MODELLING THE IMPACT OF EXTERNAL SHOCKS ON LESOTHO[1]

A. Introduction

1. As a small open economy with an open capital account and a fixed exchange rate, Lesotho has a limited range of policy levers available for managing shocks. Given its size and location, the country is also vulnerable to a broad range of external shocks—from changes in external demand to swings in commodity prices—alongside domestic supply shocks linked to climate change. This multitude of shocks force various trade-offs for policymakers between inflation, growth, employment, and fiscal sustainability.

2. This paper uses an extended semi-structural New Keynesian quarterly projection model (QPM)—similar to forecasting and policy analysis system (FPAS) tools used in central banks—to simulate shocks and analyze monetary and fiscal policy interactions in Lesotho. The model features Lesotho's cross-country linkages with South Africa and a currency peg with the South African rand. The key objectives of this framework are to develop a forward-looking framework that can (i) model the impact of shocks on an economy calibrated to mimic that of Lesotho, and (ii) inform the monetary and fiscal policy decisions given the interaction between policies. With this, we can assess the viability of traditional QPM-type models and whether they can support forward-looking analysis and policy formulation in the context of Lesotho. Section B provides an overview of the policy environment in Lesotho; Section C provides an overview of potential output estimates; Section D sets out the main features of the modelling framework, including the calibration any key results; Section E sketches a policy-relevant scenario for Lesotho, and Section F concludes with some policy implications.

B. Macroeconomic Institutions and Arrangements in Lesotho[2]

3. Lesotho's history and geography has meant that it has maintained very close economic and financial ties with South Africa. When Botswana, Eswatini, and Lesotho gained independence in the 1960s, they were already members of a common customs area—the Southern African Customs Union (SACU)—and also de facto members of a currency union with South Africa.[3] The currency union was formally established on December 5, 1974, with the signing of the Rand Monetary Area (RMA) agreement, and subsequently revised in April 1986 to establish the Common Monetary Area (CMA) of Eswatini, Lesotho, and South Africa. Under the terms of the CMA

[1] Prepared by Zviad Zedginidze.

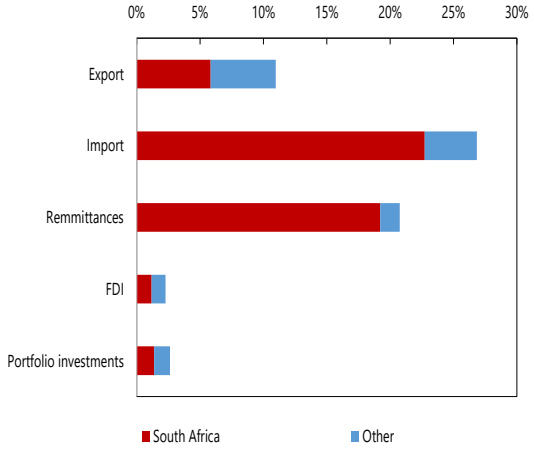
[2] This section draws on the Selected Issues Papers of the 2005 and 2022 Article IV Consultations for the Kingdom of Lesotho.

[3] SACU was established in 1910, with membership comprising South Africa, Bechuanaland (now Botswana), Basutoland (now Lesotho), Namibia, and Swaziland (now Eswatini). In 1921, after the establishment of the South African Reserve Bank, the South African pound became the sole medium of exchange and legal tender across all territories.

Agreement, the South African rand would continue to be legal tender in Eswatini and Lesotho, which would also have the right to issue their own national currencies.

4. Trade and financial linkages with South Africa are sizeable (Figure 1). In 2022, trade with South Africa amounted to 25 percent of GDP, with more than half of Lesotho's exports were to and 80 percent of imports came from their neighbor. Export markets are relatively more diversified with rough diamonds and textiles primarily exported to Europe and Unites States. Remittances are the largest component of financial flows, accounting for 20 percent of GDP, given the significant presence of Basotho workers in South Africa. Bilateral portfolio and FDI linkages are small with holdings of less than 5 percent of GDP. Portfolio investments are mostly in public debt securities held by South African residents.

Figure 1. Trade and Financial Linkages with South Africa, 2018–2022
(Percent of GDP)



5. Under the rules of the CMA, both the South African rand and the Lesotho loti (plural: Maloti) are legal tender in Lesotho and pegged at par.[4] Article 2 of the CMA Agreement permits SACU members to issue national currencies. Bilateral agreements with South Africa define the areas in which their currencies are legal tender. In general, the local currencies issued by the three members are legal tender only in their respective countries. Under the bilateral agreement between Lesotho and South Africa, both countries are required to allow authorized dealers within their territories to convert, at par, notes issued by the Central Bank of Lesotho (CBL) or the South African Reserve Bank (SARB) without restriction and subject only to normal handling charges.[5] Similar arrangements exist between the other two CMA members and South Africa.

