Bank of Uganda

Working Paper Series

Working Paper No. 01/2018

Modeling Monetary and Fiscal Policy Coordination in Low Income Countries-the case of Uganda

Karel Musil, Adam Mugume and Christine R. Asiimwe Namanya

March 2018

Modeling Monetary and Fiscal Policy Coordination in Low Income Countries-the case of Uganda

By
Karel Musil[1], *Adam Mugume*[2] *and Christine R. Asiimwe Namanya*[2]
[1]Czech National Bank, [2]Bank of Uganda

Abstract

Successful economic growth in small open economies is dependent upon a high degree of monetary and fiscal policy co-ordination between central banks and fiscal authorities. Indeed, fiscal policy plays a prominent role within macroeconomic policies and a proper analysis of the fiscal measures by central monetary authorities is inevitable. Monetary policy implementation requires taking the impact of fiscal policy into account, which is the case of low income countries in particular. To handle this, the paper introduces a new fiscal block to a benchmark quarterly projection model for monetary policy analyses, based on Berg et al. (2006). The first goal of the paper is to design a simple fiscal block enabling to capture only its basic connection to the economy without complex data requirement, but in a form that can affect and contribute to monetary policy decisions. This approach goes into an opposite direction to many recent models designed to be complex and thus relatively complicated in their fiscal part. The second goal of the paper is to demonstrate the practical usability and applicability of such designed model; for this reason, the model with a fiscal block is applied to Uganda. Despite its simplicity, the model behavior is in line with the economic intuition and historical interpretation, and development of the Ugandan economy over several past years. Additionally, the extension of the model by the fiscal block allows better understanding and proper interpretation of several remarkable periods in Uganda. These particularly involve a fiscal consolidation in mid-2000, fiscal accommodation reacting to the impact of the global crisis on the Ugandan economy, and the recent spending related to hydro-power projects. Moreover, the design of the fiscal block enables a variety of its possible extension in many directions in future.

Key words: Fiscal Policy, Fiscal impulse, monetary policy

JEL classification: E62, E63, E58

Correspondence Address: Research Department, Bank of Uganda, P.O. Box 7120, Kampala, Tel. 256 414 230791, Fax. 256 414 230791. About the Authors: Adam Mugume (amugume@bou.or.ug) is the Executive Director, Research and Policy Directorate while Christine R. Asiimwe Namanya (crasiimwe@bou.or.ug) is a Deputy Director in the Economic Research Department, at the Bank of Uganda. Karel Musil (karel.musil@cnb.cz) is a Director of the Macroeconomic Forecasting Department, Czech National Bank.

1. Introduction

Macroeconomic policies are formed in many countries by cooperation between monetary and fiscal policy. In theory, fiscal policy and monetary policy have clear division of function. In practice, they can often have frictions, while sometimes they may also overlap. Each of them has its own role and although they are usually implemented independently (at least de jure), they co-act actively and closely in practice. This requires understanding fundamental principles and implications of both of them.

Although fiscal policy is largely aimed at economic growth stimulation, it tries to avoid boost and recession business cycle as well. Monetary policy goal is to maintain the price stability. This means that monetary policy deals with a development of inflation which is closely related to business cycle dynamics of an economy. And this is the point, economic growth, where both monetary and fiscal policies cross their interests implying a necessity to coordinate macroeconomic activities. This view is generally shared not only for developed, but also developing economies and across majority of economists.[1]

Using both policies in active cooperation, they can stimulate the economy during slowing down or decelerate it when heating up. However, the goal of the macroeconomic stability does not bring a simple and unique consensus in this field - there is a dilemma whether these two policies are complementary, or act as substitutes to each.[2] In any case, the effective interaction between the policies requires good timing, a proper understanding the situation in the economy, impacts of the policies, their stance and constraints. The paper is primarily aimed at monetary policy and tries to include fiscal policy implications into monetary policy decisions to capture the overall situation in the economy more plausibly. This is crucial especially in countries, where fiscal actions drive the economic development, typically in low income countries.[3]

---

1 For a general discussion of recent interactions between fiscal and monetary policies see e.g. Bank for International Settlement (2012).

2 The issue of interaction arises when the authorities are independent of each other, it depends on a view of economic theories, short or long run implementation and impacts, specific circumstances (e.g. liquidity trap or complete crowding-out effect) and many other factors. There are many cases when the cooperation between these policies is evident. For example, in the most general case, the effects of fiscal policy can influence personal spending, capital expenditure, nominal exchange rate, fiscal deficit and even interest rates, which are associated with monetary policy.

3 To elaborate on an interaction between fiscal and monetary policy, there is a challenge of a fiscal dominance in some countries, the low-income countries in particular. This is the framework when budget deficit or debt (un)sustainability causes inflation resulting into an ignorance of the central bank's commitment to a low inflation. Thus, the monetary policy becomes subordinated to the price determination of the fiscal policy. We assume no fiscal dominance in this paper; or in other worlds, government has no incentive to improve its debt situation throughout unexpected inflation, neither to run seigniorage to fix its revenue side of the budget. For a theoretical

In general, monetary policy behavior is captured by a reaction to an inflation development. Depending on other goals and monetary policy regimes, the monetary reaction can also reflect output gap, exchange rate dynamics, development of credit growth and/or international reserves, money growth and other macroeconomic variables. In general, the policy reaction is typically captured via a Taylor rule or by its modifications and does not form a challenge for modelers. This paper does not put stress on this area, but rather deals with a fiscal part and a way how to include a fiscal block into the monetary policy modeling framework and analyses. We try to offer a lucid approach how to specify a fiscal policy effect on the economy in a simple way, but enabling to capture the main channels influencing the macroeconomic development and thus a monetary policy reaction at the same time.

To model the impact of the fiscal policy, a simple semi-structural model for monetary policy analysis and prediction is utilized. Besides its standard structure, a fiscal block is introduced. The block itself is simple enough to capture the impact of fiscal policy on the modeled economy and not to overcomplicate the core model structure. By doing so, the paper marked the model off from the existing approaches and frameworks.

The fundamental link from the fiscal block to the output gap is captured through a fiscal impulse assuming that the impulse influences business cycle dynamics and demand pressures in the economy. Monetary policy responds to this development through its reaction function. To illustrate a practical usefulness of this approach and a value added of these analyses, a model capability is demonstrated by a historical interpretation of the development of the Ugandan economy.

Reflecting the previous, the paper has two basic goals. First, it introduces the fiscal extension to the monetary policy semi-structural gap model. We try to keep the model framework simple, but at the same time offer a fundamental but effective approach for incorporating a fiscal block to a gap model. Using several assumptions, the suggested approach is believed to bring an advantage of simplicity and transparency. Moreover, it can serve as a basis for further extension or elaboration of the fiscal part with respect to country specifics or a detailed general structure. On top of that, the basic structure benefits from a low data requirement that can prevent from running more advanced analysis of the fiscal stance in some cases. The second goal of the paper is to illustrate practical applicability of the simple fiscal block model extension on Ugandan economy. The reason behind this country selection reflects the crucial importance of the fiscal policy for the economic

discussion about fiscal dominance, including quantitative evidence about this arrangement in Sub-Saharan countries see Baldini and Ribeiro (2008).

development during recent decades and thus a substantial element driving monetary policy decisions. On top of that, there is a clear cooperation between policies, requiring taking fiscal steps into account by monetary policy makers.[4]

To illustrate the importance of fiscal policy impacts on monetary policy, there has been a large literature already introduced. Common literature covering the fiscal policy effect via a model framework ranges from an econometric vector autoregression (VAR) through micro-founded dynamic stochastic general equilibrium (DSGE) models to large scaled models, see e.g. Cyrus and Elias (2014), Cebi (2011), or Kumhof et al. (2010) among others. Additionally, there were published several papers, especially DSGE approaches, with models including explicit blocks of fiscal and monetary policies, see e.g. Smets and Trabandt (2014), Algozhina (2012), or Ratto et al. (2009). All the listed approaches usually offer rigorous fundamentals resulting into a detailed structure of revenues, expenditures and various impacts of fiscal measurements. However, this finally requires the relatively rich structure of the fiscal block with various linkages between fiscal and other macroeconomic variables, strong knowledge of fiscal policy implementation and fiscal measures consequences.

