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Comparative Macroeconomic Dynamics of the IMF's Quarterly Projection Model and Shariah-Compliant Interest-Free Monetary Frameworks

Imam Ud Din Karim Dad Tunio*

School Education & Literacy Department, Government of Sindh, Larkana, Pakistan
*Corresponding author: imam.tunio@gmail.com

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Keywords
Islamic monetary policy; Shariah-compliant economy; Quarterly Projection Model (QPM); output gap targeting; interest-free finance; inflation dynamics; macroeconomic stability.

Abstract
This study examines the macroeconomic performance of a Shariah-compliant monetary framework in comparison with the IMF's interest-based Quarterly Projection Model (QPM). The baseline follows a semi-structural New Keynesian gap model commonly used in inflation-targeting regimes. Building on this framework, two alternative models are developed: a Shariah-Compliant Growth Economy Model and a Shariah-Compliant Output Gap Targeting (SC-OGT) Model. These are calibrated with zero steady-state interest, a zero-inflation target, and low inflation persistence, emphasizing output gap stabilization over interest-based mechanisms. Using a consistent modelling platform, the study evaluates all models through impulse response functions, Kalman filtering, and forecast simulations. Results suggest that the conventional framework is more sensitive to inflation volatility and external shocks, whereas the Shariah-compliant models produce smoother output adjustment, lower inflation variability, and faster recovery. The findings support Islamic economic principles and contribute by proposing a broader monetary framework for evaluating macroeconomic stability and welfare

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Introduction

Monetary policy remains a central instrument for achieving macroeconomic stability, influencing inflation, output, and financial conditions within an economy. Contemporary macroeconomic frameworks, particularly those grounded in New Keynesian theory, rely heavily on interest rate adjustments as the primary policy tool. The Quarterly Projection Model (QPM), widely used by central banks and the International Monetary Fund, exemplifies this approach by incorporating interest rate transmission mechanisms, expectations, and exchange rate dynamics into policy analysis. Despite its widespread adoption, the interest-based monetary framework has been increasingly scrutinized for its role in financial instability, cyclical volatility, and income inequality. The global financial crises and recurrent economic downturns have raised concerns about the effectiveness of interest rate adjustments in managing complex macroeconomic

environments (Blanchard, 2017; Woodford, 2003). In particular, the reliance on interest rate channels may amplify economic fluctuations in open economies exposed to volatile capital flows and external shocks.

In contrast, Islamic economic theory proposes an alternative monetary framework grounded in ethical principles, social ustice, and real-sector integration. A defining feature of this system is the prohibition of interest (riba), which is viewed as both economically inefficient and socially unjust (Chapra, 1992; Siddiqi, 2004). Instead, Islamic finance promotes risk-sharing mechanisms, asset-backed financing, and equitable distribution of resources. These principles aim to strengthen the linkage between financial and real economic activities while reducing speculative distortions.

Recent developments in Islamic finance have renewed interest in exploring the macroeconomic implications of interest-free systems. Studies such as Iqbal and Mirakhor (2011) and more recent empirical analyses (Khan, 2023; Ahmed & Khan, 2024) suggest that Islamic financial systems may enhance economic resilience by discouraging excessive leverage and promoting productive investment. However, there remains a significant gap in the literature regarding the integration of Islamic monetary principles into formal macroeconomic models used for policy analysis.

This study addresses this gap by extending the IMF's QPM framework to incorporate Shariah-compliant monetary principles. Specifically, it develops two alternative models: (i) a Shariah-Compliant Growth Economy Model and (ii) a Shariah-Compliant Output Gap Targeting (SC-OGT) Model. Both models are constructed by recalibrating key structural parameters, including setting the steady-state interest rate and inflation target to zero, reducing inflation persistence, and shifting the focus of monetary policy toward output stabilization.

The analysis employs a consistent methodological framework using identical datasets, software platforms, and empirical tools, including Impulse Response Functions (IRFs), Kalman filtering, and forecasting simulations. This ensures that differences in model performance are attributable to structural assumptions rather than methodological inconsistencies.

