The Distributional Impacts of Fiscal Consolidation in Uganda

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Abstract

While Uganda is considered to be at low risk of debt distress, the stagnant tax effort and large planned capital expenditures might significantly alter this position. This paper employs the dynamic stochastic general equilibrium (DSGE) model to examine tax design issues that arise in addressing debt increases. The results suggest that Uganda may improve it debt position by permanently increasing tax rates by 5 percentage point. However, an increase of consumption tax rates (VAT and Excise) by this magnitude to meet debt reduction is found to be relatively more distortionary affecting consumption, especially for the poor households, in both the short and long run leading to large temporary reductions in the gross domestic product (GDP).

1. Introduction

Uganda's public debt has increased significantly on average from 21 percent of Gross Domestic Product (GDP) in 2010 to about 38 percent in 2016—the highest rate since debt forgiveness through the Heavily Indebted Poor Country (HIPC) and the Multi-lateral Debt Relief Initiative (MDRI) in 2006 (Lakuma *et al*. 2017). Public debt has increased in large part due to expenditure on the National Development Plan (NDP)[5], stagnation of the ratio of tax revenues to GDP and the large and ever growing informal sector that is hard to tax. The fall of global commodity prices and the resultant lower export revenues, the lagged return to investments on capital project during the NDP, and reduction in donor financing are also attendant.

In the absence of significant fiscal consolidation measures, debt-to-GDP ratio is likely to remain high over the medium term. Against this backdrop, the government of Uganda is expected to undertake policies to reduce debt through tax revenue mobilisation and recurrent expenditure restraint. These policies are well spelled out in the various *Medium Term Debt Strategies (MDTS), the 2013 Uganda Public Debt Management Framework* and the 2016 *charter of fiscal discipline.*[6] The primary objective of fiscal consolidation is to maintain Uganda's low risk of debt distress. Other coincidental factors motivating the planned fiscal consolidation are Uganda's attempt to align its real and government sector performance to other East African Community (EAC) member states in respect of the East Africa Monetary Union (EAMU) convergence criteria (EAC 2013).[7]

However, in a developing country like Uganda with no broad social protection program and a small public pension system, a cut back on social spending on education and health programs can have dire consequences among them increased inequality. In this regard, this paper employs the Dynamic Stochastic General Equilibrium (DSGE) model to conduct an *ex-ante* regulatory impact assessment of Uganda's fiscal consolidation efforts from 2016 to 2040. The model examines the impact of a 5 percentage point increase in the income tax, corporate tax and consumption taxes (Value Added Tax (VAT) and excise tax) on household welfare, the real sector[8] and in achieving a sustained reductions in public debt burdens and fiscal deficits.

The model is calibrated so as to reflect key characteristics of Uganda's economy including debt, poverty level and output. However, we must note that this paper examines the impact of a tax rate increase fiscal consolidation policy stance only. In this regard, an extensive evaluation of the expenditure cuts policy stance is beyond the scope of this study. The focus

[5] Uganda's long-term development strategies are articulated in the Vision 2040, which is implemented through five-year NDP. Presently, Uganda is implementing its second NDP.

[6] Charter for Budget Responsibility ("the Charter") guides the government in the formulation and implementation of fiscal policy and policy for the management of the national debt. The charter also specifies indicators that will enable Uganda to attain the convergence criteria in the year 2021.

[7] The EAMU Convergence criteria requires that all EAC member states maintain inflation at 5 percent, fiscal deficit ceiling of 6 percent of GDP, Debt-to-GDP ratio of 50 percent and tax - to – GDP ratio of 25 percent .

[8] The value of 5 percentage point is influenced by the highest the current tax rate can increase without exacerbating the excess burden and the loss in consumer surplus rate.

on taxation stance is motivated by the urgency to increase Uganda's domestic tax effort and the need to identify a tax rate reforms that strengthen the fiscal position while being, if not growth-promoting, at least minimally distortionary and growth-retarding, while respecting equity concerns.[9]

The rest of the paper is organized as follows. Section 2 presents an overview of Uganda's macro and fiscal position. Section 3 presents a review of related literature on fiscal consolidation. Section 4 offers the empirical methodology. Section 5 illustrates how the model was calibrated. Section 6 discusses the results prior to conclusions in section 7.

