Quarterly Projection Model for Laos

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Abstract

The Bank of the Lao PDR (BOL) implements monetary targeting and exchange rate anchor to ensure price stability. Since money target has not provided a useful framework for discussing shocks affecting monetary policy, the adequacy of the existing monetary regime is being questioned. This paper develops a quarterly projection model (QPM) of the Lao economy that outlines the transmission mechanism of monetary policy and the relevant shocks, which help framing policy decisions in offsetting those shocks. The results show that the model provides a coherent story about transmission mechanism and closely matches the actual data. In order to bring inflation down to target, an aggressive tightening monetary policy would be needed which may cause economic contraction over the short term. The monetary policy rule experiments suggest that by focusing on solving the inflation gap, the central bank can achieve greater macroeconomic stability.

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1 Introduction

The Bank of the Lao PDR (BOL) manages monetary policy under monetary targeting framework and exchange rate policy. As a small open economy, monetary policy in Laos has been increasingly affected by external shocks that result in a large swing of inflation.

It has been acknowledged among policymakers that monetary policy with money target has not provided a useful framework of thinking about these shocks. Moreover, many studies show that money supply negatively impacts on economic growth in Laos (Xaiyavong (2015), Srithilat, Sun, and Thavisay (2017), and Srithilat et al. (2021)). This is because the effect of money on inflation and the economy is ambiguous when the demand for money becomes unstable, especially due to dollarization and innovations in the financial markets (Xaiyavong and Czerkawski (2014)).

Also, the exchange rate policy may be an effective tools for the BOL, but it requires a massive level of international reserve to keep the exchange rate stable. In such a monetary management environment, an adequacy of the existing monetary policy framework is being questioned in keeping price stability, which is the BOL's primary objective. This is viewed as an intermediate stage for the BOL to transit to an alternative policy regime.

In the recent year, many central banks have adopted monetary policy framework that focuses on steering inflation to target by using interest rates as tools. This technique is also known as inflation targeting. It has become an ideal framework since interest rates and inflation rates tend to move in opposite directions. Thus, it is likely that the central banks' action on raising or lowering interest rates become more transparent in controlling inflation.

With this framework in place, it requires central banks to invest in creating, monitoring, and projecting economic information to achieve a better understanding of monetary transmission and relationships in the domestic and world economies. A key question that requires the use of policy model is what the policy response should be to bring inflation to target when temporary shocks have pushed current inflation away from the target.

This paper constructs a canonical quarterly projection model (QPM) to serve as a monetary policy decision-making toolkit for policymakers. The QPM is often used as a core model of Forecasting and Policy Analysis System (FPAS) which is a well-organized framework to support making monetary policy decisions in a systematic, forward-looking fashion, informed by economic data and analysis (Mæhle et al. (2021)).

The paper aims to provide answers to several key questions about monetary policy in Laos. First, is a change in the policy stance needed? if yes, what should be a necessary policy response? second, what are implications of the policy response for other variables? and finally, given multiple targets under the current monetary policy framework[1], this paper seeks to answer which target should the BOL pursue in order to stabilize the economy?

This topic should contribute to monetary policy literature for three related reasons. Foremost, it furthers our understanding of the monetary policy transmission and monetary policy decision-making process in Laos. Thus, it can support a more transparent and effective conduct of monetary policy based on the policy rate. Secondly, it contributes empirical properties for inflation targeting transmission which is increasingly used by many central banks for monetary policy analysis and forecasting. In addition, my study provides useful information more generally within the context of modeling monetary policy analysis tools in small open economies.

The findings show that the QPM provides a coherent story about transmission mechanisms and closely matches actual data of Lao economy. In the context of inflation spike due to temporary shocks, aggressive tightening monetary policy would be needed in order to bring inflation down to target. However, this may have a negative effect on output at short notice. To achieve macroeconomic stability, the BOL should put more weight on inflation deviation from target when adjusting the interest rates.

The reminder of the paper is organized as follows. Section II provides a brief overview of monetary policy in Laos. Section III outlines how the model is set up. Section IV discusses the estimations of the model and the empirical results. Section V concludes the paper.

[1] money supply growth and exchange rate band for Lao Kip/US Dollar.

2 Overview of Monetary Policy in Laos

The BOL is the national authority being responsible for implementing monetary policy to guide the economy in the right direction. That is to achieve a low and stable prices to support a sustained economic growth. Key monetary instruments of the BOL are interest rates, reserve requirements, exchange rate and open market operations . Such a policy focuses on controlling the demand and supply of money through money growth and exchange rate targets.

According to the International Monetary Fund (IMF (2012)), setting multiple monetary targets is one of the main issues in conducting monetary policy in Laos. Maintaining exchange rate volatility against the US dollar within the band, for example, is challenging under low foreign reserves. Under a high ratio of foreign currency in broad money (M2), such exchange rate control leads to difficulty in predicting demand for local currency. Financial development also threatens the maintaining of money supply level (Xaiyavong and Czerkawski (2014). This reflects in the relationship between money and prices, which is often volatile and unstable, especially where a high degree of foreign currency use is taking place (Jayant (2007)).

Another issue is that demand for foreign currency puts pressure on the exchange rate and transmits into high import prices. Hence, domestic inflation is affected due to heavy import reliance. Although, maintaining the exchange rate flexibility under the exchange rate policy can keep the rates fluctuate within the band, it becomes challenging when international reserve is limited and demanded for other purpose such as external debt services.

3 Literature Review

The basic principles of QPM were put forward by Berg, Karam, and Laxton (2006), this model has been used extensively to analyze macroeconomic information in supporting monetary policy decision making process[2]. Despite their widespread use elsewhere, it is only recently that this type of model has been designed and developed in Laos under the IMF's monetary policy technical assistance (BOL (2023)).

The vast body of existing studies in Lao context investigates the effectiveness of macroeconomic policies using Lao macroeconometric model (Xaiyavong (2015)), the impact of monetary policy on economic growth by using Vector Autoregressive Model (Srithilat et al. (2021)) and Error Correction Model (Srithilat, Sun, and Thavisay (2017), and the review of monetary policy rules (Xaiyavong and Czerkawski (2014))).

For example, Xaiyavong and Czerkawski (2014) find that real monetary aggregates was the main instrument, but monetary policy tends to suffer from instability in the demand for money due to dollarization and financial innovation. Srithilat, Sun, and Thavisay (2017) find that money supply negatively affects the real GDP per capita in the long run. Similarly, Srithilat et al. (2021) confirm that an expansionary monetary policy leads to lower interest rates, and increase aggregate credit and prices, but leads to a negative output.

These studies provide useful insights about the effectiveness of the current monetary policy. However, such studies still leave a gap in guidance on what central bank should do next to overcome such incompetence. This motivates me to construct a policy model, namely QPM, to facilitate a systematic evaluation of current policy and provide policy analyses and updates for policy making.

A benchmark of my study follows the QPM put forward by Berg, Karam, and Laxton (2006) and Schmittmann and Dizioli (2015). Berg, Karam, and Laxton (2006) use a simple structural macroeconomic model with four key behavior equations to capture the key features of the economy for monetary policy analysis. Such a model is designed for an appliance of countries with a floating exchange rate regime and a formal or implicit inflation targeting monetary framework.

[2]Samples of economies with completed FPAS models include India, Indonesia, Japan, Kenya, Morocco, and Vietnam. Samples of economies with under constructed FPAS models include Australia, Brazil, Singapore, and Thailand. Source: http://www.douglaslaxton.org/fpas.html

Schmittmann and Dizioli (2015) apply this approach for Vietnam at the time that the State Bank of Vietnam has proposed an inflation targeting to the National Assembly. They find that Vietnamese macroeconomy has greater stability under a monetary policy rule with a larger weight on output stabilization and a greater exchange rate flexibility.

Although the models used in these two papers are not specifically designed for the Lao economy, there are a number of reasons why it might be regarded as a natural starting point. First, the study of Berg, Karam, and Laxton (2006) serves as a comprehensive guideline for countries that are entering or deciding to adopt inflation targeting, at least for the first time.

Also, it is useful to relate my work here with the study of Schmittmann and Dizioli (2015). In some respects, our studies have similar purpose and nature. We both examine macroeconomic aggregates and there is common ground in some of the questions we ask for the model. Vietnam and Laos share a similar economic context as neighboring countries, including the economic strategic plan with an anchor to economic growth. This allows me to use the study of Vietnam as a suitable benchmark for parameter calibration.

However, there are some important differences between our studies. First, my study focuses much more narrow than the study of Schmittmann and Dizioli (2015). I examine how the QPM is able to analyze the monetary policy transmission in Laos and what its policy recommendation implies. In contrast, they consider much wider range empirical issues, for example the effects of several shocks to Vietnam's economy. While they use Bayesian techniques to obtain parameters of the model, the parameters in my study are calibrated on the basis of the model's properties and by comparing the dynamic of my model with existing research properties. The calibration approach seems to be rational for the case of Laos where evidence of model properties on Lao context are limited.