The results indicate that the conventional interest-based model is more sensitive to inflation volatility and external shocks, often requiring aggressive policy interventions that exacerbate output instability. In contrast, the Shariah-compliant models demonstrate smoother economic adjustments, lower inflation variability, and improved resilience. These findings suggest that alternative monetary frameworks grounded in risk-sharing and real-sector integration may offer more stable and sustainable economic outcomes.

Literature Review

Interest-Based Monetary Systems and Economic Instability

Interest rates play a fundamental role in conventional monetary policy, influencing aggregate demand, investment decisions, and inflation dynamics. The New Keynesian framework emphasizes the interest rate channel as the primary mechanism through which central banks stabilize the economy (Woodford, 2003). Adjustments in policy rates affect borrowing costs, consumption, and investment, thereby shaping macroeconomic outcomes.

However, several scholars have highlighted structural limitations of interest-based systems. Chapra (1992) argues that interest-based financing contributes to wealth concentration and weakens the connection between financial and real sectors. Similarly, Stiglitz (2010) notes that excessive reliance on financial markets and debt-driven growth can lead to systemic instability and economic crises.

From an Islamic perspective, interest (riba) is considered inherently unjust because it allows lenders to earn risk-free returns while transferring all risk to borrowers (Siddiqi, 2004). This asymmetry not only creates economic inefficiencies but also exacerbates income inequality. Asutay (2007) further emphasizes that interest-based systems prioritize financial returns over social welfare, undermining the ethical foundations of economic activity.

Recent empirical research supports these concerns. For instance, Borio et al. (2023) highlight that prolonged periods of low interest rates can encourage excessive risk-taking and asset price inflation, while abrupt increases in rates can trigger financial instability. Similarly, IMF (2024) reports indicate that interest rate volatility remains a key driver of macroeconomic fluctuations in emerging economies.

Inflation and Macroeconomic Welfare

Inflation is a central concern in both conventional and Islamic economic systems, though it is interpreted differently. In mainstream macroeconomics, moderate inflation is often tolerated, provided it remains stable and predictable. However, high and volatile inflation can distort price signals, reduce purchasing power, and create uncertainty (Blanchard, 2017).

Islamic economics views inflation as a form of economic injustice, as it erodes real income and disproportionately affects lower-income groups (Naqvi, 1981). Siddiqi (1983) argues that inflation in interest-based systems is often linked to excessive credit creation and speculative financial practices. This perspective aligns with modern critiques of financialization, which associate inflationary pressures with debt-driven growth.

Recent studies (Ahmed, 2023; Khan & Mirakhor, 2024) suggest that inflation control in Islamic systems can be achieved through asset-backed financing and restrictions on

speculative activities. These mechanisms help stabilize prices while maintaining real economic growth.

Islamic Monetary Models and Emerging Evidence

Islamic monetary frameworks emphasize risk-sharing, asset-backed financing, and ethical investment. Instruments such as mudarabah, musharakah, and sukuk replace conventional debt-based financing, aligning financial returns with real economic performance (Iqbal & Mirakhor, 2011).

Recent research has explored the macroeconomic implications of these principles. For example, Khan (2023) demonstrates that risk-sharing financial systems can reduce volatility in output and investment cycles. Similarly, Ahmed and Khan (2024) find that Islamic financial systems exhibit greater resilience during financial crises due to lower leverage and reduced exposure to speculative activities.

Despite these advances, the integration of Islamic principles into formal macroeconomic models remains limited. This study contributes to the literature by embedding Shariah-compliant assumptions within the QPM framework and providing a comparative analysis using standardized empirical tools.

Methodology

Modelling Framework and Research Design

This study employs a comparative semi-structural macroeconomic modelling approach to evaluate the performance of conventional and Shariah-compliant monetary frameworks. The analysis is anchored in the Quarterly Projection Model (QPM), a standard New Keynesian gap model widely used for monetary policy analysis in open economies by central banks and the International Monetary Fund (IMF, 2019; Berg et al., 2006).