2. Overview of Uganda's Macro and Fiscal Position

In the 1990's, Uganda's debt had peaked to unsustainable levels such that the economy did not have the capacity to meet its debt obligations. Fortunately, Uganda benefited from two waves of debt relief that eased Uganda's debt service obligations. The first was the HIPC Initiative in 1998 and 2000, the second was MDRI in 2006 (MoFPED 2013).[10]

Uganda's debt remains sustainable, the present value of public debt-to-GDP ratio is projected to peak at about 41 percent in 2021 , well below the benchmark level of 56 percent associated with heightened public debt vulnerabilities for medium performers (IMF 2015). However, the relatively short average maturity of domestic debt combined with a low revenue base continue to be a matter of concern for Uganda's fiscal policy. Interest payments on debt are rising fast recorded at 12.6 percent in the 2017/18 (MoFPED 2016). Forecasts suggest that interest payments will account for 16 percent of domestic revenue in 2020 (Ibid). This is above the thresholds (15 percent) set in the Medium Term Debt Strategy.

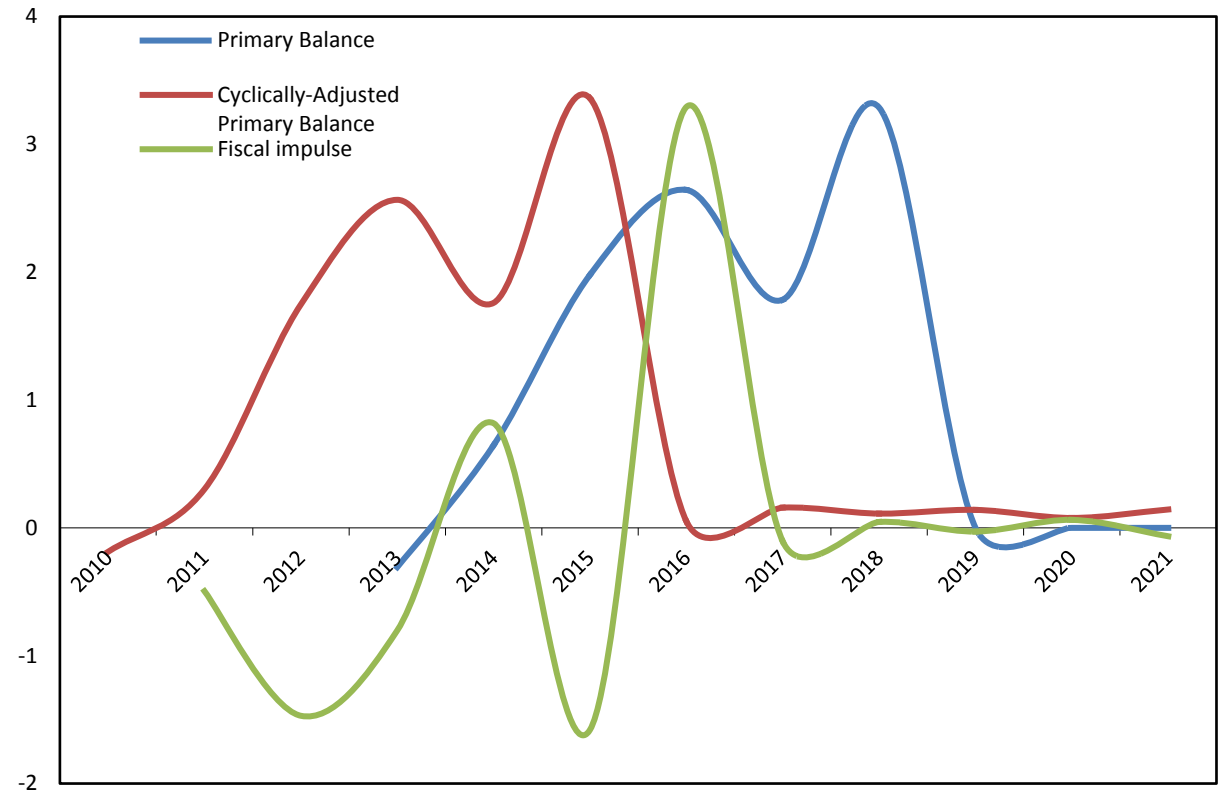
2.1 The Pace of Fiscal Consolidation

The over-arching need is for substantial fiscal consolidation, as the planned scaling up of public investment approaches completion, to both reduce levels of public debt and provide space to address social expenditure and domestic arrears. Figure 1, sets out an adjustment path for Uganda and illustrates the scope of the debt reduction challenge. The negative fiscal impulse suggest a tighter fiscal policy from 2017. This policy stance is consistent with the *Charter of Fiscal Responsibility* and criteria for the EAMU by 2021 (MoFPED 2016a).