Therefore, to incorporate the fiscal block and emphasize its importance for monetary policy analysis is not a novel approach. However, the common framework is to describe the fiscal block in relatively high details, including fiscal rules and constraints. This, together with an application on Uganda, is particularly covered in Berg et al. (2010a); the paper underscores a mixture of fiscal and monetary policies in Uganda using a DSGE approach. The model emphasizes the interaction of fiscal policy and reserve management which is important especially for the short-run effects of foreign aid inflow. The previous analysis, again with an application on Uganda, is extended in Berg et al. (2010b) by emphasizing the efficiency of public investments, degree of sterilization when the government spends the local-currency counterpart to aid inflows, importance of a central bank's balance sheet, etc. Despite a relatively complex structure used, the authors indicated that the model does not produce good forecasts and its application to historical episodes might require more reliable calibrations.

[4] The macroeconomic policy coordination between monetary and fiscal policy in Uganda is performed during budget preparation and executions. It ensures that government financing is realized without central bank's funding. This implementation has historically resulted into a single digit inflation (excluding world price shock periods) and relatively strong growth (gross domestic product per capita more than doubled) during past two decades. In line with a sharp decline in gross domestic product (GDP) during the global crisis, particularly in FY 2009/2010 and 2010/2011, fiscal policy actively supported the economic growth throughout fiscal stimulus. In line with this approach, the Bank of Uganda clearly communicated its commitment to low inflation, avoiding excessive exchange rate volatility, and keeping consistency with the fiscal policy stance. For more details see International Monetary Fund (2013) and Wanyera and Davies (2012).

Contrary to the previous approach, our model specification is specfically designed to help monetary authority to practically decide about its response to a macroeconomic development including a fiscal policy implementation. To do so in a pragmatic way, we consider fiscal policy as exogenous, i.e. without any recommendations for its implication (as we design a monetary policy analysis model). Additionally, we try to calibrate the model to deliver not only appropriate theoretical properties, but mainly to better understand and interpret episodes driven by fiscal or/and monetary policies. This is limited by a fact that we require to introduce a simple structure of a tractable model for a practical application of monetary policy.

To follow the idea of simplicity of the whole model framework, we introduce a benchmark semi-structural quarterly projection model first. This model is a standard monetary policy analysis model without fiscal part. Second, the model is extended by a fiscal block and its properties are checked by analyzing a response of the model to a fiscal stimulus and by interpreting Ugandan history. The interpretation emphasizes mutual cooperation between fiscal and monetary policies and their impacts on historical development after 2001.

2. A Simple Quarterly Projection Model Framework

A model used for the analysis is a semi-structural small scale quarterly model; for a reference see Berg et al. (2006). Despite its simplicity, it contains all necessary ingredients to be useful for monetary policy analyses, mainly rational expectations and endogenous monetary policy reaction. The core of the model consists of four equations: (i) IS curve describing real economic activity, (ii) Phillips curve capturing inflation dynamics, (iii) monetary policy reaction function, and (iv) an uncovered interest rate parity condition for the nominal exchange rate.

The model does not originally include any fiscal block. Berg et al. (2006) recommends that the incorporation of the government spending and their implications for households' savings decisions can be subject to an auxiliary model. However, we incorporate a simple fiscal block, aimed at the fiscal revenues and/or expenditure influencing the business cycle dynamics of the economy, directly into this model structure.

The core equations, adjusted to reflect country specifics of the Ugandan economy and to demonstrate its practical applicability, are following.

An IS curve describes a domestic aggregate demand (output gap $\hat{y}_t$). It depends on its expected term (labelled with the expectation operator E_t) and the lagged value, monetary policy conditions as an indicator of the monetary policy stance captured via real interest rate and real effective exchange rate gaps, $\hat{r}_t$ and $\hat{z}_t$ respectively, lagged foreign demand $\hat{y}_{t-1}^f$ (capturing a delayed effect of the foreign demand on domestic exports) and structural shock $\varepsilon_t^{\hat{y}}$,

$$\hat{y}_t = \beta_1 E_t \hat{y}_{t+1} + \beta_2 \hat{y}_{t-1} - \beta_3 \hat{r}_t + \beta_4 \hat{z}_t + \beta_5 \hat{y}_{t-1}^f + \varepsilon_t^{\hat{y}} . \quad (1)$$

In terms of general notation, for any given variable, a hat denotes a gap term, i.e. a deviation from its trend or a long run equilibrium. For example, $\hat{y}_t$ stands for an output gap as a deviation of an actual output y_t from its equilibrium (potential product) in logarithmic transformation.

According to a Phillips curve (PC), quarter-to-quarter annualized inflation dynamics π_t depends on expected and lagged inflation (capturing backward- and forward-looking expectations of agents), imported foreign inflation, π_t^f, lagged imported food inflation, π_{t-1}^{food}, output and real exchange rate gaps (together forming real marginal costs). Reflecting the structure of the Ugandan economy and CPI basket, imported foreign inflation pass-through is immediate, contrary to the influence of imported food inflation contributing to the domestic prices with a lag of roughly one quarter. The real exchange gap reflects the effect of imported prices on inflation while the output gap captures excessive aggregate demand pressures. The last term in the equation is supply shock ε_t^{π}, coming from excluded factors,

$$\pi_t = \alpha_1 E_t \pi_{t+1} + (1 - \alpha_1 - \alpha_2 - \alpha_3)\pi_{t-1} + \alpha_2 \pi_t^f + \alpha_3 \pi_{t-1}^{food} + \alpha_4 \hat{y}_t + \alpha_5 \hat{z}_t + \varepsilon_t^{\pi} . \quad (2)$$

The equation plays an important role for monetary policy by capturing the inflation dynamics. The Phillips curve captures core inflation as the monetary policy regime in Uganda is currently an inflation targeting lite with the primary policy objective to keep annual core inflation to a medium inflation target of five percent; for more details about the monetary policy framework see a discussion later. To keep the model simple, we do not introduce remaining components of the headline inflation (i.e. food crops and energy, fuel, and utility price inflation), but we focus solely on core inflation.

The nominal exchange rate (s_t, in this case UGX per USD and its increase is a depreciation) is described by the uncovered interest rate parity (UIP) condition: the expected depreciation is driven by nominal interest rate differential between domestic and foreign interest rates ($i_t - i_t^f$) adjusted by country risk premium $prem_t$ and short-term shock ε_t^s.

$$4\left(s_{t+1}^e - s_t\right) = i_t - i_t^f - prem_t + \varepsilon_t^s \,, \tag{3}$$

where, the nominal exchange rate expectations are not purely driven by market forward-looking expectations (to prevent from an extensive overshooting of the exchange rate to a structural shocks). They are also influenced by their persistence and a value of parameter δ_1 controlling the degree of flexibility of the nominal exchange rate deviations from the pure uncovered interest parity. This feature also enables the model better fit the observed data.

$$s_{t+1}^e = \delta_1 E_t s_{t+1} + \left(1-\delta_1\right) s_{t-1} \,. \tag{4}$$

The model is closed by a monetary policy reaction assuming that a nominal interest rate setting is captured by a Taylor-type rule.

