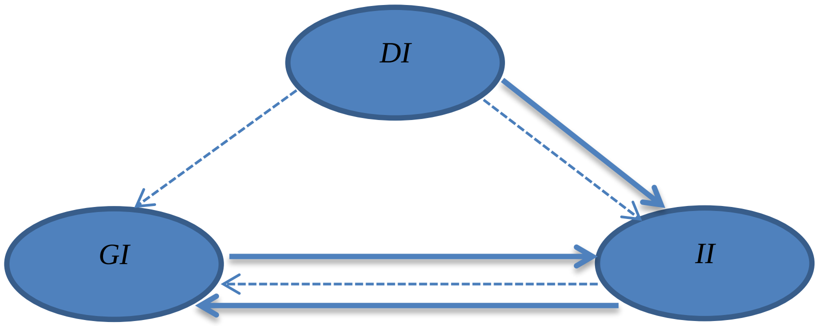
[120] Similarly, Garman and Richards (1989) noted that the cost of eliminating inflation bias by taking away flexibility (discretion) from central bank may be an increase in cyclical instability.

phenomenon. Similarly, the trends in growth cycles are likely to be relatively inconsistent with discretion because in the long-run growth is not a function of monetary policy.

Therefore, consistent with the theory, this study conceptualizes a significant long-term positive relationship between potential discretion indicator expressed as 'DI' and indicator of trends in cycle of inflation represented by 'II'. This is mainly because in the long-run inflation is a monetary phenomenon and specially in this case, an expansionary monetary policy would mean an increase in inflation and a contractionary monetary policy would mean a reduction in inflation.[121] Similarly, consistent with the findings of Ireland (1999), DI is likely to significantly affect the II even in the short-term. Again, a significant positive relationship between DI and the indicator of trends in growth-cycles expressed as 'GI' may be expected only in the short-run because in the long-run growth is not a monetary phenomenon (monetary neutrality). Specifically, the GI is more likely to rise in the expansionary phase of monetary policy compared to a contractionary phase, which would mean insignificance of their long-term relationship.[122] Further, II is likely to affect the GI negatively both in the long and short-run.[123] The GI is likely to affect the II inversely. This conceptual framework of the study is depicted in the flow chart from DI to the II and GI and between the II and GI, below.

[121] See Kydland and Prescott (1977), Barro and Gordon (1983), Rogoff (1985), Garman and Richards (1989), Ireland (1999); Ruge-Murcia (2003) and Given (2012) for theoretical and empirical literature.
[122] For example, see Barro (1977-78), Cecchetti (1986-87), Bernanke and Blinder (1988), Mankiw (2009) for the short-run impact of monetary policy on growth, and Fisher and Seater (1993), King and Watson (1997), Bernanke and Mehov (1998), Bullard (1999) for long-run neutrality and super neutrality of money.
[123] See for example, De Gregario (1992-93), Fischer (1993), Barro (1995) Barro and Sala-i-Martin (1995) and Ireland (1999) for the negative relationship between inflation and growth. Levine and Renelt (1992) and Levine and Zervos (1993) noted that the relationship between inflation and output is fragile. Bruno and Easterly (1998) however, concluded that the long-run relationship between inflation and growth is unclear.

Flow chart of the conceptual framework



The arrows (in bold) show the likeliness of a significant long-run relationship whereas the arrows with dashes represent the possibility of a short-run significant relationship.

The framework also allows testing for the long-term monetary neutrality proposition, which requires highly persistent changes in money growth to be (i) correlated with persistent changes in inflation and (ii) simultaneously uncorrelated with persistent changes in output. Since, the DI, II and GI corresponds to the most persistent policy driven changes in money growth, inflation and real growth (see next Section for details) they also serve the purpose to test for the long-term monetary neutrality.

6.2.2 Framework for generation of discretion indicator

In general, the literature uses monetary indicators such as $M0$, $M1$, $M2$ and $M3$ or interest rates for the purpose of empirical investigations. These indicators, however, may not appropriately characterize the discretionary behavior of a central banker per se over time. This study uses the time series of broad money ($M2$) to generate a discretion indicator as the State Bank of Pakistan (SBP) follows a regime of targeting monetary aggregates (Khan, 2009).

The SBP achieves its inflation and growth-stabilization objectives by maintaining appropriate growth in $M2$ (henceforth denoted by $\widehat{GM2}_t$) over time. The SBP uses its discretion to adjust monetary policy as and when required to pursue its objectives. This adjustment is likely to be executed through an increase or a decrease (denoted by $GM2T_t$) in $\widehat{GM2}_t$ about its long-term growth path expressed as $GM2P_t$.[124] The $GM2T_t$ may represent the exercise of discretion by the SBP for achievement of its objectives.

An increase in $GM2T_t$ above $GM2P_t$ would imply a pro-cyclical (expansionary) monetary policy and a decrease in $GM2T_t$ below $GM2P_t$ would reflect a counter-cyclical (contractionary) monetary policy. However, $GM2T_t$ may also be stimulated by unpredictable exogenous shocks as the central bank has imperfect control over money supply (Jordan, 2001; Khan, 2009). Such shocks may include development assistance, remittances from overseas, foreign direct investment, maturity of commitments with IMF, foreign aid and government excessive borrowing to deal with unforeseen contingencies. For example Figure 6.1 shows that the fluctuations in $M2$ growth around its natural rate ($GM2P$) are largely explained by the net official development assistance.[125] This study therefore, posits that counter-cyclical stabilization policy actions essentially represent the exercise of discretion by the SBP to smooth out the fluctuations in monetary growth cycles ($GM2T_t$) in order to achieve its long-term growth and inflation objectives.[126]

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[124] This is consistent with Lucas (1980) that the aggregate economic variables (in the underlying case $\dot{m}2_t$) experiences repeated fluctuations about their long term growth paths.

[125] The shocks in M2 growth in the period 1991-1998 may nevertheless be explained by the average rise in personal remittances and FDI. For example, for these 8 years both remittances and FDI witnessed a significant growth of 111% and 286%, respectively, over the 8 years average of the last corresponding period from 1983-1990.

[126] The central bank of Pakistan achieves its goals through monetary stability (Arby, 2004). M2 is the main monetary policy tool (intermediate target) used by the central bank for achievement of its objectives (Akhtar, 2006).

Pursuing this line of logical reasoning, DI is generated from $GM2_t$ in two steps using HP filter. In the first step the HP filter is applied to decompose the observed series of $GM2_t$ over time into its long-term growth path $GM2P_t$ and the fluctuations about it $GM2T_t$, such that:

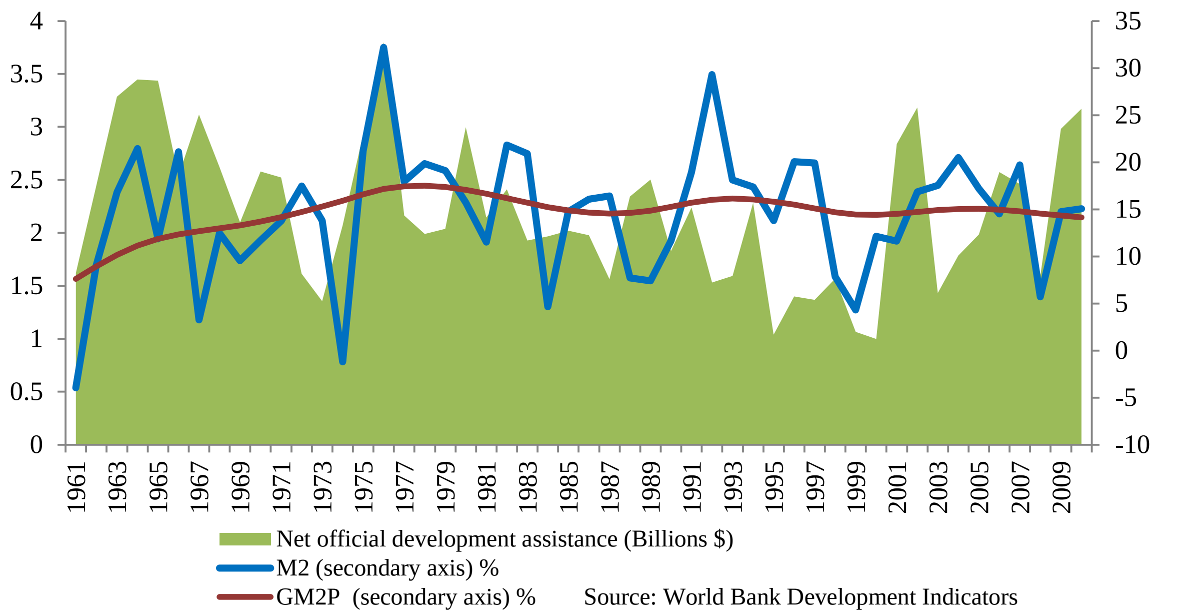
$$\widehat{GM2}_t = GM2P_t + GM2T_t \qquad \text{for } t = 1, \ldots \ldots, T.$$

In the second step, the HP filter is applied to $GM2T_t$ to obtain its long-term trend denoted by $GM2TP_t$ such that:

$$GM2T_t = GM2TP_t + GM2TT_{t_t} \qquad \text{for } t = 1, \ldots \ldots, T.$$

Where, $GM2TP_t$ is the required series of discretion indicator. In both the steps the smoothing parameter ($\lambda = 100$) is applied as is recommended for annual data (Mise *et al.* 2005).

Figure 6.1: Contribution of net official development assistance to the shocks in growth in M2

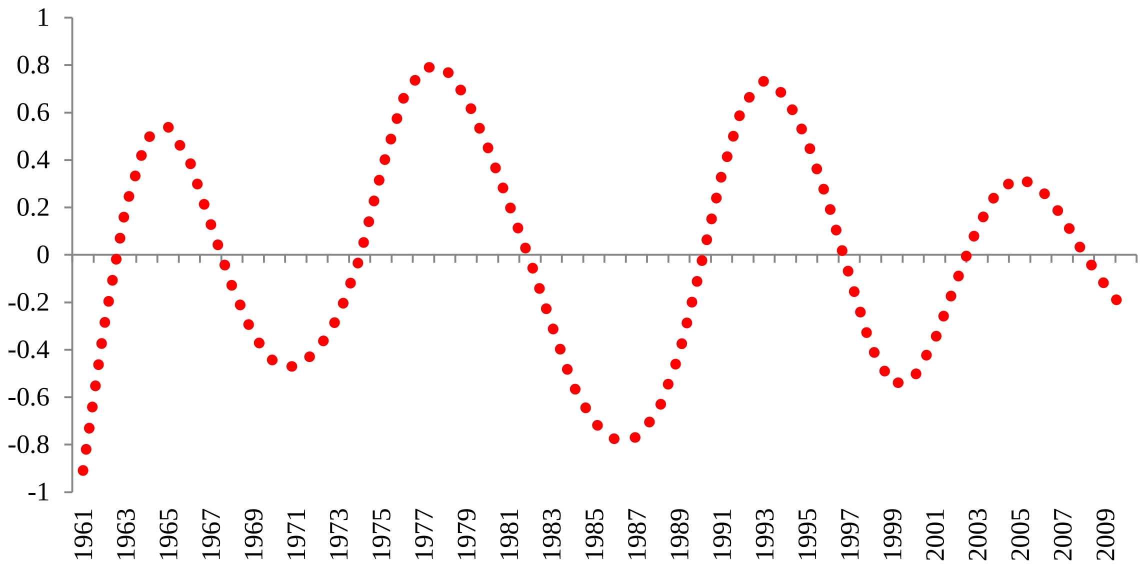


6.2.3 Identification of the proposed discretion indicator

Figure 6.2 depicts the time plot of the discretion indicator. The shape of the DI confirms the implication of all the three important explanations of discretion. For example, when the observed inflation is low, the SBP adopts a pro-cyclical monetary policy stance to accelerate growth (Table 6.1). This expansion continues till inflation approaches double digits roughly an average of 10% to 11%. The preference of the central banker shifts to the inflation objective at such high levels of inflation and adopts a counter-cyclical monetary policy to contain inflation. Thus the upswing phases of the discretion indicator from trough to peak confirm the conventional explanation of discretion put forth by Kydland and Prescott (1977). As in these phases, the SBP tries to spur the real growth because the inflation is low.

The expansionary phase for pursuit of growth peaks out because of the shift in preference of SBP from growth objective to the inflation objective. At this stage, the inflation is either near to or has surpassed the double digits level thereby forcing the SBP to reverse the trend in monetary policy from pro-cyclical to counter-cyclical.

Figure 6.2: Time plot of the Discretion Indicator (*DI*)



This confirms that the central banker's preferences for growth and inflation objectives are asymmetric over the long-term horizon. This phase of contraction comes to an end when the inflation falls to certain low level. For example, on average this low rate of inflation at the trough, which ranges from 3.5% to 4.5%. The SBP, in general, does not seem to allow the inflation fall below this level due to its fear of recession, which confirms the second explanation of discretion of new inflation bias given by Cukierman (2000) and Cukierman and Gerlach (2003).

Table 6.1: Turning points in monetary policy expansionary and contractionary phases

Peak turning points		Trough turning points	
Year	**Observed inflation***	**Year**	**Observed inflation***
1965-1966	6.40	1961-1962	0.56
1977-1978	8.14	1971-1972	4.96
1993-1994	11.17	1986-1987	4.10
2007-2008	13.95	1999-2000	4.26
Average	**9.92**	**Average**	**3.47**

* Reports the average of the two years inflation at turning points in *DI* as is shown in Figure 2. ** is the average computed while excluding the 1960s period.

6.2.4 Framework for generation of growth and inflation indicators

In this subsection the framework for generation of inflation and growth indicators is discussed. It is assumed that the central banker, through exercise of its discretion induce aggregate fluctuations in inflation and real growth about their long-term growth paths. This assumption is consistent with Uhlig (2005) who concluded that variations in monetary policy account only for a small fraction of the variation in variables such as real growth and inflation.

Nevertheless, such aggregate fluctuations may also be determined, in part, by shocks other than the central banker's exercise of discretion such as supply side shocks. For example, real growth may fluctuate upward about its long-term growth path because of positive shocks in the form of bumper crop production due to timely rains, huge inflows of foreign aid and remittances.[127] Similarly, real growth may fluctuate downward about its long-term growth path due to adverse shocks to growth. For example, pest attacks on crops, floods, earthquakes, lack of timely rains, power shortages, discontinuation of foreign aid, wars and so forth.

