A THRESHOLD APPROACH TO REVISIT MONETARY POLICY RULES

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CERTIFICATE

This is to certify that this thesis entitled: **"A Threshold Approach to Revisit Monetary Policy Rules".** submitted by **Ms. Ume Aiman** is accepted in its present form by the School of Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Economics and Finance.

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ABSTRACT

This study aims to look deep into Pakistan's monetary policy to investigate how the reaction function of Pakistan's monetary policy has evolved over time and how the monetary policy can be redefined from the perspective of Pakistan. To that aim, a mixed approach (i.e. both quantitative and qualitative approaches) is used. For quantitative analysis of monetary policy, the time-varying threshold Taylor rule has been estimated to find that what are the triggering points above and below which policy behaves differently. Pivotal variables of monetary policy i.e. inflation and output gap have been considered as threshold variables and their time-varying threshold values have been estimated based upon secondary data. The study covers the time span of more than forty years i.e. from 1977 to 2020 and inflation rate, output gap, exchange rate, and lagged interest rate are considered as the explanatory variables of monetary policy. The time-varying threshold values of inflation are found to be 3.75%, 7.95%, and 10.41% while the time-varying threshold values of the output gap are estimated as -1.74%,1.90,% and 3.90%.

The study found the asymmetry in the monetary policy conduct whilst it is also found that explanatory variables don't significantly behave differently above and below different thresholds. For qualitative analysis interviews of prestigious members of monetary policy were conducted. The process of making monetary policy decisions has evolved over the years (from money aggregate targeter to flexible inflation targeter) and won't stop revolving in the future as well. The need is to conduct more rigorous analysis of the economic data as well as trends with the keen judgement of the changing economic landscape to formulate more effective monetary policy.

Keywords: monetary policy rules, Taylor rule, threshold Taylor rule along with time-varying threshold values

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LIST OF ABBREVIATIONS

Cmr	Call money rate
Ex	Exchange rate
FED	Federal Reserves (US central bank)
FTPL	Fiscal Theory of Price Level
Inf	Inflation
SBP	State Bank of Pakistan
TH1	Threshold 1
TH2	Threshold 2
TH3	Threshold 3
ZLB	Zero Lower Bound

CHAPTER 1

INTRODUCTION

1.1 Background

In developed economies, monetary policy has to perform a function of price and economic stabilization as well as to maintain equilibrium in economic set-ups. However, if we take the case of developing countries, monetary policy has to serve a more dynamic role so that the requirements of the enlarging economies can be met. The primary objective of monetary policy is price stability, to stabilize inflation to a level that doesn't bother households and firms' decision-making process. The answer to the optimal level of inflation is still subject to substantial debate. However, we find convincing arguments for price stability as the primary objective of monetary policy. Different suggestions have been put up from time to time to formulate monetary policy in a way that its ultimate goal can be attained.

Monetary policy is an attempt to adjust the money supply in a way that monetary disequilibrium can be avoided. M. Friedman believes "money is only a machine, but it is an extraordinary machine"(Friedman, 1948). He argues that the tremendous growth in the output which has been witnessed in the past decades was not possible without it. History also teaches us a lesson that monetary policy can put a stop to money (itself) from being a prime cause of the economic disturbance. Many researchers believe that if the monetary authority had circumvented mistakes, the financial crisis would not have occurred, or at least it wouldn't have been that severe. There is a disagreement over the role of monetary policy in crisis like the financial crisis of 2007-08. However, most of researchers and practitioners believe that one of the factors of the crisis was the lower policy rate (though this factor was mere a modest one). We find a consensus on the point

that monetary policy carries, at least, some of the liability for the recession and economic disturbance.

Ideally, the central bank of the country can realize its goal of monetary policy by manipulating the supply of money and credit but in practice, it's not that simple to achieve the desired objectives, it's even more challenging in struggling economies like Pakistan. It is very important to adopt the right policy at the right time having the right objective in mind. The major concern while formulating monetary policy is whether monetary authority needs to follow a firm and a systematic rule to decide its action in order to bring stability to the economy or they should be free to take their actions which they consider fit to the prevailing economic condition, in other words, either discretion on the part of monetary policymakers should be allowed. Policymakers are sometimes, attracted to discretionary monetary policies because discretion provides them room to take action in response to economic change. A lot of literature is available on the debate of rules vs discretion.

In the debate of rules vs discretion, the foremost argument to advocate rules is the problem of time inconsistency in discretionary monetary policy, Discretionary policies by central bankers would give a route to a suboptimal outcome. This issue can be avoided if central bankers follow policy rules as it binds the behavior of central banks in a more systematic way. Furthermore, to leave the major driver of economic stability to the subjective judgments of a group of people is unwise, though this group tends to have a lot of expertise in their domain even though their intelligence is limited.

John B.Taylor (see for instance, Taylor, 1993 and 2012) has done a remarkable job to prove the superiority of policy rules over discretion. He has done substantial empirical and simulation

research to find whether rules work well or discretion. If we turn around the pages of history we find that the periods of rules-based monetary policy have caused stable economic periods. Much of the economic theory reports that improved economic performance owes to rules-based policy whereas discretionary periods resulted in economic harm. Rules-based policy not just helps to reduce fluctuations in employment and output but largely abolish the political interventions of government authorities and uncertainty about policy actions(Friedman, 1948). Much of the monetary theory projects that a go-stop kind of discretionary policy gives rise to booms and busts. For instance, Taylor (2017b)shows how a low level of interest rate in 2003-2005 initially causes a boom than a bust (he calls this period ad hoc as decisions were less predictable and more ad hoc). Whereas these booms and busts could have been impeded if more rules-based policies were used. In the nutshell, rules-based policies have superiority over discretion as discretionary policies lack credibility, transparency, and better predictability. Because of such deficiencies in discretionary policies economists have always been inclined toward rules-based monetary policy. In this context, John B. Taylor, Lars E.O Svensson, Irving Fisher, and Nobel Laureates Milton Friedman among others, have done substantial empirical and historical research to provide evidence in favor of the rules-based policy.

It is said that the Public interest is better served by rules than discretion. Rules serve as a guide for central bankers' decision-making process. Economists believe that even it's better to have a broken rule than no rule at all. However, "which rule" is still a question. In this regard, four well-known rules for monetary policy worth a discussion here.

Friedman's K-percent rule is one of the pioneer rules of monetary policy proposed by Milton Friedman. It's a constant growth rate rule where Friedman recommends increasing the money

supply by a specific fixed percentage every year. This rule is robust to provide a little discretion to the policy rule. However, implementing the rule in the real world may result in misallocation of resources, if velocity is affected by unexpected swings. McCullum's feedback rule is the instrument rule. It proposes to target the money supply like Friedman but proposes to change the target variable as other macro variables changes. McCullum's rule has the same benefit and cost as Taylor's rule but it takes into consideration the possibility of changes in other variables whilst it also requires increased knowledge on the part of policymakers. "Inflation targeting" is very popular in literature as well as in real-world policy-making decisions. It can be seen as a dynamic form of the "price-level targeting. Inflation targeting uses extra information and judgments of the economy that may be useful. Inflation targeting can help to stabilize the economy in response to aggregate demand shock but it can also destabilize the economy regarding an aggregate supply shock.

Among these prominent rules, the Taylor-type rule is probably the most recognized one. Taylor, 1993)regards nominal interest rate as the instrument of monetary policy which assumes to rise in interest rate in response to the rise in inflation deviation (deviation of inflation from its target) and output gap (output deviation from its potential level). The rule has been able to grasp the attention of both researchers and policy makers due to its usefulness in formulating monetary policy. Many central banks incorporate this rule in a "flexible inflation targeting" regime. It may guide policymakers to adjust the nominal interest rate as economic conditions changes. Theoretically speaking, it is the more adaptable rule of all but the specificity of the rule is not that straightforward, finding the right magnitude of inflation and output gap coefficient is difficult.

A large number of empirical research have studied and tested Taylor's rule and its extensions. For instance, some included interest rate smoothing as an explanatory variable. Others talked about the augmented version of Taylor's rule by incorporating the exchange rate into the rule. However, these specifications share the common feature of linear specification. But this linear and simple specification of policy rule and the stability of parameters in the particular rule has been seriously criticized by a lot of researchers. Even if the fundamental objective of policymakers is inflation stability and output stability, the policy rule needs to be more complex than the simple Taylor rule. This simple instrument rule is quite vague and not complete to be operational as a guideline for policymakers (Svensson, 2003). Mishkin, (2007) argues that simple policy rules are not adequate the real world situation which is why monetary authorities need to change their monetary conduct as needed.

Furthermore, the response of monetary authority towards the state of the economy may not be symmetric i.e. central bankers may respond differently towards key variables of the monetary policy. As different economic states of the macroeconomic variable such as growth rate, unemployment rate, and inflation rate may have a different impact on the preference of the monetary authority to formulate the policy. Consequently, the asymmetric response of the central bankers towards key variables may be observed (Taylor & Davradakis, 2006) ,(Bunzel and Enders 2010). The response of monetary authority towards key variables may be asymmetric above and below a triggering value known as the threshold value.

The asymmetric adjustment mechanism of central bankers may well be investigated by the "Threshold Taylor Rule". As threshold type rules have a better ability to attain helpful information from a threshold variable regarding the underlying variation of the policy rules. This information

helps to understand the asymmetric behavior of the policymakers in more comprehensively threshold Taylor rule models tell how the reaction of the monetary authority changes if the threshold variable is less or above the triggering value, calculated from the data. The models are enough sophisticated and mature to capture the nonlinearity than the linear models. Researchers in the developed world use these rules to investigate the underlying dynamics of the monetary policy rule. For instance, Kazanas & Tzavalis (2014)and Zhang & Pan (2019) used Threshold Taylor rules to investigate the not quadratic preferences of monetary authorities. Zhu & Chen, (2017)lays evidence of asymmetric U.S. monetary policy by using a time-changing threshold Taylor rule and we find a growing literature in this context.

1.2 Statement of the problem (SoP)

Various monetary policy rules have been proposed by researchers aiming to provide a benchmark rule however, these rules have a common feature of linear specification. The linear specification of the monetary policy reaction function has been seriously challenged in the empirical literature, see for instance, (Taylor & Davradakis, 2006) , Bunzel and Enders (2010) and Fatima and Malik (2015), and Sagir and Malik (2017) in case of Pakistan which emphasis on the threshold variables reverting the relationship of the monetary policy reaction function. Furthermore, the triggering values of the threshold variables which reverse the relationship of key variables of monetary policy and the interest rate may be fixed in the short term but in the long run, the threshold value may vary over time. As the threshold value may change when the economic situation changes. So the study aims to investigate this issue regarding Pakistan monetary policy while analyzing the time varying threshold values of the threshold variable in order to revisit the monetary policy of Pakistan.

1.3 Research Questions

The research questions will be as follows:

1. How the Monetary policy of Pakistan have evolved over the years and if State Bank of Pakistan (SBP) observe an asymmetric monetary policy?
2. What are the time-varying Threshold values of the key variables of the monetary policy which cause asymmetry in Pakistan's monetary policy?
3. In what way can the conduct of monetary policy in Pakistan be revisited so that a better monetary policy framework can be attained?

1.4. Objectives of the research

- To analyze the monetary policy conduct of Pakistan and how it evolved over years.
- This study will endeavor to propose a new lens to redefine monetary policy rules for Pakistan by using a time-changing threshold Taylor rule. The threshold values of the key variables of the monetary policy i.e. inflation and output gap will be estimated to reveal at what point the relationship of explanatory variables and interest rate reverses.
- The study also aims to investigate the monetary policy rule's underlying dynamics to bust the assumption of time-homogeneity of the triggering values of the threshold variables. This investigation will help us to provide a better framework to describe the monetary authority's asymmetric behavior hence revisiting monetary policy rules in a more sophisticated way.

1.5 Significance of the study

In the presence of heavy fiscal deficits (i.e. RS 5.5 trillion in FY 2021-22) and government debts (i.e. 72.4 % of GDP as per FY21-22), the role of monetary policy becomes more decisive to attain economic stability. To identify feasible monetary policy options, it is important to investigate how monetary policy rules have evolved. In the case of influential economies, asymmetry is the key feature of the new policy rules whereas the discussion of nonlinear monetary policy rules is limited in Pakistan. This study have revisited monetary policy rules to provide not only an insight of asymmetric response of SBP towards key variables of monetary policy but the time-changing threshold values of the threshold variables have also been investigated. This understanding will be a benchmark for the monetary authority to establish a sound monetary policy stance.

1.6 Organization of the study:

The study consists of six chapters where chapter 1 illustrates the introduction of the study. Chapter 2 provides an extensive review of the literature where both literature related to theory and methodology are discussed in detail. Chapter 3 enlists data and methodology for the empirical analysis followed by Chapter 4 which discusses the results of the empirical analysis. Chapter 5 presents methodology and results of qualitative analysis. Finally chapter 6 concludes the main findings whilst providing policy recommendations.

CHAPTER 2

LITERATURE REVIEW

Preamble

This chapter provides a detailed review of the literature regarding monetary policy. It starts with section 2.1 where the discussion of if rules are superior to discretion is given by providing empirical as well as historical evidence from the existing literature. In the section 2.2of the study International monetary policy conduct is reviewed. In section 2.3.a debate on nonlinear preferences of monetary authorities is documented followed by the review of literature concerning Pakistan monetary policy.

2.1. Rules Vs. discretion

Rules vs discretion have been a debate of interest among researchers. Economists have always been favoring monetary policy rules since the inception of economics. In the book, Wealth of Nations, Smith (1776) explained that "a well-regulated paper money" could enhance economic stability and growth. In the current decade, there is a return to the rules-based policy after a long shift of monetary policy away from rules. The post-crisis period especially from 2009 to 2013 is believed to be a period of deviation from rules since interest rates were kept too low over a long period, particularly in the influential economies.

Many researchers have used empirical models and historical analysis to suggest and propose the superiority of rules over discretion. Meltzer(2012)used a historical approach to identify that in the periods when monetary policy was more rules-based relatively better economic performance was

served. Shultz (2014) describes the significance of having a strategy. It states that it is crucial to have a monetary policy based on a strategy. Past policy decisions from different fields reveal that you get at least, somewhere while having a strategy but if you don't have a strategy it's like being a tactician that add-up to nothing.

