Anticipated Policy Rate Path in Policy Simulation: A Case Study of Pakistan

Saima Sadiq[1] Supervisor by: Dr. Ahsan ul Haq

Key Messages

- Taylor rule is efficient in the historical and stochastic simulation of the backward-looking model, whereas the optimal policy rule is efficient in the historical and stochastic simulation of the forward-looking model.
- In the case of policy projection, the Taylor rule is efficient in minimizing the gap between the actual and the threshold level of inflation and the deviation between the actual and potential output in both the backward and forward-looking models.
- SBP should use rule-based policies rather than discretionary policies. This rule-based approach provides a systematic framework that helps central banks to make informed and data-driven decisions.
- Policymakers should consider adopting the Taylor rule as a guideline for formulating and implementing monetary policy, and emphasizing forward-looking elements in decision-making to minimize the loss generated from the quadratic loss function.

[1] This document is extracted from the M.Phil. thesis entitled "Anticipated Policy Rate Path in Policy Simulation: A Case Study of Pakistan". For detailed thesis, see PIDE website: https://pide.org.pk/thesis/

Introduction

Monetary policy is responsible for shaping the interest rate in order to achieve certain macroeconomic objectives. The objective is to establish and maintain price stability, long-term economic growth and financial stability. By maintaining sustainable output and to control inflation, the economy can experience various positive outcomes and help to avoid periods of excessive boom or recession. On the other side, the constancy of time is a significant distinction between policy rule and discretion. The modern researchers emphasize on the importance of policy rules to improve policy effectiveness and create more stable and sustainable economic results, which have various advantages over discretion [3] [5]

Policy rules are designed to offer a consistent and predictable framework for decision-making, whereas discretion permits policymakers to make decisions at their own based on the current situation.

Aim of The Study

The study aims to estimate a macroeconomic model and conduct policy projections considering projected policy rate paths while comparing the performance of policy rules that are consistent with the monetary policy rule of inflation targeting. The study includes the optimal policy rule and the Taylor rule, to check which rule is efficient in minimizing the deviation between the actual and the targeted inflation and the deviation between the actual and the potential output gap. The central bank can attain agreement among the deviation of inflation and output stability by forecast targeting that minimizes the quadratic loss function. Forecast targeting, is a monetary policy approach that relies on forecasts of inflation and the real economy, in which the central bank aims to choose an interest rate path that ensures the forecasted inflation and resource utilization align with desired levels [1].

Taylor Rule: The Taylor rule is a monetary policy targeting rule used by central banks to stabilize economic activity by setting interest rates when inflation and output gap is above and below its target level.

Monetary Policy Rule: It's an equation that describes how central banks set their policy interest rate based on their valuation of the current economic conditions and their objectives (which I have called optimal policy rule in my study).

Methodology

To estimate the macroeconomic model, this study adopts the Rudebusch-Svensson and Linde models, which provide a framework to analyze and forecast the behavior of key economic variables. Historical and stochastic simulations, and projections are employed to compare the two monetary policy rules, for accessing efficiency. In the historical simulation, demand and supply shocks are added to reflect real-world economic conditions. Meanwhile, in the stochastic simulation, a series of thousands of demand and supply shocks are created and the average loss is generated by the optimal policy rule and the Taylor rule. The time span of the study is from 1993Q1 to 2022Q4.

Monetary Policy Formulation in Pakistan

The SBP (Amendment) Act of 1956 defines the broad objectives of monetary policy in Pakistan, stating the need for the State Bank to regulate the monetary and credit system to promote economic growth, ensure monetary stability, and optimize the utilization of productive resources. These goals can be interpreted in a variety of ways. While most people think of monetary stability as ensuring price stability, it may also refer to the stability of the money supply or other monetary aggregates. Furthermore, efficient bank regulation and the

preservation of the financial sector's soundness are critical for sustaining stable circumstances in the interbank market. The State Bank of Pakistan (SBP) focuses on establishing monetary stability by managing inflation and aligning it with government goals. Simultaneously, the SBP prioritizes financial stability by guaranteeing the smooth operation of the financial market and payments system, both of which are critical for a well-functioning economy.

During the 20th century, most central banks were established for central banking functions, including regulating the banking system, controlling monetary policy, managing reserves, and promoting financial stability.