We assume that the 7-day interbank rate i_t, the rate used in the model as a nominal monetary policy rate, is smoothed by the setting of the Central Bank Rate and the operations by the Bank of Uganda. It also reflects its neutral nominal interest rate i_t^{neutr}, expected annual core inflation development in one year future horizon $E_t \pi_{t+4}^{y/y}$ with respect to the expected target $E_t \pi_{t+4}^{TAR}$ and output gap dynamics. On top of that, the equation includes shock term ε_t^i as well,

$$i_t = \gamma_1 i_{t-1} + \left(1-\gamma_1\right)\left(i_t^{neutr} + \gamma_2\left(E_t \pi_{t+4}^{y/y} - E_t \pi_{t+4}^{TAR}\right) + \gamma_3 \hat{y}_t\right) + \varepsilon_t^i \,. \tag{5}$$

To complete the whole model, several identities and processes (in a form of simple first order autoregressive processes) for trends and exogenous variables are included into the model. These equations are not presented here. The model is without any fiscal variables and the effect of fiscal policy must be implemented ad-hoc via expert judgments. By extension of the model in the following section, we introduce the fiscal block as a structural part of the model driving the business cycle dynamics.

3. Fiscal Block Extension

The impact of fiscal policy, or more precisely the linkage between the fiscal policy and output gap, is captured by a fiscal impulse. The fiscal impulse (or equivalently fiscal stimulus) refers to an additional impact of government expenditures and/or taxation on economic activity. To capture the effect of fiscal stimulus on economy, we need to analyze measures on the general government balance - to evaluate effects on budget revenues and expenditures, and consequently deficits and debt. A common approach assessing overall discretionary fiscal policies relies on identifying changes in cyclically adjusted primary balances obtained by netting out the effect of automatic stabilizations from the primary balance. This indicator can be understood as a one-side impact of the government finances on the rest of the economy. Despite its own drawbacks[5], it is manageable to be reasonably calculated, publicly monitored, and mainly capturing net fiscal effects. A comprehensive discussion of an alternative measures of fiscal stimuli with respect to their cons and pros are introduced e.g. de Castro et al. (2010).

By introducing the fiscal impulse via adjusted fiscal balance, the overall fiscal balance is influenced by fluctuations in the economy (for example tax revenues decline on the back of higher social expenditures during a recession and vice a verse) and thus it is necessary to decompose it into cyclical and structural components. The core idea in all the available concepts of decomposing the overall balance relays on the fact that the structural balance (the cyclically adjusted one) is the balance net of cyclical effects and is consistent with an economy performing close to its potential. Additionally, the appropriate adjustment should also take into account country specific constraints (e.g. data availability, fiscal regime, structure of the economy), other temporal factors and shocks, which provides more accurate view about the fiscal policy stance.[6]

Although different methods can lead to a different cyclical adjustment of the overall fiscal balance and thus fiscal policy stance, we utilize output gap calculation.[7] By this approach, the structural balance identification should follow these three steps, see Bornhorst et al. (2011):

---

5 Besides discretionary fiscal measures, the cyclically adjusted balance is also affected by structural and temporal movements outside of the fiscal control. This means that the measure of active fiscal policy can be inaccurate. On the other hand, there exists no technique capturing the fiscal stance perfectly. Even assessing selective measures on the general government balance heavily depends on used classifications and thus is prone to manipulation and possible misinterpretation.

6 An adjustment by temporary factors can be found e.g. in Price and Thai-Tang (2011) for assets price effects, Turner (2006) for terms of trade and commodity price effects, Joumard et al. (2008) for one-off fiscal operations. However, all the papers conclude that the standard method adjustment by the temporary factors is the same with an exception of periods with significant change in the underlying temporal factors. During these periods, the results can differ.

7 A comparison of two alternative methods for the cyclical adjustment, one used by the European Commission and the other one used by the European System of Central Banks, is presented in Tomšík (2012).

1. identifying and removing one-off fiscal operations,
2. assessing the impact of the business cycle on revenue and expenditure, and
3. estimating the effects of other economic cycles or factors.

It means that the overall fiscal balance in nominal term is decomposed into primary balance (cyclically adjusted primary balance) and cyclical primary balance automatically reacting to the cycle adjusted by interest payments and one-off fiscal operations,

$$OB_t = PB_t^A + PB_t^C + IP_t + OFO_t \,, \tag{6}$$

Where, OB_t is the overall balance, PB_t^A and PB_t^C are primary balances adjusted and cyclical, IP_t is the net interest payment and OFO_t is the one-off fiscal operation adjustment or the transitory and temporal fiscal measure respectively.[8] The adjusted primary balance measures underlying fiscal positions that would prevail if macroeconomic variables are at their equilibrium levels.

The interest payments are usually kept separate because their movements may not be necessarily correlated with cyclical output changes; the interest rate usually changes with economic conditions, but not necessarily automatically. This means that only a part of interest rate payments is correlated with the cycle.

To keep the approach simple, we first adjust the overall balance by interest rate payment and one-off fiscal spending. The next step is to decompose the remaining part, the primary balance (PB_t), to the adjusted and cyclical components,

$$PB_t = PB_t^A + PB_t^C \,. \tag{7}$$

According to the aggregate approach, the cyclically adjusted balance is measured as a ratio to either actual or potential output respectively. Using the actual output and a connection between cyclically adjusted revenues and expenditure yield

$$pb_t^a := \frac{PB_t^A}{Y_t} = \frac{R_t^A - G_t^A}{Y_t} = \frac{1}{Y_t}\left\{ R_t \left(\frac{Y_t^P}{Y_t} \right)^{\eta_R} - G_t \left(\frac{Y_t^P}{Y_t} \right)^{\eta_G} \right\}, \tag{8}$$

[8] While seemingly straightforward, there are no universally accepted criteria for identifying one-off or temporary fiscal measures. From a practical standpoint, it is a judgmental approach. For example, a crisis-related discretionary fiscal stimulus should not be excluded from reported structural balances as they are influencing the aggregate domestic demand.

Where, small letter for pb_t^a denotes the ratio of cyclically adjusted primary balance to GDP (labelled as Y_t). Cyclically adjusted revenues and expenditures (R_t^A, G_t^A) are obtained by adjusting actual revenues and expenditures by the effect of the deviation of the potential output from its actual level using elasticity η_R and η_G , capturing the strength of the cyclical effect. This assumes that the ratio of cyclically adjusted revenue and expenditures to their actual levels move proportionally with the ratio of potential output to actual output, which is output gap. The gap is consistently expressed as a percentage deviation of actual level from its potential. This means that the previous formula can be further approximated as follows

$$pb_t^a \approx r(1-\eta_R \hat{y}_t) - g(1-\eta_G \hat{y}_t), \tag{9}$$

Where, $\hat{y}_t$ is the output gap (see the introduction of the IS curve) and r and g denote ratios of revenue and expenditure to GDP.

The previous expression captures the "structural" primary balance i.e. primary balance unaffected by cyclical fluctuations. Changes in pb_t^a are subsequently used to estimate the size/cost of discretionary policy.

To define the cyclical part of the primary balance in percent of actual GDP (pb_t^c), the previous outcome adjusts the ratio of the primary balance to actual GDP

$$pb_t^c = \frac{PB_t^c}{Y_t} = \frac{PB_t - PB_t^A}{Y_t} \approx r\eta_R \hat{y}_t - g\eta_G \hat{y}_t = (r\eta_R - g\eta_G)\hat{y}_t \ . \tag{10}$$

Following the same logic, Bornhorst et al. (2011) and Fedelino et al. (2009) suggest using the previously calculated ratios to potential output as an alternative option.[9] This means that the cyclically adjusted balance is calculated as the ratio to the potential product (pb_t^{ap}) as it measures what the fiscal balance would have been if the output of the economy had been at its potential level.

$$pb_t^{ap} := \frac{PB_t^A}{Y_t^P} = \frac{R_t^A - G_t^A}{Y_t^P} \approx r(1-(\eta_R - 1)\hat{y}_t) - g(1-(\eta_G - 1)\hat{y}_t). \tag{11}$$

[9] The papers also introduce a mixture of these ratios where the cyclically adjusted balance is a ratio to the potential output and is plugged into the primary balance ratio, which is calculated to actual GDP as in equation (10). However, this includes inconsistencies and thus it is not discussed here. For more details and elaborated explanation see the original papers.