The rules-based policy works better than discretion(Taylor, 2017b). The rule-like behavior is systemized in the way of "methodical, in accordance to plan and is not random or casual". If the monetary policy is based upon rules decisions regarding the instruments of policy are more systematic and predictable, on the contrary, the discretionary policy decisions are more ad hoc and tend to focus on the short-run improvements. Similarly, Taylor (2017a) argues that history reveals the superiority of rules over discretion as it has improved the economic performance and hence improves the lives of the people. Monetary policy rules help to cushion the economy from shocks and don't cause their shocks too. He believes that economists have always favored policy rules right from the beginning of economics. The paper argues if the interest rate hits the lower bound central banks should opt for a policy rule that keeps stable the growth rate of the money supply.

Taylor(1993) investigated the monetary policy conduct of the U. S and found that the good policy rule is the one that calls for changes in the fund rate in response to price level or real income change and assumes that the short-term nominal interest rate is linearly determined by the inflation deviation and output gap known as the Taylor rule. A considerable theoretical and empirical work regarding optimal monetary policy rules and their implication has emerged since then. Pioneer contribution describing the way to set nominal interest rates in the past includes (Clarida et al., 1998),(Judd & Rudebusch, 1998),(Orphanides, 2001),(Orphanides, 2003).

2.2. International Monetary Policy Conduct

Clarida (1998) empirically characterize the conduct of major central banks from 1979 to 1993 by using a forward-looking version of the backward-looking reaction function proposed by (Taylor, 1993). The rule is investigated for the UK, Germany, France, Italy, the US, and Japan where it has been documented that each of the influential central banks raises short-term rates large enough to increase real rates in response to a rise in expected inflation than targeted. Judd & Rudebusch (1998) estimated a model of FED's reaction function for three different empirical subsamples from 1970-to 1997 which is particularized by different chairmen of Federal reserves and recorded that monetary policy regimes in these separate subsamples substantially differ from one another.

Orphanides (2003) investigated the usefulness of the Taylor-type rule to device the monetary policy in the United States. Historical analysis of the monetary policy conduct and the Taylor rule is made in the paper where it has been stated that the Taylor-rule framework serves as a good description of the Federal Reserve's policies over the years. Nevertheless, the choice of an optimal policy rule is up to the central bank of the country. The choice of the right strategy and making it work is the policymakers' job. The criticism that policy rules often tie the hands of central banks is not appropriate as rules simply help central bankers to improve monetary policy rather than bounds them. Discretionary policy significantly contributes to the aggregate risk. On one hand discretionary policy corresponds to the good news about the macro-economy and lower risk premiums on the short-term nominal bonds whilst causes for bad news about long-term financial conditions as it gives rise to a higher risk premium on long-term nominal bonds. (Backus et al., 2021)

Taylor & Williams (2011)focuses on the robustness of the policy rules and simple rules that central banks can use as a guide to their interest rate decisions. The paper discusses the historical and empirical evidence that simple policy rules have a robust advantage over complex and optimal rules. It is empirically proven that simple rules work well in the real world scenario. Taylor (1999) also investigates if simple monetary policy rules for the nominal interest rate can be appropriately altered or amended to enhance economic performance. Simulations result of the paper lay evidence that simple monetary policy rules are more robust than those of complex rules over several models. However, it has also been argued that uncertainty regarding parameters and models is a big challenge for the monetary authorities and there is a disagreement over the magnitude of the parameters and the appropriate model. Researchers and central bankers are trying to overcome the problems in simple policy rules such as measurement errors, expectations, learning, and zero lower bound on the interest rate. Nevertheless, the papers argue that simple rules work well in real-world scenarios.

Central banks sometimes, opt for unconventional monetary policy tools if conventional monetary policy is no more effective or has been constrained by e.g. zero lower bound. However, there are no censuses over the usefulness of unconventional tools. Researchers like Sheedy (2017) have views that unconventional policy instruments are not a good substitute for conventional monetary policy as an unconventional monetary policy that is used to stabilize the economy today will have a negative effect on the economic stability tomorrow. The paper used a simple economic model to prove how different types of unconventional policy instruments are less effective than conventional policy instruments to stabilize the economy. In the article, it is suggested that to cope with the problems of unconventional monetary policy instruments, central banks need to develop

monetary policy strategies in a way that unconventional policy instruments are less likely to be required.

In the current era of low-interest rates, Zero Lower Bound (ZLB) may constrain the effectiveness of the monetary policy. It is a macroeconomic issue that occurs in the presence of a short-term nominal interest rate near zero or at zero. Interaction of monetary and fiscal policy has also been suggested by many researchers to avoid the problem of zero lower bound constraint e.g. Corsetti et al (2018) argues in their paper that in the wake of a massive adverse disturbance like the global financial crisis of 2008, monetary policy alone can't bring about economic stability due to lower bound constraint on nominal interest rate instead accommodative monetary and fiscal policy together is necessary for macroeconomic stabilization. Leeper (1991) used stochastic maximizing model to study the interaction of monetary and fiscal policy. They found that policy being active or passive depends on how it responds to government debt shocks.

Suggestions over fiscal dominance have also been made over time which set a ground for The fiscal theory of price level(FTPL) Researchers like Sims (1994) believe that equilibrium price level can be determined through the knowledge of both monetary and fiscal policy (not just through monetary policy). Determinacy of price level under either policy depends upon public expectations about the policies. A representative agent model is used where only transaction costs give rise to demand money. Their simulations suggest that in the economy of fiat money inflation is a more fiscal phenomenon than a monetary phenomenon. Cochrane (2005) also favors fiscal dominance. The paper proved that even in the presence of zero demand money price level may still be controlled through the government debt valuation model(Haas, 2006).

The issue of zero lower bound constraint on the nominal interest rates has also been addressed by (Reifschneider & Williams, 1999) who states that in the presence of immense contraction, mere open-market operations cannot be enough to restore equilibrium. There is a need for some other stimulus e.g. accommodative fiscal policy. However, their simulations through FRB/US model indicate that such events are rare probably once every hundred years if targeted inflation is around zero. Another suggestion to avoid zero lower bound constraint is Belongia & Ireland (2017) which suggests a rule which is based on the ability of the FED to affect the behavior of money stock or monetary base. Their simulations are highly supportive of the claim that even under the conditions of zero lower bound, a policy that adjusts targets for revised monetary base or Divisia MZM can make the path of nominal income more stable than the targets which have been set so far.

Swanson & Williams (2014)Questions the zero lower bound constraint in the effectiveness of the monetary policy which concludes that monetary policy has not always been constrained by zero-lower bound. The paper found that monetary policy has been unconstrained by the zero-lower bound from the period 2008 to 2010 due to financial markets and the private sector's expectations to lift off from zero bound within four quarters and the other reason was FOMC's large scale asset purchase and forward guidance. Only in late 2011 monetary policy had been constrained by zero lower bound.

Effective lower bound binding has been a major concern among researchers. Kiley et al., (2018)Used FRB/US and DSGE model to analyze the consequences of the effective lower bound. The simulations of the DSGE model and the FRB/US model indicate that monetary policy strategies lead by simple policy rules cause poor economic performance in the presence of a low equilibrium interest rate. A risk adjustment to a simple policy rule may improve economic activity

moderately. Commitment strategies to keep monetary policy accommodative until inflation or economic activities exceed its objective are more productive in the DSGE and FRB/US models.

The nexus of monetary policy and macroeconomic stability is evitable (Clarida et al, 2000). The paper attempts to explore the role of monetary policy and the nexus of monetary policy and macroeconomic stability. The paper initially acknowledges the contributions of the ex-chairman of the board of governors of the Federal Reserve System namely Paul Volcker. The monetary policy was well managed in his time. The pre Volker period is compared to the period of Volker in charge, which shows higher macroeconomic instability. The pre-Volker era of pre-1979 was a period when a sudden jump and decline in policy rate was taking place. But in Volker's time, he increased the interest rate too much until the inflation was backed to a single figure. This strategy is deemed to be the reason for successful monetary policy in his time.

New tools of monetary policy open a new era of monetary policy strategies. A major change in the conduct of monetary policy has been witnessed in the revised statement of the Federal Open Market Committee (FOMC) in August 2020 where flexible average inflation targeting has been implemented. Taylor advises rules-based average inflation targeting, he argues that "the FED could still switch to an average inflation approach and yet be far more specific than it has decided to be". Changes in the conduct of US monetary policy have an impact on the markets of emerging economies (Arora & Cerisola, 2000).

The revised statement of FOMC on monetary policy strategies has been a matter of concern among researchers as these strategies include some new rules to monetary policy. The revised statement implements flexible average inflation targeting and mentions "shortfalls" (rather than

"deviations") of employment from its maximum level. FOMC expects to maintain the federal funds rate at an effective lower bound of 0-0.25% and the committee decides to keep this rate "until labor market conditions have reached levels consistent with the committee's assessment of maximum employment and inflation has risen to 2% and is on a track to moderately exceed 2% for some time. The new policy frame is aimed to achieve price stability (Clarida, 2021).

Bernanke (2020) makes comments on the new tools of monetary policy because interests are kept low which means that a much smaller room is available for the conventional rate cut than in the past. He argues that new monetary policy tools have proved to be effective. But uncertainty about their costs and risk make policymakers more cautious to use them (at least initially). Suggestions are made to keep the neutral interest rate between the range of 2-3 cents or above when the neutral interest rate is below 2%, monetary strategies become less effective in such a scenario unconventional monetary policy is proven to be more effective. Papell & Prodan (2021)Reviews the FOMC's revised statement on monetary policy strategy and long-run goals. The paper presents how rules can be modified to be consistent with the revised FOMC's statement. They propose two new policy rules. Taylor and balanced approach (consistent) rules are in accordance with the revised statement whereas among these rules prescriptions of balanced rules seem to be more aligned with the revised statement.

The discussion about the revival of monetary policy rules in the current episodes of low inflation rate can also be seen in (Taylor, 2021). The papers explain how the jolt of the pandemic COVID-19 has been tried to be overcome and what special actions were taken by Fed to overcome the economic effects of the pandemic, these measures include reduction in the policy rate, quantitative easing which caused a large expansion of Fed's balance sheet. A balanced approach (regular,

consistent, and shortfall) is compared with Taylor's rule (regular, consistent, and shortfall). The findings indicate that Fed should make a strategy or rule to make it understandable for markets as well as for people that if economic growth increases and the inflation rate rises it would raise the policy interest rate, as they are now forecasting to do so. Explaining how policy rule or strategy would be consistent with a flexible average inflation targeting statement would remove uncertainty and remaining inconsistencies.

Woodford & Woodford (2007)Endeavor to present the extent to which forecast targeting can be taken as a desirable policy rule. Forecast targeting relies on the quantitative structural models of the effects of monetary policy, the success of this approach depends upon the output of the research program promoted by Taylor. Woodford & Woodford (2007)Believes that forecast targeting is an important step towards a more systematic policy as well as a more transparent one. Svensson (2019)presents that strategies of monetary policy of "forecast targeting" are more appropriate to fulfill both of the mandates of federal reserve i.e. maximum employment and price stability rather than by following a simple rule, for instance, the Taylor rule. Forecast targeting may include more specific strategies e.g. price level targeting, temporary price-level targeting, nominal GDP targeting, and average inflation targeting. Their simulations indicate that average inflation targeting is a comparatively better strategy than the rest.

In the case of developing countries, "instrument rules" like Taylor-type rules could even be proved a better base for monetary policy. Simulations of Malik & Ahmad (2010)confirm that macro performance could be better if the Taylor rule was adopted as a monetary policy strategy. Frankel (2010)talks about the formulation of the effective monetary policy in the developing world which is more challenging as this part of the world lack a sophisticated financial sector, the shock and

the size of adjustment they face are much greater than the high-income countries. The need for central bank independence and nominal target commitments are even more desirable in low-income countries. Developing countries also face the problem of illiquidity, asymmetric information, moral hazard, default risk, and imperfect institutions.

2.3 Non-linear preferences of monetary Authorities:

2.3.1 International Evidence

Monetary policy rules provide guidelines to formulate the monetary policy but these rules share the common feature of linear specification, which implies that the response of monetary policy towards objective variables is both symmetric and continuous. Whereas it has been demonstrated by several researchers that monetary authorities do not follow the linear specifications of the rules instead the preferences of central banks are asymmetric to better fit the monetary policy to the prevailing economic condition e.g. the act of central bank may be more aggressive in the recessionary period and the other way round during the expansion. Usually, deflation is rather more tolerable for policymakers than inflation. Similarly, during a low inflation period, the correlation between rates and inflation generally seems to be lesser. Monetary authorities may frequently adjust policy rates when the economic variables deviate from the target.

Several papers argue that nonlinear rule may better explain the behavior of central banks than linear specifications. For instance, to capture the features of the new policy framework announced by FOMC, (Fuentes-Albero & Roberts, 2021) did dynamic simulations by using the public version of the FRB/US model as well as the public FRB/US database is used. The result indicates that

asymmetry would matter more than the symmetry assumption in the policy rule in a situation where a prolonged period of positive inflation gaps and inflation is targeted.

One of the earlier contributions to the asymmetric feature of monetary policy was made by Kim et al (2005) who investigated the nature of asymmetry in the monetary policy rule and recorded significant evidence of nonlinearity between 1960-1979 i.e. the pre-Volcker period whereas, in the period of Volker-Greenspan, weak evidence of nonlinearity has been recorded. In a somewhat similar line, (Lubik & Schorfheide,2004,Cogley & Sargent, 2005 and Boivin, 2006) records high instability in the reaction of Federal Reserves to inflation over a prolonged period. It has been documented that at the beginning of the 1980s, a more aggressive monetary policy was conducted. Boivin & Giannoni (2006) reach a somewhat similar conclusion by estimating Vector Autoregression (VAR) throughout pre-1980 and post-1980. A stronger response to inflation expectation has been documented since the early 1980s which is suggested as the dominant reason for alteration in monetary policy transmission mechanism in the same period.