There are numbers of central banks that developed this core analytical model, including those adopting inflation targeting (see Hong (2022) for Japan and Abradu-Otoo et al. (2022) for Ghana) and those transitioning to inflation targeting (see Anand, Ding, and Peiris (2011) for Sri Lanka, Schmittmann and Dizioli (2015) for Vietnam, and Baksa, Bulir, and

Cardarelli (2021) for Morocco). Specifically, country characteristics and particular policy frameworks were tailored and extended to capture relevant channels of monetary transmission mechanism. These extended empirical include Benes (2022) for India, Musil, Pranovich, and Vlcek (2018) for Belarus, Baksa, Bulir, and Cardarelli (2021) for Cambodia, Vlček et al. (2020) for Rwanda, and Karam, Pranovich, and Vlcek (2021) for Philippines. The study also extends to designing FPAS models that validate for low-income countries, with an appliance of Kenya (Andrle et al. (2013)).

There are two important model property features from the studies I reviewed based on their empirical results. First, the model relatively captures theoretical consistency and closely matches the actual data. For example, Anand, Ding, and Peiris (2011) find that the model performs a relatively good forecast for inflation in Sri Lanka and suggests that inflation targeting can reduce macroeconomic volatility.

The second property is the flexibility of the model that allows for blending into specific country economic features. Many studies take advantage of this model to modify it in a more unique feature to capture the most relevant transmission mechanism in the corresponding country. One of the common extensions is an incorporating of fiscal policy which may be an important source of shock and fiscal policy stance may be a driver of output gap (see Baksa, Bulir, and Cardarelli (2021) and Baksa, Bulir, and Heng (2022)).

Although the model extension is important, there should be a clear economic motivation and a 'story' behind these types of extension. The process of building this kind of model usually evolves over a period of time. Thus, it is important to ensure that the model embodies the basic economic principles to avoid the risk that policy advice is inconsistent in the sense of defying logic and reason. Centering around simplicity when building the model, therefore, can be an important initiation and then extending it overtime as suggested by experience. My study also follows this guidance.

4 Methodology

4.1 Building the Model

This paper conducts the monetary policy analysis by using a canonical quarterly projection model (Berg, Karam, and Laxton (2006)). The QPM or Small New Keynesian model is a workhorse macroeconomic model, which is increasingly used in central banks and many country desks in the IMF for monetary policy analysis and forecasting. The model features a small open economy which incorporates forward-looking aggregate demand and supply with microfoundamentions and stylized lags in the different monetary transmission channels. It also captures external shocks from the rest of the world through U.S. growth, which directly feed into the domestic economy via foreign demand for domestic products. Also, foreign interest rates and inflation affect domestic economy through its exchange rates, demand and inflation.

The merits of such a model includes its transparency and simplicity, yet it incorporates key features of the economy for monetary policy analysis. The model is also structural because it can interpret economic intuition through its equations. In this way, causality and identification are not in question.

There are four behavioral equations in this model: (1) an aggregate demand curve that relates the level of real activity to expected and past real activity, the real interest rates, and the real exchange rate; (2) a price setting Phillips curve that relates components of inflation to past and expected inflation, the output gap, and the exchange rate; (3) an uncovered interest parity condition that ensure exchange rate stability; and (4) a rule for policy rate setting as a function of output gap, changes in exchange rate and expected inflation deviation from the authorities' inflation target. Full details on the model equations are provided in the appendix (Table 1).

4.1.1 Aggregate Demand Curve (IS curve)

The output gap ($LGDP_{GAP}$) depends on its own lag, on the monetary condition index (MCI), and on foreign demand ($LGDP_{RWGAP}$) which is approximated by the U.S. output gap. The monetary condition index depends on deviations from the neutral real interest rate (RR_{GAP}) and on deviations from steady state real exchange rate (LZ_{GAP}). The equations are identified as follows.

$$LGDP_{GAPt} = b_1 * LGDP_{GAP_{t-1}} - b_2 * MCI_t + b_3 * LGDP_{RWGAP_t} + SHK_{LGDPGAP} \quad (1)$$

$$where, MCI_t = b_4 * RR_{GAP_t} + (1 - b_4) * (-LZ_{GAP_t}) \quad (2)$$

where:

$LGDP_{GAP}$: Output Gap (in percent);

MCI: Real Monetary Condition Index (in percent per annum);

$LGDP_{RWGAP}$: Foreign Output Gap (in percent);

RR_{GAP}: Real Interest Rate Gap (in percent);

LZ_{GAP}: Real Exchange Rate Gap (in percent);

$SHK_{LGDPGAP}$: Demand Shock.

4.1.2 Phillips Curve

The Phillips curve is used to describe price dynamics. Inflation is a function of lagged inflation, expected inflation, and the real marginal costs. The real marginal costs in equation (4) approximate domestic and imported costs producing goods and services in a small open economy of Laos.

$$DLACPI_t = a_1 * DLACPI_{t-1} + (1 - a_1) * DLACPI_{t+1} + a2 * RMC_t + SHK_{DLACPI} \quad (3)$$

$$where, RMC_t = a_3 * LGDP_{GAP_t} + (1 - a_3) * LZ_{GAP_t} \quad (4)$$

where:

$DLACPI$: CPI Inflation QoQ annualized (in percent per annum);

RMC: Real Marginal Cost (in percent);

SHK_{DLACPI}: Cost Push Shock.

4.1.3 Uncovered Interest Parity (UIP)

In addition to the standard UIP, this equation takes into account that domestic and foreign bonds might not be perfectly substituted, so the risk premium reflects the liquidity and credit risk between two countries. However, agents may also incorporate some back-ward looking behavior, reflecting in high volatile and jumping in exchange rates as new information is readily incorporated into its determination.

$$LS_t = (1 - e_1) * LS_{t+1} + e_1 * (LS_{t-1} + \frac{2}{4} * (D4LCPI_t^T - DLACPI_{RW_t}^{ss}$$

$$+ DLAZ_t^{BAR})) + (-RS_t + RS_{RW_t} + PREM_t)/4 + SHK_{LS} \quad (5)$$

where:

LS: Nominal Exchange Rate (LAK/USD, 100*log);

$D4LCPI$: CPI Inflation YoY (in percent per annum);

$D4LCPI^T$: CPI Inflation Target YoY (in percent per annum);

$DLACPI_{RW}^{ss}$: Steady State Foreign Inflation QoQ annualized (in percent per annum);

$DLAZ^{BAR}$: Trend Real Exchange Rate (level, 100*log);

RS: Nominal Policy Interest Rate (in percent per annum);

RS_{RW}: Foreign Nominal Interest Rate (in percent per annum);

$PREM$: Country Risk Premium (in percent per annum);

SHK_{LS}: Exchange Rate Shock.

4.1.4 Monetary Policy Reaction Function

It is assumed that short-term nominal interest rates are the monetary policy instrument that the central bank sets to achieve a target level of inflation. The policy rate is set according to the following rule:

$$RS_t = g_1 * RS_{t-1} + (1 - g_1) * (RSNEUTRAL_t + g_2 * (D4LCPI_{t+4} - D4LCPI^T_{t+4}) +$$

$$g_3 * LGDP_{GAP_t} + g_4 * (LZ_t - LZ_{t-1})) + SHK_{RS} \quad (6)$$

$$where, RSNEUTRAL_t = RR_{BAR_t} + D4LCPI_{t+1} \quad (7)$$

where:

RS: Nominal Policy Interest Rate (in percent per annum);

$RSNEUTRAL$: Nominal Policy Neutral Interest Rate (in percent per annum);

LZ: Real Exchange Rate (LAK/USD, 100*log);

SHK_{RS}: Interest Rate Shock.

4.2 Data

I estimate the model based on the sample covers the period from 2012:Q1 to 2022:Q4, consisting of four key macroeconomic variables for Laos: real GDP, CPI [3], policy rate, and real effective exchange rate; and the U.S. economic data: federal fund rates, real GDP, and inflation. Most of the data is provided by the BOL, except for the GDP which is obtained from the National Statistic Bureau. Data related to the U.S. is based on data from the Federal Reserve Bank of St. Louis and the IMF's World Economic Outlook. The equilibrium levels of each variable are obtained from a simple Hodrick-Prescott filter.

[3]Real GDP: Gross Domestic Product at constant prices, 2012; CPI: Consumer Price Index, 2015=100.

4.3 Model Calibration

The parameters of the model were calibrated on the basis of the model's system properties to match the policy transmission mechanism and to reflect views about structural features of the Lao economy. Firstly, the calibration of the steady state is informed by the historical average of respective variables, economic intuitions and results of existing economic research, and policy objectives such as the inflation and real GDP growth target.

Secondly, core equations' coefficients are calibrated, including those in structural equations for domestic variables and in non-structure (reduced form) equations for foreign variables and long-term trends. Economic intuition about how these parameters reflect characteristics of the modeled economy and properties of the model by existing studies help calibrating these coefficients. The coefficients in the reduced form equations are guided by an autoregressive process and by ensuring reasonably smooth long-term trends.