6. The CBL is required to maintain foreign reserves equivalent to the total amount of maloti currency that it issues.[6] Market confidence in the system is high, as indicated by the low share of rand-denominated bank deposits (about 2 percent). Given close trade links with South Africa, the arrangement has served Lesotho well, but it obviously imposes tight restrictions on monetary policy. In particular, the CBL needs to maintain a reserves position that will prevent the

[4] Lesotho's exchange rate arrangement under the CMA shares certain characteristics of a currency board but differs in one important respect. All maloti currency issued by the CBL is backed entirely by the central bank's foreign exchange reserves. Such an arrangement has the advantage of insulating monetary policy from possible political interference and hence helps enhance the credibility of macroeconomic policies. However, currency boards are also typically prohibited by law from acquiring any domestic assets, so that all the currency it issues is automatically backed fully by foreign reserves. There is no such legal restriction for Lesotho under the CMA.

[5] Article 2 of the Lesotho–South Africa bilateral agreement.

[6] Article 4 of the Lesotho–South Africa bilateral agreement.

possibility of a self-fulfilling confidence crisis, in which loti cash and deposit holders would simultaneously try to convert their holdings into rand to protect against a depreciation. Such reserves may comprise the CBL's holdings of rand balances, the rand currency the CBL holds in a Special Rand Deposit Account with the SARB, South African government stock (up to 10 percent of total reserves), and its investments with the Corporation for Public Deposit in South Africa.

7. To enhance buffers and to allow for some domestic liquidity control, the CBL maintains a high reserve coverage of monetary aggregates. The coverage ratio is 100 percent of M1 plus callable deposits ("M1 plus").[7] Reserves coverage is, therefore, broader than the monetary base and covers transferable monetary asset more broadly. Even when applying this wider measure of short-term bank liabilities, coverage has remained comfortably above 100 percent (125 percent as of December 2022), giving the central bank significant firepower to defend the peg.

8. While the exchange rate peg eliminates a key lever for demand management, it provides a nominal anchor and occasional constraint on spending. Exchange rate and monetary policy cycles in Lesotho are driven entirely by South African monetary and exchange rate policies. In the absence of a formal fiscal anchor, enforcement of a net international reserves (NIR) target has acted as a spending brake when SACU transfers dip, such that changes in reserves (and government deposits) closely track changes in SACU transfers. This has led to conflict between the Ministry of Finance and the Central Bank of Lesotho (CBL) on several occasions.

9. The government has established some principles to guide the conduct of fiscal policy. These principles are documented in the government's budget strategy paper but are unenforced. Consequently, public expenditure, as managed by the Ministry of Finance (MOF), has typically been more discretionary than rules-based. For example, despite the specification of several budget principles (Budget Strategy Papers), budgets have consistently ignored them.

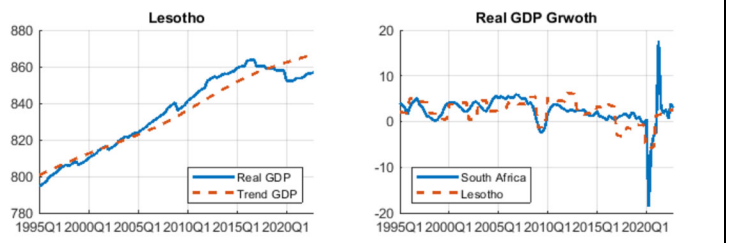
C. Estimating Potential Output

10. Potential output in Lesotho is estimated using a multivariate filter (MVF), to help locate the country's position in its business cycle (Figure 2). The model-consistent estimation of historical trend real GDP shows that Lesotho's business cycle is strongly linked to that of South Africa, but with greater volatility. In this way, potential growth in Lesotho combines South Africa-specific factors (common factors) with those specific to the country. The latter include , long standing structural challenges related with governance, fiscal management, and the delivery of public services—all captured in lower total factor productivity growth. South African-specific factors are captured in trade, remittances, capital, and financial and SACU flows. The MVF shows that potential growth has been decelerating over the recent decade and that at 2 percent, the current estimate of potential growth is below the rate needed to close the income gap with other CMA

[7] The coverage ratio is significantly higher than under a classical currency board, which would provide for 100 percent coverage of the monetary base and let domestic currency fluctuate with the supply and demand for foreign currency.

members. Furthermore, despite some rebound in growth, a negative output gap persists since the pandemic started.