Again, upward fluctuations in inflation may not necessarily be the outcome of the exercise of discretion by the central bank. Instead, they might occur due to supply side shocks. Such shocks may originate domestically through adverse shocks to the real sector.

[127] Findings of the literature on the effectiveness of aid in Pakistan are mixed, for example, Javid and Qayyum, (2011) reported positive effects whereas, Khan and Ahmed, (2007) reported negative effects of foreign aid on growth. The mixed results might be due to different sample sizes, however, the former study reported considerably higher net aid inflows in 1980s and 2000s in its Table 1, which may be treated as anecdotal evidence at the minimum. Moreover, in this period stock market and foreign exchange reserves reached its all-time peak levels. Ahmed *et al.* (2006) concluded that output would have been less than observed by two and a half percentage points in 2004-2005 in absence of the positive remittance shock that accrued in the aftermath of September 11. This also led to a substantial real exchange rate appreciation which has a positive effect on the domestic output.

For example, pest attacks on crops and floods that affect the agricultural production, which may fluctuate inflation upward about its natural path. They may also fluctuate downward about its long-term growth path due to bumper crops on the back of timely rains. The fluctuations in inflation may also be triggered by an increase or a decrease in international prices of petroleum product and other imported goods.

Therefore, the two-step strategy of application of HP filter is employed to generate indicators of inflation and real growth. For example for generation of inflation indicator, in the first step, the fluctuations around the mean path of inflation are obtained such that:

$$\pi_t = \pi l_t + \pi f_t \quad \text{for } t = 1, \dots \dots . . T.$$

Where π_t is annual CPI inflation rate in time t. The πl_t is its long-term growth path in time t and πf_t represents the aggregate fluctuations about πl_t over time. In the first step, the HP filter is applied to π_t to obtain πl_t and πf_t. In the second step, the HP filter is applied to πf_t to obtain its long-term growth path such that:

$$\pi f_t = \pi f l_t + \pi f f_t \quad \text{for } t = 1, \dots \dots . . T.$$

Where, $\pi f l_t$ is the desired inflation indicator (henceforth expressed by *II*). Similarly, the strategy of the application of the two-step HP filter is used to obtain the real growth indicator. Firstly, the time series of the real growth in GDP ($\widehat{GDP}_t$) is decomposed into its long-term growth path $GDPP_t$ and the fluctuations about it $GDPT_t$ such that:

$$\widehat{GDP}_t = GDPP_t + GDPT_t \quad \text{for } t = 1, \dots \dots . . T.$$

Secondly, the HP filter is applied to $GDPT_t$ to obtain its long-term growth path as:

$$GDPT_t = GDPTP_t + GDPTT_t \quad \text{for } t = 1, \dots \dots . . T.$$

Where, $GDPTP_t$ is the required real growth indicator (henceforth represented by GI).

6.3 METHODOLOGY AND DATA

Since, DI is a monetary variable, its effects are likely to be realized with a certain lag (see Friedman, 1968 for a discussion on monetary policy lagged effects). The nature and length of these lags may vary from country to country depending on the transmission mechanism and the state of the development of a particular economy. The lag effects of the II and GI are also important as potentially they determine their own contemporary values. As the ARDL approach allows taking into account the lag effects, the error correction versions of the two models (as there are twofold objectives of the SBP) are specified as follows (see Section 3.3.3 for details of ARDL).

$$\Delta GI_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta GI_{t-i} + \sum_{j=0}^{q1} \alpha_j^{II} \Delta II_{t-j} + \sum_{k=0}^{q2} \alpha_k^{DI} \Delta DI_{t-k} + \beta_0 GI_{t-1} + \beta_1 II_{t-1} + \beta_2 DI_{t-1} + \epsilon_t \quad (6.1)$$

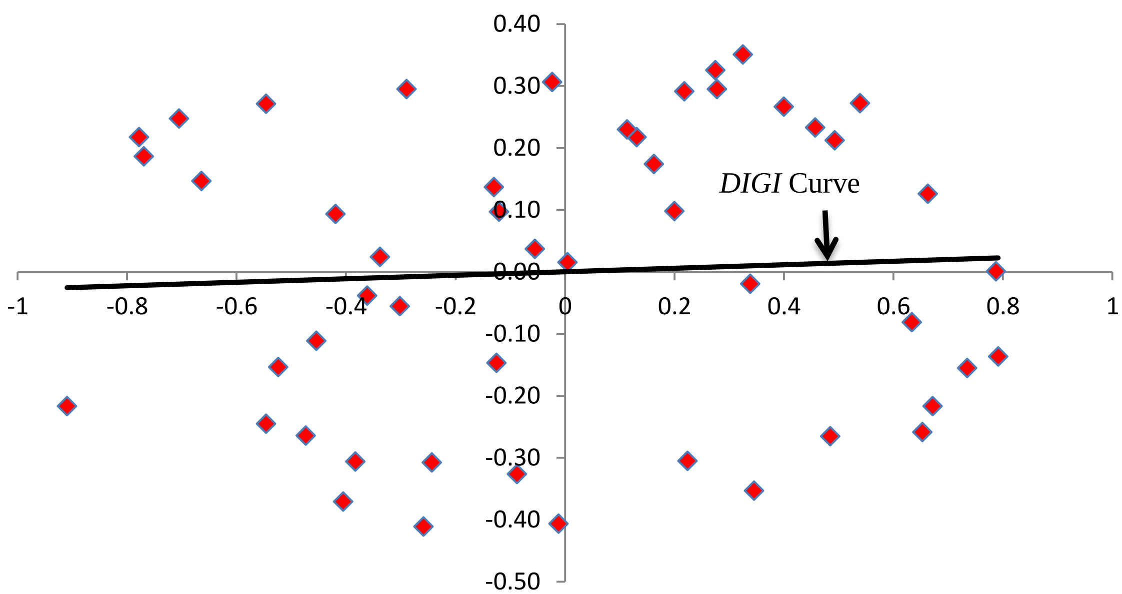
$$\Delta II_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i \Delta II_{t-i} + \sum_{j=0}^{q1} \gamma_j^{GI} \Delta GI_{t-j} + \sum_{k=0}^{q2} \gamma_k^{DI} \Delta DI_{t-k} + \rho_0 II_{t-1} + \rho_1 GI_{t-1} + \rho_2 DI_{t-1} + \varepsilon_t \quad (6.2)$$

Where, DI, II and GI are the discretion, inflation and growth indicators, respectively. The Δ denotes the first difference operator and finally ϵ and ε are the error terms. The specified models were estimated using annual time series data obtained from the World Bank Development Indicators (WDI) and the SBP. The time span of the data is from 1961 to 2010, which is dictated by data availability at the time of analysis. It is pertinent to mention that although the data are obtained from reliable sources but like any other data the possibility of errors and omissions cannot be precluded. Nevertheless, the scrutiny and verification of the data is beyond the scope of this research.

6.4 GRAPHICAL REPRESENTATION OF THE INTERRELATIONSHIP AMONG THE INDICATORS AND THEIR STATIONARITY PROPERTIES

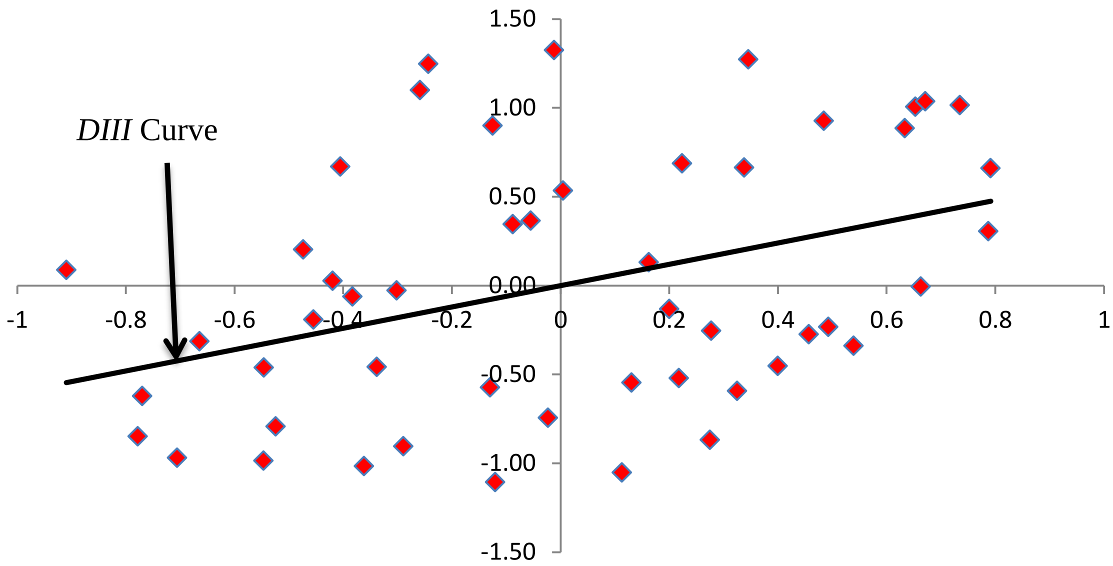
A preliminary analysis of the interrelationship among the three indicators is depicted in the Figures 6.3, 6.4 and 6.5. These Figures are not meant to represent the causality but to give a rough idea of the expected sign and the responsiveness of the change in one indicator to the other. Figure 6.3, shows that *DI* and *GI* are positively related (*DIGI* curve).

Figure 6.3: Relationsip between *DI* (X-axis) **and *GI*** (Y-axis)



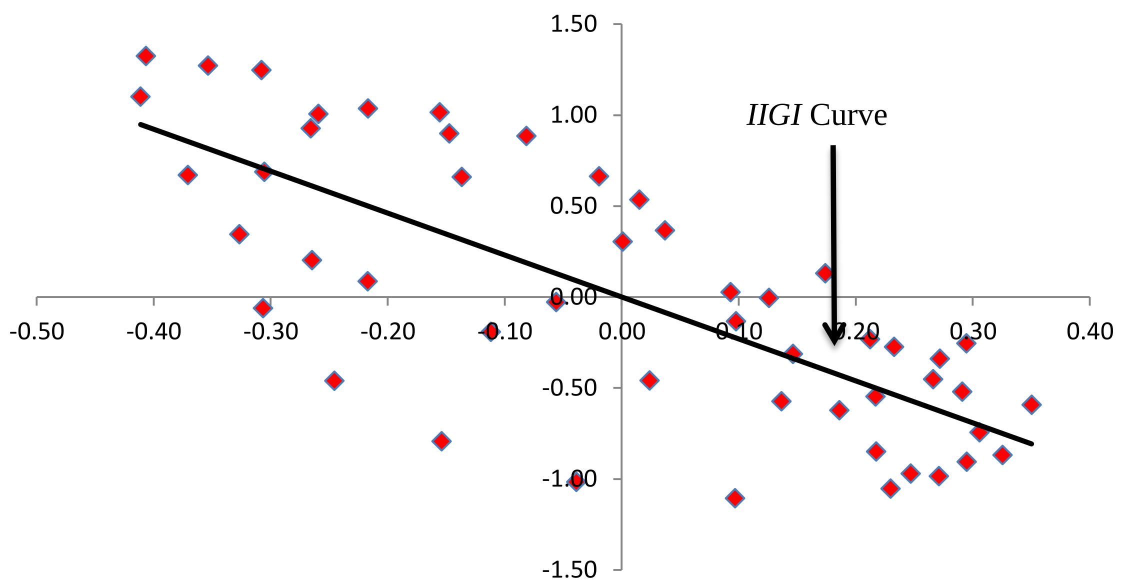
Similarly, as shown in Figure 6.4, *DI* and *II* are also positively related (*DIII* curve). However, the *DIGI* curve is relatively flat (compared to *DIII*), which indicates that the relationship between the two indicators of discretion and growth is relatively weak. This also implies a less elastic response of the GI to DI.

Figure 6.4: Relationship between *DI* (X-axis) **and *II*** (Y-axis)



In contrast, as shown in the Figure 6.4, the *DIII* curve is relatively steep. This steepness compared to the steepness of the *DIGI* curve shows that II is more responsive to DI than GI (relatively more elastic). This may also imply that the amount of the same monetary stimulus through exercise of discretion induces a disproportionately higher increase in the inflation indicator than the real growth indicator, as is envisaged by the pioneering studies of Kydland and Prescott (1977) and Barro and Gordon (1983 a, b). In Figure 6.5, *IIGI* curve depicts an inverse relationship between inflation and growth. This indicates that a higher inflation is detrimental to growth and vice versa.

Figure 6.5: Relationship between *II* (Y-axis) **and *GI*** (X-axis)



The stationarity properties of the underlying variables are tested through three popular unit root tests. They yield inconsistent results for some of the variables. For example, *II* is both I(0) and I(1) as Per ADF and DF-GLS but I(2) as per the PP tests (see Table 6.2 for unit root tests results).[128] In such a case, where the order of integration of variables cannot be determined for sure, the use of traditional cointegration techniques, which requires the variables to be integrated of order I(1) may lead to unreliable results. Similarly, the *DI* is stationary both in level and first difference by the ADF and PP tests but as per the DF-GLS test, the variable is stationary at the second difference (as the t-stat is -4.39 against the C.V of -2.61 at 1% level and the DW is 1.90). These results therefore reinforces the use of the ARDL to obtain long and short-run coefficients as against the

[128] Trying all the available specifications of no intercept, intercept, intercept and trend, the null hypothesis that the II has a unit root could not be rejected both in level and in first difference. The null could not be rejected even in the second difference [with a P-value at 0.12 and DW statistic as 0.57].

conventional cointegration techniques, which requires all the variables to be necessarily integrated of order I(1).