Finally, the standard deviations of shocks are calibrated based on observed variance in the data by ensuring that unobserved and estimated trends in the model in general are less volatile than gaps and observed variables. Full details on the main parameters in the model are available in the appendix (Table 2).

To give a flavor for this exercise, consider the equation for aggregate demand curve (equation 1 above). I choose a relatively small lagged output account for output persistence ($\beta_1 = 0.3$) to reflect the view that the output has a flexible persistence to return to its baseline when a shock hits. A small coefficient of the monetary condition index or MCI ($\beta_2 = 0.2$) reflects a relatively small impact of monetary policy on the real economy, where the negative sign implies a contraction of output as the central bank tightens the monetary policy. The degree of MCI effect is determined by the weight of the real interest rate and real exchange rate gap ($\beta_4 = 0.5$), a smaller weight implies a higher effect of exchange rate on the monetary condition index. Finally, I select the impact of external demand on domestic output ($\beta_3 = 0.4$) to take account of the degree of openness, which is at the midpoint value from the existing empirical properties.

In the Phillips curve, the parameter ($\alpha_1 = 0.3$) in the inflation equation determines the backward component of inflation, while its inverse, $1-\alpha_1$, determines the forward component. A higher value of α_1 close to 1 implies that small changes in monetary policy causes large changes in price expectations. The passthrough of marginal cost to inflation is captured by α_2 which depends on domestic producers' costs (approximated by output gap) and marginal costs of importers (approximated by real exchange rate). A smaller value of α_3 in the marginal cost equation reflects a relatively more open economy.

For the uncovered interest parity, the parameter e_1 determines the relative weight of forward- and backward-looking real exchange rate expectations. Setting e_1 equal to 0 reduces the equation to the simple UIP.

For the monetary policy rule, the parameters are determined by the speed and aggressiveness of monetary authorities in adjusting the policy rate. In other words, how aggressively the policymakers react to inflation, output and exchange rate deviations from targets. For example, a high value of lagged interest rate parameter (g_1) reflects the "wait and see" policy, that is the central bank avoids sudden change in interest rate. Whereas g_2, g_3 and g_4 reflects the importance of the inflation target versus the real activity and exchange rate targets that policymakers pay attention to. For the foreign block, output gaps and trends are guided by simple autoregressive processes or AR(1).

5 Empirical Results

5.1 Impulse Response Function

The model properties and policy implications are evaluated through impulse responses to several shocks, including the cost-push (supply) shock and the aggregate demand (output) shock. The report of responses to shocks implies the deviation from the steady-state. The purpose of this is to highlight the model properties and the reaction of monetary policy to achieve the economic and price stability objectives.

5.1.1 Cost-Push Shock

The response of the Lao economy to a one-standard deviation increase in inflation (cost-push shock) is presented in Figure 1. The impulse response report helps us to understand what brings inflation down to the level before the shock hits. Actually, it is the central bank's active intervention to achieve its policy goals. In the baseline model, the central bank reacts to inflation by increasing the nominal interest rate by approximately 40 basis points initially.

One transmission channel of the rate hike to bring down inflation is through foreign exchange market. The rate hike leads to an appreciation of nominal exchange rate in the short run as the demand for local currency assets increases.

The increase of interest rates affects the monetary condition index through two factors. First, it leads to a negative real interest rate gap due to a gradual increase of interest rate, while a large increase in inflation. As a result of this, the real interest rate is actually expansionary in the first few quarters.

Another factor is through the real exchange rate channel, which drives the inflation down in the first place. Although the nominal exchange rate appreciates, domestic prices increase due to high inflation rate. As a result, the real exchange rate gap becomes markedly negative, which indicates an overvalued domestic currency. In fact, it becomes so negative that the combined real monetary conditions index signals an unambiguously tight monetary stance.

Tightening conditions reduce domestic demand through substitution of domestic goods with imported goods caused by domestic cost pressure. Overvalued in real terms local currency and a decline in output allows for bringing inflation back to the target.

5.1.2 Aggregate Demand Shock

Figure 2 shows the responses of Lao economy to a one-standard deviation increase in domestic demand. In the baseline model, such an increase directly affects output as the output gap increases immediately. The resulting pressure affects inflation through real marginal cost, thus inflation increases above target.

In order to reduce an overheated economy in the context of booming output and rising inflation, the central bank raises the interest rate according to the policy reaction function. Such a higher rate induces capital inflows and triggers an appreciation of nominal exchange rate in line with the UIP condition. As the impulse response shows, the monetary condition index becomes tighter, accommodating saving instead of consumption and investment. While exchange rate appreciation contracts exports and favors imports, the economy is forced to cool down over time. As a result, it brings the output gap back to its long run trend. A close of output gap curbs inflationary pressures and allows inflation to return to its target.

5.2 In-Sample Forecasts

Another sign to evaluate the reasonably of the model calibration is by checking how well the model fits actual data, which an in-sample forecast can serve this purpose. An analysis of in-sample projections starts from 2018Q1 by assuming that all foreign variables are observed throughout the forecast period. All other variables are known only until the quarter proceeding every forecast realization. Figure 5 represents in-sample simulations of inflation, real GDP growth and nominal exchange rate respectively, in which the solid black line represents actual data. The model based projection performance is strong. The forecasts capture the spike of inflation in 2020 and track the dynamics of the output gap well. The in-sample simulation performance confirms the model calibration that reasonably matches Lao economy data.

5.3 Kalman Filter Decomposition

Kalman filtration helps us to understand factors shaping the dynamics of inflation and output gap, which are key successes of policy implementation under price stability objectives. Filtration decomposes narrative about macroeconomic development and informs policy action for the policymakers.

Historical data filtration in Figure 7 shows decomposition of real marginal cost which has comovement with inflation (Figure 6). It indicates that in the recent period there was a downward pressure on inflation from the domestic costs of production approximated by the domestic output gap. At the same time, costs of imported factors of production approximated by real exchange rate gap were putting upward pressure on inflation.

Figure 8 illustrates decomposition of inflation which was mostly shaped by inflation expectation and the persistence of its past effect. It can be noticed that the real exchange rate has positively affected inflation recently, indicating a positive relationship between expansionary (tightening) monetary policy and inflationary (disinflationary).

Figure 9 shows decomposition of output gap which was driven by demand shock and its lags, which are capturing persistence of the past effect of the factor. Recently, the output gap was increasingly driven by real exchange rate and the interest rate. The real exchange rate and the real interest rate define monetary conditions, which have some positive effect on output.

The decomposition of the monetary condition index is presented in Figure 10. The index was negative in the recent period, that is, monetary conditions were loosening, supporting demand in the economy. They were partly driven by a negative real interest rate gap but partly by an undervalued exchange rate. The latter effect was particularly strong in the most recent quarter.

5.4 Out-of-Sample Forecasts

This section presents the up-to eight-quarter ahead out-of-sample forecasts of the key macro variables on a quarterly basis (Figure 11). The report shows that inflation is observed above the target. In order to bring inflation back to the target, a tightened monetary policy is needed. This is consistent with an aggressive hike in policy rate in the first year of the forecast. Although the output gap is closing accordingly, it is observed that the gap is negative before the closure and thus brings inflation close to the target. This reflects a trade-off between the central bank's two objectives. In other words, a hike in the policy rate allows for slowing inflation, but the central bank must sacrifice some output to bring inflation back to target.

5.5 Monetary Policy Rule Experiments

This section examines a preference monetary policy rule based on the forecast performance. The policymakers can adjust their preference monetary rule according to the importance of the central bank's objectives. I conduct this exercise by adjusting the weight put on inflation, output, and exchange rate deviation. A higher weight represents a more importance of each objective. There are three scenarios in this exercise.

Scenario 1: More weight put on inflation.

Scenario 2: More weight put on output.

Scenario 3: More weight put on exchange rate.

The results shows that the monetary policy rule with higher weight on inflation (Figure 12) results in a lower forecast of inflation, exchange rate depreciation and output gap, leading them move closer to targets than in the baseline model. By putting more weight on output (Figure 13) can only reduce a small size of the exchange rate depreciation, but it doesn't cause a significant change in inflation and output forecasts when compares to the baseline. In contrast, the monetary policy rule with more emphasis on changes in exchange rate (Figure 14) leads to a higher forecast of inflation, exchange rate depreciation, and output gap comparing to the baseline, leaving them far from the targets.

6 Conclusions

This paper describes the analytical tool in supporting the Forecasting and Policy Analysis System (FPAS), which centers around a Quarterly Projection Model, tailored for the Lao economy. The model is based on the four core semi-structure gap equations, put forward by various central banks as well as the IMF country desk officers. Building an FPAS model under the simplicity characteristic of Lao economic features allows us to gain familiarity with the new process for policy discussion.

The model calibration displays transmission channels in the context of relevant structure shock consistent with theory. The results show that in order to bring inflation down to target, monetary policy has to maintain an aggressive tight stance for a certain period of time. However, the amount of output adjustment is necessary to steer inflation, indicating that the central bank has a trade-off between the two objectives (stable inflation and output growth).