Figure 2. Potential GDP Growth



D. A Macroeconomic Model of Lesotho

The Modeling Framework

11. The framework builds off a standard semi-structural New Keynesian model with an aggregate demand (or IS) curve, a price-setting (or Phillips) curve, a version of the uncovered interest parity condition, and a monetary policy reaction function (Berg and others, 2006a; 2006b). To capture Lesotho's interlinkages with South Africa and allow for scenarios which can model the impact of SARB's policy choices, the model utilizes a layered approach that introduces the South African economy as a gateway for Lesotho to the rest of the world. Thus, the simulation model consists of two modules: (i) a Lesotho module, and (ii) a South Africa module, which in turn incorporates the rest of the world. To this end, the model draws in part from the multicounty approach in Andrle and others (2015), Laxton and Pesenti (2003), Kumhof and Laxton (2007).

12. The model describes dynamic interaction of Lesotho's key macroeconomic aggregates and propagation channels for economic developments in South Africa. With the objective to maintain exchange rate parity and with a largely open capital account, the model features a monetary policy reaction function that closely links CBL rate with that of ZAF. Foreign exchange reserves in the model are directly impacted by fiscal policy due to leakages from government spending on imports and by interest rate deviations from the SARB's policy rate. The risk premium in turn depends on the deviation of foreign reserves from its desired level and feeds into real economy via lending rates.

13. All variables in the model are expressed in "gap" terms, as percentage deviations from their trend (or equilibrium) levels, where the latter are estimated jointly in the model. This has

the advantage of reflecting the information contained in trend-cycle interactions in the estimates of trends (as opposed to, for instance, using the Hodrick-Prescott pre-filtering applied to the dataset before analysis or modeling). More broadly, these "gaps" are assumed to be influenced by the business cycle, while trends are influenced by the underlying structural characteristics of the economy and thus driven by structural policies. The disturbance terms (denoted by ε) represent the shocks hitting every macroeconomic variable and are introduced in every behavioral equation with respective subscripts. Finally, the model is in quarterly frequency.

The Model Equations

14. At its core, the model is characterized by behavioral relations which describe the structure of the system and the shock propagation mechanisms. There are four key sets of behavioral equations for (i) aggregate demand (output), (ii) aggregate supply (inflation), (iii) monetary policy (interest rates/exchange rates), and (iv) foreign exchange reserves. These are supplemented with identities and other key variable definitions. While most of these equations could be derived from microeconomic principles, they do not strictly adhere to micro foundations, which provides flexibility in adding country-specific features.

15. Aggregate demand is modeled as an investment-savings (IS) curve:

$$\hat{y}_t^{LSO} = \alpha_1 \hat{y}_{t-1}^{LSO} + \alpha_2 E_t \hat{y}_{t+1}^{LSO} + \alpha_3 \hat{y}_t^{ZAF} - \alpha_4(\alpha_5 \hat{r}_t^{LSO} + (1-\alpha_5)\hat{z}_t^{LSO}) + \alpha_6 \hat{G}_t^{LSO} + \varepsilon_t^{y,LSO}$$

This equation relates the output gap ($\hat{y}_t^{LSO}$) to monetary conditions represented by interest rates ($\hat{r}_t^{LSO}$) and real effective exchange rate ($\hat{z}_t^{LSO}$) gaps. In addition, the equation also takes into account Lesotho's strong linkages to South Africa and incorporates the ZAF output gap ($\hat{y}_t^{ZAF}$) to capture trade and remittances. The degree of persistence in aggregate demand is represented by its lagged value ($\hat{y}_{t-1}^{LSO}$) and the economic outlook by its lead ($E_t \hat{y}_{t+1}^{LSO}$). Furthermore, given the importance of fiscal policy for the economy, government spending in the form of a shock ($\hat{G}_t^{LSO}$) is also incorporated in the equation.