Table 6.2: Stationarity properties of the variables

	ADF		DF-GLS		PP	
Variables	**Level**	**First difference**	**Level**	**First difference**	**Level**	**First difference**
II	[0.00]***	[0.02]**	[-5.47]***	[-3.10]***	[0.28]	[0.26]
(DW)	1.71	1.83	1.69	1.81	0.14	0.25
GI	[0.18]	[0.00]***	[-2.02]**	[-4.71]***	[0.17]	[0.18]
(DW)	1.68	1.83	1.71	1.43	0.13	0.29
DI	[0.01]**	[0.00]***	[-1.12]	[-1.43]	[0.03]**	[0.02]**
(DW)	1.89	1.98	1.52	1.96	0.21	0.35

This Table reports the P-values of the Augmented Dicky Fuller (ADF) and Phillips Perron (PP) tests and the t-statistics of the Elliott-Rotenberg-Stock DF-GLS in brackets. The Durbin Watson (DW) statistic is also reported to show that (i) different tests may yield varied results and (ii) stationarity was achieved while the residuals were uncorrelated. ***, ** and * indicates that the series are stationary at 1%, 5% and 10% level of significance, respectively.

6.5 EMPIRICAL ANALYSIS AND RESULTS

Given the lack of theoretical guidance about appropriate maximum lag length, this study uses a general-to-specific approach. A maximum lag of 7 is imposed as a starting point while subsequently reducing the lag length to a minimum of 1.[129] The SBC model selection criterion is used as it selects the most parsimonious model. The stability tests were conducted for Equation 6.1 and Equation 6.2 with varying maximum-lag levels from 7 to 1 (see Figure 6.6 and Figure 6.7). The important diagnostic tests (Table 6.3) indicate that the ARDL models with a maximum lag of 7 are the most appropriate. For example, the author failed to reject the null hypothesis of no serial correlation, no misspecification, normality of

[129] It is important to mention that generally a maximum lag of 2 to 3 years is used for annual data. However, in this case the underlying variables are cyclical in nature and one phase from trough to peak or peak to trough for DI, on average spreads over 6 years. An imposition of a lower lag length of 2 to 3, in this particular case may potentially lead to omitted variable bias, just in case a higher lag (more than 3) of any of the variables turns out to be statistically significant.

residuals and homoscedasticity. Thus, long and short-run estimates were subsequently obtained from these models. The high values of the fit of the data cautioned about the possibility of multicollinearity, however, a subsequent check of the correlation coefficients among the indicators is unlikely because the coefficients of correlation of *DI* with *II* and *GI* are 0.39 and 0.06, respectively.[130] The null hypothesis of 'non-existence of a long-run relationship' for Equation 6.1 and Equation 6.2 is given below,

$$H_0: \beta_1 = \beta_2 = \beta_3 = 0,$$

and the alternative hypothesis is given as:

$$H_1: \beta_1 \neq 0,\ \beta_2 \neq 0,\ \beta_3 \neq 0.$$

The F-statistics computed for joint significance of β_1, β_2 and β_3 for Equation 1 and Equation 2 are 4.93 and 5.69, respectively.

These values are larger than the asymptotic upper critical value bounds of Pesaran *et al.* (2001) for unrestricted intercept and no trend at 2.5% and 1% levels, respectively. Thus the null of no existence of a long-run relationship is rejected. This implies that the decision to proceed for computation of long and short-run coefficients is conclusive and there is no need to know the cointegration rank (Pesaran and Pesaran, 1997). The cointegration is established at 5% and 1% levels, respectively, for the two equations, even if the asymptotic upper critical value bounds of Narayan (2005) are used.

[130] Moreover, the likeliness of multicollinearity is minimal because the higher the level of the (p, q) in ARDL models, the lesser are its chances. In the selected models, the maximum order of p is 2 in Equation 1, and 4 in Equation 2. The maximum order of q in both the equations is 6.

Figure 6.6: Stability tests – Dependent variable GI

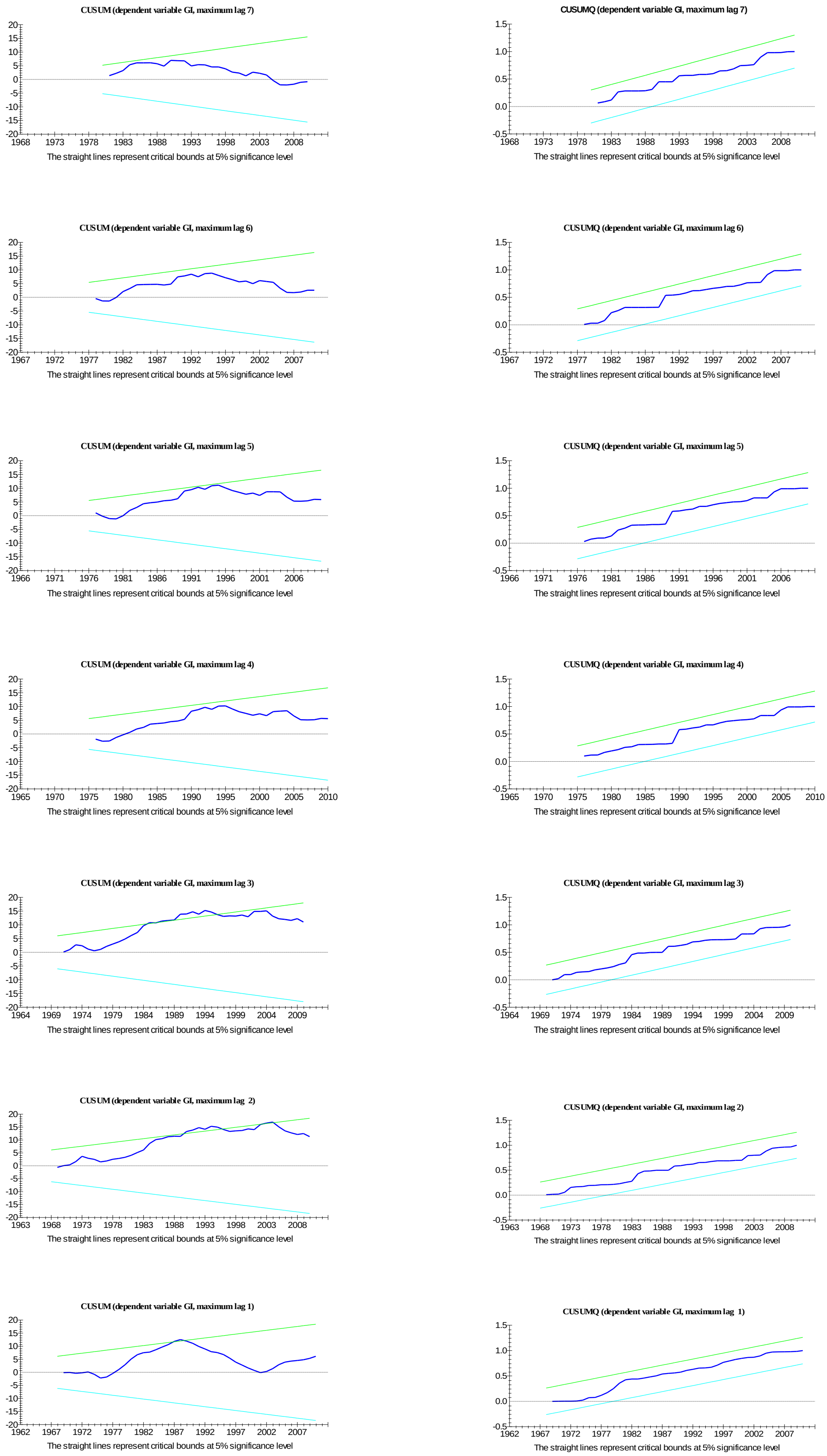


Figure 6.7: Stability tests – Dependent variable *II*

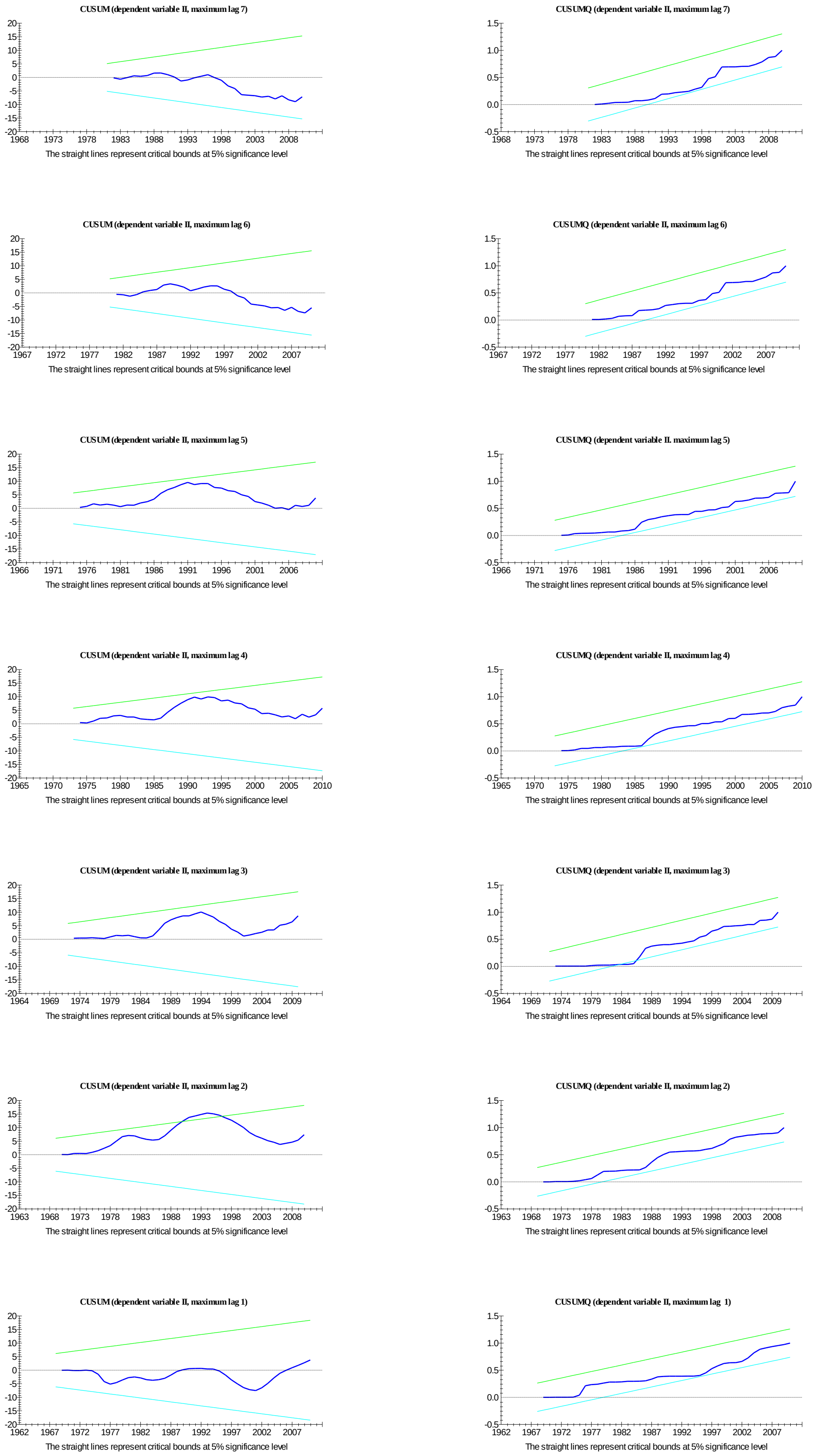


Table 6.3: ARDL order of the models, fit of the data and diagnostic tests

	Dependent Variable GI						Dependent Variable II					
Lag Length	**ARDL**	**AUTO**	**SPEC**	**NORM**	**HETR**	R^2	**ARDL**	**AUTO**	**SPEC**	**NORM**	**HETR**	R^2
7	ARDL (2,6,1)	[0.80]	[0.97]	[0.73]	[0.13]	0.99	ARDL (4,6,0)	[0.43]	[0.35]	[0.84]	[0.50]	0.99
6	ARDL (2,4,1)	[0.86]	[0.52]	[0.97]	[0.03]	0.99	ARDL (4,6,0)	[0.74]	[0.34]	[0.88]	[0.40]	0.99
5	ARDL (2,4,1)	[0.94]	[0.67]	[0.93]	[0.05]	0.99	ARDL (0,5,0)	[0.35]	[0.27]	[0.36]	[0.01]	0.99
4	ARDL (2,4,1)	[0.84]	[0.69]	[0.96]	[0.07]	0.99	ARDL (0,4,1)	[0.08]	[0.44]	[0.90]	[0.06]	0.99
3	ARDL (3,0,0)	[0.09]	[0.61]	[0.93]	[0.67]	0.99	ARDL (1,3,1)	[0.00]	[0.20]	[0.50]	[0.27]	0.99
2	ARDL (2,0,0)	[0.09]	[0.29]	[0.77]	[0.83]	0.99	ARDL (0,2,1)	[0.00]	[0.00]	[0.30]	[0.60]	0.99
1	ARDL (1,1,1)	[0.00]	[0.00]	[0.78]	[0.69]	0.98	ARDL (1,1,1)	[0.00]	[0.45]	[0.10]	[0.40]	0.98

This Table reports the ARDL order of Equation 6.1 and Equation 6.2 (using SBC) for various lags from 7 to 1, their respective diagnostic tests and R^2. The P-values of the diagnostic tests are presented sequentially with AUTO denoting the Langrange Multiplier test for Autocorrelation. The SPEC represents a general test for omitted variables and functional form test–Ramsey regression equation specification error test (RESET) test using the square of the fitted values. NORM indicates the test for normality based on a test of skewness and kurtosis of residuals. HETR represents the Heteroscedasticity test based on the regression of squared residuals on squared fitted values. The P-values reported for diagnostic tests are based on F-test except NORM, which uses LM version. All the P-values are given in the brackets

These critical values are particularly suitable for small sample sizes i.e. for observations ranging from 30 to 80. This ensures that the conclusion regarding the cointegration is strong (Narayan and Narayan, 2005).

The long and short-run results for Equation 6.1 and Equation 6.2 are reported in Table 6.4 and Table 6.5, respectively. In both these models, the lag length of the DI is highest implying that it primarily stimulates changes both in II and GI. In order to formally check the causal relationship of DI, GI on II and DI, II on GI, the LR test of block Granger non-causality was conducted in an unrestricted VAR system. In both the cases, the null hypothesis that the coefficients of the lagged values of DI, GI and DI, II are zero cannot be rejected at 1%. For example, the p-values of the tests are 0.000 and 0.002, respectively.