[9] See Trabandt, M., Uhlig, H. (2011),'The Laffer Curve Revisited', Journal of Monetary Economics, 58 (4): 305–27. doi:10.1016/j.jmoneco.2011.07.00 for a discussion on tax revenue maximizing tax rate. Otherwise known as the ''laffer curve''

[10] The savings from debt forgiveness where largely expended on the Poverty Action Fund (PAF) (see Lakuma and Lwanga 2017).

Figure 1: Fiscal Consolidation in Uganda



Note: Dotted line represents forecast.
Source: Authors' own calculation.

2.2 Composition of Fiscal Consolidation

Table 1 sets out how reductions in borrowing between 2017/18 and 2021/22 are to be achieved. The deficit is to be reduced through a combination of increase in taxes, cuts to social sector spending and a squeeze on development spending. For example, the government plans to raise an extra UGX 2,112 Billion in taxes, UGX 1,232 Billion squeeze in development expenditure and UGX 527.8 Billion cut in agriculture and social sector expenditure in 2018/19 to reduce deficits and debt. While the planned fiscal consolidation may increase the tax burden on households and have an impact on the efficiency of the productive sectors, it will reduce the budget deficit and debt significantly. MoFPED (2016) suggest that changes in the fiscal position will be largely driven by reforms in the tax system.[11]

[11] Other strategies are efficiency in tax administration, which will require investments on technology and human resources.

Table 1: Consolidation Plan: change in deficit from 2017/18 (UGX Billions)

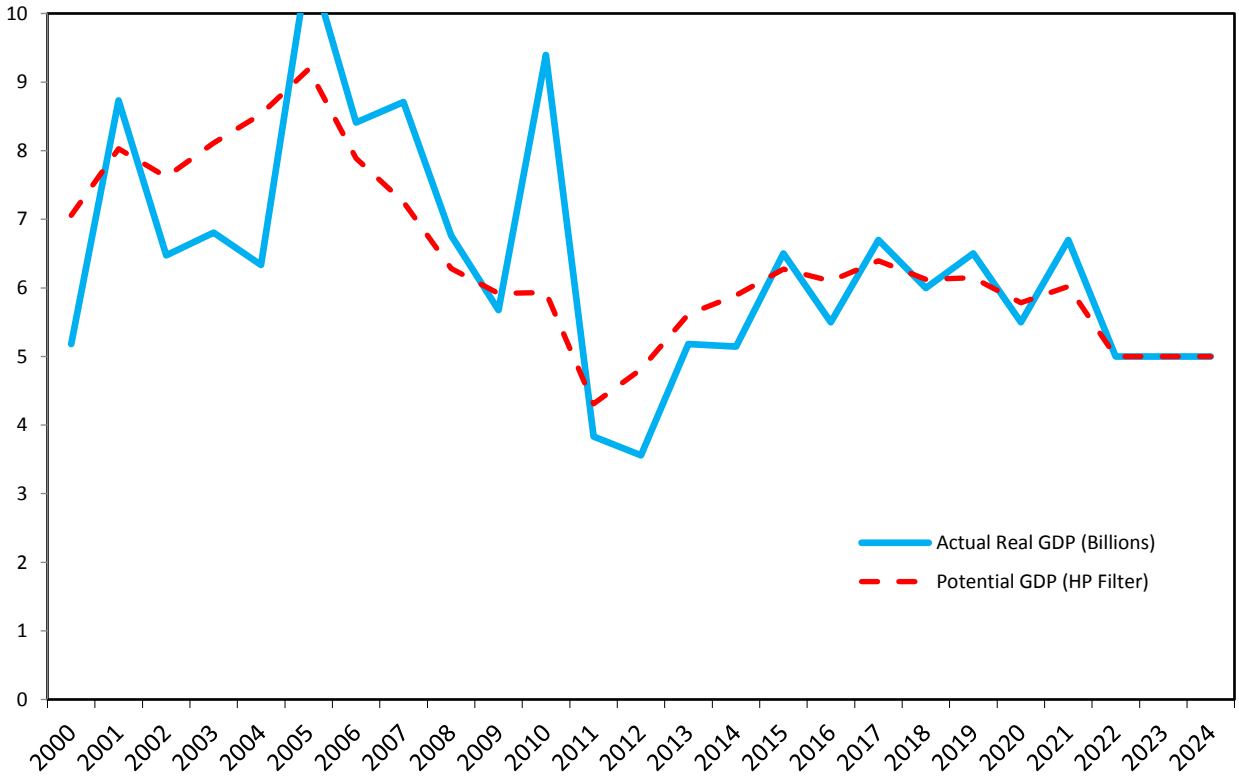
	2017/18	2018/19	2019/20	2020/21	2021/22
Taxes	-1,948.0	-2,112.0	-2,081.0	-2,376.0	-2,860.0
Non Tax Revenue	-73.0	-25.0	-69.0	-74.0	-93.9
Development Expenditure	2,208.0	-1,232.0	-104.0	288.0	3,602.0
Agriculture and Social Sector Spending*	-606.3	-527.8	277.0	560.4	2,304.9
Net Lending and Investment	266.0	-92.0	-118.0	319.0	212.0

Notes: *Social Sectors are Education, Health, Water and Environment and Social Development and other programs earmarked under the Poverty Action Fund (PAF).
Source: Authors' own Calculation with data from MoFPED (2016b).