The evidence from monetary policy rule experiments suggests that the BOL should put higher weight on solving inflation gap in order to achieve a greater macroeconomic stability, with less variability of inflation, changes in exchange rate and output gap. It emphasizes the importance of a more active monetary policy that centers on inflation target.

The accumulation of evidence attributed to the model in this paper underlines the importance of the analytical framework in routinely informing policymakers and in supporting transitioning to inflation targeting monetary policy regime. While the model has proven its usefulness surrounding the monetary policy analysis in Laos in general, sustaining and functioning FPAS typically requires accumulated experience over multiple years to avoid the risk of inconsistency across time. By supporting the development of institutional knowledge to extend the model over time, the FPAS model strengthens the forward-looking policy framework for the Lao economy in attaining its price stability objective.

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Appendices

Appendix Table 1. Model Equations

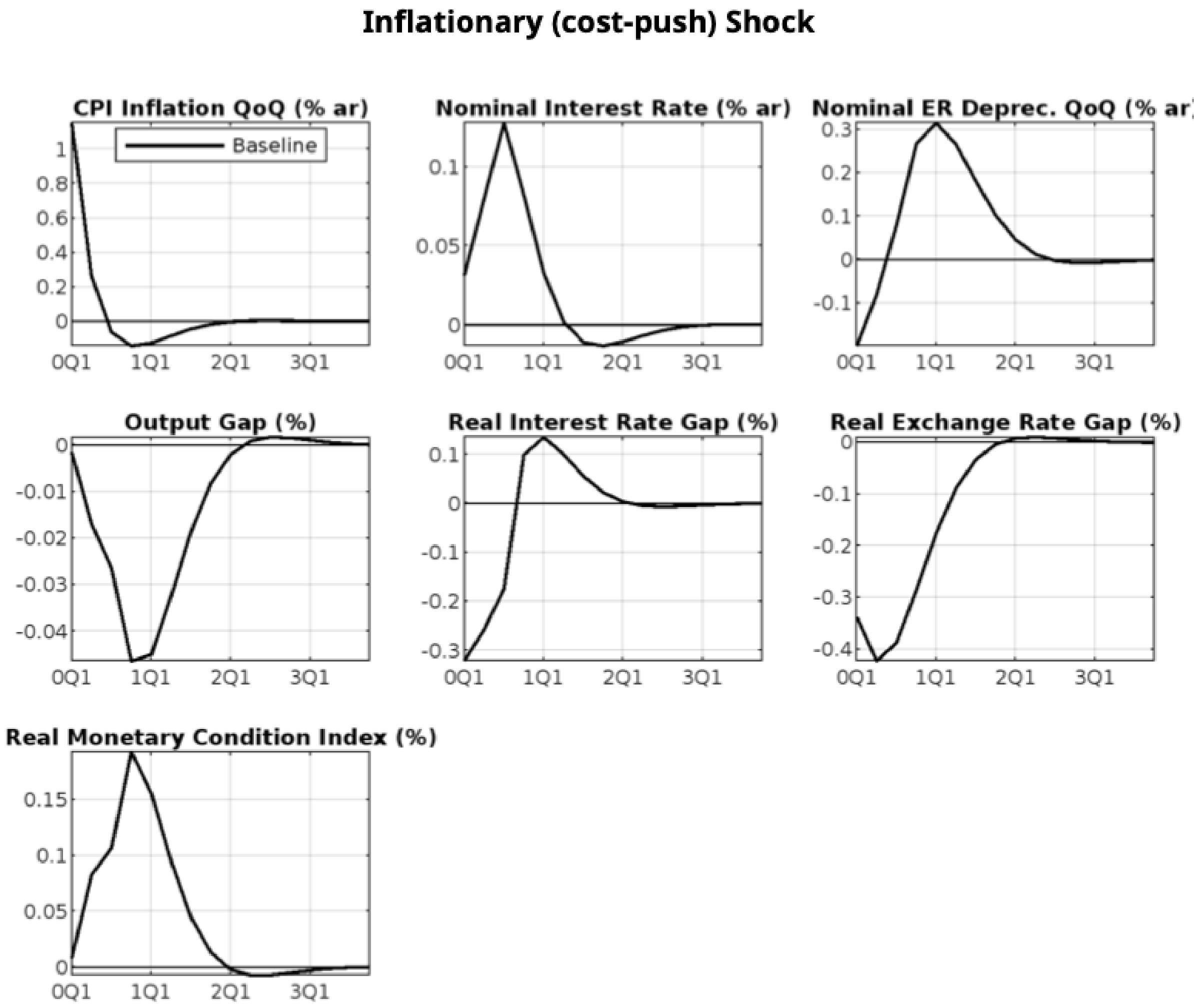
```
Aggregate demand (the IS curve)
L_GDP_GAP = b1(0.3)*L_GDP_GAP{-1} - b2(0.2)*MCI + b3(0.4)*L_GDP_RW_GAP +
SHK_L_GDP_GAP(ó=1.5);

Real monetary conditions index
MCI = b4(0.5)*RR_GAP + (1-b4(0.5))*(- L_Z_GAP);

Inflation (the Phillips curve)
DLA_CPI = a1(0.3)*DLA_CPI{-1} + (1-a1(0.3))*DLA_CPI{+1} + a2(0.3)*RMC +
SHK_DLA_CPI(ó=1.3);

Real marginal cost
RMC = a3(0.7)*L_GDP_GAP + (1-a3(0.7))*L_Z_GAP;

expected inflation
E_DLA_CPI = DLA_CPI{+1};

Monetary policy reaction function (a forward-looking Taylor-type Rule)
RS = g1(0.7)*RS{-1} + (1-g1(0.7))*(RSNEUTRAL + g2(0.7)*(D4L_CPI{+4} - D4L_CPI_TAR{+4})
+ g3(0.7)*L_GDP_GAP + g4(0.7)*(L_Z - L_Z{-1})) + SHK_RS(ó=1);

Neutral nominal policy interest rate
RSNEUTRAL = RR_BAR + D4L_CPI{+1};

Modified Uncovered Interest Rate Parity (UIP) condition
L_S = (1-e1(0.4))*L_S{+1} + e1(0.4)*(L_S{-1} + 2/4*(D4L_CPI_TAR - ss_DLA_CPI_RW(2) +
DLA_Z_BAR)) + (- RS + RS_RW + PREM)/4 + SHK_L_S(ó=3.35);

Definitions
Fisher equation (RIR)
RR = RS - D4L_CPI{+1};

Real exchange rate (RER)
L_Z = L_S + L_CPI_RW - L_CPI;

Long-term version of UIP (consistency of trends)
DLA_Z_BAR{+1} = RR_BAR - RR_RW_BAR - PREM;

Identities
DLA_GDP_BAR = 4*(L_GDP_BAR - L_GDP_BAR{-1});

DLA_Z_BAR = 4*(L_Z_BAR - L_Z_BAR{-1});

DLA_Z = 4*(L_Z - L_Z{-1});

DLA_GDP = 4*(L_GDP - L_GDP{-1});

DLA_CPI = 4*(L_CPI - L_CPI{-1});

DLA_S = 4*(L_S - L_S{-1});
```

```
D4L_GDP = L_GDP - L_GDP{-4};

D4L_CPI = L_CPI - L_CPI{-4};

D4L_S = L_S - L_S{-4};

Gaps
RR_GAP    = RR - RR_BAR;

L_Z_GAP   = L_Z - L_Z_BAR;

L_GDP_GAP = L_GDP - L_GDP_BAR;


Trends
D4L_CPI_TAR = rho_D4L_CPI_TAR(0.5)*D4L_CPI_TAR{-1} + (1-
rho_D4L_CPI_TAR(0.5))*ss_D4L_CPI_TAR(5) + SHK_D4L_CPI_TAR(ó=3);


DLA_Z_BAR = rho_DLA_Z_BAR(0.3)*DLA_Z_BAR{-1} + (1-rho_DLA_Z_BAR(0.3))*ss_DLA_Z_BAR(-
1.7) + SHK_DLA_Z_BAR(ó=0.6);


RR_BAR = rho_RR_BAR(0.3)*RR_BAR{-1} + (1-rho_RR_BAR(0.3))*ss_RR_BAR(1) +
SHK_RR_BAR(ó=0.5);


DLA_GDP_BAR = rho_DLA_GDP_BAR(0.2)*DLA_GDP_BAR{-1} + (1-
rho_DLA_GDP_BAR(0.2))*ss_DLA_GDP_BAR(7) + SHK_DLA_GDP_BAR(ó=0.75);

Foreign Sector Equations
L_GDP_RW_GAP = rho_L_GDP_RW_GAP(0.8)*L_GDP_RW_GAP{-1} + SHK_L_GDP_RW_GAP(ó=1);

DLA_CPI_RW = rho_DLA_CPI_RW(0.8)*DLA_CPI_RW{-1} + (1-
rho_DLA_CPI_RW(0.8))*ss_DLA_CPI_RW(2) + SHK_DLA_CPI_RW(ó=1.3);

RS_RW = rho_RS_RW(0.8)*RS_RW{-1} + (1-rho_RS_RW(0.8))*(RR_RW_BAR + DLA_CPI_RW) +
SHK_RS_RW(ó=1);

RR_RW_BAR = rho_RR_RW_BAR(0.3)*RR_RW_BAR{-1} + (1-rho_RR_RW_BAR(0.3))
*ss_RR_RW_BAR(0.75) + SHK_RR_RW_BAR(ó=0.5);

RR_RW = RS_RW - DLA_CPI_RW;

RR_RW_GAP = RR_RW - RR_RW_BAR;

DLA_CPI_RW = 4*(L_CPI_RW - L_CPI_RW{-1});
```