In times of financial disruption, the role of nonlinear macroeconomic models becomes more significant. The linear-quadratic framework of monetary policy rules may work well under normal circumstances as demonstrated by Mishkin (2010) but in times of financial disruption this approach is not sufficient for monetary policy conduct. Faulwasser et al (2020) records deficiency in the linear models particularly after the financial crisis of 2007-2008. The paper used nonlinear quadratic (NLQ) models to record the central bank's response to the Great Recession while moving from conventional monetary policy to unconventional monetary policy.

Not only the instability that is caused by policy shift has been a topic of concern among researchers but the central bank's asymmetric response towards inflation and the output gap has also been a matter of concern, particularly since different chairmen of the Fed seem to have different preferences regarding monetary policy and researchers have been trying to capture these different preferences. For instance, Dolado et al (2004) derive and estimate a nonlinear Taylor rule by taking a sample of US data from 1970 to 2000. The findings suggest that before 1971 US monetary policy can well be approximated by the linear Taylor rule. Inflation preferences of the Fed can be illustrated as symmetric regarding inflation in the same period whereas after 1983(the period of Volcker Greenspan) US monetary policy can be well approximated by a nonlinear Taylor rule than a linear Taylor rule whereas Surico (2004) documents high nonlinearity in the Fed's actions only before 1979 with a larger response to the output contractions than to the output expansions of the identical magnitude. The paper argues that Fed assigns different weights to positive and negative inflation deviation and the output gaps.

A rationale for the nonlinear Taylor rule can be found in(Dolado et al., 2005). The paper suggests that when the aggregate supply curve is convex that the relationship between inflation and the output gap is nonlinear. The optimal feedback rule which relates nominal interest rates to inflation and output gap needs to be nonlinear. The estimation of different nonlinear feedback rules is made in the paper to conclude that nonlinear rules better fit the data than linear rules. The debate on nonlinear policy rules can also be found in (Qin & Enders, 2008). The paper uses US real-time quarterly data to contrast in-sample and out-of-sample characteristics of linear and nonlinear Taylor rules. It also lays evidence that Fed used to follow Taylor's principle before 1979 but after

1979 nonlinearity better explains the behavior of the Fed. During the era of Paul Volcker, the ex-chairman of the Fed, nonlinearity used to matter more than in the Greenspan era.

Business cycles influence the action of central bankers. They may put different weights on inflation and output during recessionary and expansionary periods. Tan & Habibullah (2007) investigated the same phenomena by using Markov regime-switching model to analyze asymmetric monetary policy regimes in four ASEAN economies including Indonesia, Thailand, Philippines, and Malaysia from 1974 to 2003. Asymmetry in the monetary policy has been documented over the business cycles of the four economies that have been investigated.

Inflation targeting has been one of the considerable aspects of monetary policy which has been used by many developed as well as developing central banks over the globe. Many countries particularly the developed ones have been able to maintain a low level of inflation by inflation targets. Martin & Milas (2004) investigates the possibility of asymmetry in the inflation targets of the UK i.e. whether inflation deviation above and below targets are treated differently or considered equally bad. For this purpose, a nonlinear structural framework is adopted for the period of 1972 to 2000 by using quarterly data of the UK economy. The focus is on inflation targeting that was introduced in 1992 in the United Kingdom. Since 1992 asymmetric monetary policy has been recorded. The focus of policymakers is stronger towards upward deviation of inflation from its target than towards downward deviation from the target.

Recent work on nonlinear monetary policy reaction function can be found in(Agnello et al., 2020 and Faulwasser et al., 2020). Agnello (2020)used monthly data to estimate the monetary policy reaction function for Federal Reserve, particularly amid unconventional monetary policy where

preliminarily linear policy rule is employed based on the estimator of Dynamic ordinary Least Square (DOLS). Later on, the possibility of potential nonlinearity in the reaction function is assessed. Simulations from the MSR model suggest the existence of regime-dependent policy amid the unconventional monetary policy era. This is mainly because of the switching type response of conventional policy instruments to the growth rate of reserves of the central bank.

To investigate if the conduct of monetary policy in emerging countries is also nonlinear is not that straightforward as it has been hindered by the lack of sufficient and accurate data as discussed by (Miles & Schreyer, 2012). The paper further explores the nonlinear preferences of policymakers in four emerging Asian states from the period 1990-2010. They employ quantile regression by taking Thailand, Indonesia, Malaysia, and Korea as sample countries. The evidence of nonlinear monetary policy conduct has been found in all four countries under study. Though cross-country differences also exist but generally the central banks of these countries significantly respond to inflation over the sample period. For instance, in the lower quantile, the central bank of Indonesia doesn't respond to the output gap whereas the central authorities of Korea react to the output gap both in the lower quantiles and in the higher quantile. The response to inflation is further found to be "hump-shaped". Thus linear monetary policy models are insufficient to provide a better picture of the policy conduct in emerging economies of Asia.

2.3.2. Threshold models of the Taylor-type Rule:

Threshold models are among the most popular nonlinear models. Nonlinear Taylor-type rules can well be investigated by these models as suggested by several researchers(Taylor & Davradakis, 2006,Bunzel& Enders, 2010 and Koustas & Lamarche, 2012). Taylor & Davradakis (2006)

estimated forward-looking Threshold Taylor rule for the United Kingdom by using GMM to capture nonlinearity in the action of the monetary authority of the UK. The paper suggests that both the inflation and output gap are significant when inflation is above its target while a weak effect of the output gap is found when inflation is below the threshold value. Bunzel& Enders, (2010) estimated Taylor rule's threshold variants incorporating two regimes, where one regime is with high inflation and the other one is along with low inflation taking the sample period of 1965-2007. Models simulations comprise a high amount of parameter instability, suggesting that nonlinear specifications may provide more reasonable specifications. The aggressive act of the Federal Reserve has been documented when the output gap is negative and inflation is more than its interim target.

Koustas & Lamarche (2012) estimate the nonlinear Forward-looking Taylor rule allowing some of the regressors to be endogenous where the estimations are made through the method of efficient instrument variables. The period which is investigated in the paper is 1992 to 2003 taking the sample data of the United Kingdom. Important changes in the structure of the policy took place during this period e.g. switching to inflation targeting monetary policy in 1992 and 1997 and independence of the BoE (Bank of England). The paper argues that during the sample period BoE had been following the simple Taylor rule where the parameter of the interest indicates Bank's huge concern for the inflation and output gap.

In 2018 (Zhu et al., 2018) used the forward-looking threshold Taylor rule for their simulations and found that the rule well aligns with the US monetary policy. The monetary policy of the US is asymmetric. The simulation results indicate that the FED implements an active Taylor rule having a slight response to the inflation gap and a strong response to the output gap in the period of

recession. Kazanas & Tzavalis (2014)made a discussion on a forward-looking Taylor rule. To find the asymmetry in the monetary policy reaction function threshold type nonlinear monetary policy models are used and found empirical evidence of asymmetric response of the monetary authority which depends on the price level. On the same line, King (2004) and Rule & Petersen (2007)find evidence of the nonlinear conduct of monetary authority in the UK by using a threshold Taylor-type rule.

Threshold models can also be used to revisit traditional monetary policy rules for different purposes such as to make monetary policy effects in the time of effective lower bound constraint and lower bound constraint. For instance, Diaz-Roldan et al(2021) estimated the threshold values of the pivotal variables of the monetary policy i.e. inflation gap and the output gap to initially understand at what triggering point the relationship between monetary policy instrument and inflation and output gap reverts and then made suggestions that what might be the behavior of monetary authority to avoid the zero bound constraint. For this purpose, the nonlinear Taylor rule is used for the panel of 19 Euro area countries for the period of 1999Q1-2019Q3. The paper suggests showing more concern for the evolution of output than inflation.

Liu et al (2018) empirically study the behavior of interest rates in the United States and China over the different stages of business cycles. For this purpose, the multiple threshold Taylor rule is implied. The sample period is 1960-2014. It concludes that during expansionary phases strong preferences for short-term interest rate adjustments are shown to curb inflation, while during the economic recession, monetary policy is mainly adjusted to stabilize the output. The monetary authority of China follows Taylor's rule only with slight changes across business cycles while Fed seems not to follow Taylor's rules during the period of stagflation.

Nonlinearity is not just a defining feature of the influential central banks but researchers also find evidence of such conduct in emerging states (though the evidence of the nonlinear Taylor rule is less available for developing and emerging states) for instance, Maria et al (2018)Investigates the Taylor rule in five emerging countries namely Israel, Indonesia, Thailand, Turkey, and South Korea. The nonlinear threshold model is estimated via the generalized method of moment (GMM). They found that the augmented nonlinear Taylor rule better captures the behavior of central bankers in these countries as the preferences of monetary authority change over time.

2.4 Literature Review Concerning Pakistan

In the presence of a heavy budget deficit and limited resources to generate government revenue from other sources in struggling economies like Pakistan, the role of monetary policy becomes more crucial. Unfortunately, very limited studies have been put forth to understand and improvise monetary policy in Pakistan. It is a rarely discussed topic in public and its consequences for the welfare of people are even less debated. One of the contributions concentrating on the social impacts and implications of the monetary policy of Pakistan is (Javed, 2021) where it is argued that monetary policy is not just a technical endeavor handled by some experts for other experts but it impacts dramatically the social development of the country either positively or negatively. Serious reforms on the part of SBP need to be undertaken to achieve the goals of monetary policy.

In third-world countries like Pakistan, the transmission mechanism of monetary policy is not as efficient as it is in the developed world due to imperfect markets, less developed financial systems, and many other structural issues. Agha et al (2005) investigated the transmission mechanism of the monetary policy of Pakistan by using vector Autoregression (VAR). The paper documents that

contractionary monetary policy at first brings a drop in the domestic demand, as well as investment demand, this fall in demand, leads to a gradual decrease in the price pressure which eventually translates into a reduction in the overall price level of the economy but with lag.

Khan & Qayyum (2007) studied the monetary policy stance for 21 years i.e. between 1984 and 2004 by constructing the monetary condition Index (MCI) as well as an overall measure proposed by Bernanke and Mihov as a policy indicator. The results of this empirical study indicate the dominance of supply shock in the case of Pakistan which might result in a less effective monetary policy. For instance, tightening monetary policy in response to adverse supply shock will trigger inflation instead of reducing it. Moreover, in the case of Pakistan, the exchange rate might be a better option to be used as a policy instrument as the paper argue that the exchange rate channel dominates the interest rate channel.

During the heydays of "monetarism," many countries around the world including industrial and struggling economies adopted monetary targeting as a monetary policy regime and Pakistan is also among those countries. The roots of monetary targeting are embedded in the Quantity theory of money (QTM) which assumes that in the long term, the effect of money growth on the growth of production is supposed to be neutral however, it should affect the growth rate of inflation on a "one-for-one" basis. The popularity of monetary targeting spiked from the 1970s till the early 1980s. However, by the end of the 1990s, none of the influential central banks was practicing monetary targeting. Omer, Muhammad and saqib (2009) evaluated monetary targeting regime with respect to Pakistan from 1975 to 2006 and demonstrated that QTM doesn't provide an adequate explanation of inflation and money is not an exogenous phenomenon i.e. policy determined rather

it's endogenous. The paper concludes that the monetary targeting strategy is not optimum in the case of Pakistan and the central authority needs to think of some alternate options.

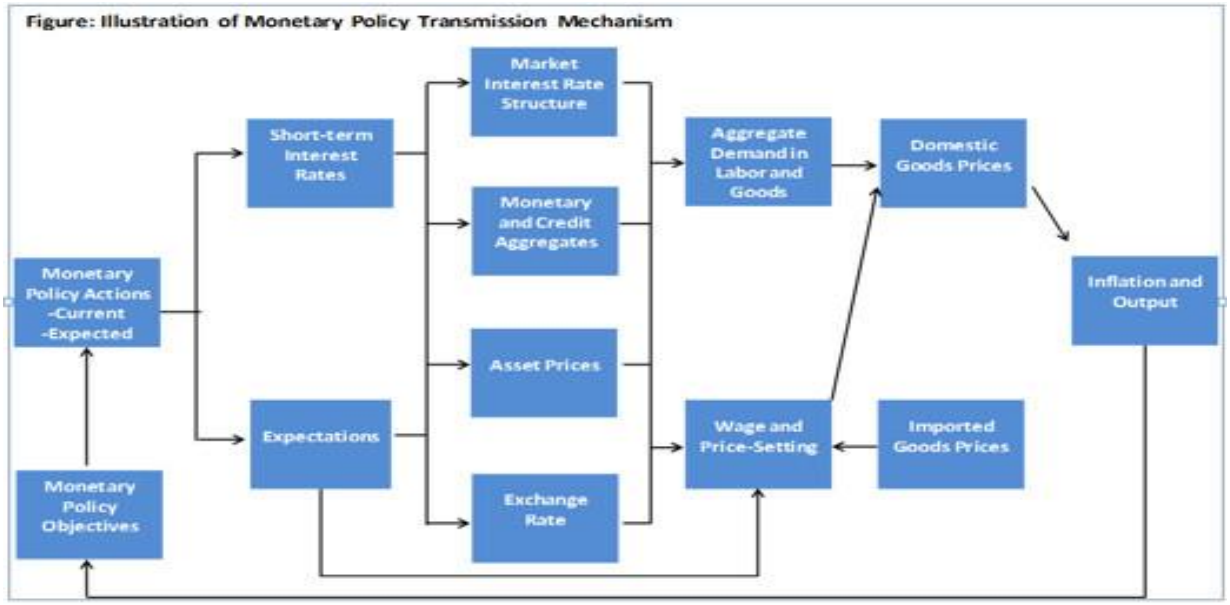
The effectiveness of monetary policy can be enhanced by better coordination between the State Bank of Pakistan and the treasury as suggested by (Shahid et al., 2016). The paper used the Dynamic Stochastic general equilibrium (DSGE) model to investigate the interaction of monetary and fiscal policy in Pakistan. The analysis of Pakistan's Monetary Policy can be found in Choudhri & Malik (2012) where a small-scale Dynamic Stochastic general equilibrium model is deployed for Pakistan. It records that the monetary authority of Pakistan doesn't strongly respond to inflation while a stronger response is suggested as it will both, lower the variability of inflation and enhance the welfare of households.