The QPM framework decomposes key macroeconomic variables—such as output, inflation, and exchange rates into trend (long-run equilibrium) and gap (short-run deviation) components, allowing for a consistent analysis of cyclical fluctuations around a balanced growth path. This "gap-model" structure enables policymakers to assess how shocks propagate through the economy and how policy instruments influence macroeconomic stability (Woodford, 2003; Blanchard, 2017).

In this study, the baseline QPM (Model 01) is used as a benchmark, while two alternative Shariah-compliant models are developed by modifying its structural parameters and policy rules. To ensure comparability, all models are implemented using the same dataset, calibration strategy, and computational tools (MATLAB and IRIS), consistent with IMF training frameworks (Berg et al., 2006).

Model Specification

Model 01: IMF QPM (MPAFx Framework)

The baseline model follows a standard New Keynesian structure consisting of four core blocks: aggregate demand, aggregate supply, monetary policy rule, and exchange rate dynamics.

The output gap is determined by an IS-type equation, where current output depends on past output, external demand, and monetary conditions. The Monetary Conditions Index (MCI), combining the real interest rate and real exchange rate, serves as the primary transmission channel linking monetary policy to aggregate demand. The dominance of the interest rate component reflects the central role of borrowing costs in influencing consumption and investment decisions (Taylor, 1993; Woodford, 2003).

Inflation dynamics are modelled using a hybrid Phillips curve that incorporates both backward-looking and forward-looking expectations. The presence of inflation persistence implies that shocks propagate over time, requiring active monetary intervention to stabilize prices (Gali, 2008). Monetary policy is implemented through a forward-looking Taylor-type rule, where the central bank adjusts the nominal interest rate in response to deviations of inflation from its target and output from its potential level.

Exchange rate dynamics are modelled using an extended uncovered interest parity (UIP) condition, incorporating expectations and a risk premium. This reflects the role of capital flows and financial market expectations in determining exchange rate movements, particularly in open economies (Borio et al., 2023).

Model 02: Shariah-Compliant Growth Economy Model

The second model modifies the baseline QPM to align with Islamic economic principles by eliminating interest (riba) and targeting a zero-inflation steady state. The key structural changes include setting the steady-state real interest rate and inflation target to zero, and reducing inflation persistence to a low level, thereby limiting the propagation of inflationary shocks.

In this framework, the interest rate channel is removed from the monetary transmission mechanism, and policy does not respond to inflation deviations. Instead, economic adjustment occurs through real-sector dynamics, with financial intermediation based on risk-sharing arrangements such as profit-and-loss sharing (mudarabah) and joint venture financing (musharakah). These mechanisms align financial returns with real economic activity, reducing speculative distortions and enhancing stability (Chapra, 1992; Iqbal & Mirakhor, 2011).

The removal of the interest-based Monetary Conditions Index significantly alters the transmission mechanism, reducing the influence of financial variables on aggregate demand. As a result, macroeconomic adjustment occurs more smoothly, with reduced amplification of shocks. This structural transformation reflects the core principles of Islamic economics, which emphasize justice, risk-sharing, and real-sector integration over financial intermediation (Siddiqi, 2004).

Model 03: Shariah-Compliant Output Gap Targeting Model (SC-OGT)

The third model extends the Shariah-compliant growth framework by introducing a policy rule that focuses

exclusively on output gap stabilization. In this specification, monetary policy does not respond to inflation and exhibits low persistence, allowing for more flexible and direct adjustment to deviations in economic activity.

This model represents a fully real-sector-oriented framework, where stabilization is achieved through direct targeting of output rather than through financial variables. The elimination of both interest rate and inflation-targeting mechanisms removes the primary sources of policy-induced volatility observed in the conventional model.

The SC-OGT framework is conceptually aligned with alternative macroeconomic approaches that emphasize real economic stability over financial targeting, particularly in environments characterized by financial fragility and external shocks (International Monetary Fund, 2024).

Empirical Strategy

The comparative analysis is conducted using three complementary techniques. First, Impulse Response Functions (IRFs) are used to evaluate the dynamic response of key macroeconomic variables to exogenous shocks, particularly cost-push disturbances. IRFs provide a time-path representation of how shocks propagate through the economy and are widely used in policy modelling to assess transmission mechanisms (Berg et al., 2006).