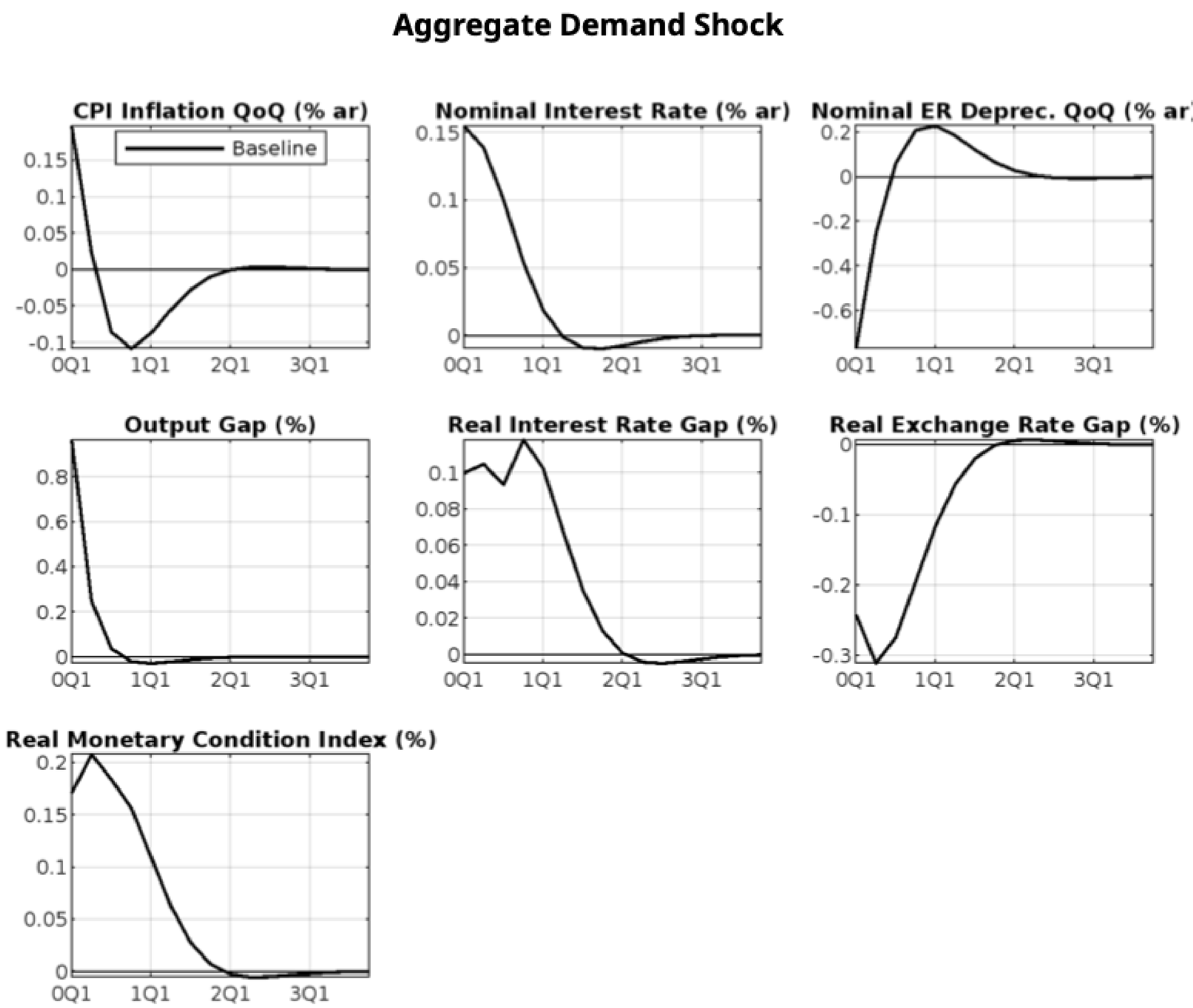
Appendix Table 2. Parameters

Parameter	Value	Parameter	Value
IS curve		Steady-state	
b1	0.3	ss_DLA_CPI_RW	2
b2	0.2	ss_D4L_CPI_TAR	6
b3	0.4	ss_DLA_Z_BAR	-1.7
b4	0.5	ss_RR_BAR	0.5
Phillips curve		ss_DLA_GDP_BAR	7
a1	0.3	ss_RR_RW_BAR	0.75
a2	0.3	Convergence of trend variables to their steady-state levels	
a3	0.7	rho_D4L_CPI_TAR	0.5
UIP condition		rho_DLA_Z_BAR	0.3
e1	0.4	rho_RR_BAR	0.3
Taylor rule		rho_DLA_GDP_BAR	0.2
g1	0.7	rho_L_GDP_RW_GAP	0.8
g2	0.7	rho_DLA_CPI_RW	0.8
g3	0.7	rho_RS_RW	0.8
g4	0.7	rho_RR_RW_BAR	0.3

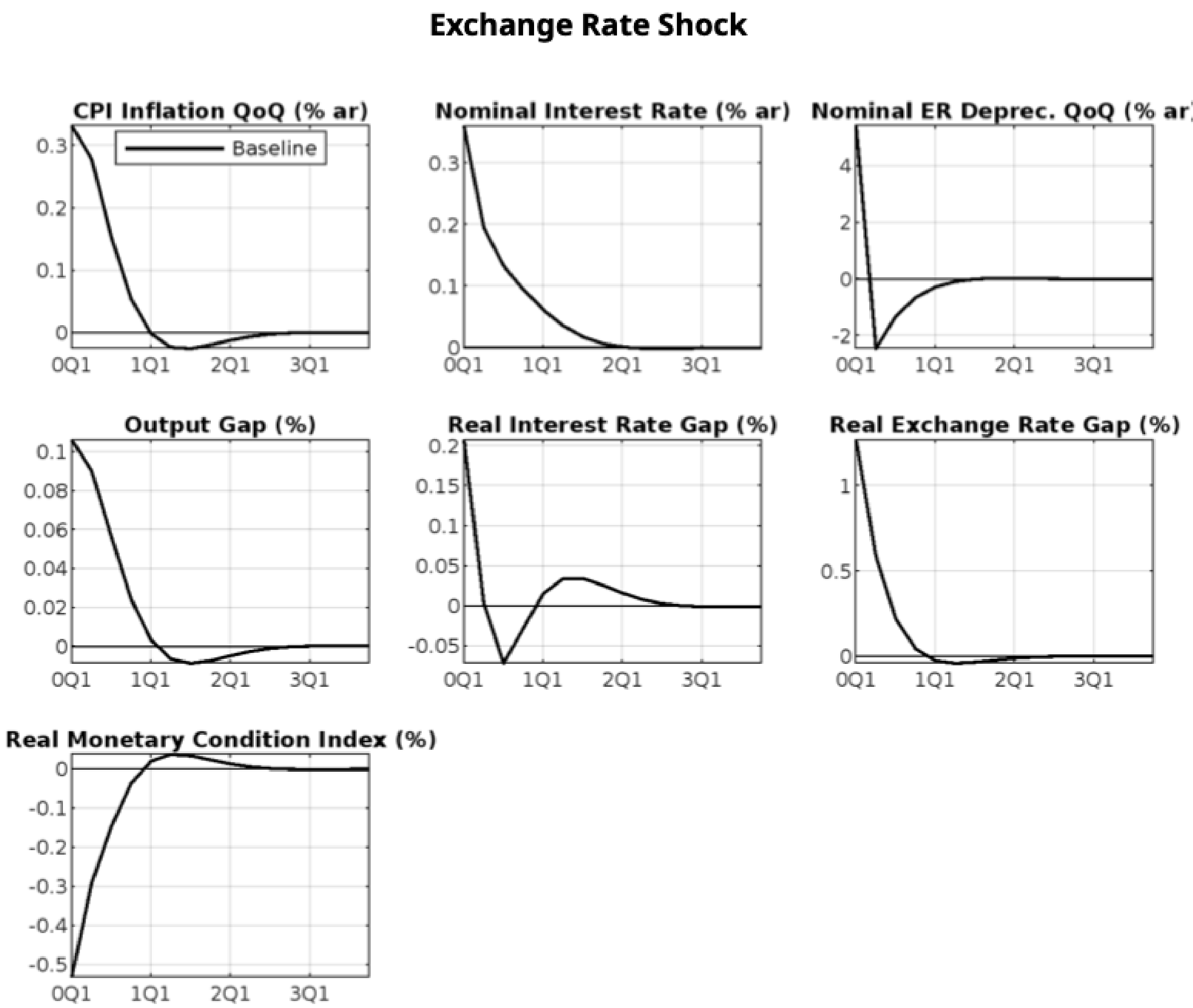
Appendix Figure 1. Impulse Response to a Cost-Push Shock