The small size of the error correction terms $ECM(-1)$ in both the models confirms the cyclical behaviors of the indicators as it takes the economy sufficiently longer to adjust to the long-term equilibrium path. The estimated results are analyzed and interpreted in two tiers. Tier 1, mainly reflects on the empirical relevance of the underlying theories and the conceptualized relationships among the indicators. In Tier 2, the results are summarized to be able to comment on the overall performance of the discretionary monetary policy strategy during the sample period in terms of indicative gains / losses.

6.5.1 Tier 1 analysis of results

The effects of the discretion indicator on the growth and inflation indicators are in conformity with the theory and preliminary idea obtained from the conceptual framework and the graphical exhibits in previous sections. In the long-run, discretion is ineffective to significantly accelerate growth but it is significantly biased towards inflation (Table 6.4). For example, the coefficient for inflation indicator (0.66) is both quantitatively large (almost 6 times for that of the growth indicator) and highly significant at 1% level as compared to an insignificant GI coefficient at 0.10. These findings endorse the relevance of the argument of Kydland and Prescott (1977) that in the long-run discretion creates excess inflation without output gains.[131] Further, this result is consistent with the proposition of Bullard (1999) for testing monetary neutrality. The DI, which essentially represents persistent changes in money growth, is significantly cointegrated with the corresponding persistent changes in the rate of inflation and simultaneously uncorrelated with permanent movements in the real growth indicator.

Table 6.4: Long-run estimates

	Dependent Variable GI ARDL (2,6,1)			**Dependent Variable II ARDL (4,6,0)**		
Variables	**Coefficient**	**S-Error**	**P-Values**	**Coefficient**	**S-Error**	**P-Values**
DI	0.10	0.3497	0.770	0.66	0.1772	0.001
II	0.05	0.1030	0.724			
GI				-0.31	0.1755	0.085
α	-0.004	0.0279	0.881	0.03	0.0192	0.141

This Table reports the long-run coefficients of Equation 1 and Equation 2.

In the long-run, the effect of inflation indicator on the growth indicator is insignificant, whereas in short-run its impact on growth is significantly detrimental. This finding is also supportive of the arguments against the discretion. This inverse relationship between the inflation indicator and the growth indicator is of particular interest because it shows that the former does not provide the link for the short-term gains in terms of the latter, implying that surprise inflation is instead harmful for growth.[132] Although not

[131] This result is supported even if the long-run coefficients are standardized for comparison purposes. For example, the standardized coefficient of the DI for Equation 1 and Equation 2 is 0.20 and 0.43, respectively (see Wooldridge, 2008 and Bring, 1994 for details on standardization of coefficients).

[132] See Barro and Gordon (1983) and Barro (1986) for discussion on surprise inflation.

sustainable in long-run, these short-term spurts in growth are likely to accrue through the expansionary monetary policy. However, this link and its transmission mechanism need further exploration, which might realize through the credit channel.[133]

In the short-run, the impact of discretion on the growth and inflation indicators is mixed with varying levels of significance and lags (see Table 6.5).

Table 6.5: Short-run estimates

	Dependent Variable GI ARDL (2,6,1)			Dependent Variable II ARDL (4,6,0)		
Variables	**Coefficient**	**S-Error**	**P-Values**	**Coefficient**	**S-Error**	**P-Values**
$DI(-1)$	0.18	0.0797	0.033	-0.02	0.145	0.879
$DI(-2)$	-0.38	0.140	0.011	0.05	0.269	0.842
$DI(-3)$	0.38	0.1622	0.025	0.08	0.258	0.761
$DI(-4)$	-0.27	0.1671	0.119	-0.32	0.160	0.054
$DI(-5)$	0.17	0.1388	0.202			
$DI(-6)$	-0.15	0.0668	0.034			
$GI(-1)$	0.84	0.0775	0.000	-0.06	0.038	0.128
$II(-1)$	-0.07	0.0194	0.002	1.65	0.1588	0.000
$II(-2)$				-0.67	0.3584	0.072
$II(-3)$				0.16	0.408	0.695
$II(-4)$				-0.24	0.3672	0.516
$II(-5)$				0.48	0.1938	0.019
α	-0.31	0.0021	0.882	0.01	0.0035	0.130
$ECT\ (-1)$	-0.07	0.0199	0.001	-0.19	0.0331	0.000

This Table reports the short-run results for Equation 1 and Equation 2. All the variables without any lag are in first difference form including dependent variables. Lag (-1) for any variable say 'X' indicates [X (-1) – X (-2)]' and lag (-2) represents [X (-2) - X(-3)].

For example, the DI significantly induces both positive and negative spurts in the GI. These might be due to the different responses of central banker to its objectives or shocks therein. Nevertheless, the overall magnitude of these short-term growth spurts is positive but negligible when the significant positive growth-spurts are compared with the significant short-term negative growth-spurts. For example, on average the statistically

[133] Broadly, the channels in which the monetary policy shocks may affect the real growth are interest rate, exchange rate, other prices effects and credit (Mishkin, 1996). The transmission of the effects of monetary policy to real growth is considered as "Black Box" (Bernanke and Gertler, 1995, p.1). Specific research on the underlying economy in this direction seems necessary for prudent conduct of monetary policy.

significant short-run positive marginal impact is faintly higher than the statistically significant negative marginal impact (0.28-0.26=0.02).

6.5.2 Tier 2 analysis of results

The analysis of this sub-section is particularly meant to assess the extent of the trade-off involved between the gains and losses that accrue from discretion. If the gains from discretion are sustainable and quantitatively larger than the losses, an obvious recommendation in favor of continuation of discretion is warranted. However, if the gains from discretion are only short-term and are lesser than losses, then reorientation of the focus of monetary policy worth consideration. To this end, the results presented in Table 6.4 and Table 6.5 are summarized and analyzed in Table 6.6.[134]

It is hard to exactly ascertain the gains and losses from discretion, however, for the purpose of this study indicative gains and losses are deduced from the coefficients of growth and inflation indicators as follows. The indicative gains are defined as (i) at-least a 10% statistically significant positive effect observed for growth indicator both in long and short-run coefficients and (ii) a negative effect observed for inflation indicator. Similarly, the indicative losses are defined as (i) at-least a 10% statistically significant positive effect (long and short-run coefficients) observed for the inflation indicator or (ii) a negative effect observed for the growth indicator.

Since the signs of the short-term statistically significant coefficients vary with different lags, they are added to get a final numeral, which represents the net positive or negative

[134] It may be noted that the comparative analysis of the short-term gains and losses from discretion is qualitative (indicative). The short-term coefficients cannot be standardized due to the presence of the various lag effects of both the dependent and independent variables. Nevertheless, since the indicators are generated through a uniform process, their results may arguably be comparable.

impact. The net gains are represented by a positive sign and the net losses by a negative sign (Table 6.6).

Table 6.6: Summary of the indicative gains/losses of long and short-run statistically significant effects

	II		GI	
	Long-term	**Short-term**	**Long-term**	**Short-term**
DI	-0.66	+0.32		+0.03*
II		-1.46*		-0.07
GI				+0.84
Net indicative gains/losses	-0.66	-1.14		+0.80

* represent net-off numbers for various lags.

Table 6.6 gives an account of the long and short-term indicative gains and losses emanated from the pursuit of discretionary monetary policy. Discretion produced net indicative losses (-0.66) in the long-run in terms of excess inflation. The corresponding short-term net indicative losses in terms of the inflation indicator are even more severe and quantitatively large (-1.14). Therefore, the assessment on the basis of inflation indicator shows that discretionary monetary policy is a sub-optimal choice as it produced net overall indicative losses both in long and short-runs.

When assessed on the basis of the growth indicator, discretion is a sub-optimal monetary policy in the long-run as it does not produce any significant indicative gains in the long-run in terms of growth. However, in the short-term the net indicative gains are less than its corresponding short-term losses in terms of inflation indicator. In a nutshell, this analysis shows that in a half century time frame, the discretionary monetary policy strategy benefited to the extent that can neither offset the long-term nor the short-term indicative losses it produces.

6.6 CONCLUSION

This study attempted to quantify the long-term discretionary behavior of Pakistan's central bank. The central bank exercises its discretion primarily for the achievement of dual objectives of inflation and growth. The discretion indicator exhibited a behavior that conforms to the conventional theory of inflation bias, new inflation bias proposition and central banker's asymmetric preferences. The study posited that the exercise of discretion by the central bank to spur the growth induces persistent variations in inflation and growth variables in the long-term.

While generating indicators of the persistent paths of the variations in inflation and growth variables and testing for its long-term relationship with discretion, the study shows that the latter is significantly biased towards inflation without significant growth gains. This finding confirms the conventional critique given by Kydland and Prescott (1977) against discretion. The finding also envisages that in the long-term money is neutral. In the short-term, discretion creates growth spurts but the indicative gains from these spurts are small enough even to offset the corresponding discretion induced indicative losses.

Based on the findings, the study suggest that to avoid both the long and short-term discretion induced losses, the focus of Pakistan's central bank needs reorientation. The prime attention should be given to inflation instead of growth as is the standard monetary policy practice. This in turn implies transformation from the existing discretionary monetary policy set-up into a commitment based framework. Under this framework, the central bank of Pakistan would commit to a low level of inflation and would not renege on its commitment. This may help build credibility of Pakistan's central bank and hence its capability to effectively anchor inflation expectations.

CHAPTER 7

SUMMARY AND CONCLUSION

The thesis builds on the premise that inflation rates in Pakistan have been critically high and volatile for the last four decades. In contrast, the central banks around the world recognize a low and stable inflation as an important determinant of a sustainable economic growth. In pursuit of this objective of attainment of low and stable inflation (price stability) many advanced, emerging and developing countries have reoriented the focus of their monetary policy towards price stability rather than pursuing a higher than natural growth level.

The ineffectiveness of monetary policy in attaining higher than natural growth rates in the long-run in the wake of monetary neutrality over time has reshaped the conduct of monetary policy from discretionary to a commitment-based framework. This transformation helped build central bank's credibility and its capability to effectively anchor inflation expectations. The countries that have transformed their monetary policy regimes from discretionary to commitment have witnessed commendable performance in terms of attaining macroeconomic stability viz. price stability, output stability, exchange rate stability and interest rate stability.

Against this backdrop, Pakistan continues to adhere to the discretionary monetary policy set-up. A logical question then arises as to why be it so? Has the discretionary monetary policy performed well for the country to warrant its continuation? Has the discretion induced excessive inflation rates (inflation bias) helped boost the real output? What essentially has determined the inflation bias in Pakistan, has it been the SBP itself or has other factors played a robust role? Finally, is discretion the real culprit that has induced inflation bias without output gains over the long-run, as heavily critiqued by a wide range of literature?

This thesis seeks answers to each of these broader questions in its analytical Chapters 3, 4, 5 and 6, respectively. The thesis informs the readers by critically synthesizing the literature in its Chapter 2. All the analytical chapters of the thesis make unique empirical contributions to the general literature instantaneously and to Pakistan in particular. For example in Chapter 3, the thesis proposes a new approach particularly suited for the evaluation of typical discretionary monetary policy strategies. Such strategies may be common in developing countries as they generally are ambitious to achieve rapid economic growth levels than naturally they would. Evaluation of Pakistan's discretionary monetary policy on the basis of the new proposed approach portrays a dismal picture. The central bank of Pakistan has caused twofold losses to the economy. Firstly, it has induced higher average inflation rates for a majority of the time, which has serious consequences for the populace through the loss of purchasing power and increased inequality. Secondly, higher average inflation rates have negatively and significantly affected the real output, thus causing welfare losses.

In Chapter 4, the thesis proposes an approach for quantification of inflation bias that has resulted from the exercise of discretion. The main argument in this chapter is that in empirical investigations, the distinction between inflation and inflation bias per se needs to be maintained. Further, it tests whether the inflation bias, which the discretionary central banker of Pakistan accepted to boost real growth, has effectively done the job? Unfortunately, the evidence tells the opposite story. The inflation bias has essentially harmed the real growth significantly and thus the overall welfare of the society.

In Chapter 5, the thesis ascertains if the inflation bias is significantly determined by the central bank through the conduct of monetary policy in a discretionary way or has any other potential sources beyond its control played a key role? Towards this end, the chapter pools the determinants of inflation bias; constructs appropriate proxy indicators, and conduct rigorous robustness analysis. The investigation leads to robust evidence that the SBP itself is the major driver of inflation bias instead of other factors.

Finally, in Chapter 6, the thesis quantifies the discretionary behavior of the central banker and the corresponding induced-behaviors in its objective indicators of inflation and real growth. The empirical examination of these indicators revealed that discretion is significantly biased towards inflation as it significantly affects the inflation in the long-run. In contrast, it does not help create any significant long-term gains in output. This endorses the fundamental critique against discretionary monetary policy in case of Pakistan.

The evidence in all four analytical chapters is consistent, seriously questioning the rationale for the continuation of the current discretionary monetary policy practices. The recommendation to transform the focus of the SBP from an output objective towards the inflation objective will help achieve both price and output stability. For this transformation to occur, monetary policy must change from a discretionary to a commitment-based policy framework. The closest practical example of a commitment-based monetary policy regime is the inflation targeting framework. Inflation targeting has been adopted by several countries and their economic performance has been commendable as discussed in Chapter 2 of the thesis.

Successful transformation would require further work to explore possible interrelated areas within the SBP. For example, an assessment may be required of the forecasting capability and efficacy of the existing core inflation indicators. Another area where further research may be needed is the identification of an appropriate speed of disinflation just in case a principal decision is made to adopt inflation targeting.

REFERENCES

Agha, A. I., & Khan, M. S. (2006). An empirical analysis of fiscal imbalances and inflation in Pakistan. [SBP Research Bulletin]. *2*(2).

Aguiar, A., & Martins, M. M. F. (2008). Testing for asymmetries in the preferences of the Euro-area monetary policy maker. *Applied Economics, 40*(13), 1651-1667.

Ahmad, E., & Ali, S. A. (1999). Exchange rate and inflation dynamics. *The Pakistan Development Review, 38*, 235-251.

Ahmad, E., & Ali, S. A. (1999a). Relationship between exchange rate and inflation. *Pakistan Economic and Social Review, 37*(2), 139-154.

Ahmad, E., & Munirs, M. (2000). An analysis of money demand in Pakistan. *Pakistan Economic and Social Review, 38*(1), 47-67.

Ahmad, E., & Ram, H. (1991). Foreign price shocks and inflation in Pakistan: A monetarist approach. *Pakistan Economic and Social Review, 29*(1), 1-20.