Second, Kalman filtering is employed to estimate unobservable variables such as the output gap and its decomposition into trend and cyclical components. This technique allows for a more accurate representation of underlying economic dynamics and is commonly used in gap-based macroeconomic models (Harvey, 1989).

Third, forecast simulations are conducted to assess the medium-term performance of the models. These simulations provide insights into the predictability, stability, and resilience of each framework under different economic conditions.

Identification of Structural Differences

The key differences across the models arise from three structural dimensions: the presence or absence of the interest rate channel, the degree of inflation persistence, and the nature of the monetary policy rule. The baseline QPM relies on interest-based transmission mechanisms and exhibits higher inflation persistence, leading to stronger and more prolonged responses to shocks.

In contrast, the Shariah-compliant models eliminate the interest rate channel and reduce inflation persistence, resulting in smoother adjustment dynamics and enhanced macroeconomic stability. The SC-OGT model further strengthens this framework by directly targeting output, thereby minimizing cyclical fluctuations and improving convergence to equilibrium.

Results

To provide a focused and analytically coherent presentation, the results are synthesised using three representative figures capturing impulse responses, comparative macroeconomic dynamics, and filtered output gap behaviour. These figures reflect the key mechanisms embedded in the three models and allow for a direct comparison of their macroeconomic performance.

Impulse Response Dynamics

The IMF QPM model displays a strong and persistent inflationary response, driven by the hybrid Phillips curve structure with significant backward-looking components. Inflation rises sharply and remains above its steady-state level for an extended period, indicating the presence of inflation persistence within the system. In response, the monetary authority increases the nominal interest rate substantially, reflecting the Taylor-type reaction function embedded in the model as shown in Figure 1.

This policy response, however, induces a pronounced contraction in the output gap. The decline in output reflects the transmission of higher borrowing costs to consumption and investment, confirming the dominant role of the interest rate channel in aggregate demand determination. Furthermore, exchange rate depreciation amplifies inflationary pressures, creating a feedback loop that reinforces macroeconomic instability. These dynamics are consistent with the structural features of the QPM, where interest rates and exchange rates jointly influence the Monetary Conditions Index (MCI).

In contrast, the Shariah-compliant growth model demonstrates a fundamentally different adjustment pattern. Inflation increases only marginally and returns rapidly to equilibrium, reflecting the low inflation persistence assumed in the model. The absence of an interest rate response eliminates the contractionary effects observed in the QPM model, allowing output to remain close to its potential level. The adjustment process is therefore smoother, with reduced volatility across all variables.

The SC-OGT model further strengthens this stabilization mechanism. By directly targeting the output gap, the model ensures a faster convergence to equilibrium without generating additional fluctuations in inflation or other macroeconomic variables. The impulse responses indicate that the system absorbs shocks efficiently, maintaining stability throughout the adjustment process. This confirms that output-gap targeting within a Shariah-compliant framework provides a more robust mechanism for macroeconomic stabilization.

Structural Comparison of Transmission Mechanisms

The differences observed in Figure 1 can be traced to the underlying transmission mechanisms of the models. In the QPM framework, monetary policy operates through multiple channels, including interest rate effects on consumption and investment, exchange rate movements affecting net exports, and expectations influencing inflation dynamics. These channels interact in a way that amplifies shocks, leading to larger fluctuations in macroeconomic variables.

By contrast, the Shariah-compliant models eliminate the interest rate channel and rely on real-sector adjustments. Financial intermediation is based on risk-sharing mechanisms such as mudarabah and musharakah, which align financial returns with actual economic performance. As a result, the transmission of shocks is less distorted by financial factors, and the economy adjusts more smoothly to external disturbances.