2.3 Medium Term Risk

Fostering underlying growth in the second NDP (2015 – 2020) remains imperative to manage the debt dynamics as suggested in Figure 2. Growth is critical to debt sustainability, reducing the relative scale of taxation needed (de Mooij and Keen 2013). In addition, tax burden on households and firms tend to change much less as cash receipts tend to move more in line with the size of the economy. However, Figure 2 shows an underlying poor growth performance during the first NDP (2010 – 2015). This is likely a reflection of the less than potential demand, particularly for Uganda's exports as made evident in Uganda's sustained trade deficits (IMF 2016).

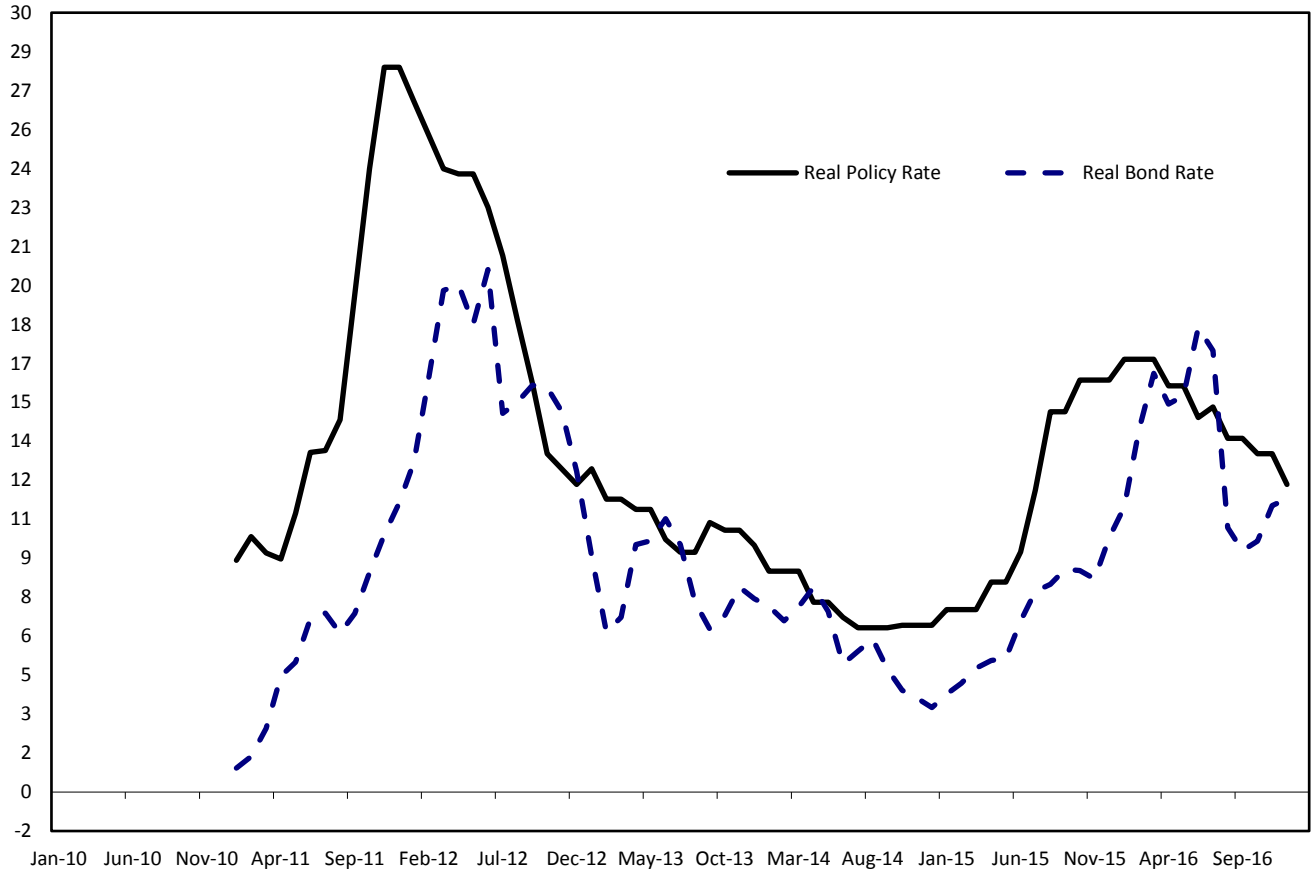
Figure 2: Uganda's GDP Growth (Actual and Potential billions Shillings)



Source: Authors' Own Calculation.