In a similar way, the cyclical part of the primary balance in percent of potential GDP (pb_t^{cp}) yields

$$pb_t^{cp} = \frac{PB_t^c}{Y_t^P} = \frac{PB_t - PB_t^A}{Y_t^P} \approx (r\eta_R - g\eta_G)\hat{y}_t \,. \qquad (12)$$

Although both Bornhorst et al. (2011) and Fedelino et al. (2009) provide the consistent calculations of the ratios to only potential output (even without any single indication of a possible calculation of the ratios to actual output), using actual GDP results into the same outcomes: the cyclical primary balance depends on output gap with respect to shares of government revenues and expenditures adjusted by their elasticities. Assuming small output gaps, utilized in approximation (9), the ratios of balances to either actual or potential output are close to each other. These conclusions are used for the specification of the fiscal block in the model.

For a model extension by the fiscal impulse block, we use all the fiscal ratios expressed to actual output as it better fits to the used model framework and general discussion about the fiscal policy and its impact on the economy (numbers are usually reported as the shares to annual GDP).

To summarize the already introduced, the attractiveness and the parsimony of the described approach are based on minimal data requirements, its relatively simple communication and consequences, and a strong intuition. Additionally, it enables to simply and flexible extend the model.[10]

All the previous means that the outlined approach is the perfect candidate to be utilized and it enables to identify structural (cyclically adjusted) primary deficit and quantify a fiscal impulse respectively. To follow this simple approach, we calculate the fiscal impulse not by introducing a fiscal policy rule, but simply by a change in structural deficit (a top-down approach): changes in structural balances indicate the impact of discretionary fiscal policy on the economy. Then the fiscal impulse influences the key model mechanisms that describe the behavior of aggregate demand (via cyclical private consumption and investment captured through output gap) and the exchange rate (enriching the country risk premium related to public indebtedness).
Following the idea of keeping the concept simple, we do not include an impact of the fiscal policy on financial market interest rates and long-term equilibria. The long-term effect, for example when higher public indebtedness increases a likelihood default and thus directly translates into higher

[10] Contrary to the disaggregated approach based on individual revenue and expenditures categories and the used approach does not require to estimate potential product dynamics first and not to calculate the shares of primary balance and cyclical primary balance to the potential GDP.

spreads on government bonds and subsequently on higher long-term interest rates, forms a potential area for a future work as it is not related to the business cycle dynamics, but rather to the long-term trends in economies.

4. The Core Model Equations and Data

The four core quarterly projection model equations are extended by the equation for the fiscal impulse and its effect on the domestic demand and nominal exchange rate. The impact of the fiscal impulse influences directly output gap and additionally the impulse also affects the nominal exchange rate: part of the current fiscal expenditures are financed through the external funding putting a pressure on expected nominal depreciation (the deficit is financed on average only by two thirds from the domestic sources in case of Uganda).[11]

To overview the structural equations with the impact of the fiscal impulse (imp_t), the core model structure has the following form

$$\hat{y}_t = \beta_1 E_t \hat{y}_{t+1} + \beta_2 \hat{y}_{t-1} - \beta_3 \hat{r}_t + \beta_4 \hat{z}_t + \beta_5 \hat{y}^f_{t-1} + \beta_6 imp_{t-1} + \varepsilon^{\hat{y}}_t, \tag{13}$$

$$\pi_t = \alpha_1 E_t \pi_{t+1} + (1-\alpha_1-\alpha_2-\alpha_3)\pi_{t-1} + \alpha_2 \pi^f_t + \alpha_3 \pi^{food}_{t-1} + \alpha_4 y_t + \alpha_5 z_t + \varepsilon^{\pi}_t, \tag{14}$$

$$4(s^e_{t+1} - s_t) = i_t - i^f_t - prem_t - \delta_2 imp_t + \varepsilon^s_t, \tag{15}$$

$$i_t = \gamma_1 i_{t-1} + (1-\gamma_1)\left(i^{neutr}_t + \gamma_2\left(E_t \pi^{y/y}_{t+4} - E_t \pi^{TAR}_{t+4}\right) + \gamma_3 \hat{y}_t\right) + \varepsilon^i_t, \tag{16}$$

$$imp_t = pb^a_t - \left(pb^a_t + pb^a_{t-1} + pb^a_{t-2} + pb^a_{t-3}\right)/4. \tag{17}$$

The fiscal impulse is calculated as a change in the adjusted primary balance with respect to its historical development during past one year.[12] The parameters related to the fiscal block are calibrated to be $\beta_6 = 0.2$ and $\delta_2 = 0.2$.

The model parameters and steady state values are calibrated to fit the data and to reflect basic economic principles. The value of all core structural parameters is presented in Appendix 1. To check the consistency of the calibration, several tools and checks were employed. These mainly include impulse response functions, in-sample simulations and the interpretation of the historical development of the Ugandan economy. The final calibration is generally in line with common and

[11] Here we consider the fiscal impulse as a fiscal expenditure based impulse financed through external sources. As it is typical in Uganda, there is a low share of tax revenues to GDP: only about 13 percent for FY 2014/2015, see International Monetary Fund (2014). This means that the fiscal impulse is not very likely to be financed through a tax increase, which would require extending the Phillips curve as well.

[12] The used calculation of the fiscal impulse is in line with the general understanding of the fiscal impulse as a change in cyclically adjusted primary balance between two periods.

recommended calibration for this type of models, but it reflects country specifics of the Ugandan economy at the same time as well.

The range used for the filtration and the historical interpretation covers the period from the first quarter of 2001 up to the end of FY 2013/2014. The starting point excluded the early 2000s when the Ugandan banking industry underwent significant restructuring. During this process several commercial banks were declared insolvent and taken over by the central bank. Also, the government contributed to the financing of the process. This makes the quantification of the one-off fiscal operation adjustment of the overall fiscal balance extremely difficult with a potential for miss-specifications of the fiscal expenditures. The end of the used period covers the complete fiscal year ending in June 2014.

The complete data set for Ugandan and foreign economy, as the model observed variables, is described in Appendix 2. The structure of the model was designed to reflect Ugandan data availability; the domestic data consists of real GDP growth, core inflation, 7-day interbank rate and nominal exchange rate (UGX per USD). By extending the model by the fiscal block, the adjusted primary deficit time series is observed as well.

The primary balance is measured net of one-off factors (both revenues and expenditures) and interest rate payments. The resulting balance, contrary to the overall one, better reflects demand fiscal pressures on the economy. All the data are available on quarterly frequency and are seasonally adjusted. The fiscal balance is recalculated as a share to nominal GDP.