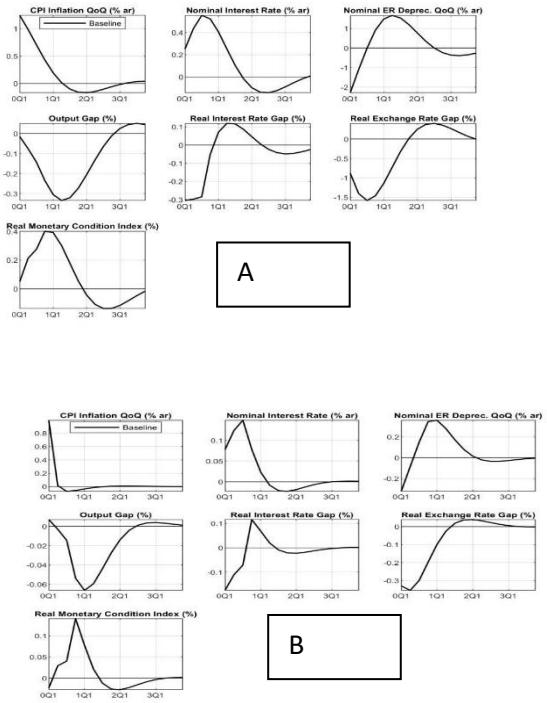

Figure 1. Impulse response functions of the IMF QPM (baseline), Shariah-Compliant Growth Model, and Shariah-Compliant Output Gap Targeting (SC-OGT) model following a cost-push shock. Panels (a), (b), and (c) present the dynamic responses of CPI inflation, nominal interest rate, exchange rate depreciation, output gap, real interest rate gap, real exchange rate gap, and the monetary conditions index. The conventional QPM exhibits stronger inflation persistence and policy-driven output contraction, whereas the Shariah-compliant models show smoother adjustment, lower volatility, and faster convergence to equilibrium.

Inflation–Output Trade-off

The QPM model exhibits a clear trade-off between inflation and output. Inflation stabilization is achieved through aggressive policy tightening, which leads to a significant negative output gap. This outcome reflects the classical sacrifice ratio problem, where reducing inflation requires a contraction in economic activity.

In contrast, the Shariah-compliant models demonstrate that this trade-off can be substantially reduced. Inflation remains stable without requiring large adjustments in output, suggesting that the elimination of interest-based mechanisms reduces the propagation of shocks. The SC-OGT model, in particular, achieves near-zero inflation and stable output simultaneously, indicating that output-gap targeting can serve as an effective alternative to inflation targeting.

These findings highlight the importance of model structure in determining macroeconomic outcomes. While the conventional framework prioritizes inflation control, the Shariah-compliant models achieve a more balanced stabilization of both inflation and output. This is shown in Figure 2.

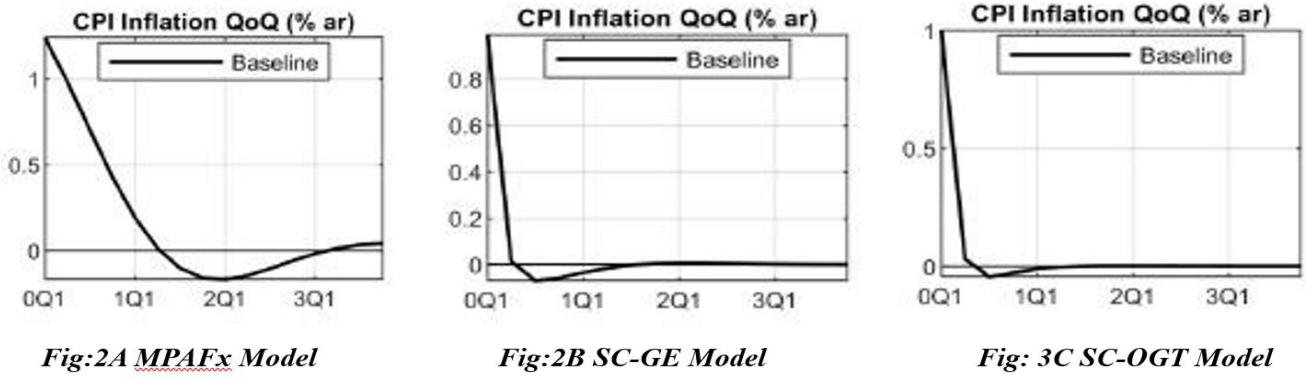

Figure 2. Inflation dynamics across the IMF QPM (MPAFx), Shariah-Compliant Growth Economy (SC-GE), and Shariah-Compliant Output Gap Targeting (SC-OGT) models following a cost-push shock. The conventional QPM model exhibits a more persistent inflation response, whereas the Shariah-compliant models show a rapid decline in inflation and quicker convergence to equilibrium, reflecting lower inflation persistence and improved macroeconomic stability.