Figure 3 reveals that real interest rate are high due to uncertainty about the future outlook and inflationary effect of fiscal policy. This has often necessitated Bank of Uganda to tighten monetary policy, with negative effect on private sector credit. The uncertainty has also presented a challenge to the coordination of monetary and fiscal policy.

Figure 3: Real Interest rate (computed Using expected inflation rate)



Source: Authors' own calculations.

3. A Review of Related Literature

After the financial crises of 2008, many countries, particularly OECD members, have adopted and are implementing fiscal consolidation through increase in tax rates and expenditure cuts to reduce debt (OECD 2012). This is largely because high debt weighs negatively on output growth, limits room for accommodation of future negative shocks and add to fiscal challenges resulting from future government expenditure (Rawdanowicz 2014).

In addition, a high debt-to-GDP ratio plays an important role in the determination of government bonds and treasury bills rates. Typically, the returns to bonds and treasury bills increase with risk perception (De Grauwe and Ji 2013). In this case, the perception of risk by the financial market participants and behavioural factors such as perception biases and

extrapolative expectations may influence the bond rates (Ibid). Moreover, high bond rates have the potential to pass through to borrowing costs increasing credit cost for the private sector and heightening the risk of sovereign default (Rawdanowicz 2014). This phenomena can lead to sudden escalation of debt as was evidenced during the Greece economic crisis (Arghyrou and Kontonikas 2011).

Also, carrying out a fiscal consolidation to reduce debt is associated with reduction in fixed capital. For example, while the South African government reduced its debt/GDP ratio from almost 50 percent to 27 percent between 1994 and 2008, this reduction was accompanied by a significant decrease in government's fixed capital/GDP ratio from 90 percent to 55 percent (Burger 2016). This suggest that fiscal sustainability may not necessarily improve the government's balance sheet. For this reason, Auerbach and Gorodnichenko (2012) argues for postponing consolidation as a large frontloaded adjustment can reduce GDP growth with negative fallout for the fiscal situation. Such effects are more likely when output and unemployment gaps are large and credit constraints are binding (Lakuma et al. 2016).

Moreover, fiscal consolidation has been associated with an increase in poverty (Smeeding 2000) and an increase in income inequality (Bova *et al*. 2013). In some OECD countries, increased taxation and expenditure cuts have led to a record unemployment, economic stagnation, and a collapsing financial sector (OECD 2012). Some governments have lost elections due to implementing fiscal consolidation (Ibid).

This brings to fore the capacity gaps in developing countries, such as Uganda, in carrying out fiscal consolidation. The question then is what impact will increased taxation on incomes and consumption, and expenditure cuts have on a developing country. It should be noted that, even without fiscal consolidation, income inequality has risen in Uganda and is higher today than it was 25 years ago (Ssewanyana and Kasirye 2012). Nearly 10 percent of households continue to live in chronic poverty (Ibid).

However, Uganda has also achieved a sustained decline in poverty to 19.7 percent over the years, which suggests that a rise in income inequality can be avoided (World Bank 2016). As such, the rise in inequality is relevant to this study granted its' negative consequences on growth, efficiency and welfare. Nevertheless, the impact of inequality on growth and of growth on inequality is unclear since there are equalizing and un-equalizing effects during the economic cycle (Hoeller and Pisu 2014). Indeed, Kuznets' (1955) pioneering findings suggest that a country goes through an inverted U-curve of economic growth and economic inequality.

The last set of issues concern the increment in the tax rates itself as a policy tool for achieving reduction in debt and a substantial shift in the tax effort. Hutton *et al.* (2017) argues that there is no room for tax rate increment in developing countries with low collection efficiency and, as such, much of tax mobilization efforts should concentrate on expanding the number of tax payers. However, the cost and the benefits of a tax rate increment has not been empirically examined in the developing world, in particular Uganda. The aim of Section 6 of

the paper is therefore to assess the merits of income and consumption taxes in achieving consolidation, growth and fairness.