16. Aggregate supply equation is modified Phillips Curve with country specific features:

$$\pi_t^{LSO} = \pi_t^{ZAF} + (\omega_1^{LSO} - \omega_1^{ZAF})\pi_t^{oil} + (\omega_2^{LSO} - \omega_2^{ZAF})\pi_t^{food} + \beta_1 \hat{y}_t^{Lso}$$

$$+\varepsilon_t^{u,LSO} + \rho\varepsilon_{t-1}^{u,LSO} + \varepsilon_t^{\pi,LSO}$$

Given Lesotho's close links with South Africa, headline inflation (π_t^{LSO}) is driven largely by that of South Africa (π_t^{ZAF}) adjusted for differences in food and fuel weights between the two CPI baskets. In addition, to account for the domestic economy's marginal costs, the output gap—along with long-lived persistent shock ($\varepsilon_t^{u,LSO}$)—are also included. For example, $\varepsilon_t^{u,LSO}$ can represent energy price shocks that are capable of having a persistent impact on the economy.

17. With the objective to maintain exchange rate parity with the rand, the monetary policy reaction function boils down to a simple rule of tracking SARB's policy rate.

$$S_t^{LSO} = S_t^{ZAF} + \varepsilon_t^{S,LSO}$$

$$i_t^{LSO} = i_t^{ZAF} + prem_t^{LSO} + \varepsilon_t^{i,LSO}$$

The CBL has explicit operating targets to keep the parity with the rand, which—under an open capital account—requires rates closely track those in South Africa[8]. In order to achieve alignment, the CBL policy rate (i_t^{LSO}) is assumed to equal SARB's policy rate (i_t^{ZAF}) plus a small wedge that accounts for currency risk premia ($prem_t^{LSO}$) for the loti (S_t^{LSO}) versus the rand (S_t^{ZAF}).

18. Foreign exchange reserves are determined by government spending and the exchange rate:

$$\widehat{res}_t^{LSO} = res_t^{LSO} - \overline{res}_t^{LSO}$$

$$\widehat{res}_t^{LSO} = \delta \widehat{res}_{t-1}^{LSO} - f_1 \hat{G}_t^{LSO} - f_2 \hat{Z}_t^{LSO} + \varepsilon_t^{res}$$

$$\overline{res}_t^{LSO} = \rho \overline{res}_{t-1}^{LSO} + (1-\rho)\overline{res}_{ss}^{LSO}$$

The deviation of international reserves (expressed in terms of months of import coverage, $\widehat{res}_t^{LSO}$) from desired levels ($\overline{res}_t^{LSO}$) is linked to both government spending and pressure on the exchange rate, which is specified using the real effective exchange rate gap. Lagged reserve values ($\widehat{res}_{t-1}^{LSO}$) with the coefficient, δ, close to one[9] capture the accumulation of reserves between periods (similar to a capital accumulation equation). The desired level of reserves is assumed to follow an autoregressive process that converges to its steady-state value, ($\overline{res}_{ss}^{LSO}$)[10].

19. Currency risk premium is determined by the deviation of international reserves from desired levels:

$$\widehat{prem}_t^{LSO} = \theta(\overline{res}_t^{LSO} - res_t^{LSO}) + \varepsilon_t^{prem,LSO}, \qquad d\theta/d(res) > 0$$

Given the role reserves play to provide confidence in the peg, the currency risk premium ($\widehat{prem}_t^{LSO}$)—measured in terms of percentage point deviation from its trend value—depends negatively on the deviation of reserves from desired levels. The risk premium, in turn, impacts the real economy through its impact on market lending rates, indirectly linking the reserve position to the real economy. As reserves fall below desired levels, this applies pressure on lending rates and tightens monetary conditions, implying limited room for independent monetary policy to stabilize output under the peg.

[8] However, due to structural liquidity in the interbank market and in the absence of adequate short-term liquidity management facilities at the CBL, the CBL policy rate has limited influence on the market rates. That said, should the deviation between the policy rates be large enough, this is likely to put pressure on the peg.

[9] Inherent dependence of reserves to the expected path of government spending and exchange rate pressures suggests the δ to be less than 1 that ensures stationarity of the model (Schmitt-Grohé and Uribe 2002).

[10] Assessing reserves adequacy for Credit-Constrained Economies (ARA for CCEs) act as a reference point for calibration of the desired level of reserves, which as March-2023 is 4.7 month of import coverage.

20. The South Africa module also has four main equations that link Lesotho with the rest of the world. These includes: (i) investment-saving (IS) curve for the output gap; (ii) an open economy forward-looking Phillips curve for inflation; (iii) an uncovered interest rate parity (UIP) condition for the exchange rate, and (iv) a forward-looking monetary policy rule. These equations form a canonical small open economy model with inflation targeting and flexible exchange rate and allow for a model consistent specification of Lesotho's external environment. In this way, scenarios featuring external shocks and policy decisions, for example, by the SARB, can be modelled.