Output Gap Stability and Long-Term Dynamics

The filtered output gap for the QPM model exhibits significant cyclical volatility, characterized by repeated

deviations from the steady-state path. These fluctuations reflect the interaction of monetary policy shocks, external disturbances, and financial market responses. The decomposition of the Monetary Conditions Index further shows that both interest rate and exchange rate components contribute to this instability.

In contrast, the Shariah-compliant growth model displays a more stable output trajectory, with smaller and less persistent deviations from equilibrium. The SC-OGT model further reduces volatility, showing a smooth and consistent adjustment path. The absence of interest rate shocks eliminates one of the primary sources of cyclical instability, allowing the economy to maintain a balanced growth path.
These results confirm that Shariah-compliant frameworks are better aligned with long-term macroeconomic stability, as they minimize deviations from potential output and reduce the impact of external shocks.

Forecasting Performance

The forecasting analysis further supports these findings. The QPM model exhibits a wide dispersion in forecast outcomes, reflecting high uncertainty and sensitivity to shocks. Inflation and output projections show considerable variability, indicating a less predictable macroeconomic environment.

In contrast, the Shariah-compliant models produce more stable and predictable forecasts. Inflation remains close to zero, and output follows a steady growth path with minimal fluctuations. The SC-OGT model demonstrates the highest level of forecast stability, with narrow confidence bands and consistent convergence toward equilibrium.
These results suggest that Shariah-compliant monetary frameworks not only improve short-term stability but also enhance the predictability of long-term economic outcomes. This is depicted in Figure 3, 4, 5.

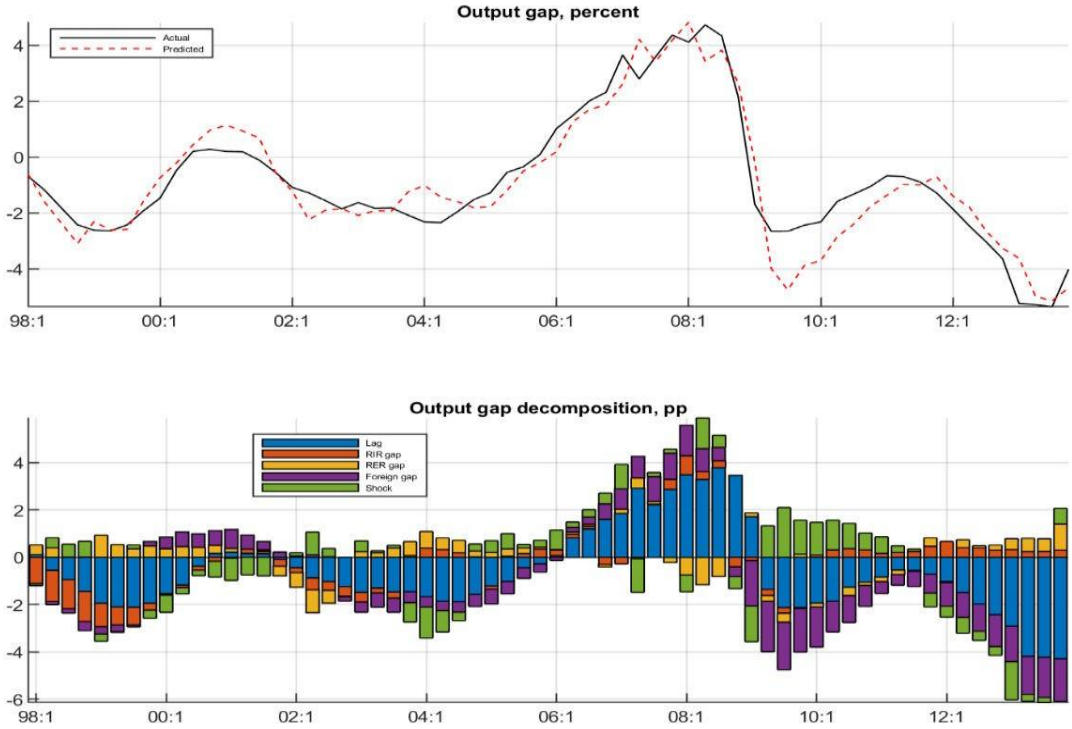

Figure 3. Kalman filter estimates of output gap and its components for the SC-OGT model.