4. The Model

As earlier mentioned, this paper models the impact of a 5 percentage point increase in the tax rate on a closed economy with sectors for households (non- poor (Ricardian) and poor (Non-Ricardian)), firms and government (fiscal authority, social sector (education, pension and health)) and the monetary authority. The modelling implemented in this work is a variant of the work by Costa Junior and Sampaio (2014). The model includes poor household to reflect the inability of households to quickly adjust their consumption and investments in event of a shock[12].

4.1 Households

The household sector is composed of two types of representative agents: non- poor (Ricardian) and poor (Non-Ricardian). The non-poor household represents households living above the poverty line. Typically, these kinds of households are economically active and pay a variant of taxes other than consumption taxes. These households form (1-ω) of the total population, while the poor households form the remaining proportion of the population. The non-poor household is able to maximise its intertemporal utility by choosing consumption, savings, investment and leisure. For saving, the household can choose between two different savings instruments - physical capital and government bonds. Also, with the disposable income after payment of taxes, the non-poor household can purchase consumer goods, capital goods, and/or government bonds. On the other hand, the poor household just allocates its income in acquisition of consumer goods.

Non-Poor (Ricardian) Households (R): Taxpayers

Relying on the behaviour described about the households, the non-poor household chooses how much to consume, how to work and how to acquire financial and physical assets to maximize the discounted stream of the expected utility[13] [14] as expressed in Eq. (1):

[12] Besides the inclusion of poor households, this model has two other frictions: monopolistic competition and staggered pricing a la Calvo. The latter friction aims to avoid the model to have a very fast adjustment in relation to shocks, a factor noticed in empirical evidence.

[13] The most common utility function to represent the choices of Family Representative is the utility function of constant of constant relative risk aversion (CRRA) (Gali 2008; Lim and McNelis 2008; Clarida et. al. 2008; Gali and Monaceli 2005; Christoffel and Kuester 2000; Christoffel et. al. 2009; Ravenna and Walsh 2006). The other common parameterizations for the utility function in the literature, examples logarithmic utility function, $U(C_t, L_t) = \ln C_t + \frac{L_t}{L_o} A \ln(1 - L_0)$ (Hansen 1985); and utility function that would be a combination of logarithmic and of the CRRA, $U(C_t, L_t) = \ln(C_t) - \frac{v}{1+x} L_t^{1+x}$ (Gertler and Karadi 2011).

[14] A utility function must have certain characteristics: $U_C > 0$ and $U_L < 0$, This means that consumption and labor have a positive and negative effects, respectively, over the happiness of the households. On the other hand, $U_{CC} < 0$ and $U_{LL} < 0$, indicating the utility function is concave. This represents that if the consumption increases the utility level also increases, but in a smaller and smaller proportion. Another assumption regarding the utility function says that this function is additionally separable in time. This assumption allows to speak of an instantaneous utility function, wherein the agent receives utility solely from consumption that performs at a given moment in time.

(1) $$max\ E_t \sum_{t=0}^{\infty} \beta^t S_t^C \left[\frac{C_{R,t}^{1-\sigma}}{1-\sigma} - S_t^L \frac{L_t^{1+\psi}}{1-\psi}\right]$$

Subject to their budget constraint as expressed in Eq. (2):

(2) $$P_t(1+\mathrm{T}_c)\left(C_{R,t}+I_t\right) + \frac{B_{t+1}}{R_t^B} = W_t L_t \left(1-\frac{\mathrm{T}_l}{\phi_t^l}-\mathrm{T}_p\right) + R_t K_t \left(1-\frac{\mathrm{T}_k}{\phi_t^k}\right) + B_t$$

And in relation to the law of motion of capital as expressed in Eq. (3):

(3) $$K_{t+1} = (1-\delta)K_t + I_t$$

Where E_t is the expectations operator, $\beta \in (0,1)$ is the intertemporal discount factor, C_R is the consumption of non-poor household, L is the labour, S^C is the intertemporal consumption shock, S^L is the shock on the labour supply, ψ is the marginal disutilty of labour and $\boldsymbol{\sigma}$ is the coefficient of relative risk aversion.

In the budget constraint, P is the general price level, I is the investment, B is the government bond maturing in one period, R^B is the rate of return on government bond (basic interest rate). W is the wage , R is the return to capital, K is the stock of capital, ϕ^l and $\phi^k$are the stochastic components of labour income and capital/corporation income respectively. While $\mathrm{T}_c, \mathrm{T}_l, \mathrm{T}_k, \mathrm{T}_p$ represent the statistic components of the tax on consumption, labour, capital[15] and pension respectively. This paper adopts the convention that B_t is the nominal bond issued in (t-1) and matured in t. Then, B_{t+1} and K_{t+1} are decided in t.