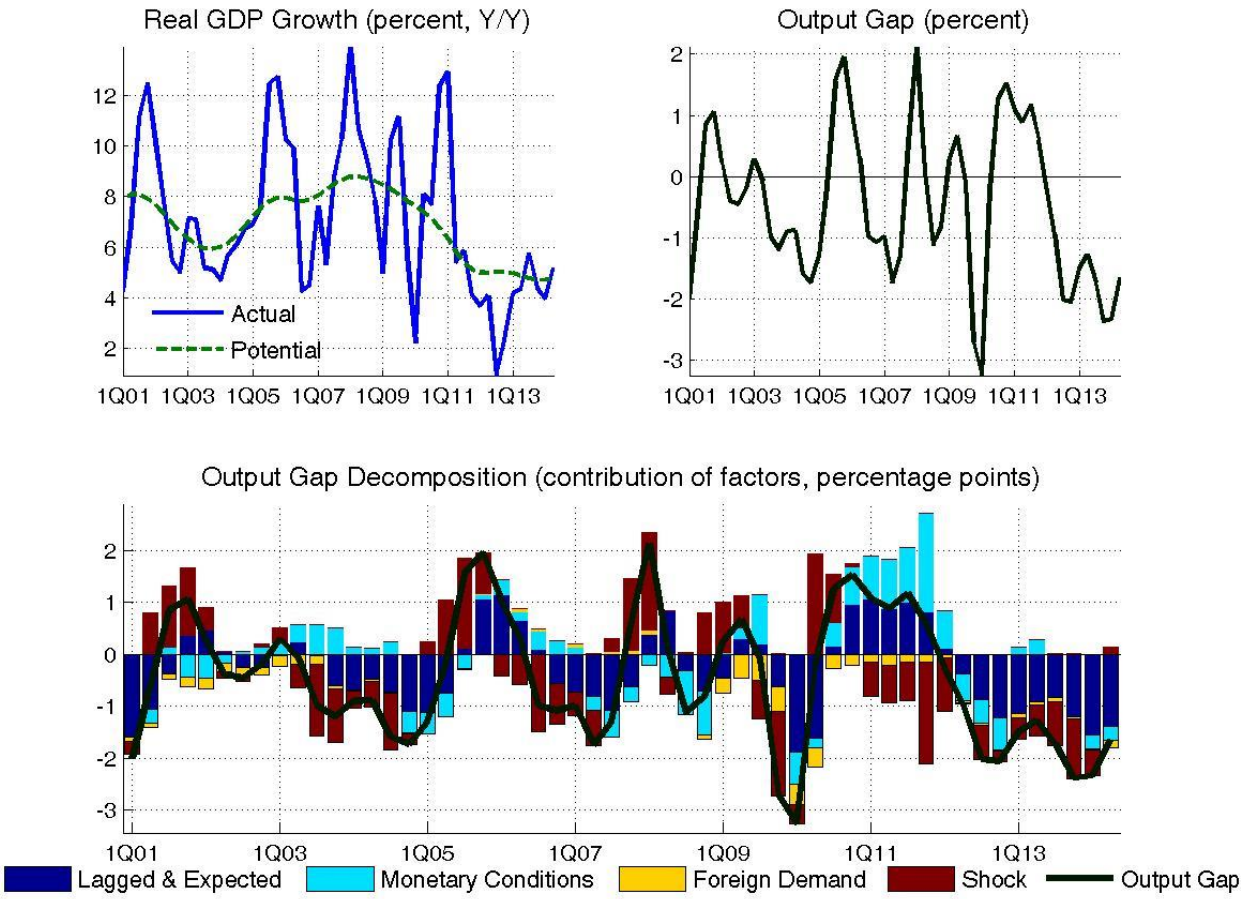
4.1 Model Properties and Interpretation

Although the fiscal extension of the model has been already introduced, let's first check the historical interpretation of the Ugandan development without fiscal incorporation into the model framework. The result indicates the necessity of including a fiscal variable into the model to better capture and interpret the historical development.

The model filtration of the potential growth and output gap from historically observed data for GDP through the model with no fiscal block is presented in Figure 1. The output gap dynamics (decomposed into the contribution of several factors according to the IS curve) is significantly driven by an aggregate demand shock with a relatively high correlation. This indicates a missing term in the IS curve – the fiscal impulse. This confirms also the observed data, where fiscal policy

expansions and restrictions especially during some particular periods can be clearly identified, see e.g. FY 2010/2011 or FY 2011/2012. By extending the model by the fiscal bock, we interpret part of the shocks as a fiscal impulse to the economy.

Figure 1: Historical Filtration without a Fiscal Block



Before we re-check the historical interpretation of the real economic development by applying the extended model with the fiscal equation, let's review the theoretical behavior of the model first.

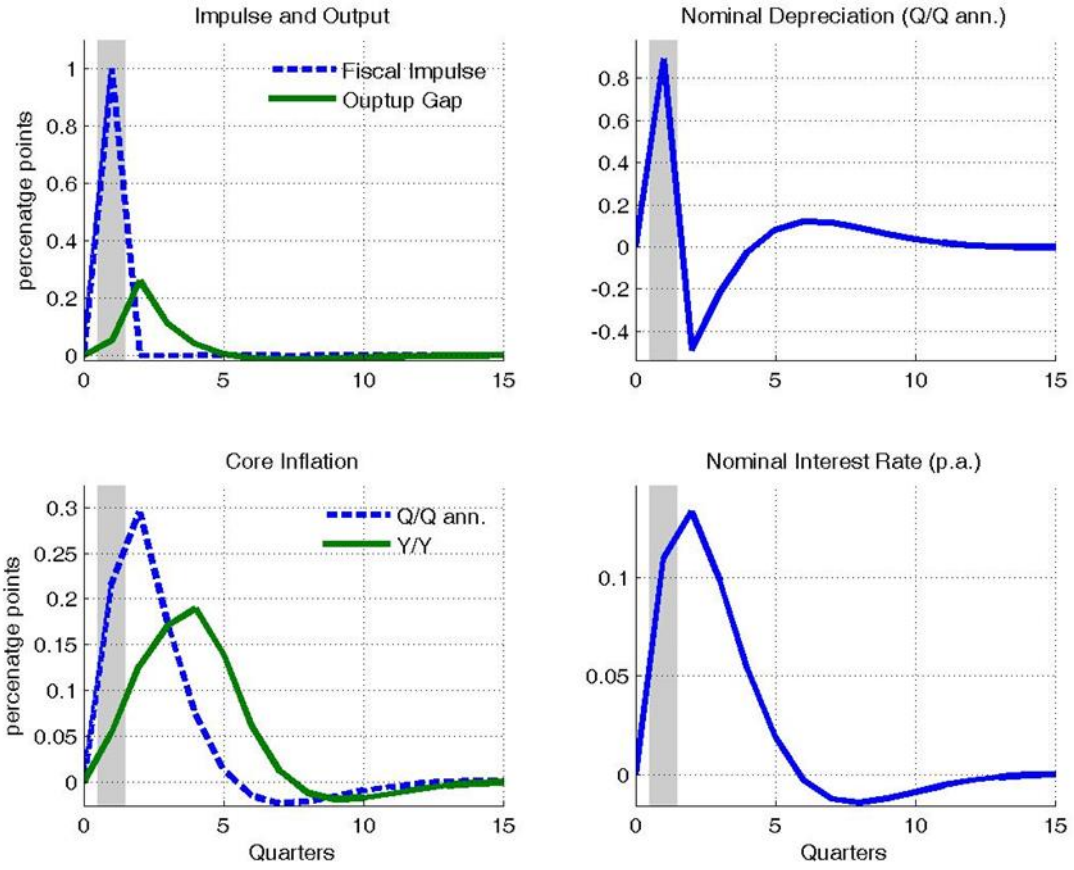
To illustrate the basic logic behind the fiscal impulse, model impulse responses are presented in Figure 2. A positive fiscal impulse (i.e. a temporal increase in imp_t by one percentage points in the first quarter after the economy is in its equilibrium initially) translates into a lagged rise in output gap. The one percentage point rise in the fiscal impulse increases output gap by about 0.3 percentage points next period. The fiscal stimulus persists about one year and increases the output by about 0.45 percentage points cumulatively (the fiscal multiplier).[13] Simultaneously, the fiscal

[13] The fiscal multiplier is relatively low in this calibration of the model for the Ugandan economy; for example, the value of the multiplier for the Czech Republic is about 0.6. The low value can be contributed to the range of the factors. The most important are, for a detailed discussion see Philip and Janssen (2002): (i) high crowding-out effect, (ii) Ricardian households assumption in the model, (iii) debt sustainability problem of a country, and (iv)

impulse leads to a nominal exchange rate depreciation of almost one percentage points in annualized quarter to quarter dynamics.