Procedure of Monetary Policy Decision-Making Process

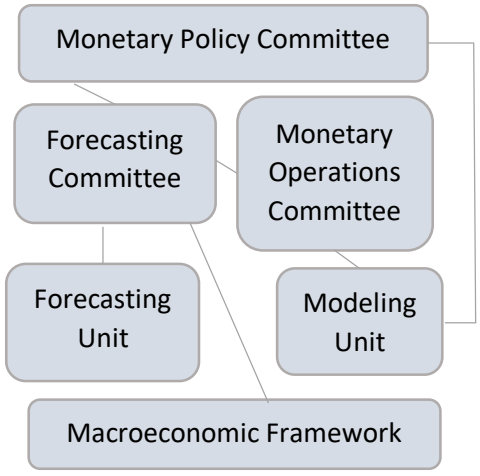

Figure 1: Decision-Making Process

Implementation of Monetary Policy

The implementation of monetary policy involves setting targets and utilizing Open Market Operations to manage liquidity in the money market. The transmission of monetary policy occurs through various channels.

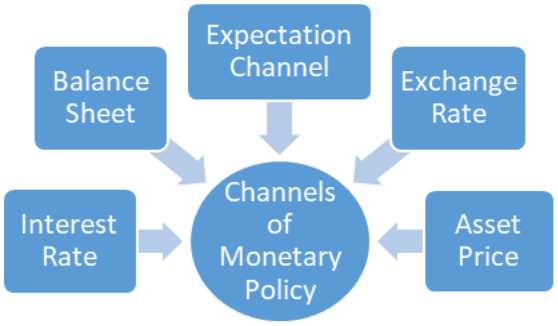

Figure 2: Transmission Mechanism of Monetary Policy

Equations for The Model

Rudebusch-Svensson Model

$$\pi_t = \alpha_{\pi 1}\pi_{t-1} + \alpha_{\pi 2}\pi_{t-2} + \alpha_{\pi 3}\pi_{t-3} + \alpha_{\pi 4}\pi_{t-4} + \alpha_y y_t + \varepsilon_{\pi,t+1}$$

$$Y_t = \beta_{y1}y_{t-1} + \beta_{y2}y_{t-2} + \beta_r\left(i_{t-j} - \pi_{t-j}\right) + \varepsilon_{y,t+1}$$

$$i_t = \gamma_{\pi 1}\pi_t + \gamma_{y1}y_t + \gamma_{i1}i_{t-1} + \gamma_{i2}i_{t-2}$$

Linde Model

$$\pi_t = \alpha_1\pi_{t+1} + (1-\alpha_1)\pi_{t-1} + \beta_0 y_t + \varepsilon_{\pi,t}$$

$$y_t = \beta_o y_{t+1} + (1-\beta_o)y_{t-1} - \beta_r(i_t - \pi_{t+1}) + \varepsilon_{y,t}$$

$$i_t = \gamma_1\varepsilon_{\pi t} + \gamma_2\varepsilon_{yt} + \gamma_3\pi_{t-1} + \gamma_4 y_{t-1} + \gamma_5 i_{t-1}$$

Result of Rudebusch-Svensson Model (Backward-Looking Model)

Table 1: Estimation of R-S Model

	IS Equation	Phillips Curve	Policy Rate Rule
Coefficient	y_t	π_t	i_t
π_t	-	-	0.099 (0.008)
π_{t-1}	-	1.366 (0.00)	-
π_{t-2}	-	-0.493 (0.00)	-
y_t	-	-	0.142 (0.015)

y_{t-1}	0.705 (0.00)	0.102 (0.087)	-
y_{t-2}	0.157 (0.09)	-	-
i_{t-1}	-	-	0.563 (0.00)
i_{t-2}	-	-	0.196 (0.024)
$i_{t-j} - \pi_{t-j}$	-0.039 (0.280)	-	-
S.E	1.487	1.721	1.674
D.W	2.010	2.037	2.071

The estimation results of the backward-looking model are consistent with the findings of Malik and Ahmed [2]. The real interest rate is insignificant indicating there is a need for rule-based policies.