Malik (2007) endeavor to understand the monetary policy reaction function of SBP where the investigation of Pakistan's monetary policy reaction function is made to recognize the objectives of Pakistan's monetary policy. The paper concludes that SBP puts little focus on inflation and the output gap. Instead, SBP heavily focuses on the trade deficit, foreign exchange reserves, and government borrowing as a monetary policy objectives. The asymmetric preferences of SBP for monetary policy have also been pointed out in the literature.

Monetary Policy Transmission Channels:

Monetary policy stance in Pakistan is transmitted to the economy through five channels. As per the reports of SBP five prominent channels of monetary policy transmission are the interest rate channel, balance sheet channel, exchange rate channel, asset price channel, and expectation channel. Through the interest rate channel, a rise/fall in policy rates is used as a tool to

increase/decrease the retail interest rates as well as lending interest rates e.g. repo and KIBOR which at first influence real interest rate through the money market operations and then the economic activity is influenced with a lag. The next channel of transmission as per SBP is the balance sheet channel of monetary policy which works by affecting the credit portfolios of financial intermediaries. The availability of loanable funds is affected when the policy rates are changed due to changes in cash flow and the net wealth of the financial intermediaries.



*source: State Bank of Pakistan

Another channel of monetary policy transmission is the exchange rate channel where the domestic economy is linked with the international economy. As the rise/fall in the domestic interest rate causes to increase/ decrease in the attention of foreign investors. The very next channel of monetary transmission which SBP talks about is the asset price channel which runs through the assets prices whether real or financial. Lastly, SBP talks about the expectation channel where the conduct of monetary policy triggers the expectations of investors and the general public regarding

future rates and inflation. This channel is found to be significantly important as market expectations influence the long-term interest rates.

Evidence of nonlinear preferences of SBP

The study of (Saghir & Malik, 2017) also attempts to discover the monetary policy reaction function that borders on the behavior of SBP regarding the policy. For this purpose, linear and nonlinear Taylor type rule and linear/nonlinear McCallum rule are examined to determine which rule best explains the monetary policy reaction function of Pakistan. Their research revealed that the Taylor rule is not followed in Pakistan. Whereas, a strong preference of the State Bank of Pakistan (SBP) has been discovered towards interest rate smoothing and exchange rate management. The asymmetry in the conduct of monetary authority has also been found i.e. interest rate behaves differently above and below the threshold value. The threshold value of the output gap is found to be 2.5pc, whereas the threshold value of inflation is found to be approximately 6pc. Ahmed & Malik (2011) also lays the evidence of the nonlinear monetary policy reaction function. Their simulations estimated the threshold value of the inflation rate as 6.4pc above and below which monetary authority behaves differently.

Different models like Markov regime-switching, threshold regression, and smooth transition regression models have been put up to capture nonlinearity in the reaction function of the monetary policy. However, the most appropriate form of the specification to capture nonlinearity hasn't been explored so far. The study Fatima & Malik (2015) compared these models to find the best-fitted model. They concluded that threshold regression having inflation as a threshold variable best fits Pakistan's monetary policy reaction function.

Literature Gap

The current literature with reference to Pakistan mainly focuses on the fixed threshold values of the key variables of the monetary policy. However, this threshold value may change with changing economic situation which means that the threshold values might be time-varying. None of the existing study finds the time varying threshold values of the key variables of the monetary policy so the study fills the gap by exploring the time varying threshold values of the key variables of monetary policy and records the monetary policy reaction function of Pakistan below and above the values.

CHAPTER 3

DATA AND METHODOLOGY

Preamble

This chapter provides description of data and methodology used for empirical analysis. In section 3.1 data of the study is discussed in detail along with data sources and the construction of concerned variables. As the study use a mixed methodology (i.e. quantitative as well as qualitative approach) in order to revisit monetary policy rules. It starts with the theoretical foundation in section 3.2, where the Taylor rule is discussed as a benchmark monetary policy rule followed by Threshold Taylor rule along with time-varying threshold values for the purpose of empirical analysis. In section 3.3, methodology to estimate the threshold Taylor rule along with time varying threshold values is discussed. The quantitative analysis is complemented with qualitative analysis for further analysis of the monetary policy conduct of Pakistan.

3.1. Data

The time-series quarterly data from 1977Q1 to 2020Q4 have been used as sample data and the variables of the study are Gross Domestic Product, inflation rate, interest rates, output gap, and targeted inflation. The annual data of the variables of interest are available on several platforms such as the website of the state bank of Pakistan (SBP), Pakistan Bureau of Statistics, Federal Reserve Economic Data (FRED), World Bank, and International Financial Statistics (IFS) but since the quarterly data of the variables are not readily available so we have done certain calculations to obtain the desired data whose detail is given below.

Table 1: List of Variables

Variables	Data Source
GDP	Yearly data is converted into Quarterly data using (Kemal, n.d.)
Inflation	Data on Consumer Price Index has been extracted from IFS to estimate the quarterly Inflation rate.
Policy rate	Data on the Policy rate has been obtained from IFS
Output gap	The output gap is the unobserved concept hence estimated by using HP filter and quadratic time trend method
Threshold Inflation	Unobserved(estimated)

Discussion about Variables

Gross Domestic Product (GDP)

State Bank of Pakistan defines Gross Domestic Product (GDP) as the "total market value of all final goods and service period in a given country in a given period of time (usually a calendar year)". It is a measure of a large set of economic data which captures the economic activity of a country. GDP is measured by using different approaches such as the production approach, income approach, and expenditure approach. A blend of income, production, and expenditure approach is used to compile the annual GDP in Pakistan whose data is readily available on the website of the World Bank, International Financial Statistics (IFS), and several other platforms but the high-frequency data on GDP is not readily available so it has been estimated through the techniques proposed by Kemal (2004), the approach is a mix of all relevant information on quarterly data and mechanical technique.

Inflation

The rate of increase in the prices of goods and services over a specific period (usually a year) is defined as inflation by the International monetary fund (IMF). Inflation is a vast measure,

indicative of how much the cost of living in a specific country has increased over time. Most of the time, the central bank of the country has a charge to control inflation and make prices stable in the country. It is a matter of high concern from the perspective of Pakistan as we have been unable to attain stable inflation for many years. SBP uses inflation stability as the objective of monetary policy as documented by many researchers and SBP itself. Since the high-frequency inflation rate is not available so it is measured as a year-on-year increase in the consumer price Index for Pakistan i.e.

$$\pi_t = \frac{CPI_t - CPI_{t-4}}{CPI_{t-4}} \times 100 \qquad (3.1)$$

Policy Rate

The time-series data of policy rate have been used as the proxy variable of the nominal interest rate as it is the benchmark interest rate of Pakistan. It is the interest rate that SBP sets to affect the key monetary variables for instance exchange rate and consumer prices in the economy. The policy rate is revised in alternate months. Monetary policy decisions and statements are issued six times a year where the information on the new policy rate is given. The data on the Policy rate has been obtained from IFS.

Output gap

The output gap is widely used as the input of the monetary policy reaction function to set the relevant instrument of the policy. It is an indicator used to assess the economic condition. The output gap is the unobserved but estimated concept. The difference between potential output and

the actual level of output is termed as the output gap. The amount of goods and services that an economy can produce at maximum is the potential output and it is deemed that a healthy economy is the one where actual and potential output grow together. Output gaps can be positive or negative but none of them is desirable. When the actual output is more than the potential output it is tagged as a positive output gap whereas a negative output gap is the one where the actual output is less than the potential output. To minimize the output gap central bank adjusts the nominal interest rate.

In the literature, different approaches have been proposed to estimate the output gap. These approaches can be categorized as structural approach, statistical approach, and mixed approach. In the structural approach potential output is estimated by using the economic theory, the most commonly used structural approaches are structural vector autoregressive and the production function while the statistical approach is based upon statistical procedures to estimate potential output. Some of the most prominent statistical approaches include the linear trend method, quadratic trend method, Hodrick-Prescott (HP) filter(Hodrick &Prescott, 1997), the BN filter, and the Baxter and King filter, and the Band-pass (BP) filter. A mixed approach to estimating the output gap is the blend of both a statistical approach and economic theory such as The Kuttner approach and The Gerlach and Smets approach.

Hodrick-Prescott (HP) filter is a widely used filter to estimate potential output. It decomposes under the stochastic-process approach. H-P filter divides the GDP into two parts i.e. potential or trend component and a cyclical component (Prescott, 1997) i.e.

$$X=X^*+C$$

Where X is GDP, X* is the potential component and C is the cyclical component. X* is the sum of squares of second differences of GDP which can be found by minimizing the following loss function:

$$\min L = \{\sum_{t=1}^{t} C_t^2 + \gamma \sum_{t=2}^{t} (\Delta X_t^* - \Delta X_{t-1}^*)\text{^}2\}$$

$$=\{\sum_{t=1}^{t}(X_t - X_t^*)^2 + \lambda \sum_{t=2}^{t}[(X_t^* - X_{t-1}^*) - (X_{t-1}^* - X_{t-2}^*)]\text{^}2\} \qquad (3.2)$$

WhereX_t^* represents GDP at time t and X_t^* is its trend. λ is the smoothing parameter that is usually set as 1600 for quarterly data. The estimation results are given in the figure.

The quadratic trend method is another approach to estimating potential output. The benefit of using this approach is that Seasonal variations may be filtered through dummy variables(Satti & Malik.,2017). More precisely the following equation is used.

$$y_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \varepsilon_t \qquad (3.3)$$

Where t represents time and D_2 and D_3 are the dummy variables to adjust seasonality. The application results of the filter are given in the figure below.

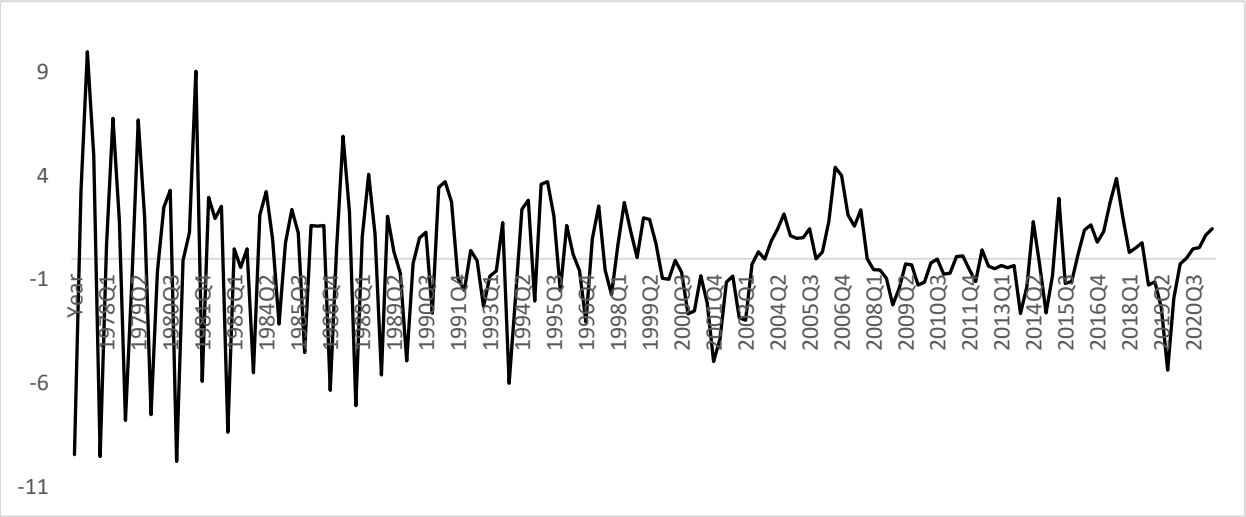


Figure 1: Output gap estimated through HP filter

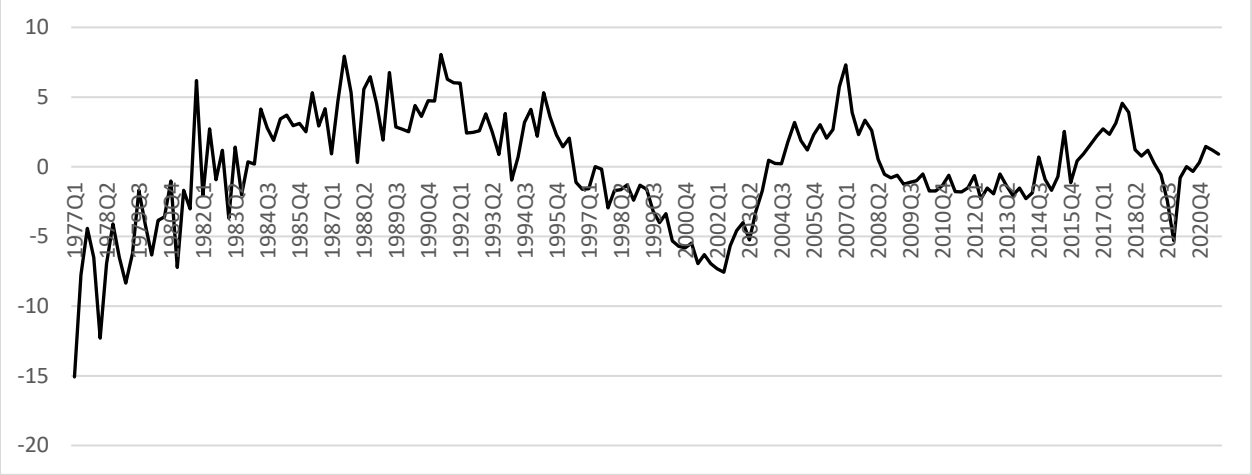


Figure 2: Output gap estimated through quadratic trend

The figures above show that seasonality is well adjusted by using the quadratic time trend method for our sample data. Moreover, the output gap estimate is more consistent with the historical evaluation of business cycles in the economy of Pakistan. This finding is consistent with (Satti & Malik.,2017). So we shall be using the output gap estimated through the quadratic time trend method.