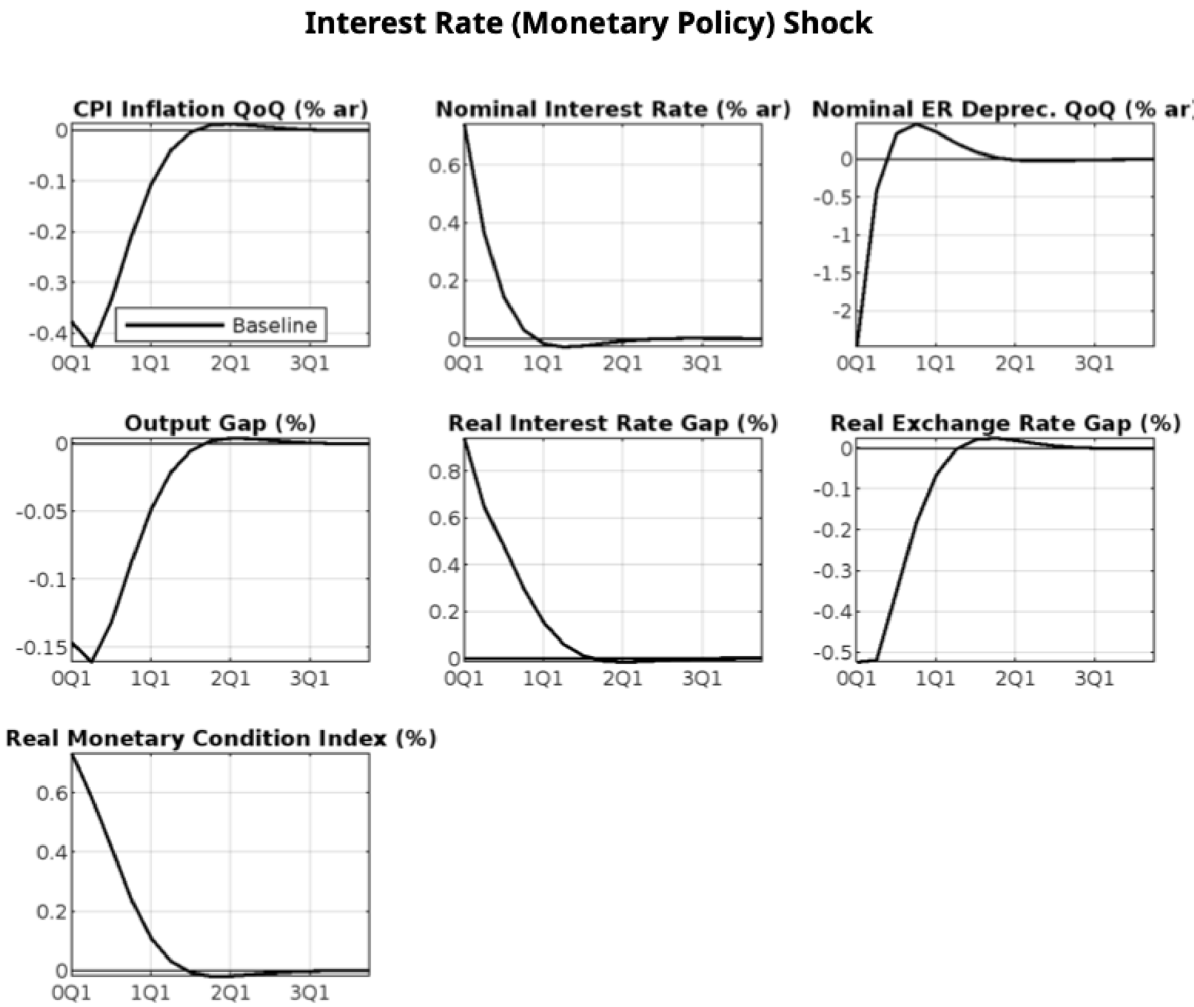
Appendix Figure 2. Impulse Response to an Aggregate Demand Shock



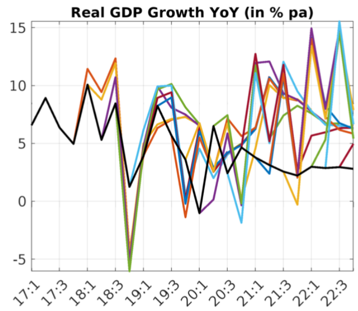
Appendix Figure 3. Impulse Response to an Exchange Rate Shock

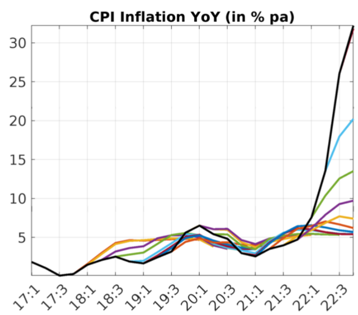


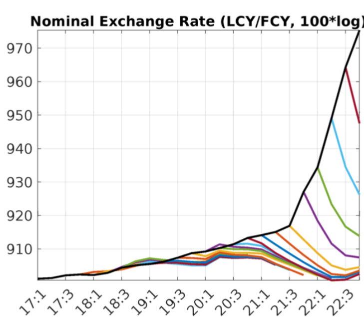
Appendix Figure 4. Impulse Response to an Interest Rate Shock



Appendix Figure 5. In-Sample Forecasts

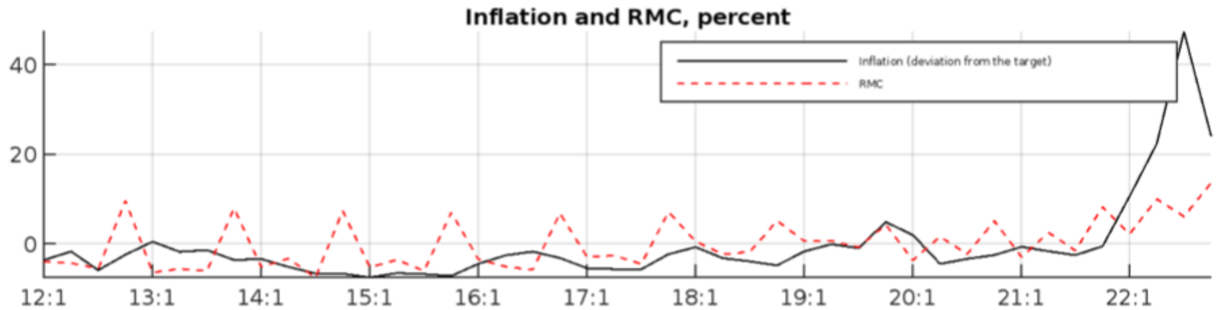




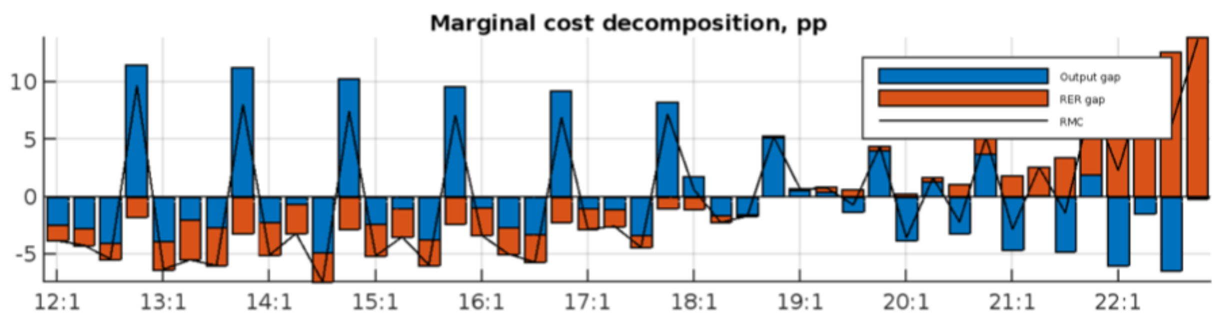


Remark: The black solid lines represent the actual data.