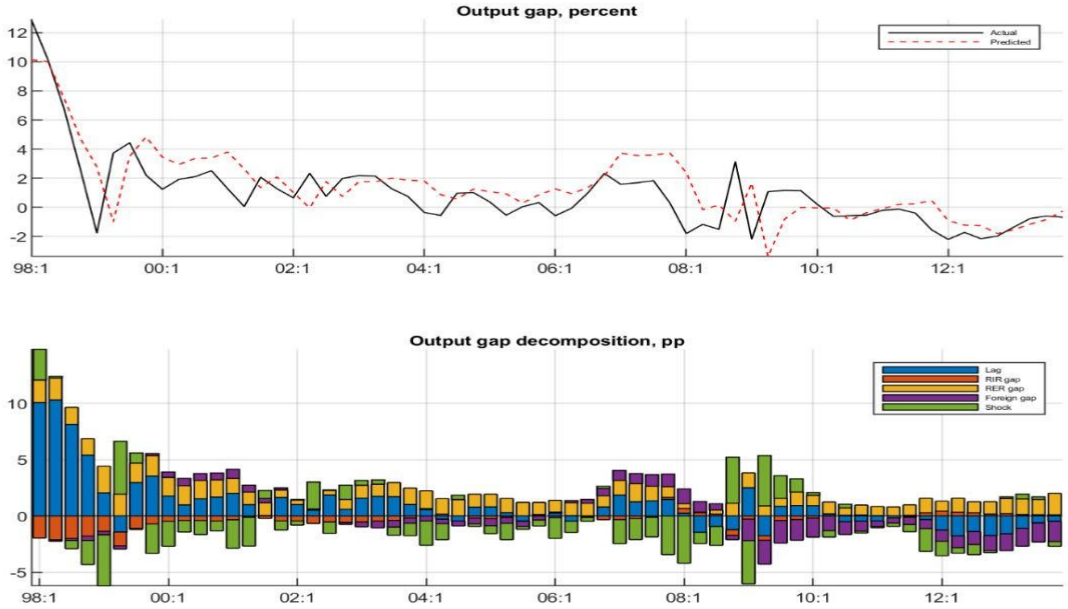

Figure 4. Kalman filter estimates of output gap and its components for the IMF QPM model.