3.2. Theoretical Framework for empirical analysis

Monetary Policy Reaction Function

3.2.1 Linear Taylor Rule

In 1993 John Taylor investigated monetary policy operations of the United States and found that central bankers follow the following general criterion (known as the Taylor rule)(J. B. Taylor, 1993).

$$r_t^* = \beta_1 + \beta_2(\pi_t - \pi^*) + \gamma Y_t^{gap} \qquad (3.4)$$

Where r_t^* is the nominal interest rate in the short term, π^* represents the targeted inflation rate. $(\pi_t - \pi^*)$ And Y_t^{gap} are the inflation deviation and output gap respectively. β_1 is representing the desired level of nominal interest rate while $\beta_2$and γ are the coefficients to indicate the sensitivity of interest rate towards inflation and output gap. The Taylor principle implies that the economy is in stability if $\beta > 1$ and $\gamma > 0$ and if $\beta < 1$ and $\gamma < 0$ then the interest rate is destabilizing. The above equation depicts the linear characteristics of the monetary authority i.e. policy rate is linearly determined as the function of inflation and output gap.

Following the pioneering work of Taylor (1993)**,** several researchers endeavored to estimate the appropriate weight for the inflation gap and output gap rather than relying on the weights proposed by Taylor himself. These models have the following form:

$$r_t^* = \beta_1 + \beta_2(\pi_t - \pi^*) + \gamma Y_t^{gap} + \epsilon_t \qquad (3.5)$$

Where the error term ϵ_t is i.i.d.

Taylor-type rules at large, are backward-looking or contemporaneous since they assume that interest rate is the reaction function of current or lagged values of output and inflation gap.

However, Clarida et al (1998) started the debate that central banks are forward-looking when determining the nominal interest rate. Following his work, several other researchers related the monetary policy rules to anticipated economic conditions. Specifically, they used forward-looking rules to determine nominal interest rate as a reaction function of anticipated inflation and the output gap. i.e.

$$r_t^* = \bar{r} + \alpha\{E(\pi_{t+k}|\Omega_t) - \pi^*\} + \beta\left[E\left\{y_{t+n}^{gap}\middle|\Omega_t\right\}\right] \qquad (3.6)$$

Where r_t^* is the target interest rate, E and $\Omega_t$represent (rational) expectations and information set respectively, while $\bar{r}$ is the equilibrium nominal interest rate, in the long run, π_{t+k} is the n period ahead inflation rate, π^* is the target inflation rate, and y_{t+n}^{gap} is the k period ahead output gap.

The above equations assume that central banks immediately adjust the interest rate to their target value whereas, in reality, central banks tend to smooth changes in nominal interest rates. Traditionally, several reasons are presented to explain this smoothing tendency of a central bank

such as the central bank's desire not to disrupt the capital market and loss of credibility from the huge reversal of policy. Furthermore, interest rate smoothing may be regarded as a learning device for the central bank because of the central bank's inability to have perfect knowledge o,f the economy. These factors are difficult to be captured explicitly. For this reason, we follow the spirit of R. Clarida et al (1998) to assume that the central bank adjusts the actual interest rate partially to its target as follows:

$$r_t = (1-\rho)r_t^* + \rho r_{t-1} + \epsilon_t \qquad (3.7)$$

Where ϵ_t is the exogenous random shock that might reflect the central bank's imperfect forecast for demand for reserves or simply randomness to policy. Moreover, by this partial adjustment behavior, the central bank aims to adjust the rate to remove merely a fraction $(1-\rho)$ of the gap between the current target level of its instrument and some linear combination of its previous values(Taylor & Davradakis, 2006). The following form for the forward-looking or contemporaneous model is obtained by substituting (3.5) and (3.6) in (3.7)

$$r_t = (1-\rho)\left[\beta_1 + \beta_2(\pi_t - \pi^*) + \gamma Y_t^{gap}\right] + \rho r_{t-1} + \epsilon_t$$

$$r_t = (1-\rho)\left[\bar{r} + \alpha\{E(\pi_{t+k}|\Omega_t) - \pi^*\} + \beta\left[E\{y_{t+n}^{gap}|\Omega_t\}\right]\right] + \rho r_{t-1} + \epsilon_t \qquad (3.8)$$

The driving rationale behind using the forward-looking Taylor rule is that decisions regarding monetary policy taken today impact the economy after some lag. In this context, a forward-looking monetary policy can be more effective. However, Saghir & Malik (2017) discovered that the results of the backward-looking Taylor rule are identical to the Forward-looking Taylor rule in the perspective of Pakistan. So in this study, we shall start by using a

backward-looking Taylor rule for simplicity to examine the robustness of the relationship that existed in the usual monetary policy rules.

3.3. Threshold Taylor rule along with time-changing threshold values:

The specification discussed above assumes that the response of monetary authority towards its policy objectives is symmetric. However, this aforementioned linear specification is not able to capture the response of policymakers in the real world(Judd & Rudebusch, 1998, Clarida et al., 2000). Largely due to macroeconomic variables the interest adjustment mechanism of central bankers may show nonlinearity. In order to test and record the asymmetric characteristics of the monetary policy rule, a Threshold Taylor type rule with time-changing threshold values will be used. As in the presence of asymmetric preferences of monetary authority linear Taylor rule is not optimal(Journal et al., 2008 and malik, 2015). Hence Threshold Taylor rule will not only effectively capture different policy preferences of the central bankers to formulate monetary policy in different regimes, during different economic states but also threshold values which may not be constant over time. Threshold variables in the model will allow us to capture different sensitivities of the policy rate towards inflation deviation and the output gap.

Our threshold model will have the following form:

$$\boldsymbol{i_t^*} = (1-\rho_1)\left[\beta_1 + \beta_2(\pi_t - \pi^*) + \gamma Y_t^{gap}\right] + \rho r_{t-1} + \epsilon_{1t} \qquad q_t \le \tau_t \qquad (3.9)$$

$$(1-\rho_2)\left[\beta_1' + \beta_2'(\pi_t - \pi^*) + \gamma' Y_t^{gap}\right] + \rho r_{t-1} + \epsilon_{2t} \qquad q_t > \tau_t \qquad (3.10)$$

In equation (1), q_t is the threshold variable and τ_t represents the threshold value. $\rho_1, and\ \rho_2$ are the interest smoothing parameters in the regimes. π^* Represents inflation rate.$(\pi_t - \pi^*)$ And Y_t^{gap}

represent inflation deviation and output gap respectively. $\beta_1 \; and \beta_2$ are the slope parameters of the inflation deviation and output gap in the first regime, while in the second regime β_1' and β_2' are the slope parameters of inflation and, output gap respectively. ϵ_{1t} And ϵ_{2t} are the white-noise disturbance terms.

3.3.1 Threshold Level of Inflation and output gap

Threshold values estimation

The equation to estimate the threshold/thresholds of inflation has the following specification:

$$\pi_t^* = \alpha_0 + \alpha_1\pi_{t-1}^* + \alpha_2\pi_{t-2}^* + \alpha_3\pi_{t-3}^* + \cdots \ldots \ldots \ldots + \alpha_{12}\pi_{t-12}^* \qquad (3.11)$$

Where π_t^* represents inflation and the threshold level of Inflation is estimated by allowing up to "5" breaks and ε (trimming) is set to be 0.15.

While the equation to estimate the threshold/threshold of output gap has the following form:

$$y_t^* = \alpha_0 + \alpha_1 y_{t-1}^* + \alpha_2 y_{t-2}^* + \alpha_3 y_{t-3}^* + \cdots \ldots \ldots \ldots + \alpha_{12} y_{t-12}^* \qquad (3.12)$$

Where y_t^* represents the output gap.

Bai-Perron tests to determine thresholds:

To estimate and test for a threshold of Inflation Bai-perron tests have been used. (Bai & Perron, 1998)and(Bai & Perron, 2003a) derived a test that is capable of accounting for multiple structural breaks. (Bai & Perron, 1998) proposed minimizing the residuals of the sum of squares for a set of breakpoints as follows:

$$S\{\beta,\gamma|(T)\} = \sum_{k=0}^{p}\left[\sum_{t=T_p}^{T_{p+1}^{-1}}\{X_t = Y_{1t}'\beta + Y_{2t}'\gamma_k + e_t\}\right] \quad (3.13)$$

Where the estimates of $\beta\ and\ \gamma$ are attained through OLS i.e. Ordinary Least Square.

The null hypothesis of no threshold is tested against "P" structural breaks. The test is the F-test where the null hypothesis is the presence of zero thresholds while the test has the following form:

$$F\{\widehat{\gamma}\} = \frac{1}{T}\left\{\frac{T-\langle p+1\rangle q-s}{jq}\right\} R'\widehat{\gamma}'\left[R\hat{V}(\hat{\gamma})R'\right]^{-1}R\hat{\gamma} \quad (3.14)$$

$(R'\widehat{\gamma}')$= $\{\gamma_0' - \gamma_1', \dots\dots\dots, \gamma_p' - \gamma_{p+1}'\}$ where $\hat{\gamma}$ denotes the optimal p-structural break estimate of γ and $\hat{V}(\hat{\gamma})$ is $\hat{\gamma}$'s variance-covariance matrix. The critical values and the number of breaks have been proposed by (Bai & Perron, 2003b).

Methodology for qualitative analysis:

The formation and execution of the monetary policy of Pakistan is the direct concern of SBP where the policy is made by the Monetary Policy Committee (MPC). We approached members of MPC to analyze the monetary policy of Pakistan and how it evolved over the years. Questions were provided them through email and they were asked to spare some time for telephonic interviews as per their convenience. They were also briefed about the study background and were also taken into confidence about neither revealing their identity nor wrong representation of their responses. All Ethical considerations were kept in view while documenting the interviews. Respondents didn't allow call recording hence points were recorded and analyzed for compilation.

Conclusion

The Objective of the study is to estimate the threshold model of the monetary policy of Pakistan .These models are mostly based on Taylor type rules so we shall first estimate the backward looking Taylor type rule as Saghir & Malik (2017) discovered that the results of the backward-looking Taylor rule are identical to the Forward-looking Taylor rule in the perspective of Pakistan. Next we shall estimate Threshold Taylor rule along with time-changing threshold values based on equations (3.9) and (3.10) while Threshold values of inflation and output gap will be estimated through equations (3.11) and (3.12) respectively. To determine the level of thresholds we shall be using Bai- Perron Test as explained above. The quantitative analysis is further complimented by qualitative analysis, for which in-depth interviews were conducted from the members of MPC.

CHAPTER 4

RESULTS AND DISCUSSION

Preamble

This chapter comprises of the result and discussion of empirical as well as qualitative analysis. Initially the descriptive statistics is presented and discussed followed by the estimation results of Taylor rule and threshold Taylor rule along with time varying threshold values.

4.1 Descriptive Statistics

Table 2 briefly explains some fundamental statistics i.e. mean, standard deviation (SD), stability ratio (SR), and, min and max. For this purpose ten-year average, SD, SR, min and max is found out. The explanation of each sub-column is given below.

Table 2: Descriptive Statistics

Variables	Years	Mean	SD	SR	Min	Max
Inflation Rate	1977-1980	8.69	2.41	27.72	5.25	13.17
	1981-1990	6.72	2.72	40.47	2.83	12.22
	1991-2000	8.81	2.99	34	3.25	13.53
	2001-2010	8.18	5	61.12	1.76	21.84
	2011-2020	6.94	3.15	45.46	1.62	12.43
Output Gap	1977-1980	-6.18	3.61	-58.4	-15.08	-1.02
	1981-1990	2.34	3.14	134.15	-7.23	7.93
	1991-2000	0.71	3.52	493.14	-5.83	8.05
	2001-2010	-0.77	3.74	-482.7	-7.56	7.32
	2011-2020	-0.17	1.99	-1158	-5.3	4.55
CMR	1977-1980	9.8	1.157	11.81	8.21	11.83
	1981-1990	7.73	1.39	18.08	6.21	10.42
	1991-2000	9.65	2.68	27.81	4.83	15.42
	2001-2010	7.74	3.53	45.63	1.05	14.1
	2011-2020	8.88	2.45	27.55	5.67	13.06
	1977-1980	10	0	0	10	10
Discount Rate	1981-1990	10	0	0	10	10
	1991-2000	14.18	3.25	22.92	10	20
	2001-2010	10.3	2.46	23.88	7.5	15
	2011-2020	9.08	2.38	26.21	6.25	13.75
Exchange Rate	1977-1980	9.91	0	0	9.91	9.9
	1981-1990	15.34	3.6	23.48	9.91	21.87
	1991-2000	34.85	9.6	27.55	21.8	51.87
	2001-2010	64.06	8.99	14.03	54.2	84.58
	2011-2020	108.85	21.45	19.71	85.21	163.2

CMR

We have used the call money rate (CMR) as the instrument of monetary policy which is equivalent to the U.S Federal funds rate. The reason for using CMR instead of discount rate is the fact that to attain operational targets discount rate is merely used as a policy tool that may also be attained by using other policy tools e.g. changes in the required reserve ratio and open market operations (OMO). This is consistent with the empirical literature related to the issue including (R. Clarida et al., 1998 and Taylor, 1993). Since the quarterly data of CMR is not publicly available so we have

used high-frequency data to calculate the desired data of CMR from 1977Q1 to 2020Q4. Figure 1 shows the behavior of the interest rate since 1977.

From 1948 to the late 1980s interest rate was rarely used as the instrument of monetary policy as SBP was of the view that the efficacy of interest rate change in the economy was constrained by many factors(Janjua, 2005). In the early 1990s, initiatives on the part of the Government were taken to reform the financial sector. In February 1992, the State Bank of Pakistan started using the SBP reverse repo rate as the instrument of monetary policy, called it a policy rate, and an upswing in the policy rate was observed. From 1992 until 2022, the policy rate in Pakistan averages 10.99cent.