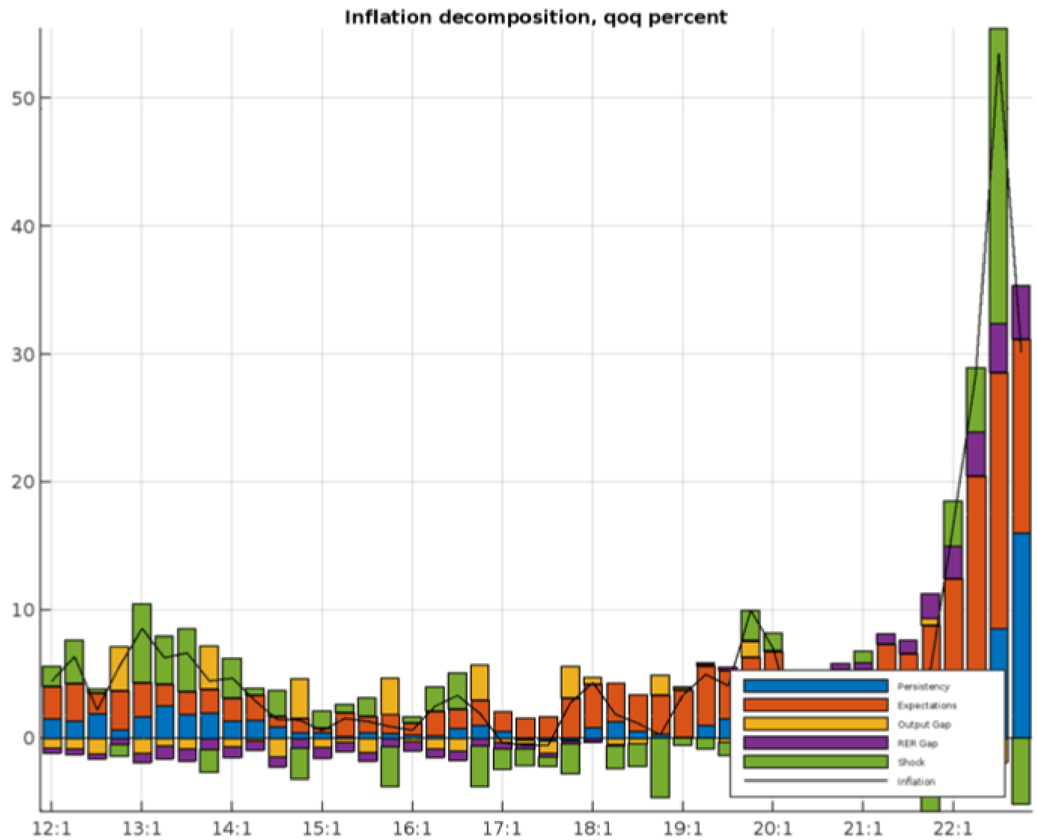
Appendix Figure 6. Movement between Inflation and the Real Marginal Costs



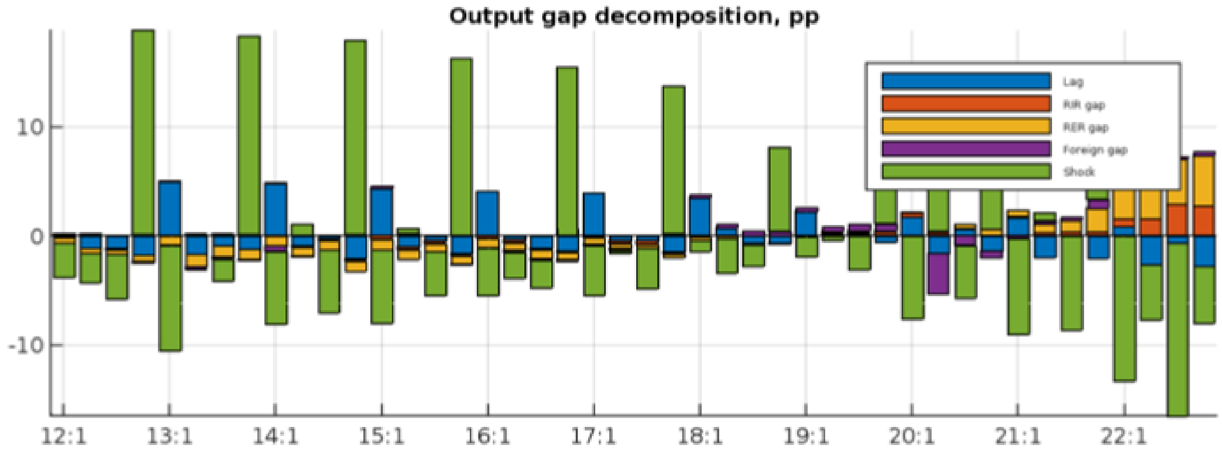
Appendix Figure 7. Kalman Filter Decomposition of Real Marginal Costs



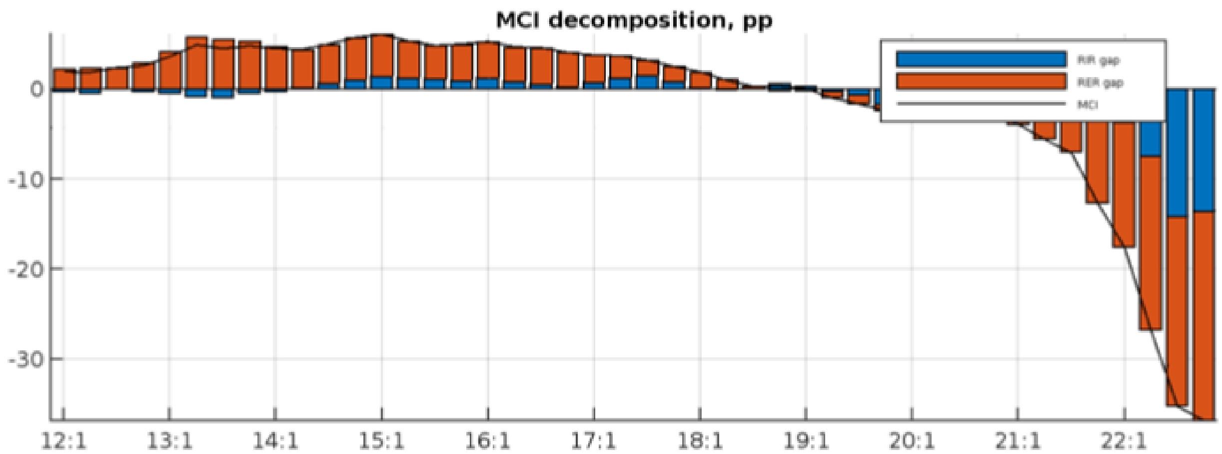
Appendix Figure 8. Kalman Filter Decomposition of Inflation



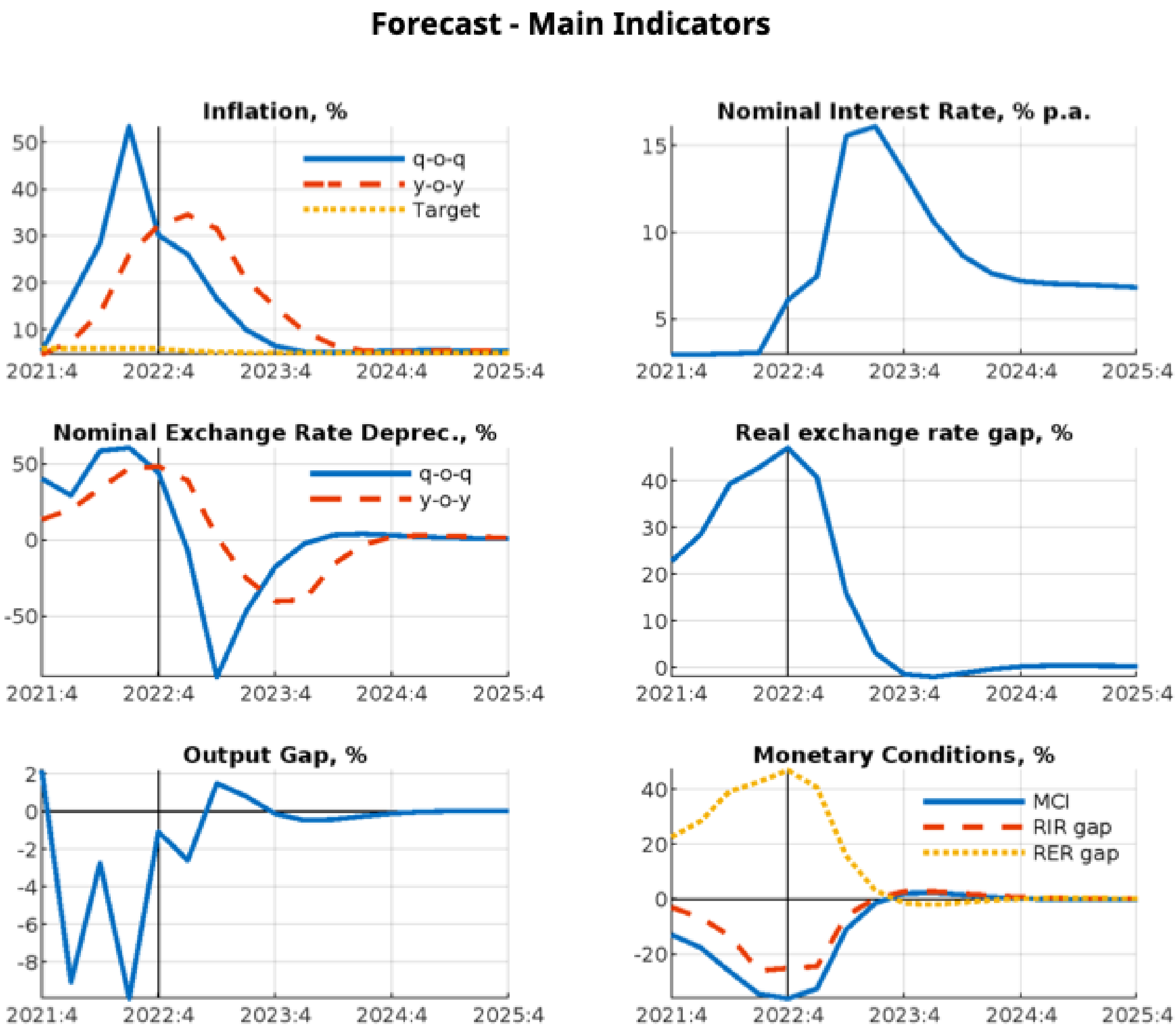
Appendix Figure 9. Kalman Filter Decomposition of output