Both, the higher demand and more depreciated exchange rate, forms inflationary pressures and increases core inflation by a similar magnitude as output gap. As the monetary policy reacts to the expected annual inflation, which is deviating from its target, a rise in nominal interest rate is required. However, the reaction is not strong.[14]

Figure 2: Impulse Response Functions to a Fiscal Impulse Increase



As the impulse responses confirmed the economic intuition behind the fiscal impulse, it is useful to review the historical development of the fiscal policy in the Ugandan economy as well.

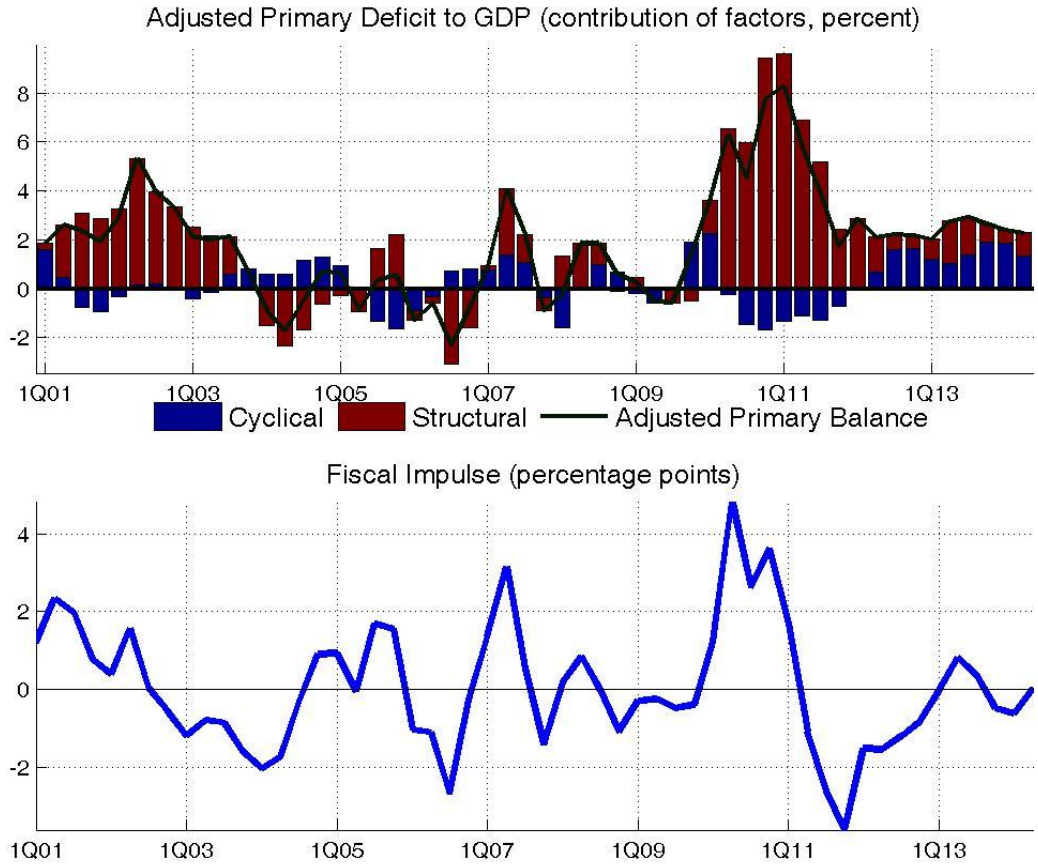
To identify a fiscal stance (or the fiscal impulse equivalently) in the Ugandan economy, the adjusted primary deficit is decomposed into structural and cyclical part first, using the foregoing logic and the introduced fiscal block in the model. The result is revealed in Figure 3. Then the filtered fiscal

high uncertainties about expansionary fiscal policy.

[14] Measured in real terms, i.e. a change in real interest rate, there is almost no reaction. This means that the monetary policy is neutral to the fiscal impulse in this model framework and particular calibration. This characteristic corresponds to the historical interpretation of the Ugandan development, see the discussion later.

impulse is a change in the structural components of the adjusted deficit with respect to its historical development, see the respective equation in the core model introduction part.

Figure 3: Adjusted Primary Deficit Decomposition and Fiscal Impulse

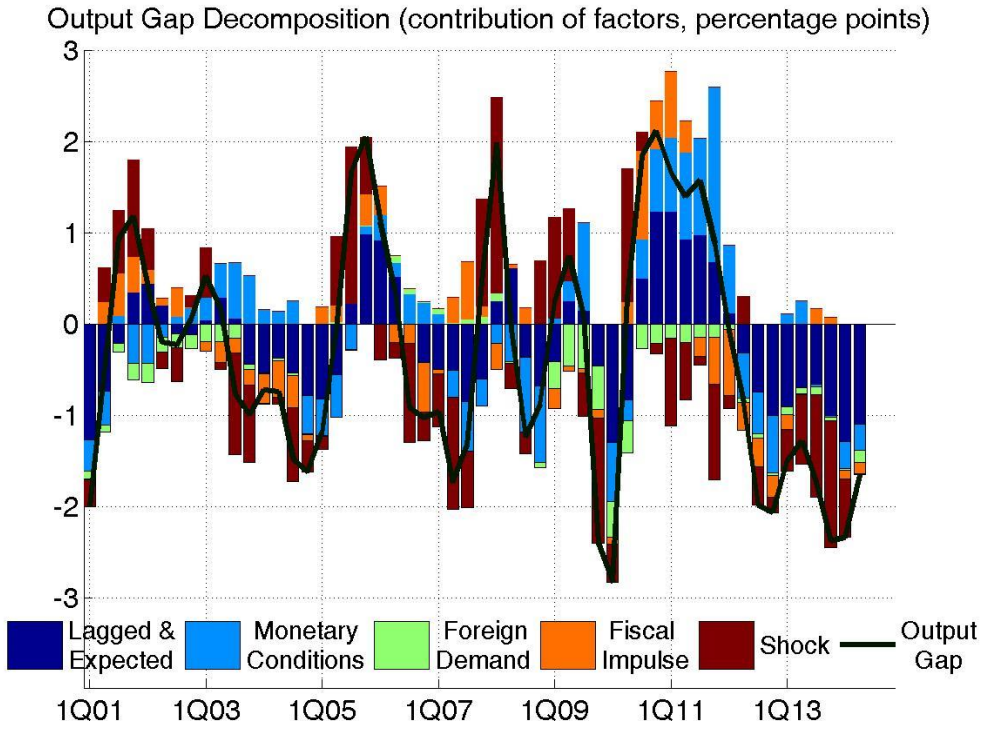


Fiscal impulse in Figure 3 nicely shows that the fiscal stance was roughly neutral during some years (see e.g. 2005–2009 period) and that public spending clearly accelerated or decelerated in other particular periods. A negative impact of the global crisis on the economy was partly compensated by the government's reallocation of the development to current spending especially in the second half of FY 2009/2010. This continued throughout whole FY 2010/2011. The mobilization of the domestic revenues during this period was supported by an increase in domestic financing to cover the expected shortfall in grants and to keep the expansionary fiscal stance. The contractionary fiscal stance appeared in the next fiscal year as an attempt to reduce fiscal deficit by sharp cuts in current spending; the authorities brought the overall deficit (including grants) down below 4.0 percent of GDP in that fiscal year, compared to 7.2 percent in FY 2010/2011. After the period of a relatively neutral stance, the government plans to significantly widen its fiscal deficit in FY 2014/2015 as a result of the buoyant investment and related current expenditures in hydro power projects. However, the full realization of the project will cover a future horizon and it is a part of the forecasting simulation.