Results of Linde Model (Forward-Looking)

Table 2: Estimation of Linde Model

	IS Equation	Phillips Curve	Policy Rate Rule
Coefficient	y_t	π_t	i_t
π_{t+1}	-	0.683 (0.00)	-
π_{t-1}	-	-	0.086 (0.07)
y_t	-	0.107 (0.06)	-
y_{t+1}	0.688 (0.00)	-	-
y_{t-1}	-	-	0.229 (0.04)
i_{t-1}	-	-	0.521 (0.00)
i_{t-2}	-	-	0.187 (0.03)
$i_{t-j} - \pi_{t-j}$	-0.039 (0.27)	-	-
e_pi	-	-	0.045 (0.42)
e_is	-	-	0.254 (0.00)
S.E	1.480	1.709	1.571
D.W	2.011	1.996	1.902

The findings of the current study are consistent with the work of Nawaz & Ahmed [4]. Again the real interest rate is insignificant indicating there is a need for rule-based policies.

Loss Function

A small macroeconomic model can be used to simulate data on the output gap and inflation rate. A historical series of interest rates can be constructed using the optimal policy rule and Taylor rule. While, in the stochastic simulation, a series of thousands of demand and supply shocks are created and the average loss is generated by the optimal policy rule and the Taylor rule.

$$L_t = \frac{1}{2}[\alpha_\pi(\pi - \pi^*)^2 + \alpha_y(y - y^*)^2]$$

Loss in Actual and Historical Simulation Series of R_S Model

Table 3: Historical Simulation

	Variance of y-gap	Variance of Inflation	Loss
Actual	7.794	23.023	30.817
Optimal Policy Rule	6.202	23.881	30.083
Taylor Rule	6.124	20.859	26.983

Historical simulations show that the Taylor rule performed well in the small macroeconomic model for Pakistan's economy as the loss for the Taylor rule is 26.983 which is less than the optimal policy rule and the actual loss which is 30.083 and 30.817 respectively.

Loss in Stochastic Simulations of R_S Model

Table 4: Stochastic Simulation

	Optimal Policy Rule	Taylor Rule
Average	35.773	29.585
S.D	9.5870	7.7409
Max	78.779	63.813
Min	16.025	13.430

Stochastic simulation that the Taylor rule performed well in the macroeconomic model for the Pakistan economy as the average loss for the Taylor rule is 29.585 which is less than the 35.773 found in the optimal policy rule.

Loss in Actual and Historical Simulation Series of Linde Model

Table 5: Historical Simulation

	Variance of y-gap	Variance of Inflation	Loss
Actual	7.794	23.023	30.817
Optimal Policy Rule	6.402	23.275	29.677
Taylor Rule	7.340	23.330	30.671

The calculated loss for the Taylor rule is 30.671, which is slightly higher than both the optimal policy rule's loss of 29.677 and the actual loss of 30.817. These findings indicate that the optimal policy rule performed more efficiently in the historical simulation of the forward-looking model.

Loss in Stochastic Simulations of Linde Model

Table 6: Stochastic Simulation

	Optimal Policy Rule	Taylor Rule
Average	30.293	30.864
S.D	1.6872	1.7612
Max	36.531	37.654
Min	25.831	26.325

The stochastic simulation also yielded consistent results, demonstrating that the optimal policy rule was effective within the macroeconomic model for Pakistan's economy. In this case, the average loss for the optimal policy rule is 30.293, which was lower than the loss of 30.864 observed for the Taylor rule.

Projection for The Rudebusch-Svensson Model for Optimal Policy and The Taylor Rule.