Ahmad, M., & Khan, A. H. (1990). A re-examination of the stability of the demand for money in Pakistan. *Journal of Macroeconomics, 12(2)*, 307-321.

Ahmed, S., Ara, I., & Hyder, K. (2006). How external shocks and exchange rate depreciations affect Pakistan? implications for choice of an exchange rate regime. [SBP_Research Bulletin]. *2*, 61-88.

Ahortor, C. R. K., Adenekan, A., & Ohemeng, W. (2012). An estimate of inflation threshold in the WAMZ: the case of Ghana and Nigeria. *Journal of Monetary and Economic integration, 11*(2), 158-201.

Ahsan, A., Skully, M., & Wickramanayake, J. (2006). Determinants of central bank independence and governance: problems and policy implications. *JOAAG, 1*(1), 47-67.

Akaike, H. (1973). Information theory and the extension of the maximum likelihood principle *Proceeding of the Second International Symposium on Information Theory* (B.N. Petrov and F.Csaki ed., p. 267-281). Budapest.

Akaike, H. (1974). A New Look at the Statistical Model Identification. *IEEE Transactions on Automatic Control*, *Ac-19*(6), 716-723.

Akbari, A. H., & Rankaduwa, W. (2006). Inflation targeting in small emerging market economy: the case of Pakistan. [SBP Research Bulletin]. *2*, 169-190.

Akhtar, S. (2006). Pakistan—economic outlook and prospects. [Speech Delivered at the Adam Smith Institute, Thun, Switzerland, June 27].

Akmal, M. (2011). Inflation and relative price variability. [SBP Research Bulletin]. *7*(2).

Alcala, F., & Ciccone, A. (2004). Trade and productivity. *The Quarterly Journal of Economics, 119*(2), 613-646.

Alesina, A., & Grilli, V. (1991). The European Central Bank: reshaping monetary politics in Europe. [CEPR Discussion Paper 563].

Alesina, A., & Jeffrey, S. (1988). Political parties and the business cycle in the United States, 1948-1984. *Journal of Money, Credit, and Banking, 20*, 63-82.

Alesina, A., & Stella, A. (2010). The politics of monetary policy. [NBER Working Paper Series No. 15856].

Alesina, A., & Summers, L. H. (1993). Central bank independence and macroeconomic performance: some comparative evidence. *Journal of Money Credit and Baking*, *25*(2), 151-162.

Al-Nowaihi, A., & Garratt. (1998). The new political macroeconomics. [Department of Economics, University of Leicester, mimeo].

Amato, J. D., & Gerlach, S. (2002). Inflation targeting in emerging market and transition economies: lessons after a decade. *European Economic Review*, *46*, 781-790.

Anderson, G. S., Kim, J., & Yun, T. (2010). Using a projection method to analyze inflation bias in a micro-founded model. *Journal of Economic Dynamics and Control, 34*(9), 1572-1581.

Anwar, S., & Asghar, N. (2012). Is demand for money stable in Pakistan. *Pakistan Economic and Social Review, 50*(1), 1-22.

Arby, M. F. (2004). State Bank of Pakistan: evolution, functions and organization. [MPRA Paper No. 13614].

Arby, M. F. (2006). Seigniorage earnings of commercial banks and state bank of Pakistan. [MPRA Paper No. 4955].

Arestis, P., & Sawyer, M. (2008). New consensus macroeconomics and inflation targeting: keynesian critique. [Economia e Sociedade, Campinas]. *17*, 629-653.

Arif, M. (2011). Evaluating experiences of developing countries moving towards inflation targeting: a lesson learning for Pakistan. *Indus Journal of Management and Social Sciences, 5(1)*, 45-59.

Arnone, M., Laurens, B. J., & Segalotto, J.-F. (2006). The measurement of central bank autonomy: survey of models, indicators and empirical evidence. [IMF Working Paper No. WP/06/227].

Auernheimer, L. (1974). The honest government's guide to the revenue from the creation of money. *Journal of Political Economy, 82,* 598-606.

Aydin, B., & Volkan, E. (2011). Incorporating financial stability in inflation targeting frameworks. [IMF Working Paper, WP/11/224].

Azim, P., Ahmed, N., Ullah, S., & Zaman, B. (2010). Demand for money in Pakistan: an ARDL approach. *Global Journal of Management and Business Research, 10*(9), 76-80.

Backus, D., & Driffill, J. (1985a). Inflation and reputation. *American Economic Review, 75*, 530-538.

Backus, D., & Driffill, J. (1985b). Rational expectations and policy credibility following a change in regime. *Review of Economic Studies 52*, 211-221.

Bahmani-Oskooee, M. (2001). How stable is money demand function in Japan? *Japan and the World Economy, 13*, 455-461.

Bahmani-Oskooee, M., & Bohl, M. T. (2000). German monetary unification and the stability of long-run German money demand function. [Economic Letters]. *66*, 203-208.

Bailey, M. J. (1956). The weight welfare cost of inflationary finance. *Journal of Political Economy, 64*, 98-110.

Ball, L. (1993). What determines the sacrifice ratio? [NBER Working Paper Series, WP No. 4306].

Ball, L., & Sheridan, N. (2003). Does inflation targeting matter? [NBER Working Paper No. 9577].

Ball, L., & Sheridan, N. (2005). Does inflation targeting matter? [Bernanke, B.S. and Woodford, M. (eds), The Inflation-Targeting Debate. Chicago: University of Chicago Press, 249-76.].

Baltensperger, E., & Jordan, T. J. (1997). Seigniorage, banking and the optimal quantity of money. *Journal of Banking and Finance, 21*, 781-796.

Barro, R. J., & Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy*, *100*, 223-251

Barro, R.J, & Sala-i-Martin, X. (1995). *Economic growth*. New York: McGraw-Hill.

Barro, R. J. (1977a). Unanticipated money growth and unemployment in the United States. *American economic review*, *67*, 101-115.

Barro, R. J. (1978). Unanticipated money, output, and the price level in the United States. *Journal of Political Economy*, *86*(4), 549-580.

Barro, R. J. (1986). Reputation in a model of monetary policy with incomplete information. *Journal of Monetary Economics*, *17(1)*, 3-20.

Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, *98*(2), 103-125.

Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics, 106*, 407-444.

Barro, R. J. (1995). Inflation and economic growth. [NBER Working Paper No. 5326].

Barro, R. J., & Gordon, D. B. (1983a). A positive theory of monetary policy in a natural rate model. *Journal of Political Economy, 91*, 589–610.

Barro, R. J., & Gordon, D. B. (1983b). Rules, discretion and reputation in a model of monetary policy. *Journal of Monetary Economics, 12*, 101-121. .

Batini, N., & Laxton, D. (2006). Under what conditions can inflation targeting be adopted? the experience of emerging markets. [Central Bank of Chile Working Paper No. 406.].

Bean, C. R. (1983). Targeting nominal income: an appraisal. *Economic Journal*, *93*, 806-819.

Bec, F., Salem, M., & Collard, F. (2002). Asymmetries in monetary policy reaction function, evidence for the U.S., French and German central banks. In B. Mizrach (Ed.), *Studies in Nonlinear Dynamics & Econometrics* (Vol. 6(2)).

Beetsma, R. M. W. J., & Jensen, H. (1998). Targets and contracts with uncertain central banker preferences *Journal of Money Credit and Baking, 30*, 384-403.

Bengali, K., Khan, H. A., & Sadaqat, M. (1999). Money, income, prices and causality: the Pakistani experience. *The Journal of Developing Areas, 33*, 503-514.

Berg, C., & Jonung, L. (1999). Pioneering price level targeting: the Sweedish experience 1931-1937. *Journal of monetary economics, 43*, 525-551.

Berlemann, M. (2005). Time inconsistency of monetary policy: empirical evidence from polls. *Public Choice, 125*, 1-15.

Bernanke, B. S. (2004a). Panel discussion: inflation targeting. [Federal Reserve Bank of St. Louis, Review]. *86*(4), 165-168.

Bernanke, B. S., & Blinder, A. (1988). Credit, money and aggregate demand. *American Economic Review, 78*(435-439).

Bernanke, B. S., & Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission. *The Journal of Economic Perspectives, 9*(4), 27-48.

Bernanke, B. S., Laubach, T., Mishkin, F. S., & Posen, A. S. (1999). *Inflation targeting: lessons from the international experience*: Princeton University Press.

Bernanke, B. S., & Mihov, I. (1998). The liquidity effect and long-run neutrality. [NBER Working Paper Series No. 6608].

Bernanke, B. S., & Mishkin, F. S. (1992). Central bank behaviour and the strategy of monetary policy: observations from six industrialized countries. [NBER Macroeconomics]. 183-228.

Billi, R. M. (2010). Optimal inflation for the U.S. economy. [The Federal Reserve Bank of Kansas City, RWP 07-03].

Billi, R. M., & Kahn, G. A. (2008). What is the optimal inflation rate. [Federal Reserve Bank of Kansas City, Economic Review, Second Quarter]. 5-28.

Birks, K.S. (2014). Rethinking Economics: from analogies to the real world. SpringerBrief, Forthcoming. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2466830

Blanchard, O. (2003). Comment on inflation targeting in transition economies: experience and prospects by Jiri Jonas and Frederic Mishkin. [NBER Conference on Inflation Targeting, Bal Harbour, Florida].

Blanchard, O., DellAriccia, G., & Mauro, P. (2010). Rethinking macroeconomic policy. *Journal of Money Credit and Baking, 42*, 199-215.

Blinder, A. (1997). Commentary [Federal Reserve Bank of St. Louis Review]. 157–160.

Blinder, A. S. (1998). *Central banking in theory and practice*: MIT Press, Cambridge.

Bodenstein, M., Hebden, J., & Nunes, R. (2012). Imperfect credibility and the zero lower bound. *Journal of Monetary Economics, 59*(2), 135-149.

Bokil, M., & Schimmelpfennig, A. (2005). Three attempts at inflation forecasting in Pakistan. [IMF Working Paper No. WP/05/105].

Bowen, A. (1995). British experience with inflation targetry. [Centre for Economic Policy Research, London]. 32-52.

Briault, C. B. (1995). The costs of inflation. [Bank of England, Quarterly Bulletin]. 33-45.

Bring, J. (1994). How to standardize regression coefficients. *The American Statistician, 48*(3), 209-213.

Brito, R. D., & Bystedt, B. (2010). Inflation targeting in emerging economies: panel evidence. *Journal of Development Economics, 91*, 198-210.

Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for testing the constancy of regression relationships over time. *Journal of the Royal Statistical Society, 37*(2), 149-192.

Bruno, M., & Easterly, W. (1998). Inflation crisis and long-run growth. *Journal of Monetary Economics, 41*, 3-26.

Bryan, M. F., Cecchetti, G. S., & Wiggins, L. (1997). Efficient inflation estimation. [NBER Working Paper No. 6183].

Bryan, M. F., & Cecchetti, S. G. (1994). *Measuring core inflation*: University of Chicago Press.

Bryan, M. F., & Pike, J. C. (1991). Median price changes: an alternative approach to measuring current monetary inflation. [Federal Reserve Bank of Cleveland Economic Commentary].

Bryant, R. C. (1996). Central bank independence, fiscal responsibility and the goals of macroeconomic policy: An American perspective on the New Zealand experience. [Brookings Discussion Papers in International Economics 126].

Bullard, J. (1999). Testing the long-run neutrality of money: lessons from the recent research. [Federal Reserve Bank of St. Louis Review]. *81*, 57-77.

Bullard, J., & Keating, D. (1995). The long-run relationship between inflation and output in postwar economies. *Journal of Monetary Economics*, *36*, 477-496.

Burdekin, R. C. K., Denzau, A. T., Keil, M. W., Sitthiyot, T., & Willett, T. D. (2004). When does inflation hurt economic growth? different nonlinearities for different countries. *Journal of Macroeconomics, 26*(2004), 519-532.

Burney, N. A., & Akmal, M. (1990). Expected inflation rate, its variability and desired real money demand in Pakistan: some alternative estimates using non-linear squares method. *Pakistan Economic and Social Review, 28*(1), 69-87.

Calvo, G., & Mishkin, F. S. (2003). The mirage of exchange rate regimes for emerging market countries. *Journal Of Economic Perspectives*, *17*, 99-118.

Canova, F. (1998). Detrending and business cycle facts. *Journal of Monetary Economics, 41*, 475-512.

Canzoneri, M. B. (1985). Monetary policy games and the role of private information. *American Economic Review, 75(4)*, 1056-1070

Carare, A., Schaechter, A., Stone, M., & Zelmer, M. (2002). Establishing initial conditions in support of inflation targeting. [IMF Working Paper No.02/102].

Carlson, J. B. (1988). Rules versus discretion: making a monetary rule operational. [Federal Reserve Bank of Cleveland]. (Q3).

Carstensen, K. (2007). Is core money growth a good and stable inflation predictor in the Euro Area. [Kieler Working Paper No. 1318].

Cecchetti, G. S. (1986). Testing short-run neutrality. *Journal of Monetary Economics, 17*, 409-423.

Cecchetti, G. S. (1987). Testing short-run neutrality: international evidence. *The Review Of Economic and Statistics, 69*, 135-140.

Cecchetti, S. G. (1996). Inflation indicators and inflation policy. [NBER Working Paper No. 5161].

Cecchetti, S. G., & Ehrmann, M. (1999). Does inflation targeting increase output volatility? an international comparison of policy makers' preferences and outcome. [NBER Working Paper No. 7426.].

Chaudhary, M. A., & Ahmad, N. (1996). Sources and impacts of inflation in Pakistan. *Pakistan Economic and Social Review, 34*(1), 21-39.

Chaudhary, M. A., Choudhary, M. A. S., & Ejaz, M. (2005). Equilibrium versus disequilibrium theories of business cycles evidence from Pakistan. *Pakistan Economic and Social Review, XLIII*(1), 1-20.

Chaudhry, M. A., & Choudhry, M. A. S. (2006). Why the state bank of Pakistan should not adopt inflation targeting? [SBP Research Bulletin]. *2*, 195-209.

Choudhri, E. U., & Khan, M. S. (2002). The exchange rate and consumer prices in Pakistan: Is rupee devaluation inflationary? *The Pakistan Development Review 41* (2), 107–120.