A tight monetary policy stance was adopted in 1993-1997 as inflation and output gap were above their long-term average. To suppress this trend, a contractionary monetary policy stance was adopted. In October 1996, the interest rate reached an all-time high of 19.5 cents. In the early 2000s, the interest rate gradually started to decline in the recessionary phase. Easy monetary policy to stimulate economic growth was the purpose of the monetary authority. This decrease in the rate was partly due to the co-movement of the domestic interest rate with the foreign interest rate. But the tendency gradually changed in late 2007 as to curb the price hike in 2008, the interest rate was increased from 9.5 cents in July 2007

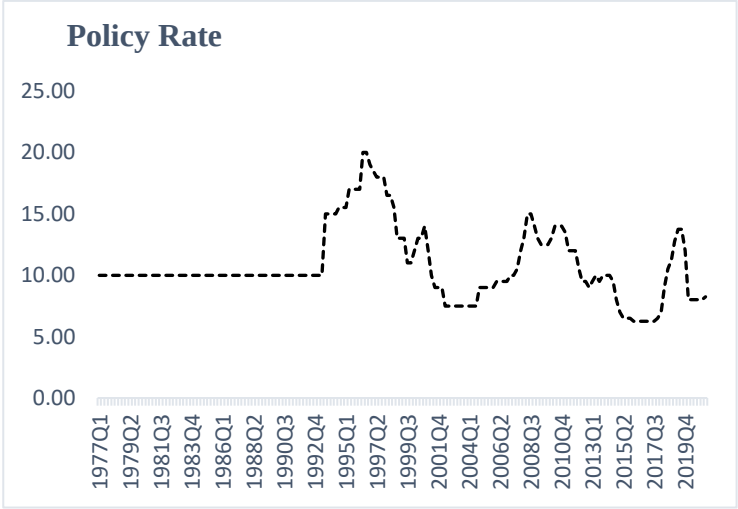


Figure 3: Policy rate (1977-2020)

to 15cent in March 2009. Between 2005 and 2016, the interest rate has been averaged 12.12 cents with a peak of 14.33 cents in 2008. In 2016-2017, an accommodative monetary policy stance was instrumented to boost the economy. In May 2016, the interest rate reached a record low level of 5.75 cents followed by a tight monetary policy in later years. But in the year 2020, an accommodative policy stance was adopted to cope with the economic slowdown caused by COVID-19.

Inflation:

An erratic trend in inflation in Pakistan has been seen over the years due to many reasons, for instance, retarded economic growth, loose monetary policies, high taxes, and duties, depreciating Pakistani currency, and political instability. Before the 1970s inflation has been at quite a steady level, inflation had been recorded low in the 1950s and then second lowest in the 1960s but in the 1970s inflation quadrupled in comparison to a steady-state level of 1951-1970(i.e. 3.1cent), due to this jump in inflation rate Pakistan turned into the high inflationary country from comparatively low inflationary country. Inflation jumped three times from 1970 to the 2000s(9.5cent) (hanif et al., 2014).

From 2000 through 2007 inflation had been restrained despite enormous economic growth through a combination of resolving different supply obstructions and tight monetary policy but never went back to the steady level of 1950-1970. In August 2008, the international oil price shock heavily impacted the economy. Domestic prices sharply spiked due to an upward spike in global commodity prices. As Pakistan heavily depends on oil imports the international shock hit hard the economy that the inflation rate reached the second-highest level after the all-time high inflation of 37.81 cents in 1973. In 2009, high and volatile inflation has been faced by Pakistan followed by double-digit inflation till 2012. This upward surge was somehow, contained in the latter years. In 2016, inflation had been contained to 2.79cent, which was the lowest in 13 years whereas in the current era of COVID-19 inflation is being spiked up again.

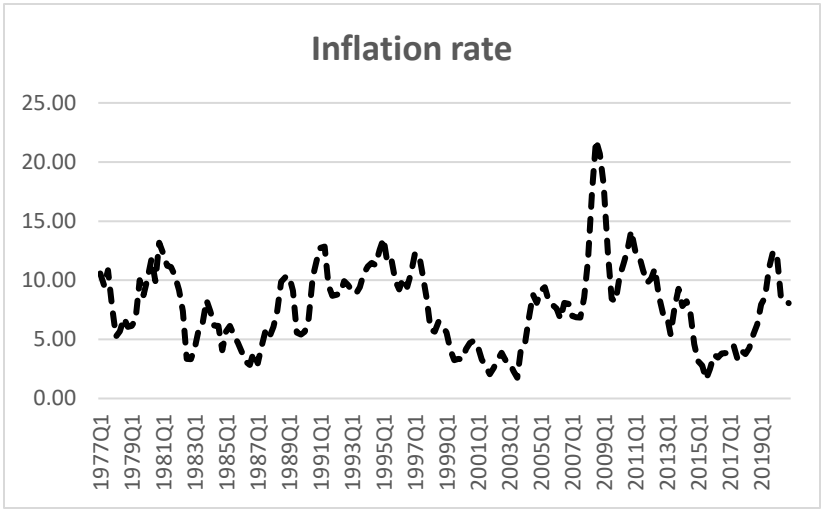


Figure 4: Inflation rate (1977-2020)

Output Gap

Pakistan's economy has been volatile and prone to shorter business cycles since 1947. The growth patterns of the economy have been volatile over the years where regular boom and bust cycles have been obstacles in the way of inclusive and long-term growth. The first recessionary phase hit the economy during the 1950s followed by the second recessionary phase in the 1970s, the negative average value of the output gap estimated to be -6.18 during 1977-80 is the indication of the trough

in the period. The partition of East Pakistan and nationalization negatively affected the confidence of investors during the period (Arby, 2001). The economy took 12 years to recover from the recessionary phase. The period of 1990-1991 may be entitled a boom since output was above its long-run average.

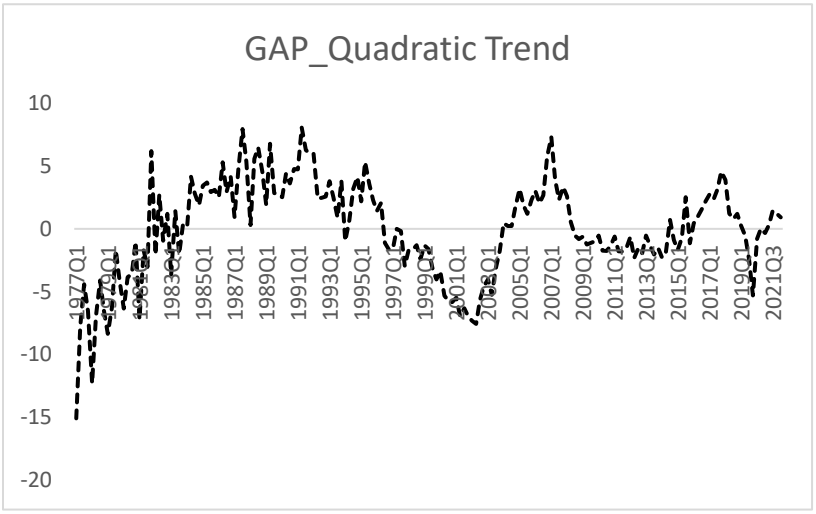


Figure 5: Output gap (1977-2020)

In the late 1990s, the economy entered in yet another recessionary period which continued till 2003, one of the main contributors to this recessionary phase was the Asian Financial crisis of 1998. In the last half of the 90s supply, the pressure was dominating while in the first half of the decade demand pressure was observed. From 2001 to 2010 Pakistan's economy can be characterized as highly vulnerable to internal and external shocks. The economy went through a recovery phase in the early 2000s. But it could hardly recover than in 2007-08, the Global Financial crisis adversely affected the economy again. In the year 2010, a devastating flood-affected almost 78 districts of Pakistan. . The battle against terrorism was also at its peak during the period which did a lot of damage to the economy. In the decade 2011-2020, the output gap has been negative with a mean value of -0.17 while small spikes in the output gap curve has been witnessed during the period e.g. in the years 2014-15 growth rate increased due to a fall in oil prices, increased remittances, and enhanced consumer spending. But it again slowed down in 2019

due to many economic reasons, in 2020 likewise all other economies of the world Pakistan's economy suffered from the global pandemic COVID-19 which caused negative economic growth.

4.2 Estimation Results

4.2.1 Linear Taylor Rule:

At first, the Linear Taylor rule is estimated by using three models where model 1 is the standard Taylor rule where deviations of nominal interest rate are a response to deviations of inflation and output gap. The estimation results are presented in Table 3. The results in column 2 show that the coefficient of inflation gap and the output is are though, statistically significant but the coefficient of($\pi_t - \pi^*) < 1$ and $y_t^{gap} < 0$ whereas the Taylor principle implies that the coefficient of inflation gap needs to be greater than 1 (1.5 as per Taylor rule) and output gap needs to be positive. This indicates that SBP doesn't follow the Taylor rule. Furthermore, the value of adjusted R-square and Durbin-Watson stat is also very small which may suggest that the model doesn't truly reflect the monetary policy objectives of Pakistan rather, SBP has some other objectives of monetary policy than price and output stability. To investigate this issue simple Taylor rule is augmented by lagged differenced exchange rate as a policy objective. The estimation results of this reaction function are given in Column 3 of the Table under discussion.

Table 3: Estimation results of Taylor rule

	Model 1	**Model 2**	**Model 3**
Constant	7.74	7.56	2.49
	(0.00)	(0.00)	(0.00)
$(\pi_t - \pi^*)$	0.22	0.20	0.09
	(0.00)	(0.00)	(0.01)
y_t^{gap}	-0.21	-0.21	-0.03
	(0.00)	(0.00)	(0.35)
r(-1)			0.72
			(0.00)
ex^*		0.33	0.19
		(0.00)	(0.00)
Adjusted R-square	0.14	0.21	0.65
F-statistics	16.41	16.74	81.01
Durbin-Watson stat	0.56	0.58	2.23

****$(\pi_t - \pi^*)$ is the deviation of inflation from its threshold level.y_t^{gap} is the output gap. r(-1) is the lagged interest rate and ex^* is the lagged differenced exchange rate. The respective p-values are given in parenthesis.

The coefficient of inflation deviation, output gap, and lagged differenced exchange rate is found to be statistically significant at a 5% significance level. The positive coefficient of the inflation gap indicates that when inflation deviates from its threshold value it leads to monetary tightening but the effect of this deviation is less than the coefficient of ex^*. It reflects that SBP is more concerned with the stabilization of the exchange rate than price stability. The coefficient of lagged differenced exchange rate shows that the effect of currency depreciation on the monetary policy reaction function of Pakistan occurs with a lag while the coefficient of the output gap is again found to be negative and the same as model 1 which means that the output gap has a countercyclical effect the on nominal interest rate. The value of R-square is improved a bit but it is still small. Furthermore, the value of the Durbin-Watson stat also remains quite low which indicates that the dynamics of model 2 are also incomplete. This result provides an incentive to augment the Taylor

rule by including lagged interest rates as several banks over the globe have a tendency to incorporate interest rate smoothing as the policy objective.

The 4th Column of the Table shows the results of the parameters when the lagged interest rate has been added to Model 2. All the coefficients are statistically significant but the coefficient of output gap turned out to be statistically insignificant when the lagged interest rate is augmented to the Taylor rule. Although this coefficient was also negative in the previous two models but with the inclusion of lagged interest rate this coefficient becomes insignificant. The value of the coefficients of inflation gap and exchange rate also gets smaller than its values in the previous 2 models. The rationale behind this change might be the fact that monetary policy affects the economy and prices with a lag. So adding lagged interest rate make the output gap insignificant and lower the coefficient of inflation deviation also the large coefficient of lagged interest rate indicates that SBP has a strong tendency to smooth interest rate change. Furthermore, the value of the adjusted R-square is 0.65 for Model 3 as well as the value of the Durbin-Watson stat has also risen above 2 which shows that central bankers of Pakistan sign significantly smooth interest rate change and the smaller sensitivity of the interest rate responsive to the policy.

Hence the table above confirms the previous conjecture regarding the monetary policy reaction function of Pakistan that SBP is more concerned to smooth interest rates and stabilize exchange rates than price and output stability(Saghir and Malik, 2017and Malik, 2007). The output gap has a countercyclical effect on interest rate in all three models which is contrary to (Taylor, 1993), also the coefficient becomes insignificant in the model where both exchange rate management and interest rate smoothing have been augmented in the simple Taylor rule. This indicates that interest rate smoothing and exchange rate stability are the preferred objectives of Pakistan monetary policy

over output stability. Furthermore, the coefficient of inflation gap remains almost the same in the first two specifications while it is closer to zero in the third model which reflects the same conjecture that SBP are more concerned about smoothing interest rate and exchange rate than other objectives. Nevertheless, the main concern of the study is to estimate the Threshold Taylor-type rule for the sample data of Pakistan to understand the underlying dynamics of Pakistan's monetary policy. In this context, step-by-step results and an explanation of the procedure adopted are given below.

4.2.2 Threshold Level of Inflation/Result

The threshold/Thresholds of inflation are estimated by using the Threshold Autoregressive Model (TAR) where the number of thresholds is determined by the Bai and Perron Test. Bai & Perron, (2003b) suggest determining the numbers of statistically significant breaks endogenously through an algorithm in which the initial breakpoint is recognized. The sample is then, divided into two samples to test the null hypothesis of the model to be linear or more precisely the null of the single regime is tested against the alternative hypothesis of the two-regime model. If the null of one regime is rejected then the null hypothesis of the model having two regimes is tested against the alternative hypothesis that is model contains three-regime. The same procedure is adopted to test the null of three regimes and so forth unless the number of *m* regimes is identified where the null hypothesis may not be rejected at the significance level of 0.05.

The results of the multiple structural break model presented by (Bai & Perron, 2003b) are given in the Table. The null hypothesis of the one regime model is rejected against the alternative hypothesis of the two regime model (i.e. the model of one break) at a significance level of 0.05.

Then the null hypothesis of the two-regime model is tested against the 3-regime alternative hypothesis and the null is again rejected at a 5% significance level. However, the test does not identify a four-regime model.

4.2.3 Number of thresholds

Hence, these results indicate the presence of three thresholds in inflation and the break dates are 1983Q1, 1994Q1, and 2006Q1 and the threshold values of inflation are 3.75, 7.95, and 10.41. It is also found that 24 observations of inflation are below the threshold of 3.75. 54 observations are found to be below threshold 7.95. 50 observations are below the threshold of 10.41 and the remaining 36 are above this threshold.