Interesting and exemplary period, from the point of the fiscal policy analysis, was the first half of the 2000s when the expansionary stance smoothly turned to the restrictive one, see Figure 3. The fiscal deficits excluding grants were increasing from the mid-1990s until FY 2002/2003, led by a donor-supported expansion in poverty-reduction spending (about 50 percent of the total expenditures were funded by the donor inflows). This is interpreted as a positive fiscal impulse to the economy. However, the policy stance turned to the restrictive one subsequently according to the figure. This is in line with the planned fiscal consolidation starting from FY 2003/2004. Although the consolidation was not completely achieved in line with the original plan, the policy stance was unambiguously restrictive for the next two years.

The fiscal stance, measured by the fiscal impulse in the extended model, helps to quantify the effect of the fiscal policy on the performance of the economy. The contribution of the fiscal impulse to the development of Ugandan output gap reveals Figure 4.

Figure 4: Historical Filtration with the Fiscal Impulse: Output Gap Decomposition



Based on this interpretation, the fiscal policy contributed to the development of the economy. In some particular periods the fiscal stance even significantly drove the macroeconomic performance. The fiscal consolidation that started in FY 2003/2004 weighted on the recession, driving output gap towards negative values and slowed down real growth towards 5.0 percent during the fiscal year. Monetary policy initially accommodated the impact of the fiscal consolidation by loose monetary conditions, especially through the depreciation of the nominal exchange rate. Afterward the fiscal

policy (or in general both policies) stance remained roughly neutral within every fiscal year. Immediately after the global crisis, the output gap turned to be negative driven by foreign demand and a tiny negative contribution of the fiscal policy, as the government reallocated its expenditures in favor of the current ones. While the foreign demand continued to be weak, a proper mixture of fiscal and monetary policy contributed to the quickly closing output gap in FY 2010/2011. The change in the expansionary stance of the fiscal policy weakened the domestic demand driving real growth down to 4.1 percent and 3.2 percent in FY 2011/2012 and FY 2012/2013 respectively. However, the fiscal policy was not the only factor pushing the economy below the potential growth at about two percent as the monetary policy turned into a neutral or later even slightly restrictive stance.

The fiscal situation in Uganda will be influenced by the co-financing of the construction of the two large hydro power projects during the next fiscal years. The Kuruma and Isamba projects are planned to be under construction during next several years and the related fiscal current expenditures will contribute to the aggregate demand in Uganda. These investments will drive also current expenditures. The establishment of the fiscal block to the model can contribute to the discussion and help to analyze potential impacts of these projects.

5. Conclusion

There is a consensus that the cooperation between monetary and fiscal policy is crucial for the sound development of economies. Indeed, close coordination of fiscal and monetary policies ensures that fiscal deficit is neither monetized by the Bank of Uganda nor is the private sector credit squeezed. This is quintessential for achieving macroeconomic stability. Although these two policies follow different goals, the interaction is desired; this has been recently empirically approved particularly during the financial crisis. Unsurprisingly, it was proved in case of the Ugandan economy as well. Moreover, the fiscal policy in Uganda is expected to play a substantial role in future, particularly related to the hydro power projects. However, the complete and detailed understanding of interactions between fiscal and monetary policy is too complex and their detailed description and analyses are out of this paper's scope. Thus, the paper, as one of its goals, introduced a simple but operating model structure to better understand the fundamental impact of the fiscal policy implication on the economy and monetary policy decisions especially.

Despite its simplicity, the fiscal block, extending a simple quarterly projection model for monetary policy analyses and forecasting, is able to satisfactorily describe the fiscal stance of the Ugandan

fiscal policy and its contribution to the aggregate demand. This satisfied the second goal of the paper aimed at illustrating the practical applicability of the simple model on the Ugandan economy. Moreover, the used theoretical approach is also in line with the understanding of the International Monetary Fund (IMF). The IMF has recently introduced the concept of the underlying deficit, which better reflects demand pressures on the domestic economy because it is measured net of one-off factors. It excludes extraordinary investments (especially for the hydro-power projects) and in case of the Ugandan economy analysis also the recapitalization of the Bank of Uganda. For the more explanatory notes about the underlying deficit see International Monetary Fund (2014) and International Monetary Fund (2013).

Additionally, the simplicity of the model forms a solid base for further extensions. These can involve a decomposition of the deficit into revenues (possibly into domestic revenues and grant components) and expenditures. The expenditures can be further structured by their usage. However, any of these extensions make the structure of the fiscal block, and subsequently of the whole model, more complex and complicated.

However, even without any further extensions, the simple model structure does not prevent from its usage for analysis or historical interpretation. Based on the results, the model in such a structure can be effectively used for medium-term forecasting by the monetary authority. And contrary to the existing literature, it tries to follow an uncomplicated way of fiscal policy inclusion into the model framework.

References

Aliya, Algozhina (2012): Monetary and Fiscal Policy Interactions in an Emerging Open Economy: A Non-Ricardian DSGE Approach. CERGE-EI Working Papers wp476.

Baldini, Alfredo and Ribeiro, Marcos (2008): Fiscal and Monetary Anchors for Price Stability: Evidence from Sub-Saharan Africa. IMF Working Paper /08/121.

Bank for International Settlement (2012): Fiscal policy, public debt and monetary policy in emerging market economies. BIS Papers No 67.

Berg, Andy, Mirzoev, Tokhir, Portillo, Rafael and Zanna, Luis-Felipe (2010a). The Short-Run Macroeconomics of Aid Inflows: Understanding the Interaction of Fiscal and Reserve Policy. IMF Working Paper 10/65.

Berg, Andy, Gottschalk, Jan, Portillo, Rafael and Zanna Luis Felipe (2010b): The Macroeconomics of Medium-Term Aid Scaling-Up Scenarios. IMF WP 10/160.

Berg, Andrew, Karam, Philippe and Laxton, Douglas (2006): Practical Model-Based Monetary Policy Analysis: A How-To Guide. IMF Working Paper 06/81.

Bornhorst, Fabian, Dobrescu, Gabriela, Fedelino, Annalisa, Gottschalk, Jan and Nakata Taisuke (2011): When and How to Adjust Beyond the Business Cycle? A Guide to Structural Fiscal Balances. IMF Technical Notes and Manuals No 11/02.

de Castro, Francisco, Kremer, Jana and Warmedinger, Thomas (2010): How to measure a fiscal stimulus. Presupuesto y Gasto Público. No 59, 2010, pp 103-116.

Cebi, Cem (2011): The Interaction between Monetary and Fiscal Policies in Turkey:An Estimated New Keynesian DSGE Model. Central Bank of the Republic of Turkey. Working Paper no. 11/04.

Fedelino, Annalisa, Horton, Mark and Ivanova, Anna (2009): Computing Cyclically Adjusted Balances and Automatic Stabilizers. IMF Technical Note and Manuals 09/05.

International Monetary Fund (2014): Uganda: Third Review under the Policy Support Instruments. IMF country report No. 14/344.

International Monetary Fund (2013): Uganda: First Review under the Policy Support Instruments. IMF country report No. 13/375.

Joumard, Isabelle, Minegishi, Makoto, André, Christophe, Nicq, Chantal and Price, Robert (2008): Accounting for One-off Operations when Assessing Underlying Fiscal Positions. OECD Economic Department Working Paper No. 642.

Kumhof, Michael, Laxton, Douglas, Muir, Dirk and Mursula, Susanna. (2010): The global integrated monetary and fiscal model (GIMF). Theoretical structure. IMF Working Paper WP/10/34.

Mutuku, Cyrus and Koech, Elias (2014). Monetary and Fiscal Policy Shocks and Economic Growth in Kenya: VAR Econometric Approach. *Journal of World Economic Research*. Vol. 3, No. 6, 2014, pp. 95-108.