Calibration and Estimation

21. Model parameters are largely calibrated. In the absence of sufficient time series for robust parameter estimation and given structural changes in the economy, calibration is commonly used to parameterize semi-structural models of this type (Maehle and others, (2021)). Specifically, the calibration is informed by impulse response analysis, the Kalman filter, and other QPM models.[11] The advantage of a calibrated model is that it allows for the inclusion of forward-looking factors rather than reflect solely historical patterns. Moreover, calibration serves to facilitate a deeper understanding of the model's properties.

22. Some parameters of the model are estimated using Bayesian methods (Figure 3). As in Smets and Wouters (2004), for example, Bayesian methodology involves estimating model parameters based on prior density, evaluation of data likelihood given the parameters and the model. The analyst first approaches the data with a set of prior views on the values of the parameters of their model, and then asks whether those views ought to be modified in light of the data at hand.

23. The estimations results show prior and posterior distributions. As the results show, posterior modes for most of the parameters are close to the prior, confirming the calibration values. Coefficient with fiscal impulse in the output gap equation ranges from 0.25 to 0.35, with the mean close to a prior value of 0.3. This suggests relatively lower fiscal multiplier in Lesotho compared to other countries. Relatively low value of fiscal multiplier can be explained by the large size of public spending In Lesotho relative to GDP and thus diminishing return along with large share of historically less inefficient spending.

Impulse Response Analysis

24. The results from simulations confirm the model's desirable properties. To study the model properties impulse responses to policy shocks on (i) the SARB's monetary policy rate, (ii) CBL's reaction on the SARB's policy rate, and (iii) government spending are examined. All variables are expressed as deviations from that steady state and the starting point for each simulation is that steady state. In this way, the starting values of all variables are set to zero when the shock takes

[11]Calibrated parameters are in part based on other QPM models by Benes (2015), Andrle (2009), Alichi (2008), and QPM models of South Africa by Botha et al (2017), Steinbach (2015) and Jager (2007).

place. Alongside studying model properties, understanding how shocks propagate through the main transmission channels will be of particular use for policy making.

- **A one percentage point unanticipated increase in the SARB's monetary policy rate, followed by an immediate increase in the CBL's monetary policy rate** (Figure 4). The initial increase in policy rate is transmitted to the market lending rate by the similar magnitude. The real market lending rate increases even more as inflation expectations fall compounding the impact of nominal rate increase on real rates. A higher SARB rate suggests rand appreciating against major trading partner's currencies, leading to short-lived appreciation of Lesotho's NEER and REER by 0.6 and 0.9 of a percentage point, respectively. Higher real rates and a stronger currency result in weaker external demand, which widens the output gap by 0.6 of a percentage point relative to trend and puts downward pressure on inflation and inflation expectations.

- **A delayed (2-quarter) hike in the CBL policy rate following the change in SARB's policy rate** (Figure 5). As Figure A3 shows, the result would be declining international reserves amid mounting pressures on the exchange rate**.** Falling reserves would affect the currency risk premium, which in turn would raise long-term interest and lending rates. Thus, the CBL's delayed reaction would cause the output gap to widen as the growth falls and risk peg. The results are in line with empirical studies on monetary policy shocks in countries with peg exchange rates. This analysis of this shock highlights the need CBL to follow SARB policy rate within the committed objective to maintain the hard peg to South African rand.

- **A government spending shock is simulated as one percentage point of GDP increase in fiscal deficit** (Figure 6). Aggregate demand increases on impact. However, due to the large import share, the output gap increases only by 0.3 of a percentage point of GDP. Moreover, international reserves fall by 0.5 of a month of import coverage before it recovers as the spending shocks dissipates. Lower reserves, in turn, raise the currency risk premium by almost 0.5 of a percentage point, leading to an increase in market interest rates, which compensates for the positive impact of extra public spending on real growth. Following the initial increase in the output gap, it falls below zero suggesting even lower long-term effects of government spending on economic growth. The negative effect of the fiscal impulse on market rates--and consequently output growth—is stronger the lower the reserves are. Therefore, higher reserve buffers would insulate fiscal policy from affecting the currency risk premium and, subsequently, real economy. In addition, the direct impact of the fiscal impulse on the real economy is muted by spending inefficiencies.