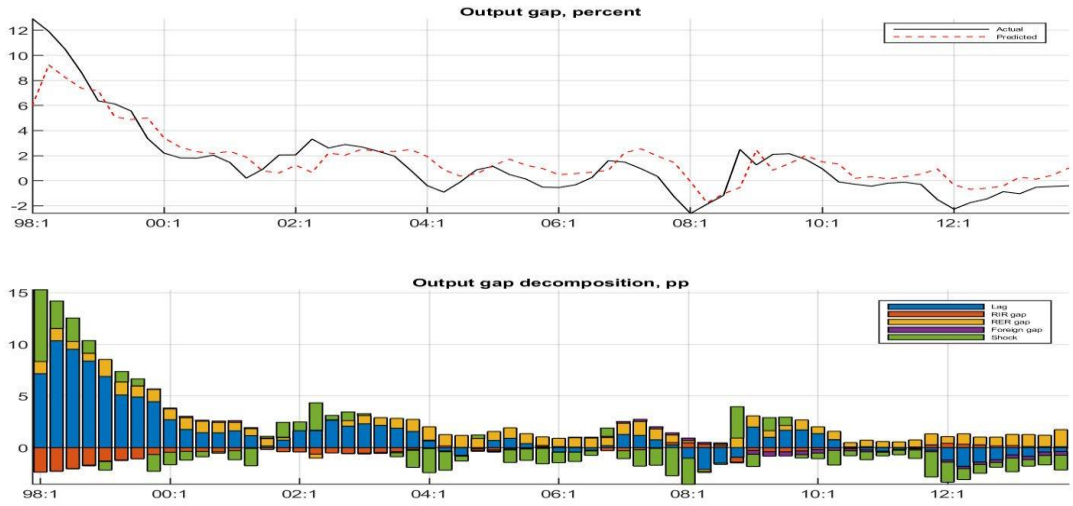

Figure 5. Kalman filter estimates of output gap and its components for the Shariah-Compliant Growth model.

Discussion

The empirical results provide strong support for the argument that the design of monetary frameworks significantly influences macroeconomic stability. The conventional interest-based system, as represented by the IMF QPM, relies heavily on financial variables to achieve stabilization. While effective in controlling inflation, this approach introduces substantial volatility into the real economy.

The observed contraction in output following interest rate tightening reflects the inherent limitations of the interest rate channel. As noted by Woodford (2003), monetary policy operates indirectly through expectations and financial markets, which can amplify shocks rather than dampen them. Similarly, Blanchard (2017) highlights that aggressive policy responses may lead to unnecessary output losses, particularly in the presence of supply-side disturbances.

From the perspective of Islamic economics, these outcomes are not merely technical inefficiencies but also reflect deeper structural issues. The prohibition of riba is rooted in concerns about fairness, risk distribution, and social welfare. Interest-based systems allow lenders to earn returns without sharing risk, leading to wealth concentration and economic inequality (Chapra, 1992; Siddiqi, 2004). These concerns are consistent with the instability observed in the QPM model, where financial mechanisms amplify macroeconomic fluctuations.

The Shariah-compliant models offer an alternative approach by eliminating interest-based distortions and promoting real-sector integration. The results show that these models achieve stabilization through structural features rather than policy interventions. Inflation is naturally contained due to low persistence, while output remains stable due to the absence of contractionary monetary shocks.

The superior performance of the SC-OGT model highlights the importance of targeting real economic variables directly. By focusing on the output gap, the model ensures that economic activity remains aligned with its potential level, reducing the need for reactive policy adjustments. This finding is consistent with recent research suggesting that alternative policy frameworks may be more effective in managing complex macroeconomic environments (International Monetary Fund, 2024).

Recent empirical studies further support these conclusions. Borio et al. (2023) argue that financial cycles driven by interest rate dynamics contribute significantly to macroeconomic instability. Ahmed (2024) demonstrates that Islamic financial systems, which emphasize risk-sharing and asset-backed financing, exhibit greater resilience during economic shocks. Similarly, Khan (2023) finds that reduced reliance on debt-based financing leads to lower volatility in output and investment.

These insights suggest that Shariah-compliant monetary frameworks provide a viable alternative to conventional systems, particularly in economies characterized by financial instability and external vulnerabilities. By reducing the role of financial distortions and strengthening the link between financial and real sectors, these models offer a more stable and sustainable approach to macroeconomic management.

Conclusions

This study provides a comparative evaluation of conventional interest-based and Shariah-compliant monetary frameworks using a unified QPM-based modelling approach. The findings reveal that the IMF QPM, while effective in controlling inflation, introduces significant macroeconomic volatility due to its reliance on interest rate adjustments. Inflation stabilization in this framework is achieved at the cost of output contraction, reflecting the inherent trade-off between price stability and real economic performance. In contrast, the Shariah-compliant models demonstrate a more stable adjustment mechanism. By eliminating interest (riba) and reducing inflation persistence, these models prevent the amplification of shocks and maintain output closer to its potential level. The results indicate that macroeconomic stability can be achieved through structural features rather than aggressive policy interventions. Among the alternative frameworks, the SC-OGT model shows the strongest performance, ensuring rapid stabilization of the output gap with minimal volatility. Overall, the findings suggest that Shariah-compliant monetary systems offer a viable and potentially more stable alternative to conventional frameworks, particularly in economies vulnerable to financial instability and external shocks.

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