The non-poor household purchases consumer goods (C_R) and investment goods (I) at the price level (P), also buys or sells government bonds (B) maturing in one period. These bonds pay a risk-free return, R_B , which is also controlled by the monetary authority.

This kind of household pays 3 types of taxes (consumption tax[16], income tax on labour, and income tax on capital/corporate tax) and also contributes to social security. The household income comes from three sources: Labour income, which depends on the level of nominal wages (W); return on capital rental to firms, which is a function of the rate of return to capital (R); and income from government bonds acquired in the previous period.

[15] Can be referred to as corporate

[16] VAT and Excise tax

To solve the problem of the non-poor household, a lagrangian function is used:

(4) $$\mathcal{Y} = E_t \sum_{t=0}^{\infty} \beta^t \left\{ S_t^C \left[\frac{C_{R,t}^{1-\sigma}}{1-\sigma} - S_t^L \frac{L_t^{1+\psi}}{1+\psi} \right] - \lambda_t \left[P_t(1+\mathrm{T}_c)\left(C_{R,t} + K_{t+1} - (1-\delta)K_t\right) + \frac{B_{t+1}}{R_t^B} - W_t L_t \left(1 - \frac{\mathrm{T}_l}{\phi_t^l} - \mathrm{T}_P\right) - R_t K_t \left(1 - \frac{\mathrm{T}_k}{\phi_t^k}\right) - B_t \right] \right\}$$

The first order conditions associated with the choices of $C_{R,t}, L_t, K_{t+1}$ and B_{t+1} are respectively:

(5) $$\frac{\partial \mathcal{Y}}{\partial C_{R,t}} = S_t^C C_{R,t}^{-\sigma} - \lambda_t P_t (1+\mathrm{T}_c) = 0$$

(6) $$\frac{\partial \mathcal{Y}}{\partial L_t} = -S_t^C S_t^L L_t^{\psi} + \lambda_t W_t \left(1 - \frac{\mathrm{T}_l}{\phi_t^l} - \mathrm{T}_p\right) = 0$$

(7) $$\frac{\partial \mathcal{Y}}{\partial K_{t+1}} = -\lambda_t P_t (1+\mathrm{T}_c) + \beta E_t \lambda_{t+1} \left[(1-\delta) P_{t+1} (1+\mathrm{T}_c) + R_{t+1} \left(1 - \frac{\mathrm{T}_k}{\phi_t^k}\right) \right] = 0$$

(8) $$\frac{\partial \mathcal{Y}}{\partial B_{t+1}} = -\frac{\lambda_t}{R_t^B} + \beta E_t \lambda_{t+1} = 0$$

From equation (5):

(9) $$\lambda_t = \frac{S_t^C C_{R,t}^{-\sigma}}{P_t(1+\mathrm{T}_c)}$$

Substituting the equation (9) into (6), it results in the equation of labour supply:

(10) $$S_t^L L_t^{\psi} C_{R,t}^{\sigma} \left[\frac{(1+\mathrm{T}_c)}{\left(1 - \frac{\mathrm{T}_l}{\phi_t^l} - \mathrm{T}_p\right)} \right] = \frac{W_t}{P_t}$$

Substituting equation (9) in equations (7) and (8), we obtain the Euler equations:

(11) $$S_t^C C_{R,t}^{-\sigma} = \beta E_t \frac{S_{t+1}^C C_{R,t+1}^{-\sigma}}{P_{t+1}(1+\mathrm{T}_c)} \left[(1-\delta) P_{t+1} (1+\mathrm{T}_c) + R_{t+1} \left(1 - \frac{T_k}{\phi_{t+1}^k}\right) \right]$$

(12) $$\frac{S_t^C C_{R,t}^{-\sigma}}{P_t} = R_t^B \beta E_t \frac{S_{t+1}^C C_{R,t+1}^{-\sigma}}{P_{t+1}}$$

Non-Ricardian Households (NR): Poor Household

Poor Households have a simpler behaviour[17]. Because they do not maximize their intertemporal utility, their consumption is limited to the value government social expenditure ($Soc.Exp._t$). Under this hypothesis:

(13) $$(1 + \mathrm{T}_c)P_t C_{NR,t} = Soc.Exp._t$$

Aggregate Consumption

The aggregate consumption of this work follows the functional form $(C = (1-\omega)C_R + \omega C_{NR})$[18] very common in this type of literature (Coenen and Straub, 2004[19]).