E. A Policy-Relevant Scenario

25. This section examines a composite shock that simulates weaker external demand for Lesotho and tighter global financial conditions (Figure 7). The richness and flexibility of the framework is demonstrated using a scenario where (i) the output gap in South Africa widens by 1 percentage point, and (ii) the U.S. Fed funds rate is higher by 0.5 of a percentage point for two quarters. This is a counterfactual scenario designed to capture SARB's policy choices. The SARB's

monetary policy reaction function is endogenously determined and reflects trade-offs between the country's growth and inflation objectives. The relevance of SARB's monetary policy reaction on Lesotho is key, given that the CBL follows suit.

- **SARB raises rates.** Following the tightening of global financial conditions, SARB—anticipating FX pressures and the resulting impact on inflation—raises the rate but to a lesser extent than inflation expectations, as the output gap widens on the back of the domestic shock. The nominal exchange rate depreciates while its impact on the real effective exchange rate is relatively muted, as inflation rises compared to the rest of the world.

- **SARB lowers rates.** If SARB eases monetary policy, the exchange rate adjusts to account for lower demand, thus allowing relatively higher inflation and a somewhat muted demand shock. However, inflation pressures (due to oil and food prices, unanchored expectations or power outages) might limit the scope for monetary policy easing as further depreciation in exchange rate may endanger inflation target and elicit wage adjustments. In this case, the external demand shock to Lesotho will be more severe. To restore competitiveness, fiscal adjustment would be advisable by limiting wage growth below inflation and thus increase productivity.

- **Fiscal space.** The room for fiscal stimulus to help prop up domestic demand would depend on the level of reserves and the efficiency of spending. The optimal policy mix might require a combination of adjustment to the shock and structural reforms to improve spending efficiency.

F. Policy Implications

26. This framework has allowed for the modelling of external shocks and their impact on the Basotho economy. In this way, monetary and fiscal policy analysis can be enriched by accounting for linkages with South Africa and their impact on reserves and the domestic output gap. The scenarios demonstrate policy trade-offs in response to shocks, for example, between accumulating reserves and providing space to fiscal and monetary policy to stabilize output. Given the frequent and often large shocks hitting the economy, understanding how monetary and fiscal policies interact—and what policy trade-offs are involved—are key for designing the optimal policy mix.

27. The model highlights that while the peg insulates domestic monetary policy from political interference and thus lends credibility to the price stability objective, it amplifies the transmission of external (South African) shocks. It also increases Lesotho's exposure to developments in international markets despite limited market access and integration with the rest of the world. The model shows that fiscal policy affects the output gap through two channels: (i) directly by changing the aggregate demand; and (ii) indirectly by exerting pressure on reserves because of leakage on imports and affecting currency risk premium and lending rates. Fiscal multiplier is estimated to be weak. The scenario analysis show that precautionary reserve buffers enhance autonomy of fiscal policy to stabilize the output gap. In an environment with stretched

reserves and without independent monetary policy, domestic shocks are found to be prolonged and severe.

28. Effective coordination of fiscal and monetary policies in the context of a currency peg in a small open economy such as Lesotho also requires forward-looking analysis. Changes in the fiscal policy affect the economy with a time lag. Thus, the fiscal policy response in the face of a shock should be based on macroeconomic forecasts. Similarly, setting an optimal target for international reserves should be guided and conditioned on fiscal policy.