Chowdhury, A., & Islam, I. (2011). Attaining the millennium development goals: the role of macroeconomic policies. *International Jounal of Social Economics, 38*(12), 930-952.

Clarida, R., Gali, J., & Gertler, M. (1999). The science of monetary policy: a new keynesian perspective. *Journal of Economic Literature, 37*, 1661-1707.

Clarida, R., & Gertler, M. (1997). How the Bundesbank conducts monetary policy. [NBER Working Paper No. 5581].

Cogley, T. (2002). A simple adaptive measure of core inflation. *Journal of Money, Credit and Banking 34(1)*, 94-113.

Concalves, C. E. S., & Salles, J. M. (2008). Inflation targeting in emerging economies: what do the data say? *Journal of Development Economics, 85(1)*, 312-318.

Corbo, V., landerretche, O., & Schmidt-Hebbel, K. (2001). Assessing inflation targeting after a decade of world experience. *Internaitonal Journal of Finance and Economics, 6*, 343-368.

Cukierman, A. (1992). *Central bank strategy, credibility and independence: theory and evidence*: Cambridge: MIT Press.

Cukierman, A. (2000). The inflation bias result revisited. [Berglas School of Economics, Tel-Aviv University].

Cukierman, A. (2002). Are contemporary central banks transparent about economic models and objectives and what difference does it make? [Federal Reserve Bank of St Louis Review]. *84*, 15-35.

Cukierman, A., & Gerlach, S. (2003). The inflation bias revisited: theory and some international evidence. [The Manchester School]. *71*, 541-565.

Cukierman, A., web, S. B., & Neyapti, b. (1992). Measuring the independence of central banks and its effect on policy outcomes *The World Bank Economic Review* (Vol. 6, pp. 353-398): Oxford University Press.

Cutler, J. (2001). A new measure of core inflation in the U.K. [MPC Unit Discussion Paper No. 3 (London, Bank of England)].

Dale, S. (2009). Inflation targeting: learning the lessons from the financial crisis. [Remarks at Society of Business Economists' Annual Conference, London].

David, H. L. (2007). A guide to measures of trade openness and policy. Retrieved from http://www.cgu.edu/Include/spe/Conf%20Pol%20Econ%20Indicators%202007/A%20Guide%20To%20Measures%20of%20Trade%20Openness%20and%20Policy.pdf

De Gregorio, J. (1992). The effects of inflation on economic growth. *European Economic Review, 36*(2-3), 417-424.

De Gregorio, J. (1993). Inflation, taxation and long-run growth. *Journal of Monetary Economics, 31*(271-298).

Debelle, G. (1998). Inflation targeting and output stabilization. [IMF Working Paper 97/35.].

Debelle, G. (1999). Inflation targeting in practice. [Research Discussion Paper 1999-08, Economic Analysis Department Reserve Bank of Australia].

Debelle, G., & Stevens, G. (1995). Monetary policy goals for inflation in Australia [Research Discussion Paper 9503 Reserve Bank of Australia].

Dennis, R. (1997). Bandwidth, bandlength, and inflation targeting: some observations. [Reserve Bank of New Zealand Bulletin, No.1].

Dennis, R. (2005). Inflation targeting under commitment and discretion. *Economic Review*, 1-13.

Dennis, R. (2010). When is discretion superior to timeless perspective of policymaking? *Journal of Monetary Economics*, *57*, 266-277.

Dennis, R. (2014). Imperfect credibility and robust monetary policy. *Journal of Economic Dynamics and Control*, *44*, 218-234.

Dolado, J., Pedrero, R. M., & Ruge-Murcia, F. J. (2004). Nonlinear monetary policy rules: some new evidence for the U.S. *Studies in Nonlinear Dynamics & Econometrics, 8*(3). Retrieved from http://www.eco.uc3m.es/temp/snldepaper.pdf

Dotsey, M. (2008). Commitment versus discretion in monetary policy. [Federal Reserve Bank of Philadelphia, Business Review]. (Q4), 1-8.

Doyle, M., & Falk, B. L. (2010). Do asymmetric central bank preferences help explain observed inflation outcomes? *Journal of Macroeconomics*, *32*, 527-540.

Drazen., A. (2000). *Political economy in macroeconomics*: Princeton University Press.

Drew, A., & Hunt, B. (1998). The forecasting and policy system: preparing economic projections. [Reserve Bank of New Zealand Discussion Paper No. G98/7].

Driffill, J. (1988). Macroeconomic policy games with incomplete information: a survey. *European Economic Review, 32(2-3)*, 533-541.

Drukker, D., Gomis-Porqueras, P., & Hernandez-Verme, P. (2005). Threshold effects in the relationship between inflation and growth: a new panel-data approach. [Proceedings of the 11th International Conference on Panel Data].

Eckstein, O. (1981). Core inflation. [Englewood Cliffs, N.J. Prentice-Hall].

Enders, W. (1995). *Applied econometric time series*: John Wiley and Sons, USA.

Enders, W. (2004). *Applied econometric time series* (2nd ed.). New York: John Wiley & Sons.

Engel, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: representation, estimation and testing *Econometrica, 55*(2), 251-276.

English, W. B. (1996). Inflation and financial sector size. [Finance and Economics Discussion Series No. 96-16, Federal Reserve Board, Washington].

Epstein, G. A., & Yeldan, A. E. (Eds.). (2010). *Beyond inflation targeting: assessing the impacts and policy alternatives*: Edward Elgar Publishing Limited.

Escudero, W. S. (2000). A primer on unit-root and cointegration. [Trabajo Docente Nro. 3 Retrieved from www.depeco.econo.unlp.edu.ar/trabdoce/docen3.pdf].

Fair, R. (1994). *Testing macroeconometric models*: Harvard University Press.

Falki, N. (2009). Impact of foreign direct investment on economic growth in Pakistan. *International Review of Business Research Papers, 5*, 110-120.

Felipe, J. (2009). Does Pakistan need to adopt inflation targeting? some questions. [SBP Research Bulletin]. *5(1)*, 113-161.

Filho, I. C. (2010). Inflation targeting and the crisis: an empirical assessment. [IMF Working Paper, WP/10/45].

Fillion, J. F., & Tetlow, R. (1993). Zero inflation or price level targeting? some answers from stochastic simulations on a small open-economy macro model in economic behaviour and policy choice under price stability. [Bank of Canada Publications].

Fischer, S. (1981). Towards an understanding of the costs of inflation: II. [Carnegie-Rochester Conferences Series on Public Policy, Amsterdam, North Holland]. *15*

Fischer, S. (1988). Rules versus discretion in monetary policy. [NBER Working Paper Series No. 2518].

Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics, 32*(3), 485-511.

Fischer, S. (1995). Modern approaches to central banking. [NBER Working Paper No. 5064].

Fischer., & Modigliani. (1975). Towards an understanding of the real effects and costs of inflation. *Review of World Economics, 114(4),* 810-833.

Fisher, M. E., & Seater, J. J. (1993). Long run neutrality and super neutrality in an ARIMA framework. *The American Economic Review, 83*, 402-415.

Flood, R., & Isard, P. (1989). Monetary policy strategies. [IMF Working Paper, WP/88/88]. 612-632.

Fratianni, M., Hagen, J. V., & Christopher, W. (1997). Central banking as a political principal-agent model. [Economic Inquiry]. *35*, 378-393.

Friedman, B., & Kuttner, K. (1996). A price target for U.S. monetary policy? lessons from the experience with money growth targets. [Brookings Papers on Economic Activity]. 77-146.

Friedman, B. M. (2012). Rules versus discretion at the Federal Reserve System: on to the second century. *Journal of Macroeconomics, 34*(2012), 608-615.

Friedman, M. (1968). The role of monetary policy. *The American Economic Review 58*, 1-17.

Friedman, M. (1969). *The optimum quantity of money and other essays*. Chicago: Aldine Publishing.

Friedman, M., & Schwartz, A. J. (1991). Alternative approaches to analyzing economic data. *The American Economic Review, 81*(1), 39-49.

Fuhrer, J. C. (2009). Inflation persistence. [Federal Reserve Bank of Boston Working Paper No. 09-14.].

Garfinkel, M. R., & Oh. S. (1993). Strategic discipline in monetary policy with private information: optimal targeting horizons. *American Economic Review, 83*, 99-117.

Garman, D. M., & Richards, D. J. (1989). Policy rules, inflationary bias and cyclical stability. *Journal of Money, Credit and Banking, 21*, 409-421.

Garratt, D. (1998). An analysis of political business cycle theory and its relationship with the new political macroeconomics. [Department of Economics, University of Leicester, mimeo].

Gartner, M. (1994). Democracy, elections and macroeconomic policy: two decades of progress. *European Journal of Political Economy, 10*, 85-109

Gartner, M. (2000). Political macroeconomics: a survey of recent developments. *Journal of Economic Surveys*, *14*, 527-561.

Gavin, W. T. (2003). Inflation targeting: why it works and how to make it work better [Federal Reserve Bank of St. Louis, Working Paper 2003-027B].

Genberg, H. (2002). Inflation targeting - the holy grail of monetary policy? [IHEID Working Papers, 022002, Hong Kong Institute for Monetary Research].

Gerlach, S. (2003). The ECB's two pillars. [CEPR Discussion Paper No. 3689].

Gerlach, S. (2004). The two pillars of the ECB. [Centre of Economic Policy Research 19]. 390-439.

Ghosh, A., & Phillips, S. (1998). Warning: Inflation may be harmful to your growth. [IMF Staff Paper No. 45]. 672-710.

Givens, G. E. (2012). Estimating central bank preferences under commitment and discretion. *Journal of Money Credit and Baking, 44*(6), 1033-1061.

Goodhart, C. A. E. (1975a). Monetary relationships: a view from threadneedle street. [Papers in Monetary Economics, Reserve Bank of Australia]. *1*.

Goodhart, C. A. E. (1988). *The evolution of central banks*. Cambridge: MIT Press.

Gordon, R. J. (1985). The conduct of domestic monetary policy. [NBER Working Paper No. 1221].

Gordon, R. J. (2011). The history of Phillips curve: consensus and bifurcation. *Economica, 78*, 10-50.

Granger, C. W. J., & Newbold, P. (1974). Spurious regressions in econometrics. *Journal of Econometrics, 2*, 111-120.

Griffiths, W. E., Hill, R. C., & Judge, G. J. (1993). *Learning and practicing econometrics*. New York: John Wiley & Sons.

Grilli, V., Masciandaro, D., Tabellini, G., Malinvaud, E., & Pagano, M. (1991). Political and monetary institutions and public financial policies in the industrial countries. *Economic Policy, 6*(13), 341-392.

Groshen, E. L., & Schweitzer, M. E. (1996). The effects of inflation on wage adjustments in firm-level data: grease or sand? [Federal Reserve Bank of New York, Staff reports, No. 9.].

Guender, A. V. (1998). Nominal income targeting vs strict inflation targeting: a comparison. [Department of Economics University of Canterbury Christchurch, New Zealand].

Guender, A. V., & McCaw, S. (1999). The inflationary bias in a model of open economy. [Department of Economics University of Canterbury Christchurch, New Zealand].

Guender, A. V., & Oh, D. Y. (2006). Price stability through price-level targeting or inflation targeting? a tale of two experiments. [Department of Economics, University of Canterbury Christchurch, New Zealand].

Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics* (5th ed.). New York: McGraw-Hill Irwin.

Haider, A., & Khan, S. U. (2007). Does volatility in government borrowing leads to higher inflation? evidence from Pakistan. *Journal of Applied Economic Sciences, 2008*(5), 187-202.

Haldane, A. (1995). Inflation targeting. [A Conference of Central Banks on the Use of Inflation Targets Organized by the Bank of England.].

Haldane, A. (2000). Ghostbusting: The UK experience of inflation targeting. [IMF Seminar, March 2000].

Hall, R. E., & Mankiw, N. G. (1994). Nominal income targeting. [NBER Working Paper No. 4439].

Hanif, M. N., & Arby, M. F. (2003). Monetary and fiscal coordination. [MPRA Paper No. 10307].

Hanif, M. N., & Batool, I. (2006). Openness and inflation: a case study of Pakistan. *Pakistan Business Review 7*(4), 1-7.

Hannan, E. J., & Quinn, B. G. (1979). The determination of the order of an autoregression. *Journal of the Royal Statistical Society, 41*(2), 190-195.

Hassan, R., & Shahzad, M. M. (2011). A macroeconometric framework for monetary policy evaluation: a case study of Pakistan. *Economic Modelling, 28*(118-137).

Hatch, N., Haldane, A. D., & Bakhshi, H. (1998). Some costs and benefits of price stability in the United Kingdom. [Working Paper No. 78].

Hayat, Z. U. C., & Kalirajan, K. P. (2009). Is there a threshold level of inflation for Bangladesh? *Margin-The Journal of Applied Economic Research, 3*(1), 1-20.

Herrendorf, B. (1998). Inflation targeting as a way of precommittment. [Oxford Economic Papers 50]. 431-448.

Hetzel, L. R. (1985). The rules versus discretion debate over monetary policy in the 1920s. [Federal Reserve Bank of Richmond Economic Review]. (Novemer/December), 3-14.

Hjalmarsson, E., & Osterholm, P. (2007). Testing for cointegration using the Johansen methodology when variables are near-integrated. [IMF Working Paper WP/07/141].

Hodrick, R. J., & Prescott, E. C. (1997). Postwar U.S. business cycles: an empirical investigation. *Journal of Money Credit and Baking, 29*, 1-16.

Hossain, A. (1994). The search for a stable money demand function for Pakistan: an application of the method of cointegration. *The Pakistan Development Review, 33*(4), 969-983.

Hu, Y. (2003a.). *Empirical investigation of inflation targeting in essays on monetary policy and international finance.* Unpublished PhD Dissertation, Georgetown University, Washington.

Hu, Y. (2003b). Empirical investigation of inflation. [Institute of International Economics Working Papers 03-6. Washington].

Hussain, M. (2005). Inflation and growth: estimation of threshold point for Pakistan. *Pakistan Business Review, 7(3)*, 1-15.

Hyder, Z., & Shah, S. (2004). Exchange rate pass-through to domestic prices in Pakistan. [State bank of Pakistan Working Paper No. 5].

Ilbas, P. (2010). Estimation of monetary policy preferences in a forward-lookig model: a Bayesian approach. *International Journal of Central Banking*, *6*(3), 169-209.