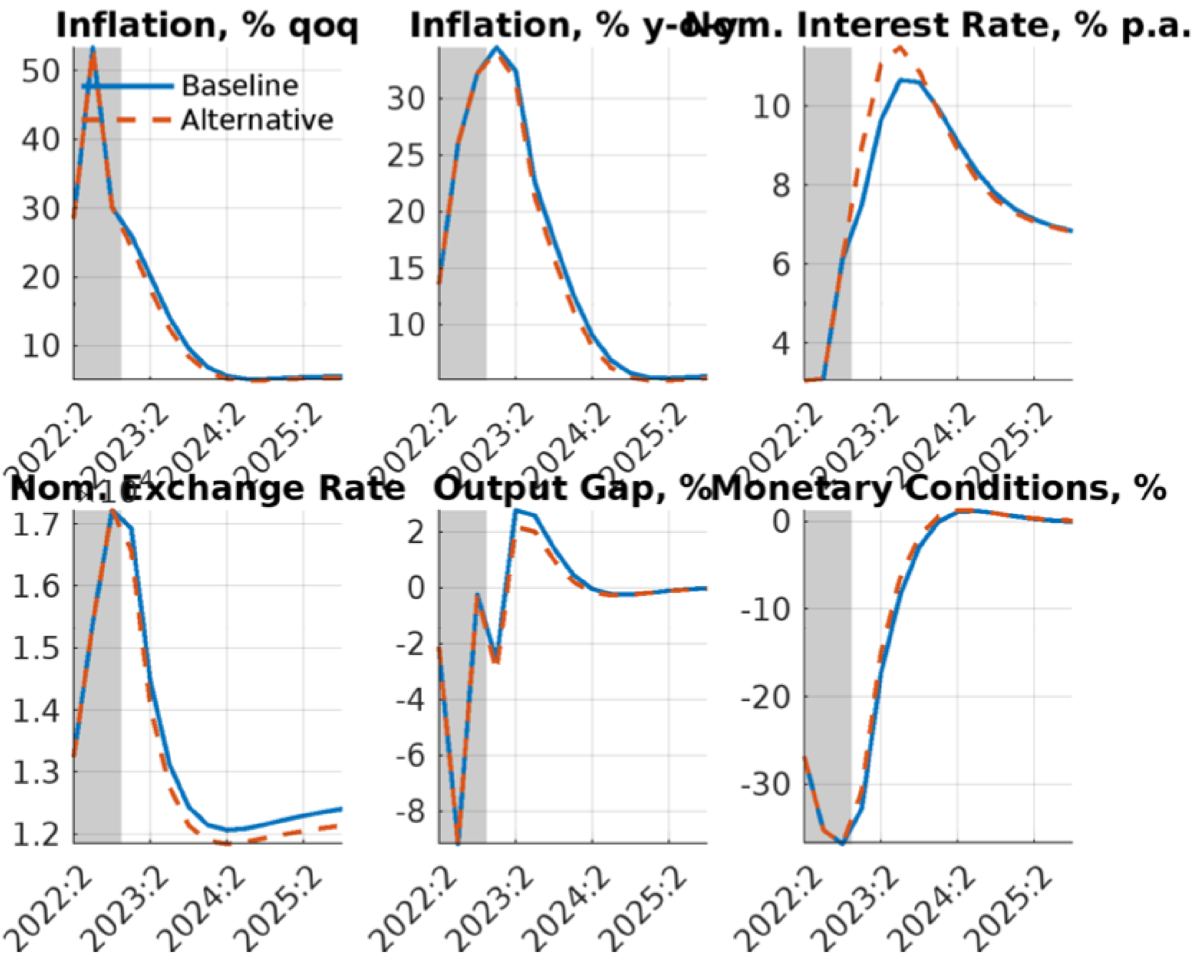
Appendix Figure 10. Kalman Filter Decomposition of Monetary Condition Index



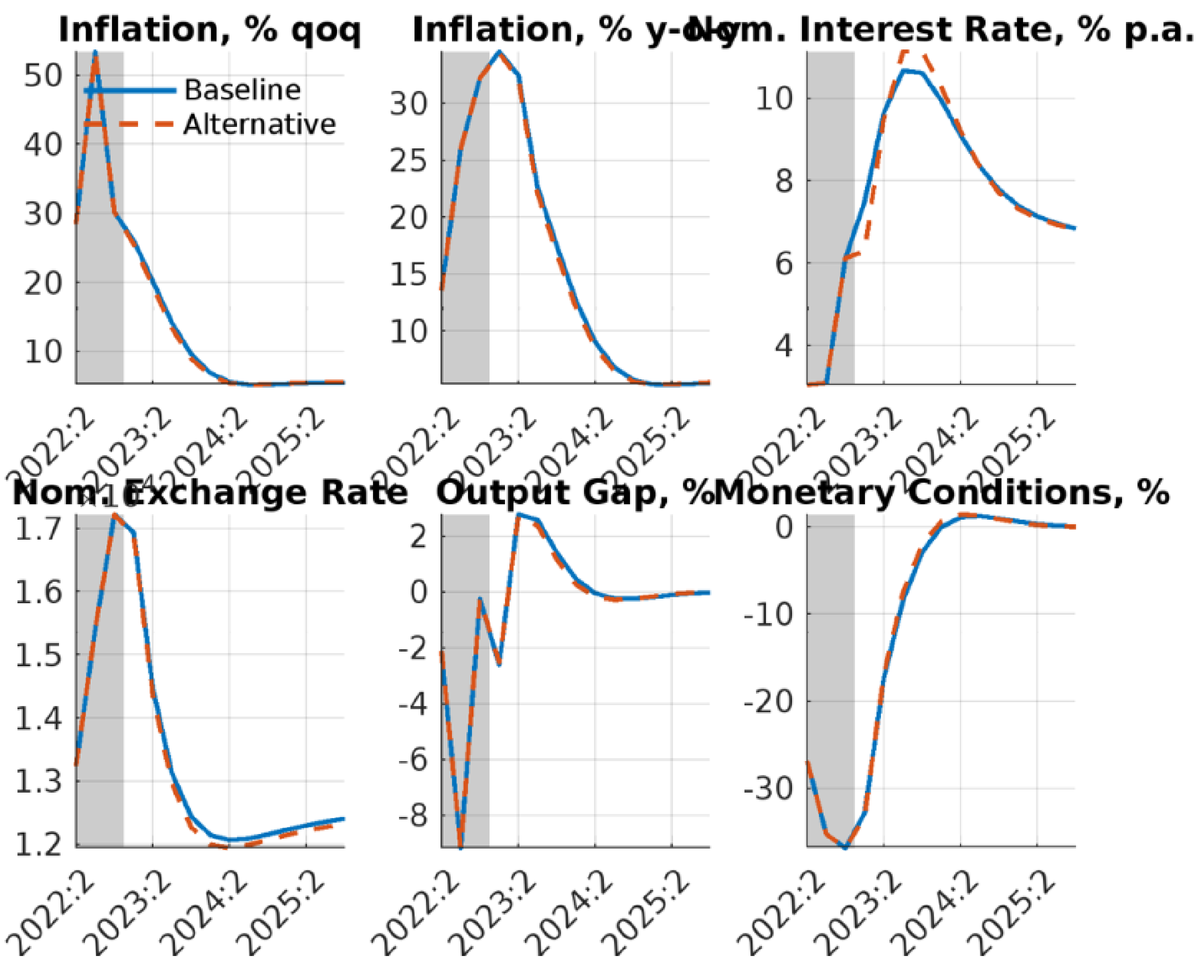
Appendix Figure 11. Out-of-Sample Forecast



Appendix Figure 12. Alternative Forecasts (Scenario 1. More Weight Put on Inflation)



Appendix Figure 13. Alternative Forecasts (Scenario 2. More Weight Put on Output)



Appendix Figure 14. Alternative Forecasts (Scenario 3. More Weight Put on Exchange Rate)