Philip, Renee and Janssen, John (2002): Indicators of Fiscal Impulse for New Zealand. New Zealand Treasury Working Paper 02/30.

Price, Robert, and Thai-Thanh, Dang (2011): Adjusting Fiscal balances for Asset Price Cycles. OECD Economics Department Working Paper No. 868.

Ratto, Marco, Werner, Roeger and Veld, Jan: QUEST III (2009): An estimated open-economy DSGE model of the euro area with fiscal and monetary policy. *Journal of Economic Modelling*, vol. 26, no. 1, pp. 222-233.

Smets, Frank and Trabandt Mathias (2012): Government Debt, the Zero Lower Bound and Monetary Policy. Preliminary version of WP.

Tomšík, Vladimír (2012): Some Insights into Monetary and Fiscal Policy Interactions in the Czech Republic. BIS Paper No. 67.

Turner, David (2006): Should Measures of Fiscal Stance be Adjusted for Terms of Trade Effects?. OECD Economics Department Working Paper No. 519.

Wanyera, Maris, and Davies Fiona (2012): Uganda: macroeconomic policy co-ordination and management. Ministry of Finance, Planning and Economic Development, Republic of Uganda. Budget Strengthening Initiative – Country Learning Notes.

Appendix 1: Model Calibration

The calibrated values of the fiscal-equation extended model parameters are summarized in Table 1. The calibration is not away of the common values with respect to the Ugandan country specifics. It passes through typical model testing techniques as well.

Table 1: Calibration of the Parameters of the Core Equations in the Model

Parameter	Calibrated Value	Description of the Parameter
β_1	0.45	IS curve: coefficient on the expected value
β_2	0.20	IS curve: persistence in the output gap
β_3	0.06	IS curve: weight of the real interest rate gap component of the monetary condition
β_4	0.09	IS curve: weight of the real exchange rate gap component of the monetary condition
β_5	0.10	IS curve: impact of the foreign demand
β_6	0.20	IS curve: impact of the fiscal impulse on the output gap
α_1	0.40	PC: coefficient on expected inflation
α_2	0.04	PC: coefficient of the imported foreign inflation
α_3	0.05	PC: coefficient of the imported food inflation
α_4	0.42	PC: weights of the output gap component of the real marginal cost
α_5	0.18	PC: weights of the real exchange rate gap component of the real marginal cost
δ_2	0.2	UIP condition: impact of the fiscal impulse on the nominal exchange rate
γ_1	0.6	Policy rule: interest rate smoothing parameter
γ_2	1.7	Policy rule: coefficient on expected inflation deviation from target
γ_3	0.2	Policy rule: coefficient on the output gap

Appendix 2: Model Observed Data

The simple structure fits to Ugandan data availability. The complete list of the observed data for the model filtration is listed in Table 2. As the model is the quarterly one, all the data are converted into this frequency. If necessary, the time series is also seasonally adjusted.

Table 2: Data Series Observed in the Model

Variable	Source	Note
Real GDP	Uganda Bureau of Statistics	Gross domestic product at 2002 constant price in billions of shillings, seasonally adjusted
Core price index	Uganda Bureau of Statistics	Monthly core consumer price index (CPI) with base year in 2005/2006, seasonally adjusted
Core inflation target	Bank of Uganda	Inflation target for core inflation, observed after the introduction of the inflation targeting lite regime
Nominal interest rate	Band of Uganda	Monthly weighted average of the 7-day interbank interest rate
Nominal exchange rate	Bank of Uganda	Mid-rate of the bilateral exchange rate of the Ugandan shilling per the United State dollar, monthly average
Adjusted primary deficit	Ministry of Finance, Planning and Economic Development	Adjusted overall fiscal deficit as a ratio to nominal GDP (calculated from real GDP and core CPI), seasonally adjusted
Foreign consumer price index	Organization for Economic Cooperation and Development	Monthly United States headline CPI, seasonally adjusted
International food price	Food and Agricultural Organization of the United Nations	Monthly world food price index with a base period of 2002-2004, seasonally adjusted
Foreign interest rate	American Federal Reserve Board	Monthly United States Fed Fund overnight nominal interest rate
Foreign real interest rate trend	own calculation*	Trend in the real United States Fed Fund overnight nominal interest rate
Foreign output gap	own calculation**	Gap in United States real GDP in chained 2005 United States dollars, seasonally adjusted

* The foreign real interest rate trend was filtered out from the foreign real interest rate, calculated from the United States Fed Fund overnight nominal interest rate adjusted by annual United States consumer price index inflation in line with the Fisher equation, by the Hodrick-Prescott filter.

** To identify foreign output gap, the Hodrick-Prescott filtration was run on the seasonally adjusted United States real GDP data.

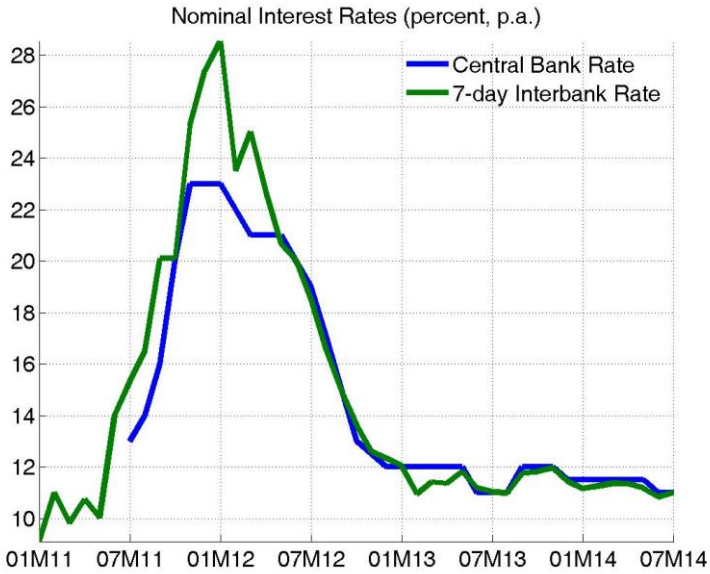
There are two model-observed variables deserving special attention in case of the Ugandan economy: nominal interest rates and nominal GDP.

Nominal Interest Rates

In July 2011, the Bank of Uganda reformed its monetary policy framework and introduced and inflation targeting lite regime. Under this framework, the central bank sets its monetary policy rate (the Central Bank Rate) to guide short-term interbank lending rates. To ensure that the 7-day interbank rate is close to the Central Bank Rate, regular interventions in the money market are conducted by the central bank (see Figure 5 for a mutual co-movement in the Central Bank Rate and 7-day interbank rate, especially after March 2012). A secondary monetary policy objective is to reduce output gap and keep the economic performance close the potential level of production in the economy.

To observe the nominal interest rate throughout the whole filtration sample starting at the beginning of 2001 and to keep consistency, 7-day interbank rate is used as a monetary policy rate.

Figure 5: Comparison of Central Bank Rate and 7-day Interbank Rate



Nominal GDP

The fiscal balance is recalculated as a share to nominal GDP. However, nominal GDP is available only in annual frequency for Uganda. The same case is valid for a GDP deflator. To handle this problem, core inflation is used as a proxy for the deflator. Thus the quarterly nominal GDP is calculated by the real counterpart and inflation approximating the GDP deflator. The comparison between observed annual nominal GDP growth and calculated nominal GDP, using inflation and converted to the annual frequency, presents Figure 6. The comparison reveals that the identified small differences do not prevent from using this approximation.

Figure 3 also displays the share the adjusted primary balance to nominal GDP. This variable is among the observed time series for the model-based filtration.

Figure 6: Nominal GDP Comparison and Adjusted Primary Balance Ratio