G. Key Results

Figure 3. Bayesian Estimation of Key Parameters

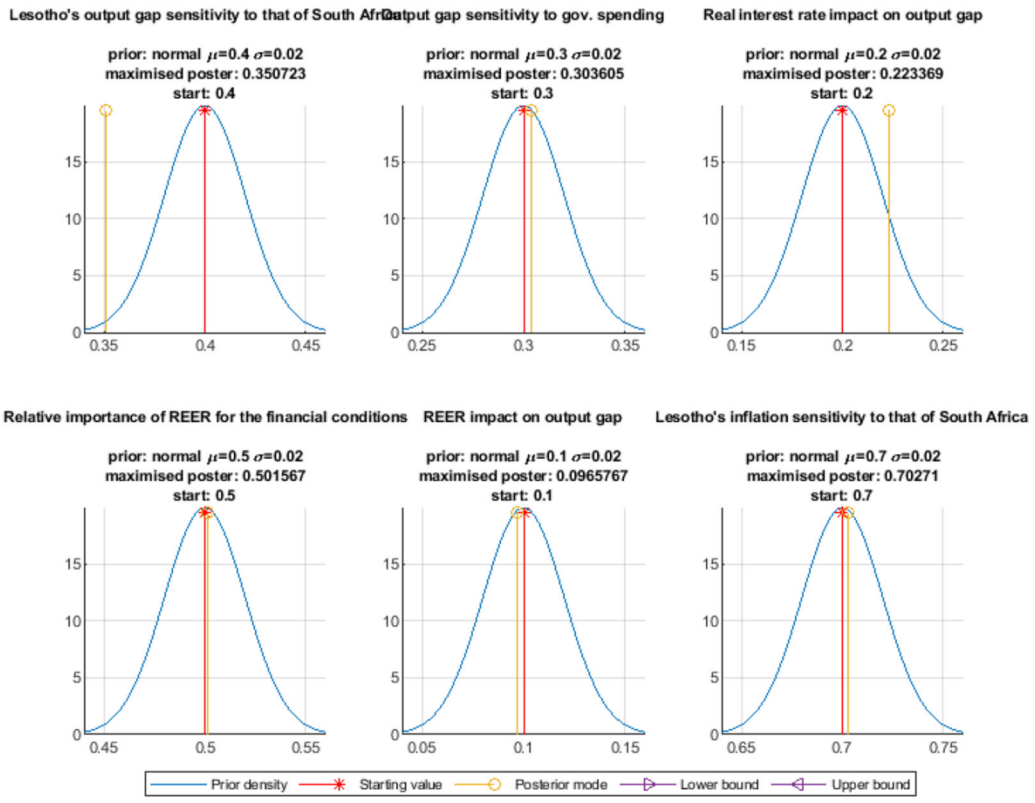


Figure 4. A South African Monetary Policy Rate Shock

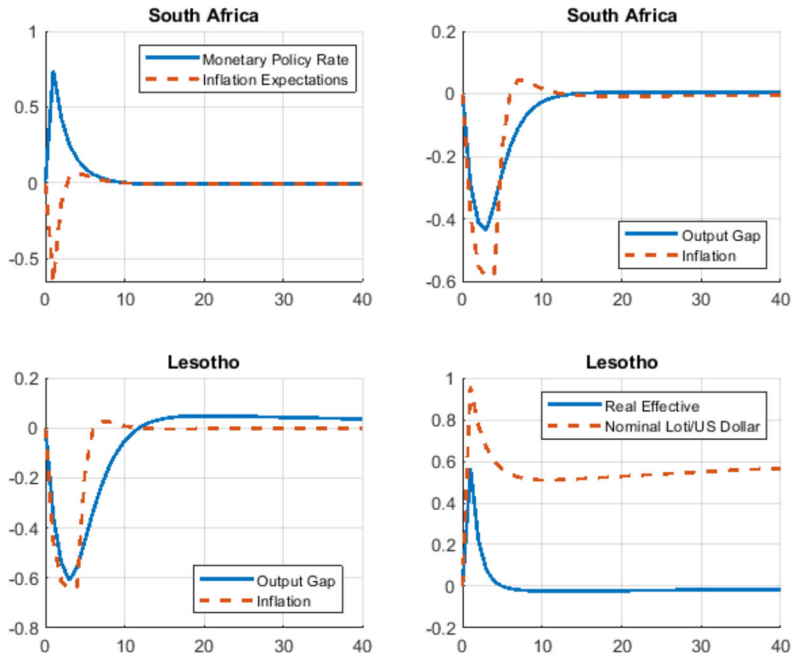


Figure 5. A Delayed Monetary Policy Response Shock