Ireland, P. N. (1997). Sustainable monetary policies. *Journal of Economic Dynamics and Control, 22*, 87-108.

Ireland, P. N. (1999). Does the time-inconsistency problem explain the behavior of inflation in the United States. *Journal of Monetary Economics, 44*, 279-291.

Javid, M., & Qayyum, A. (2011). Foreign aid and growth nexus in Pakistan: the role of macroeconomic policies. [PIDE Working Papers 2011:72].

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, *12*, 231-214.

Johansen, S. (1991). Estimation and hypothesis testing of cointegrating vectors in Gaussian vector autoregressive models. *Econometrica, 59*, 1551-1580.

Johansen, S. (1995a). *Likelihood-based inference in cointegrated vector autoregressive models*. Oxford: Oxford University Press.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration–with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, *52*, 169-210.

Johnson, D. (2003). The effect of inflation targets on the level of expected inflation in five countries *The Review of Economics and Statistics, 85,* 1076-1081.

Johnson, D. R. (2002). The effect of inflation targeting on the behaviour of expected inflation: Evidence from an 11 country panel. *Journal of Monetary Economics 49*, 1493-1519.

Jonas, J., & Mishkin, F. S. (2003). Inflation targeting in transition countries: experience and prospects [NBER Working Paper No. 9667].

Jones, J., & Khilji, L. (1988). Money growth, inflation and causality: empirical evidence for Pakistan 1973-85. *Pakistan Development Review, 28*(1), 45-58.

Jordan, T. J. (2001). Monetary control uncertainty and inflation bias. *Journal of Economics, 73*(2), 125-147.

Juhasz, R. (2008). The optimal rate of inflation and the inflation target: International experience and the Hungarian perspective. [MNB Bulletin, retrieved from http://www.mnb.hu/Root/Dokumentumtar/ENMNB/Kiadvanyok/mnben_mnbszemle/mnben_szemle_cikkei/mnb_bull_2008_09_reka_juhasz_en.pdf].

Kahn, G. A., & Parrish, K. (1998). Conducting monetary policy with inflation targets. [Federal Reserve Bank of Kansas City Economic Review]. 5-32.

Kannan, R., & Joshi, H. (1998). Growth-inflation trade-off: Empirical estimation of threshold rate of inflation for India. [Economic and Political Weekly 33(42/43)]. 2724-2728.

Kazoo, M., & Tsutsui, S. (1990). Reputational constraint and signalling effect in a monetary policy game. [Oxford Economic Papers]. *42*, 603-619.

Kemal, M. A. (2006). Is inflation in Pakistan a monetary phenomenon? *The Pakistan Development Review, 45*(2), 213-220.

Khalid, A. M. (2005). Economic Growth, Inflation and Monetary Policy in Pakistan: Preliminary Empirical Estimates. *The Pakistan Development Review* 961-974.

Khalid, A. M. (2006). Is inflation targeting the best policy choice for emerging economies? a survey of emerging market experiences and lessons for Pakistan. [State Bank of Pakistan Research Bulletin]. *2*.

Khan, A. H. (1994). Financial liberalisation and the demand for money in Pakistan. *The Pakistan Development Review, 33*(4), 997-1010.

Khan, M. (2009). The design and conduct of monetary policy: lessons from Pakistan. *The Pakistan Development Review, 48*(4), 337-356.

Khan, M. A., & Ahmed, A. (2007). Foreign aid-blessing or curse: evidence from Pakistan. *The Pakistan Development Review, 46*, 215-240.

Khan , M. S., & Schimmelpfennig, A. (2006). Inflation in Pakistan. *The Pakistan Development Review, 45*, 185-202.

Khan, M. S., & Schimmepfennig, A. (2006). Inflation in Pakistan: money or wheat? [IMF Working Paper, WP/06/60].

Khan, M. S., & Senhadji, A. S. (2001). Threshold effects in the relationship between inflation and growth. [IMF Staff Papers]. *48*, 1-21.

Khan, R. E. A., & Gill, A. B. (2007). Impact of supply of money on food and general price indices: a case of Pakistan. *IUB Journal of Social Sciences and Humanities, 5*(2).

Khan, S. U., & Saqib, O. M. (2007). An analysis of Pakistan's vulnerability to economic crisis. *The Pakistan Development Review, 46*(Part II), 597-610.

Kim, J., & Henderson, D. W. (2005). Inflation targeting and nominal-income-growth targeting: When and why are they suboptimal? *Journal of Monetary Economics, 52*, 1463-1495.

King, M. (1996). How should central banks reduce inflation? conceptual issues. [Economic Review, Federal Reserve Bank of Kansas City, Issue Q IV]. 25-52.

King, R. G., & Watson, M. W. (1997). Testing long-run neutrality. [Federal Reserve Bank of Richmond Economic Quarterly]. *83*.

King. M. (2002). The inflation target ten years on [Bank of England Quarterly Bulletin (Winter 2002)].

Klamer, A. (2007). Speaking of economics, how to get in the conversation. [NewYork: Routledge].

Kobbi, I. (2013). Asymmetric central bank preferences and inflation rate in Tunisia. *International Journal of Innovation and Applied Studies, 2*(4), 588-596.

Koop, G. (2009). *Analysis of economic data* (3rd ed.): John Wiley & Sons, Limited, England.

Kreps, D., & Wilson, R. (1982a). Sequential equilibria. *Econometrica*, 863-894.

Kreps, D., & Wilson, R. (1982b). Reputation and imperfect information. *Journal of Economic Theory*, 253-279.

Kumhof, M. (2002). A critical view of inflation targeting : crisis, limited sustainability, and aggregate shocks. [Central Bank of Chile Working Paper No. 27].

Kuttner, K. N., & Posen, A. S. (1999). Does talk matter after all? inflation targeting and central bank behaviour. [Federal Reserve Bank of New York Staff Report No.88].

Kuttner, K. N., & Posen, A. S. (2000). Inflation, monetary transparency, and G3 exchange rate volatility. [Institute for International Economics Working Papers 00-6].

Kuttner, K. N., & Posen, A. S. (2001). Beyond bipolar: a three dimensional assessment of monetary frameworks. *International Journal of Finance and Economics, 6(4)*, 369-387.

Kydland, F. E., & Prescott, E. C. (1977). Rules rather than discretion: the inconsistency of optimal plans. *Journal of Political Economy 85*, 473–492.

Laidler, D., & Robson, W. (1993). The great Canadian disinflation. [Montreal:C.D Howe Research Institute].

Lane, P. R. (1997). Inflation in open economies. *Journal of International Economics, 42,* 327-347.

Layton, A., Robinson, T., & Tucker, I. B. (2005). *Economics for today* (2nd ed.). South Melbourne: Thomson.

Lear, W. V. (2000). A review of the rules versus discretion debate in monetary policy. *Eastern Economic Journal, 26*, 29-39.

Lee, C. C., & Wong, S. Y. (2005). Inflationary threshold effects in the relationship between financial development and economic growth: Evidence from Taiwan and Japan. *Asian Pacific Development Journal, 8*, 123-135.

Leiderman, L., & Svensson, L. E. O. (1995). Inflation targets [Centre for Economic Policy and Research, London].

Levin. A.T., Natalucci, F. M., & Piger, J. M. (2004). The macroeconomic effects of inflation targeting. [Economic Research, Federal Reserve Bank of St. Louis].

Levine, R., & Renelt, D. (1991). Cross country studies of growth and policy: Some methodological, conceptual and statistical problems. [World Bank Working paper Series No. 608].

Levine, R., & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economic Review*, *82*, 942-963.

Levine, R., & Zervous, S. J. (1993). What we have learned about policy and growth from cross-country regressions. *American Economic Review, Papers and Proceedings, 83*, 426-430.

Lin, S. (2010). On the international effects of inflation targeting. *The Review of Economic and Statistics*, *92(1)*, 195-199.

Lin, S., & Ye, H. (2009). Does inflation targeting make a difference in developing countries? *Journal of Development Economics*, *89*, 118-123.

Lohman, S. (1992). The optimal degree of commitment: credibility versus flexibility. *American Economic Review*, 273-286.

Lopez-Villavicencio, A., & Mignon, V. (2011). On the impact of inflation on output growth: does the level of inflation matter? *Journal of Macroeconomics, 33*(2011), 455-464.

Lucas, R. E. (1973). International evidence on output-inflation trade-offs. *The American Economic Review*, *63,* 326-334.

Lucas, R. E. (1980). Methods and problems in business cycle theory. *Journal of Money Credit and Baking*, *12*, 696-715.

Mangano, G. (1998). Measuring central bank autonomy: a tale of subjectivity and of its consequences. *Oxford Economic Papers, 50*, 468-492.

Mankiw, N. G. (2009). *Macroeconomics*: Worth Publishers, New York.

Masson, P. R., Savastano, M. A., & Sharma, S. (1997). The scope for inflation targeting in developing countries. [IMF Working Paper No. 97/130.].

McCallum, B. (1985). On consequences and criticisms of monetary targeting. *Journal of Money Credit and Baking*, *17*, 570-597.

McCallum, B. (1988). Robustness properties of a rule for monetary policy. [Carnegie-Rochester Series on Public Policy]. *29*, 173-204.

McCallum, B. (1995). Two fallacies concerning central bank independence. *American Economic Review, 85*, 207-211.

McCallum, B., & Nelson, E. (1998). Nominal income targeting in an open-economy optimizing market. [NBER Working Paper No. 6675].

McCallum, B. T. (1996). Inflation targeting in Canada, New Zealand, Sweden, the United Kingdom and in general. [NBER Working Paper No. 5597].

McCallum, B. T. (1999). Issues in the design of monetary policy rules In J. B. Taylor & M. Woodford (Eds.), *Handbook of Macroeconomics* (Vol. 1). Amsterdam: Elsevier.

McCallum, B. T. (2000). The present and future of monetary policy rules. [NBER Workig Paper Series No. 7916].

Mendonca, H. F. (2005). Inflation bias: an appraisal. *Brazilian Journal of Political Economy, 25*, 96-100.

Milgrom, P., & Roberts, J. (1982a). Predation reputation and entry deterrence. *Journal of Economic Theory*, 253-279.

Milgrom, P., & Roberts, J. (1982b). Limit pricing and entry under incomplete information: an equilibrium analysis. *Econometrica*, *50*, 443-459.

Mise, E., Kim, T. H., & Newbold, P. (2005). On suboptimality of the Hodrick-Prescott filter at time series endpoints. *Journal of Macroeconomics, 27*, 53-67.

Mishkin, F. S. (1996). The channels for monetary transmission: lessons for monetary policy. [NBER Working Paper No. 5464].

Mishkin, F. S. (1997). Strategies for controlling inflation. [NBER Working Paper No. 6122.].

Mishkin, F. S. (1999). International experiences with different monetary policy regimes. *Journal of Monetary Economics, 43,* 579-605.

Mishkin, F. S. (2000b). Inflation targeting in emerging market countries. *American Economic Review, 90(2),* 105-109.

Mishkin, F. S. (2004). Can inflation targeting work in emerging market countries? [NBER Working Paper No. 10646.].

Mishkin, F. S. (2006). Monetary policy strategy: how did we get here? [NBER Working Paper No. 12515].

Mishkin, F. S., & Posen, A. S. (1997). Inflation targeting: lessons from four countries. [NBER Working Paper Series, WP No. 6126].

Mishkin, F. S., & Savastano, M. (2000). Monetary policy strategies for Latin America. [NBER Working Paper No. 7617].

Mishkin, F. S., & Schmidt-Hebbel, K. (2001). One decade of inflation targeting in the world: what do we know and what do we need to know [Central Bank of Chile Working Paper No. 101].

Mishkin, F. S., & Schmidt-Hebbel, K. (2007). Does inflation targeting make a difference? [NBER Working Paper Series No. 12876].

Mohanty, D., Chakraborty, A., Das, A., & John, J. (2011). Inflation threshold in India: an empirical investigation. [RBI Working Paper Series 18 (2011)].

Moinuddin. (2009). Choice of monetary policy regime: should the SBP adopt inflation targeting? [SBP Research Bulletin]. *5(1).*

Moron, E., & Winkelried, D. (2005). Monetary policy rules for financially vulnerable economies. *Journal of Development Economics, 76*(1), 23-51.

Mubarik, Y. (2005). Inflation and growth: an estimate of the threshold level of inflation in Pakistan. [SBP- Research Bulletin]. *1*, 35-44.

Munir, Q., & Mansur, K. (2009). Non-linearity between inflation rate and GDP growth in Malaysia. [Economics Bulletin]. *29*(3), 1555-1569.

Naqvi, B., & Rizvi, S. K. A. (2010). What does Pakistan have to join inflation targeters club, a royal flush or a seven-deuce offsuit? [MPRA Paper No. 19575].

Narayan, P. K. (2005). The saving and investment nexus for China: evidence from cointegration tests. *Applied Economics, 37*(17), 1979-1990.

Narayan, P. K., & Narayan, S. (2005). Estimating income and price elasticities of imports for Fiji in a cointegration framework. *Economic Modelling, 22*, 423-438.

Nawaz, S., & Iqbal, N. (2010). Investment, inflation and economic growth nexus. *Pakistan Development Review*.

Neuman, M. J. M., & Greiber, C. (2004). Inflation and core money growth in the Euro area. [Bundesbank Discussion Paper No. 36/2004].

Neumann, M. J., & Von, H. (2002). Does inflation targeting matter? [Federal Reserve Bank of St. Louis Review]. *85*, 127-148.

Neyapati, B. (2003). Budget deficits and inflation: the roles of central bank independence and financial market development. *Contemporary Economic Policy, 21*(4), 1458-1475.

Nordhaus, W. D. (1975). The political business cycle. *The Review of Economic Studies, 42*, 169-19.

Omer, M. (2010). Stability of money demand function in Pakistan. [SBP Working Paper Series No. 36].

Omer, M., & Saqib, O. M. (2009). Monetary targeting in Pakistan: a skeptical note. [SBP Research Bulletin]. *5*(1).

Orphanides, A., & Norden, S. V. (1999). The reliability of output gap estimates in real time. [SSRN Working Paper Series NO. 171795].

Person, T., & Tabellini, G. (1990). *Macroeconomic policy, credibility and politics*: London: Harwood Economic Publishers.