Table 4: Estimated thresholds of Inflation

Sequential F-statistic determined thresholds:			3	
			Scaled	Critical Values
Threshold Test	Break	F-statistic	F-statistic	
0 vs. 1 *	2006Q1	4.431376	57.60789	27.03
1 vs. 2 *	1994Q1	4.632328	60.22026	27.03
2 vs. 3 *	1983Q1	3.034588	39.44964	27.03

* Significant at the 0.05 level

** Bai-Perron (Econometric Journal, 2003) critical values.27.03

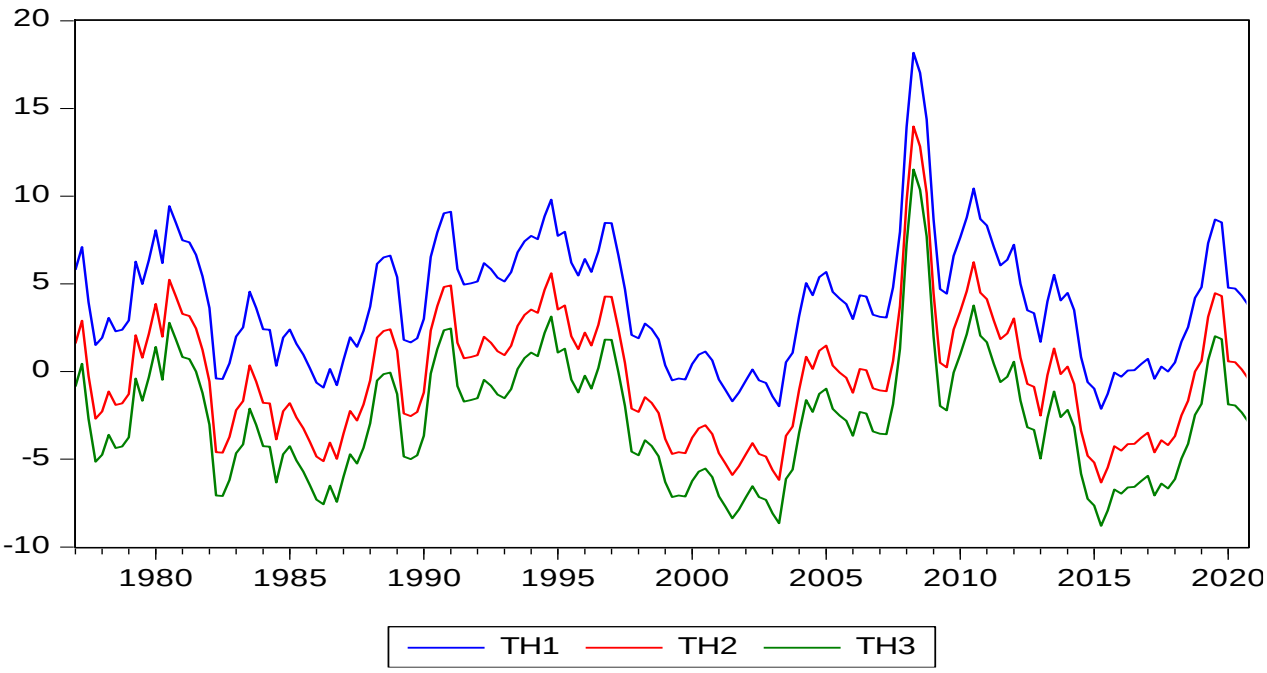


Figure 6: inflation threshold over the time

4.3 Threshold Taylor rules with Inflation as Threshold Variable:

In the table, Inflation has been considered as a threshold variable, and the behavior of inflation, output gap, exchange rate, and the lagged interest rates have been observed above and below the threshold values. For this purpose, a dummy variable is constructed with a value of 1 when inflation deviation is positive and 0 otherwise. This divides the sample into high inflationary and low inflationary regimes. This process is followed for all three threshold values of the threshold variable and three different dummies are generated for three different triggering values. In the next step, dummies are interacted with inflation, output gap, and exchange rate and lagged interest rate to observe the marginal effect of these variables above and below the trigger point.

In model 1, the inflation rate is interacted with three different dummies of threshold and the results are presented by dividing the column into three sub-columns. In sub-column 1 “3.75” is considered

as threshold value followed by "7.95" and "10.41" as threshold values. The coefficient of inflation is found to be significant in a high inflationary regime which means that SBP is more concerned about price stability in a high-inflationary regime and inflation leads to tightening of the monetary policy since the coefficient is positive while the coefficient of inflation turns out to be insignificant below this threshold which reflects other objectives of the monetary policy below this threshold than inflation. More precisely in a low inflationary regime, SBP has other monetary policy objectives than price stability. In the 2nd sub-column of Model 1, almost the same results can be seen as the coefficient of inflation is positive and statistically significant above the threshold but insignificant below the threshold. But when 10.41 is taken as the triggering value, the coefficient of inflation becomes statistically significant in both regimes whether high inflationary or low inflationary regimes. It means that at this threshold inflation always contributes to increasing the nominal interest rate no matter economy is in expansion or contraction. The value of the adjusted R-square is 0.64 and the Durbin-Watson stat is 2.23. These values remain the same in almost all the specified Models. It shows that the variables under study adequately explain the variation in Pakistan's monetary policy.

Table 5: Estimation Results of Threshold Model (inflation rate as threshold variable)

	Model 1			**Model 2**			**Model 3**			**Model 4**		
τ_t	3.75	7.95	10.41	3.75	7.95	10.41	3.75	7.95	10.41	3.75	7.95	10.41
constant	1.34	1.60	1.37	1.54	1.54	1.53	1.54	1.52	1.54	1.49	1.84	1.38
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Inf				0.09	0.09	0.09	0.09	0.10	0.09	0.10	0..06	0.11
				(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.29)	(0.02)
y_t^{gap}	-0.03	-0.04	-0.04				-0.04	-0.04	-0.04	-0.03	-0.04	-0.04
	(0.35)	(0.28)	(0.24)				(0.24)	(0.24)	(0.25)	(0.30)	(0.23)	(0.25)
ex^*	0.20	0.19	0.19	0.19	0.19	0.19				0.20	0.18	0.19
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.03)
r(-1)	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
Inf*D1	0.11	0.09	0.10									
	(0.01)	(0.04)	(0.01)									
Inf*(1-D1)	0.22	0.08	0.12									
	(0.17)	(0.37)	(0.03)									
y_t^{gap}*D1				-0.04	-0.04	-0.06						
				(0.32)	(0.45)	(0.54)						
y_t^{gap}*(1-D1)				-0.04	-0.04	-0.04						
				(0.66)	(0.40)	(0.35)						
ex^* D1							0.20	0.19	0.20			
							(0.00)	(0.01)	(0.08)			
ex^**(1-D1)							0.15	0.21	0.19			
							(0.39)	(0.07)	(0.01)			
r(-1)*D1										0.72	0.74	0.69
										(0.00)	(0.00)	(0.00)
r(-1)*(1-D1)										0.73	0.69	0.72
										(0.00)	(0.00)	(0.00)
Adjusted R-square	0.65	0.65	0.66	0.65	0.65	0.66	0.65	0.65	0.65	0.65	0.65	0.65
F-statistics	64.84	64.46	64.67	64.43	64.43	64.45	64.86	64.86	64.84	64.45	64.9	64.64
Durbin-Watson stat	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.21	2.23

Model 2 indicates that the coefficient of output gap remains insignificant whether inflation is above or below the threshold value. This result reveals that monetary authority in Pakistan doesn't

include the stability of output as its objective of monetary policy no matter what is the state of the economy. Furthermore, the coefficient of output gap does not change much at all triggering points of inflation and is negatively correlated with the nominal interest rate. The value of adjusted R-square and Durbin Watson remains the same as in the previous model.

In the third model, the asymmetric response of the nominal interest rate to the lagged differenced exchange rate has been recorded as the coefficient of the exchange rate is significant when inflation is above the threshold while the coefficient becomes insignificant when inflation is below the threshold. Moreover, the coefficient remains positive in both cases. It hints that the nominal interest rate rises in response to the exchange rate merely when the economy is in a high inflationary regime while in an anti-inflationary regime response of the interest rate to the exchange rate becomes insignificant. In the second sub-column where 7.95 is studied as a threshold variable, the positive and significant correlation between interest rate and the exchange rate is demonstrated. The coefficient is significant at 5% when the economy is in an inflationary regime. In an anti-inflationary regime, the coefficient almost remains stable but statistically significant only at a 10% significance level. In the third part of model 2, where 10.41 is taken as a threshold value, the coefficient of lagged differenced exchange rate becomes statistically insignificant at 0.05 significance level but significant at 0.1 significance level in high inflationary regime while the coefficient is statistically significant at 5% significance level when inflation is below its threshold value. Nevertheless, the coefficient of lagged differenced exchange rate remains positive at all three triggering points which reflects that exchange rate always contributes to tightening monetary policy however at different significance levels.

In model 4, the coefficient of lagged interest rate remains positive and statistically significant at a 5% significance level above and below all the threshold values no matter if is it 3.75, 7.95, or 10.41. Furthermore, this coefficient is almost 0.7 at all three trigger points which is quite high as compared to the coefficients of other variables of the monetary policy loss function. This shows the higher tendency of SBP for interest rate smoothing irrespective of if the economy is in a high inflationary regime or an anti-inflationary regime. The current interest rate is largely determined by the interest rates in the recent past.

In all the four models the value of adjusted R-square and Durbin-Watson is almost 0.65 and 2.23 respectively. The coefficient of the output gap is negative and statistically insignificant throughout the models which means that policymaker has not been including output as a policy objective. The coefficient of inflation is about 0.10 in all four models. Coefficient of lagged differenced exchange rate is marginally larger than the coefficient of inflation i.e. 0.19 which suggests that SBP is a bit more concerned to exchange rate stabilization than price stabilization. Next, the coefficient of lagged interest rate is found to be larger than any other coefficient and remains almost 0.70 throughout the models.

4.4 Threshold Taylor rules with output gap as Threshold Variable:

Table 6 reports the threshold estimation results of output gap. Threshold values of the output gap are estimated following the same methodology as used to estimate thresholds of inflation. Maximum number of thresholds found for output gap is 4 which are found to be -1.74%, 1.90%, and 3.90%.

Table 6: Estimated Thresholds of output gap

Sequential F-statistic determined thresholds:			3 Scaled
Threshold Test	Break	F-statistic	F-statistic
0 vs. 1 *	1992Q4	6.409760	83.32688
1 vs. 2 *	2011Q2	10.20564	132.6733
2 vs. 3 *	2002Q3	3.783228	49.18197

* Significant at the 0.05 level, Bai-Perron (Econometric Journal, (2003) critical value 27.03.

Table 7: Estimation Results of Threshold Model (output gap as threshold variable)

	Model 1			**Model 2**			**Model 3**			**Model 4**		
Threshold	-1.74	1.90	3.90	-1.74	1.90	3.90	-1.74	1.90	3.90	-1.74	1.90	3.90
constant	1.53	1.54	1.55	1.52	1.49	1.56	1.53	1.56	1.58	1.52	1.53	1.56
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Inf				0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
				(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
y_t^{gap}	-0.03	-0.04	-0.03				-0.04	-0.03	-0.03	-0.03	-0.04	-0.03
	(0.44)	(0.43)	(0.45)				(0.26)	(0.38)	(0.38)	(0.50)	(0.44)	(0.47)
ex^*	0.19	0.19	0.19	0.19	0.20	0.19				0.19	0.19	0.19
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.00)
r(-1)	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
Inf*D1	0.09	0.09	0.08									
	(0.01)	(0.06)	(0.18)									
Inf*(1-D1)	0.10	0.09	0.09									
	(0.06)	(0.01)	(0.01)									
y_t^{gap} *D1				-0.04	-0.03	-0.05						
				(0.56)	(0.69)	(0.39)						
y_t^{gap}(1-D1)				-0.04	-0.05	-0.03						
				(0.47)	(0.40)	(0.48)						
ex^* *D1							0.19	-0.09	-0.60			
							(0.01)	(0.86)	(0.53)			
ex^* *(1-D1)							0.20	0.19	0.19			
							(0.08)	(0.00)	(0.00)			
r(-1)*D1										0.72	0.72	0.70
										(0.00)	(0.00)	(0.00)
r(-1)*(1-D1)										0.73	0.72	0.72
										(0.00)	(0.00)	(0.00)
Adjusted R-square	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
F-statistics	64.45	64.43	64.52	64.43	64.46	64.48	64.84	65.01	65.24	64.44	64.43	64.49
Durbin-Watson stat	2.23	2.23	2.24	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23

The value of Adjusted R-square in the four models is almost 0.65 which means our variables adequately explain the variation in the short-term interest rate. Durbin-Watson statistics is above

2. The coefficient of lagged differenced exchange rate and interest rate is around 0.2 and 0.7 respectively and found to be statistically significant. Furthermore, the coefficient of the output gap is discovered to be insignificant throughout the models.

The estimated results further indicate variation in the significance level of the coefficient of inflation above and below the threshold values. For instance, at -1.74% threshold value of output gap, inflation is merely statistically significant above the threshold value at 0.05 significance level while its coefficient is statistically significant at 0.1 below the triggering point. In either case, inflation contributes to an increase in the interest rate as the coefficient is positive above and below the threshold. For 1.9% and 3.9% triggering values of the output gap, the coefficient of inflation is statistically significant only below the threshold. The coefficients of the output gap are statistically insignificant below and above all triggering points giving a clear indication of growth not to be the objective of Pakistan's monetary policy at least for sample years. The exchange rate coefficient is statistically significant and positive only above the threshold when the triggering point of the output gap is taken as -1.74%. But for the triggering value 1.9% and 3.9%, the coefficient of lagged differenced exchange rate becomes statistically insignificant and negative above the threshold but significant and near 0.2 below the threshold whilst the coefficient of lagged interest rate always have a positive impact on the rate no matter if the output gap is above or below the threshold value.