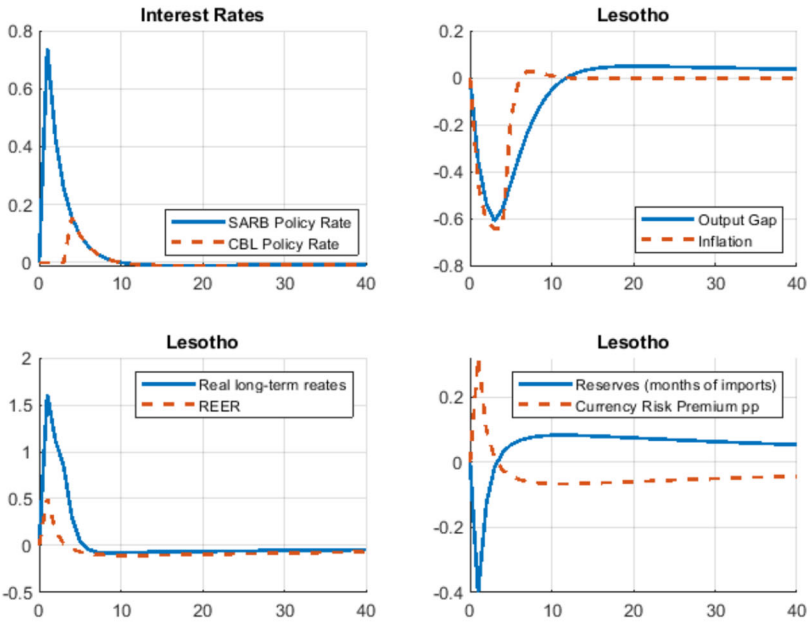


Figure 6. A Government Spending Shock

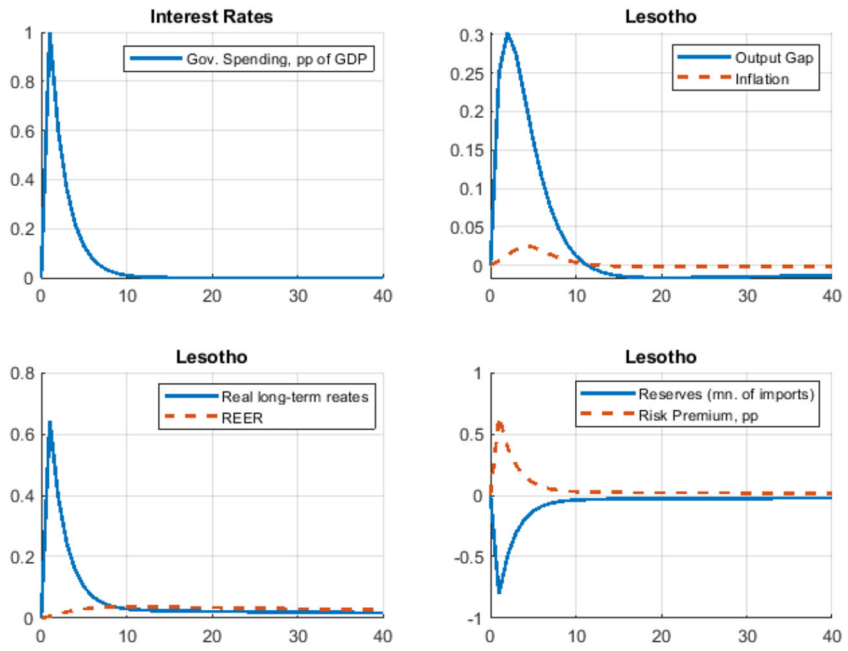
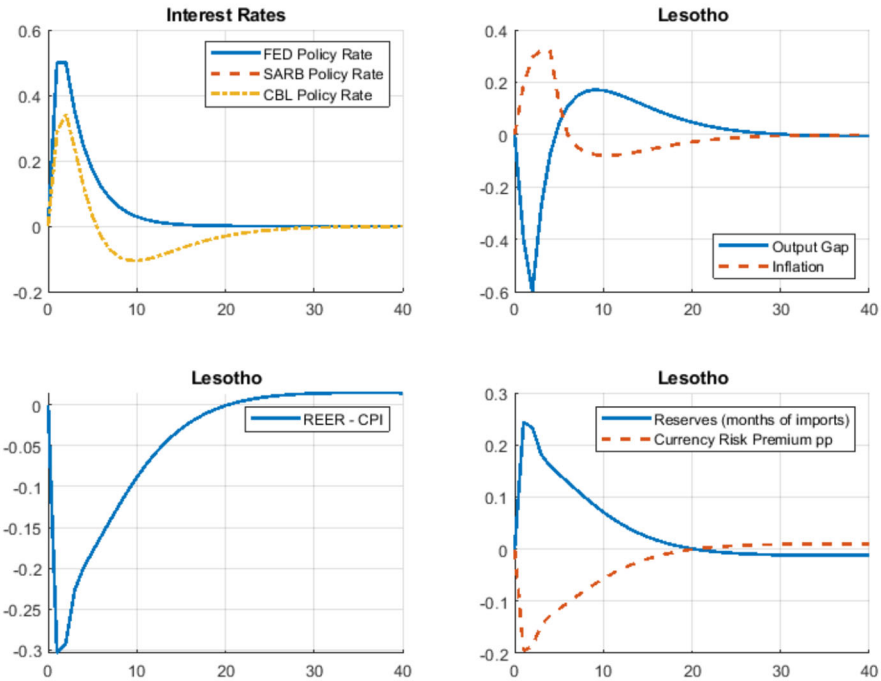


Figure 7. A Composite Shock: Weaker Demand and Higher U.S. Fed Funds Rate



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