Person, T., & Tabellini, G. (1993). Designing institutions for monetary stability. [Carnegie-Rochester Conference Series on Public Policy 39]. 53-89.

Person, T., & Tabellini, G. (1999). Political economics and macroeconomic poloicy. In J. B. Taylor & M. Woodford (Eds.), *Handbook of Macroeconomics* (Vol. 1c, pp. 1397-1482). Amsterdam, North Holland.

Pesaran, H. M., & Pesaran, B. (1997). *Working with Microfit 4.0: interactive econometric analysis*. Oxford: Oxford University Press.

Pesaran, H. M., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*, 289-326.

Pesaran, M. H., & Shin, Y. (1999). An auto regressive distributed lag modelling approach to cointegration analysis *Econometrics and economic theory in the 20th century: the Ragner Frisch Centennial Symposium* (S.Strom ed.). Cambridge: Cambridge University Press.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*, 289-326.

Petursson, T. G. (2005). Inflation targeting and its effects on macroeconomic performance. [The European Money and Finance Forum].

Phillips, P. C. B. (1987). Time series regression with a unit root. *Econometrica, 55*, 227-301.

Phillips, P. C. B., & Ouliaris, S. (1990). Asymptotic properties of residual based tests for cointegration. *Econometrica, 58*, 165-193.

Piga, G. (2004). On the sources of inflation bias and output variability. *Scottish Journal of Political Economy, 52*(4), 607-622.

Pollin, R., & Zhu, A. (2006). Inflation and economic growth: a cross-country non-linear analysis. *Journal of Post Keynesian Economics, 4*, 593-614.

Powell, J. L. (1984). Least absolute deviations estimation for the censored regression model. *Journal of Econometrics*, *25*, 303-325.

Price, S., & Nasim, A. (1999). Modelling inflation and the demand for money in Pakistan; cointegration and the causal structure. *Economic Modelling*, *16*(1999), 87-103.

Qayyum, A. (2001). Sectoral analysis of the demand for real money balances in Pakistan. *The Pakistan Development Review, 40*(4), 953-966.

Qayyum, A. (2006). Money, inflation and growth in Pakistan. *The Pakistan Development Review*, *45(2)*, 203-212.

Qayyum, A. (2008). Does monetary policy play effective role in controlling inflation in Pakistan. [MPRA paper No. 13080].

Quah, D., & Vahey, S. P. (1995). Measuring core inflation. *Economic Journal, 105*, 1130-1144.

Rao, N. H. (2011). Seigniorage revenues in Pakistan. [SBP Research Bulletin]. *7*(2).

Rivlin, A. M. (2002). *Comment on U.S. monetary policy in the 1990s by N. Gregory Mankiw*: Cambridge, MIT Press

Riazuddin, R., Lodhi, M. A. K., Ashfaq, M., & Ahmad, B. A. (2013). A new measure of core inflation in Pakistan. [SBP Working Paper Series No. 66].

Roger, S. (2010). Inflation targeting turns 20. *Finance and Development, 47(1)*, 46-49.

Roger, S., & Stone, M. (2005). On target? the international experience with achieving inflation targets. [IMF Working Paper, WP/05/163, Washington DC].

Rogoff, K. (1985). The optimal degree of commitment to a monetary target. *Quarterly Journal of Economics, 100*, 1169–1190.

Rogoff, K. (1985b). Can international monetary policy cooperation be counterproductive? *Journal of International Economics, 18*, 199-217.

Rogoff, K. (1987). Reputational constraints on monetary policy. [Carneige-Rochester Conference Series on Public Policy 26]. 141-182.

Rogoff, K., & Sibert, A. (1988). Elections and macroeconmic policy cycles. [Review of Economic Studies]. *55*, 1-16.

Romer, C. D., & Romer, D. H. (1997). Institutions for monetary stability. Retrieved from http://www.nber.org/chapters/c8888.pdf.

Romer, D. (1993). Openness and inflation: theory and evidence. *Quarterly Journal of Economics, 98*, 869-903.

Romer, D. (2006). *Advanced Macroeconomics* (3rd ed.): McGraw-Hill/Irwin Publishers, New York.

Romer, D., & Romer, C. (2002). The evolution of economic understanding and postwar stabilization policy. [Federal Reserve bank of Kansas City Symposium on Rethinking stabilization policy]. 11-78.

Romer, P. M. (1989). Human Capital and Growth: Theory and Evidence. [NBER Working Paper No.3173].

Romer, P. M. (1990b). Endogenous technological change. *Journal of Political Economy, 98*(2), 71-102.

Rudebusch, G. D., & Svenson, L. E. O. (1998). Policy rules for inflation targeting. [NBER Working Paper No. 6512].

Ruge-Murcia, & Francisco J. (2001). The inflation bias when the central bank targets the natural rate of unemployment. [Centre for Interuniversity Research in Quantitative Economics, No. 22-2001].

Ruge-Murcia, F. (2003a). Does the Barro-Gordon model explain the behaviour of US inflation? A re-examination of the empirical evidence. *Journal of Monetary Economics*, *50*, 1375-1390.

Ruge-Murcia, F. (2004). The inflation bias when the central bank targets the natural rate of unemployment. *European Economic Review*, *48*, 91-107.

Ruge-Murcia, F. J. (2002). A prudent central banker. [IMF Staff Papers]. *49*(3), 456-469.

Ruge-Murcia, F. J. (2003b). Inflation targeting under asymmetric preferences. *Journal of Money Credit and Baking*, *35*(5), 763-785.

Rushdi, M., Kim, J. H., & Silvapulle, P. (2012). ARDL bounds tests and robust inference for the long run relationship between real stock returns and inflation in Australia. *Economic Modelling, 29*, 535-543.

Salami, D., & Kelikume, L. (2010). An estimation of inflaiton threshold for Nigeria 1970-2008. *International Review of Business Research Papers, 6*(5), 375-385.

Saleem, N. (2010). Adopting inflation targeting in Pakistan: an empirical analysis. *The Lahore Journal of Economics, 15*(2), 51-76.

Samantaraya, A., & Prasad, A. (2001). Growth and Inflation in India: Detecting the threshold level. *Asian Economic review, 43*, 414-420.

Samuelson, P. A., & Solow, R. M. (1960). Analytical aspects of anti-inflation policy. *The American Economic Review, 50*, 177-194.

Sarel, M. (1996). Nonlinear effects of inflation on economic growth. [IMF Staff Papers]. *43*(1).

sargent, T. J. (1983). Stopping moderate inflations: the methods of Poincare and Thatcher. [Federal Reserve Bank of Minneapolis Research Department Working Paper].

Sargent, T. J. (1986). *Rational expectations and inflation*: New York: Harper and Row.

SBP. (2000). State Bank of Pakistan Act, 1956. Retrieved from http://www.sbp.org.pk/about/sbpact/SBP_ACT_1956.pdf

SBP. (2012-13). Annual report. Retrieved from http://www.sbp.org.pk/reports/annual/arFY13/Anul-index-eng-13.htm

Schaechter, A., Stone, M. R., & Zelmer, M. (2000). Adopting inflation targeting: practical issues for emerging market countries. [International Monetary Fund, Washington DC].

Schwarz, G. (1978). estimating the dimensions of a model. *Annals of Statistics, 6*(2), 461-464.

Seleteng, M. (2005). Inflation and growth: An estimate of an optimal level of inflation in Lesotho.

Sellon, G. H., & Weiner, S. E. (1996). Monetary policy without reserve requirements: analytical issues. [Federal Reserve Bank of Kansas City, Economic Review, Fourth Quarter]. 5-24.

Serfraz, A., & Anwar, M. (2009). Fiscal imbalances and inflation: A case study of Pakistan. *Pakistan Journal of Social Sciences (PJSS)*, *29*(1), 39-50.

Siklos, P. L. (1999). Inflation target design: changing inflation performance and persistence in industrial countries. [Federal Reserve Bank of St. Louis Review 81, No.2]. 46-58.

Silver, M. (2007). Core inflation: measurement and statistical issues in choosing among alternative measures. [IMF Staff Papers. 54 (1)]. 163-190.

Simons, H. C. (1936). Rules versus authorities in monetary policy. *Journal of Political Economy*, *44*(1), 1-30.

Sinclair, P. (2009). The whys and wherefores of controlling inflation. [SBP Research Bulletin]. *5*(1).

Singh, K., & Kalirajan, K. (2003). The inflation-growth nexus in India: An empirical analysis. *Journal of Policy Modelling*, *25*, 377-396.

Smith, J. K. (2004). Weighted median inflation: is this core inflation? *Journal of Money, Credit, and Banking*, *36*, 253-263.

Söderström, U. (2001). Targeting inflation with a prominent role for money. [Sveriges Riksbank Working Paper No. 123].

Surico, P. (2007). The Fed's monetary policy rule and U.S. inflation: the case of asymmetric preferences. *Journal of Economic Dynamics and Control*, *31*, 305-324.

Surico, P. (2008). Measuring the time inconsistency of US monetary policy. *Economica*, *75*, 22-38.

Svenson, L. E. O. (1999). Price-level targeting versus inflation targeting: a free lunch? *Journal of Money Credit and Baking*, *31*, 277-293.

Svenson, L. E. O. (2009). Flexible inflation targeting: lessons from the financial crisis. [BIS Review 112/2009].

Svensson, L. E. O. (1995). Optimal inflation targets, conservative central banks and linear inflation contracts. [NBER Working Paper No. 5251.].

Svensson, L. E. O. (1997). Inflation forecast targeting: implementing and monitoring inflation targets. *European Economic Review, 41*, 1111-1146.

Svensson, L. E. O. (1997a). Optimal inflation targets, conservative central banks, and linear inflation contracts. *American Economic Review, 87*, 98–114.

Sweidan, O. D. (2009). Asymmetric central bank's preference and inflation rate in Jordan. *Emerald Studies in Economics and Finance, 26*, 232-245.

Tahir, S. (2006). Core inflation measures for Pakistan. [SBP Research Bulletin]. *2*(2).

Tambakis, D. N. (2004). Inflation bias with a convex short-run Philips curve and no time-inconsistency. [Pembroke College, Cambridge and Cambridge Endowment for Research in Finance].

Tariq, S. M., & Matthews, K. (1997). The demand for simple-sum and divisia monetary aggregates for Pakistan: a cointegration approach. *The Pakistan Development Review, 36*(3), 275-291.

Taylor, J. B. (1979). Estimation and control of a macroeconomic model with rational expectations. *Econometrica, 47*(5), 1267-1286.

Taylor, J. B. (1983). Comments. *Journal of monetary economics, 12*, 123-125.

Taylor, J. B. (1985). What would nominal GNP targeting do to the business cycle? [Carnegie-Rochester Conference Series on public Policy]. *22*, 61-84.

Taylor, J. B. (1999). *Monetary policy rules*: Chicago University Press.

Temple, J. (2002). Openness, inflation and the Phillips curve: a puzzle. *Journal of Money Credit and Baking, 34*(2), 450-468.

Terra, M. C. T. (1998). Openness and inflation: a new assessment. *Quarterly Journal of Economics, 113*, 641-648.

Tobin, J. (1980). Stabilization policy ten years after. [Brookings Papers on Economic Activity]. *1*, 19-89.

Truman, E. M. (2003). *Inflation targeting in the world economy*: Institute for International Economics,Washington.

Turner, D. (1996). Inflation targeting in New Zealand: what is the appropriate bandwidth? [Reserve bank of New Zealand Monetary Policy Workshop].

Uhlig, H. (2005). What are the effects of monetary policy on output? Results from an agnostic identification procedure. *Journal of Monetary Economics, 52*, 381-419.

Vaubel, R. (1990). Currency competition and European economic integration. *The Economic Journal, 100*, 936-946.

Vega, J. L., & Wynne, M. A. (2001). An evaluation of some measures of core inflation for the Euro Area. [ECB Working Paper No. 53].

Vega, M., & Winkelried, D. (2005). Inflation targeting and inflation behavior: a successful story. *International Journal of Central Banking, 1(3),* 153-175.

Vickers, J. (1986). Signalling in a model of monetary policy with incomplete information. [Oxford Economic Papers]. 443-455.

Vickers, J. (1998). Inflation targeting in practice: the UK experience. [Bank of England Quarterly Bulletin]. *38*, 368–375.

Viqar, A., & Amjad, R. (1984). *The management of Pakistan's economy 1947-82*: Oxford University Press, Karachi.

Walsh, C. (1995a). Optimal contracts for central bankers. *American Economic Review*, *85*, 150–167.

Walsh, C. (1995b). Is New Zealand's Reserve Bank Act of 1989 an optimal central bank contract? . *Journal of Money, Credit and Banking*, *27*, 1179-1191.

Walsh, C. E. (1993b). When should central bankers be fired? [University of California, Santa Cruz, Ca95064, USA].

Walsh, C. E. (2000). *Monetary theory and policy*: Cambridge, 2nd Printing.

Walsh, C. E. (2009). Inflation targeting: what have we learned? *International Finance, 12*, 195-233.

Walter., E. (2010). *Applied econometric time series* (4 ed.). New York: John Wiley & Sons.

Wang, B. (2007). Stability properties of the nominal income rule in the open economy. [Economic program University of Northern British Colombia].

Watshman, T. J., & Parramore, K. (1997). *Quantitative methods in finance*. London: International Thomson Business Press.

Wilson, B. K. (2006). The links between inflation, inflation uncertainty and output growth: new time series evidence from Japan. *Journal of Macroeconomics, 28*(2006), 609-620.

Wooldridge, J. M. (2008). *Introductory econometrics a modern approach* (4 ed.): South-Western.

Wynne, M., A. (1999). Core inflation: a review of some conceptual issues. [ECB Working Paper No. 5 (Frankfurt, European Central Bank)].

Yuan, H., & Miller, S. M. (2010). Designing central bank loss functions. *International Journal of Business and Economics, 9*, 77-81.

Zaidi, A. K., & zaidi, I. (2011). Rethinking monetary policy framework of State Bank of Pakistan. [SBP Research Bulletin]. *7(1)*.

Zaidi, I. M. (2006). Exchange rate flexibility and the monetary policy framework in Pakistan. [SBP Research Bulletin]. *2(1)*, 115-140.

Zhang, L. H. (2001). Sacrifice ratios with long-lived effects. [Department of Economics, The Johns Hopkins University].