Wrapping up, our empirical analysis indicates that since the 1980s, the threshold values of inflation deviation (i.e. 3.75%, 7.95%, and 10.41%) and output gap (i.e. -1.74%, 1.90% and 3.90%) have been increasing and monetary policy has shown nonlinearity (though not significant) above and below these triggering points. This implies that threshold values have changed along with changing

economic situations and central banks preferences which bust the assumption of the constant threshold value. However, the response of interest rate to inflation and output stability has been weak over the sample whilst a vigorous response has been witnessed to exchange rate management and interest rate smoothing no matter if the threshold variable is above or below the threshold value. The possible explanation of this phenomenon may be that exchange rate fluctuations would further deteriorate the financial stability as well as worsen the confidence on the economy which further destabilize the exchange rate via capital outflow ultimately further deteriorate the economic stability so SBP is more concerned about exchange rate management in order to avoid such deterioration and keeps exchange rate management as one of the leading objective of monetary policy.

CHAPTER 5

QUALITATIVE ANALYSIS

In this chapter, a brief analysis of Pakistan monetary policy has been made. The structure and activities of the monetary policy have been investigated by textual analysis as well as the interviews of policymakers have been made to deeply interrogate the conduct of monetary policy. Moreover, the results of the empirical analysis is also discussed with the prestigious interviewees for further analysis.

In section 5.1 the objectives of monetary policy of Pakistan as per the SBP Acts have been discussed followed by the responses of MPC members about monetary policy. The questionnaire is attached in the annexure.

5.1 Objectives of monetary policy as per SBP Act

SBP Act 1956 explains the objective of monetary policy as:

"whereas it is necessary to provide for the constitution of a State Bank to regulate the monetary and credit system of Pakistan and to foster its growth in the best national interest with a view to securing monetary stability and fuller utilization of the country's productive resources."

Since then several amendments to the act have been made. In 1994 the act was undergone by the first amendment then the second in 1997 than in 2012, 2015, and recently it was proposed in 2021. Under this act, SBP has a charge to regulate the monetary as well as the credit system. It is at the disposal of the State Bank of Pakistan to select the monetary policy framework in order to attain

the objectives of the policy. State Bank amendment Act 2021 clearly specify the objectives of Pakistan monetary Policy which makes the State bank more accountable to attain them. It clearly states that:

"WHEREAS it is necessary to provide for the constitution of State Bank to achieve domestic price stability by way of regulating the monetary and credit system of Pakistan and, without prejudice to said primary objective, contribute to the stability of the financial system of Pakistan and supporting the general economic policies of the Federal Government to foster development and fuller utilization of the country's productive resources;".

5.3 Viewpoints of esteemed members of the monetary policy Committee of Pakistan

The top authorities of SBP directly involved in the formation of the monetary policy of Pakistan have been interviewed to have an in-depth understanding of Pakistan's monetary policy. They were inquired about the variables that come into play while formulating the monetary policy of Pakistan other than inflation and inflation expectations. They told that as per the State Bank amendment Act 2021, the primary objective of monetary policy is domestic price stability i.e. to keep prices to a level that is not harmful to the economy. The secondary objective is financial stability and thirdly, it aims to boost economic growth i.e. fuller utilization of economic resources.

With reference to a question regarding budget deficit and whether it had any impact on the Pakistan monetary policy reaction function of Pakistan, to which they told that there was no direct impact of the budget deficit on Pakistan's monetary policy but the budget deficit had an indirect impact

on the monetary policy reaction function as when there would be a budget deficit, Government opts for an expansionary fiscal policy where the spending of government is increased tax revenue decrease due to which the prices of goods increase and when SBP projects high prices or more precisely high inflation expectations it goes for tight monetary policy likewise other central banks of the world. Hence budget deficit indirectly causes contractionary monetary policy.

On inquiring about if SBP uses the Taylor-type rule as a guide to formulate monetary policy. They told that central bankers who help to formulate the policy make their analysis based on their subjective judgments and provide a draft to the monetary policy committee of Pakistan and then the MPC makes decisions about the monetary policy regime by making their subjective analysis. As the final decision-making of monetary policy is made through the Monetary Policy Committee (MPC). Section 9E of the SBP Act 1956 identifies the functions and powers of the Monetary Policy Committee (MPC) to formulate and recommend monetary policy actions as well as the approval and issuance of monetary policy statements and other relevant measures. Monetary Policy Committee comprises ten members, the chairman, three board members nominated by the board of SBP, three senior executives of the SBP, and three economists (external members) named by the governor and federal government respectively. The appointment of the external member is for a term which is of three years and then the decision of the Monetary Policy Committee is published after every 8^{th} week in the month of July, September, November, January, March, and May of every fiscal year. The initial communication of monetary policy stance is made through both websites and press releases. The press conference is usually made twice in a fiscal year (in July and January) and relevant monetary policy statements are published on the website of SBP.

The implementation of monetary policy is made through setting a target and Open Market Operations for the management of liquidity in the money market.

They were inquired that why SBP was so concerned about inertia in interest rates. They explained that whatever monetary policy regime SBP opts for, it prevails for a longer time, for instance, from the year 2018 to 2020 Pakistan was in a tightening monetary policy regime, and during this period interest rate gradually increased from 5.75 to 13.25 cents. But then due to the recession caused by the COVID-19 pandemic, an expansionary monetary policy stance was adopted and SBP decreased the policy rate to 700 basis points within 3 to 4 months. But in normal times, SBP tries to keep inertia in the interest rates as the current policy stance transmits to the economy with a lag i.e. the current interest rate influences the future inflation rate and other macroeconomic variables e.g. growth which is why SBP is concerned about interest rate smoothing.

I also told them that as per our empirical analysis, the coefficient of output gap was found to be negative. They told that this statistically insignificant coefficient is telling that growth has never been the primary objective of the monetary policy of Pakistan. They further explained that price stability has ever been the primary objective of Pakistan's monetary policy. The only difference is that previously, it was the implicitly primary objective of monetary policy but now as per the State Bank amendment Act 2021, SBP explicitly incorporated price stability as the primary objective of monetary policy.

It was also inquired if the current monetary policy stance was effective enough to surpass the inflationary pressure. On which they responded that nowadays, SBP is having a contractionary monetary policy and contractionary monetary policy is more capable to reduce demand-side

inflationary pressure but not the supply-side inflationary pressure. They further elaborated that because of COVID-19 overall growth in the world has gone down. Generally reduced growth causes a fall in prices and demand due to which SBP opts for expansionary monetary policy. But nowadays, the situation is not so. Growth has gone down whilst prices have increased due to supply-side inflationary pressure (as the prices of raw materials have gone up in the international markets) which can't be controlled by monetary policy directly. Currently, inflation has globally intensified because of the Russia-Ukraine war, this caused a supply side inflation in Pakistan likewise other countries of the world. This supply-side inflationary pressure is coupled with high inflation expectations and SBP can't control supply-side inflation but inflation expectations can be controlled through monetary policy and SBP is currently trying to do so through the tightening monetary policy regime.

When they were asked to make generic comments on Pakistan monetary policy. I got the answer that SBP is currently doing "Flexible Inflation Targeting" likewise many other central banks of the world as price stability is the foremost objective of Pakistan monetary policy. When a central bank is an inflation targeter the weight of the coefficient of inflation is kept greater than the coefficient of other macroeconomic variables e.g. output gap and exchange rate. SBP has opted for different monetary policy regimes over the past, for instance from 1977-2006, SBP has been Money Aggregate targeter, and then from 2008 onward it has been exchange rate targeter but by 2020 it started flexible inflation targeting.

On inquiring if SBP is enough transparent and accountable, the central bankers told that we have seen more stable inflation in countries where central banks are more transparent and accountable. A clear specification of the functions of SBP in the state Bank amendment Act 2021 makes SBP

more transparent and accountable than ever. GOP has clearly defined the functions of SBP and SBP performs its duties within the specified limits and is answerable for its acts.

Summary:

Summing up, the process of making monetary policy decisions has evolved over the years (from money aggregate targeter to flexible inflation targeter) and won't stop revolving in the future as well. Recent changing in central banking i.e. autonomy of SBP and State bank amendment Act 2021 are the major turning point in this process as the act explicitly defines price stability as the primary monetary policy objective and since then the central bankers are seem determined to formulate the policy in a way that it attain the said objective. More transparent central banking is more vigorous monetary policy conduct would be as it would held every member liable and accountable for its act and responsibility.

Moreover there is no explicit benchmark rule which the SBP follows to formulate the policy rather the choice of optimal monetary policy is up to the prevailing economic situation. At the same time, there are certain elements which have endured for long for instance, interest rate smoothing has been one of the main objective of the monetary policy of Pakistan and is likely to remain.

CHAPTER 6

CONCLUSION

6.1 Summary and conclusion:

This paper initially aimed to investigate the monetary policy of Pakistan for a longer period of more than forty years in order to redefine monetary policy in a more comprehensive way. Since in the current economic condition of Pakistan, the need to establish a strong monetary policy stance is most desirable. On the flip side, we find limited studies dealing with monetary policy of Pakistan extensively.

The asymmetry in the conduct of influential central bankers regarding monetary policy has been found in a reaction to different economic conditions(Zhu & Chen, 2017) and the most appropriate way to model this asymmetry is to use threshold models(Fatima & Malik, 2015). Based on these narratives, we built out hypothesis of asymmetry in the monetary policy of Pakistan and tried to explain the behavior of Pakistan monetary policy since 1977 by estimating a time-varying threshold Taylor rule.

The study initially provides background of the monetary policy conduct with a brief discussion of rules vs discretion where it has been documented that empirical research based on economic models largely propose to use policy rules. Rules based policy not just help to reduce fluctuations in the employment and output but largely abolish the political interventions of government authorities and uncertainty about policy actions(Friedman, 1948). In this regard, several researchers have been proposing different instrument and targeting rules. For instance, (J. B. Taylor, 1993) makes pioneer contribution proposing a policy rule known as “Taylor rule” which

is an instrument rule and inflation targeting can be taken as an example of targeting rule. Nonetheless, the linear and symmetric specification of these rules have been seriously criticized by researchers. So the paper aims to revisit monetary policy rules in the perspective of Pakistan while focusing on the asymmetry in the policy reaction function.

Both theoretical and empirical literature have been documented in the study to give a pathway to our analysis. Empirical literature examining the monetary policy conduct of various industrial countries have been demonstrated as their monetary policy actions has spillover effect on the policy actions of developing economies. Furthermore, the discussion of Policy rules have been included followed by the criticism on simple policy rules. The first sub-heading of the chapter deals with asymmetric preferences of monetary authority. The empirical literature lays evidence of different preferences of policymakers related to policy actions amid different economic conditions. The next sub-heading specifically focus on the threshold Taylor type rules as threshold models are more capable to capture to show that if the behavior of policy instrument remains constant or different above or below the threshold value. Lastly, the literature concerning Pakistan has been included in the debate.

Data and methodology chapter enlists the data and methodology used for the empirical analysis as the quarterly data of variables is not readily available so we have calculated our desired data of variables. The chapter first explain the construction of concerned variables and then simple Taylor rule followed by approach to estimate threshold values of the key variables of the policy rule and model of time-varying threshold Taylor rule.

To summarize the characteristics of our data set we have estimated the descriptive statistics. The descriptive analysis is initially presented and then discussion upon the variables is included. Simple Taylor rule is estimated where the coefficients of inflation, exchange rate and lagged interest rate is found to be statistically significant and positively correlated with the interest rate but the effect of output gap on interest rate is found to be countercyclical and when lagged interest rate is included in the model, the coefficient of output gap becomes statistically insignificant which indicates that growth is not the primary objective of the monetary policy in Pakistan when lagged interest rate and exchange rate is included as policy objectives. The coefficients of exchange rate and lagged interest rate are statistically significant and larger than inflation and output gap which means SBP prioritize these objectives than price stability and growth. Our results of Taylor rule are consistent with the previous studies that SBP doesn't follow Taylor rule. The only difference of our simulations and the previous work done is that the coefficient of output gap remains statistically insignificant throughout the models which means economic growth has never been the objective of Pakistan monetary policy in the long run.

After estimating Linear Taylor rule our next job was to estimate the Threshold Taylor rule along with time-varying threshold values. The threshold values of inflation are estimated as 3.75, 7.95 and 10.41. Response coefficients don't vary a lot over the models which is an indication that there is not much variation in the monetary policy conduct of Pakistan. Inflation deviation always contribute to increase interest rate irrespective of if the variable is above or below the threshold. At 3.75 threshold level, interest rate response a bit strongly to the inflation rate when inflation rate is below the threshold. But this different is marginal. For the rest of two triggering points of inflation, the response coefficient remains almost the same. Similarly, the threshold values of

output gap are found to be -1.74, 1.9 and 3.9 and the coefficient of variables almost show the same behavior above and below the triggering point.

6.2 Policy Recommendation:

It is recommended that SBP need to make adjustments to the parameters of the key variables in accordance to need and economic conditions as when the economic condition changes it requires to make certain changes in the monetary policy conduct as well (which is witnessed in the case of industrial countries). However, the analysis doesn't support any major asymmetry in the monetary policy conduct over different thresholds. It is recommended that monetary policy must be conducted by making more rigorous analysis of the economic data as well as trends with the keen judgement of the changing economic landscape.

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Текстотипологические Особенности Научного Типа Текста В Аспекте Перевода (На Материале "an Inquiry Into the Nature and Causes of the Wealth of Nations" Адама Смита И Его Переводов На Немецкий И Русский Языки). (2018). Вестник Воронежского Государственного Университета. Серия: Лингвистика И Межкультурная Коммуникация, 4, 2–11.

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Appendix

The questionnaire which is used to conduct in-depth interviews of esteemed members of MPC is annexured below:

➢ Questionnaire

- Which variables come into play when SBP determines monetary policy else than inflation and inflation expectation?
- Does the budget deficit have an impact on the monetary policy of Pakistan?
- Has the SBP amendment Act 2021 successfully made the State Bank of Pakistan and its decisions independent?
- Did SBP ever follow the Taylor-type rule? Why or why not?
- How transparent and accountable State Bank of Pakistan is?
- Do you think threshold models can be used to explain monetary policy conduct of Pakistan?
- Why SBP is so concerned about interest rate smoothing?
- Does the output gap has a positive or countercyclical impact on Pakistan's monetary policy reaction function?
- In your viewpoint is the current monetary policy regime effective enough to suppress the inflationary pressure? Please elaborate.
- Please make generic comments on the current monetary policy stance.