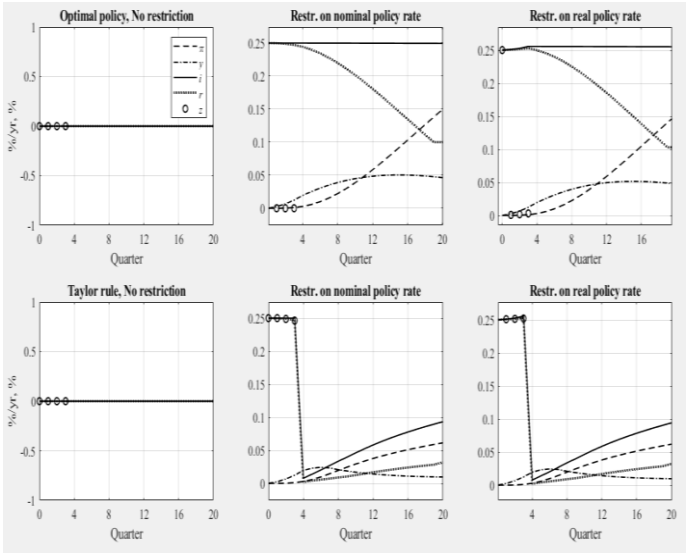

Figure 3: Projection for R-S Model

The optimal policy path has more variation to bring the negative inflation and output gap back to zero so Taylor's rule is more appropriate and efficient than the optimal policy.

Projection for The Linde Model for Optimal Policy and The Taylor Rule

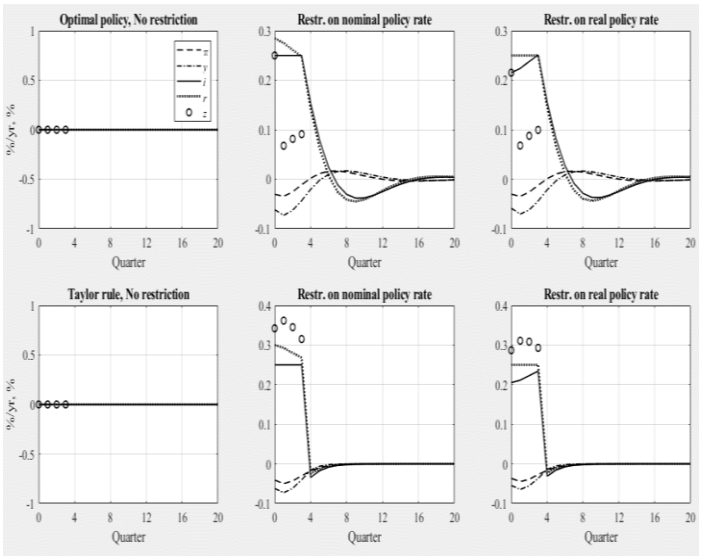

Figure 4: Projection for Linde Model

The same results are obtained that the deviation among the variables of the optimal policy rule is

more than that of the Taylor rule. So in the Linde model Taylor rule is efficient in minimizing the loss function.

Policy Recommendation

Based on the findings of this study, the following policy recommendations can be made to promote price stability and sustainable economic growth through the stabilization of inflation and output. SBP should use rule-based policies rather than discretionary policies. This rule-based approach provides a systematic framework that helps central banks to make informed and data-driven decisions. Policymakers should consider adopting the Taylor rule as a guideline for formulating and implementing monetary policy, as the Taylor rule has demonstrated efficiency in minimizing deviations and bringing inflation and output gaps back to their targets. Emphasizing forward-looking elements in decision-making, such as inflation forecasts and economic expectations, is crucial to minimize the loss generated from the expected quadratic loss function. It allows policymakers to act swiftly and decisively to counter potential economic challenges. By implementing these policy recommendations, policymakers can create a conducive environment for price stability and sustainable economic growth in Pakistan.

Reference

1. Leeson, R., Koenig, E. F., & Kahn, G. A. (2013). The Taylor Rule and the Transformation of Monetary Policy. Hoover Press.
2. Malik, W. S., & Ahmed, A. M. (2010). Taylor Rule and the Macroeconomic Performance in Pakistan. The Pakistan Development Review, 49(1), Article 1. https://doi.org/10.30541/v49i1pp.37-56
3. Meltzer, A. H. (2012). Federal Reserve Policy in the Great Recession. Cato Journal, 32, 255.
4. Nawaz, S. M. N., & Ahmed, A. M. (2015). New Keynesian Macroeconomic Model and Monetary Policy in Pakistan. The Pakistan Development Review, 54(1), 55–71. https://doi.org/10.30541/v54i1pp.55-71
5. Taylor, J. B. (1993a). Discretion versus policy rules in practice. Carnegie-Rochester Conference Series on Public Policy, 39, 195–214. https://doi.org/10.1016/0167-2231(93)90009-L