Thus, aggregate consumption of the individual non-poor households and poor-households is performed as follows:

(14) $$C_t = (1-\omega)C_{R,t} + \omega C_{NR,t}$$

Shocks to Related Households

There are two shocks related to non-poor household behaviour: the shock in intertemporal preferences (S^C) and the shock on labor supply(S^L). While the first affects the choice of intertemporal consumption, the second affects labour supply and determination of nominal wages. The shock S^C was included to capture changes in valuation between the present and future, which the literature on intertemporal behavior suggested as key to the understanding of aggregate fluctuations (Primiceri *et al*. 2006). Additionally, the shock S^L was added to model changes in labor supply that Hall (1997) and Chari *et al*. (2007) identified as responsible for major changes in employment over the business cycle. There are two other shocks in the stochastic components of the taxes on labour income (ϕ^l) and on capital income(ϕ^k). These shocks were included to characterize the stochastic component related to these 3 types of taxes, which are the objects of this paper. Thus, the movement rules of such shocks are presented in Eq. (15)-(18):

(15) $$\log S_t^C = (1-p_{sc})\log S_{ss}^C + p_{sc}S_{t-1}^C + \epsilon_{sc,t}$$

[17] Generally, the DSGE literature treats the non-Ricardian agent/poor household as an individual without capacity to maximize the intertemporal utility due to liquidity conditions. In this work, the assumption is that this type of agent does not maximize its utility due to poverty.

[18] $C_t = \int_0^1 C_{h,t}\,dh = (1-\omega)C_{R,t} + \omega C_{NR,t}$ given that agents belonging to the same group are identical.

[19] Also see Bosca et. al. 2010; Gali et. al. 2007; Itawa 2009; Fulanetto 2007; Dallari 2012; Mayer et. al. 2010; Stahler and Thomas 2011; Swarbrick 2012; Motta and Trelli 2010; Diaz 2012; Colciago 2011; Mayer and Stahler 2009; and Forni et. al. 2009

(16) $\log S_t^L = (1 - p_{sl}) \log S_{ss}^L + p_{sl} S_{t-1}^L + \epsilon_{sl,t}$

(17) $\log \phi_t^l = (1 - p_l) \log \phi_{ss}^l + p_l \phi_{t-1}^l + \varepsilon_{l,t}$

(18) $\log \phi_t^k = (1 - p_k) \log \phi_{ss}^k + p_k \phi_{t-1}^k + \epsilon_{k,t}$

Where $\epsilon_{sc,t}, \epsilon_{sl,t}, \epsilon_{l,t}, \epsilon_{k,t}$ are exogenous shocks, and p_{sc}, p_{sl}, p_l, p_k are autoregressive components, of the intertemporal consumption shock, of the shock on labor supply, of the shock of taxes on consumption, shock of taxes on labor income and of the shock of taxes on capital income, respectively.

4.2 Firms

The productive sector of the economy in this paper is divided into two subsectors: firm producers of finished goods (retail); and firm producers of intermediate goods (wholesale). The wholesale sector is formed by great number of firms, each producing a different good according to the structure of monopoly competition. In the retail industry, there is a single firm that aggregates intermediate goods in a single good (Y) that will be consumed by economic agents. Besides these features, it should be mentioned that the markets for productive factors follow a structure of perfect competition.

Firm Producers of Finished Goods (Retail)

First, it is necessary to define the aggregator behaviour of the production function. The finished good is produced by a single firm that operates in perfect competition. For this purpose, the firm combines a continuum of intermediate goods and aggregates them into a single finished good using the following technology:

(19) $Y_t = \left(\int_0^1 Y_{j,t}^{\frac{\varphi-1}{\varphi}} dj \right)^{\frac{\varphi}{\varphi-1}}$

Y is aggregate output, Y_j is the intermediate product j, φ is the elasticity of substitution between intermediate goods. The form adopted to aggregate the assets is called a Dixit-Stiglitz aggregator (Dixit and Stiglitz 1977).

As mentioned, the finished goods producer is in perfect competition and maximizes its profit by using the technology of equation (19), whereas the prices of intermediate goods are given. Therefore, the problem of the retail firm is:

(20) $\max_{Y_{j,t}} P_t Y_t - \int_0^1 P_{j,t} Y_{j,t} dj$

Substituting (19) into (20)

$$\max_{Y_{j,t}} P_t \left(\int_0^1 Y_{j,t}^{\frac{\varphi-1}{\varphi}} dj \right)^{\frac{\varphi}{\varphi-1}} - \int_0^1 P_{j,t} Y_{j,t} dj$$

The first order condition for each intermediate good j is:

$$P_t \left(\int_0^1 Y_{j,t}^{\frac{\varphi-1}{\varphi}} dj \right)^{\frac{\varphi}{\varphi-1}-1} Y_{j,t}^{\frac{\varphi-1}{\varphi}-1} - P_{j,t} = 0$$

(21) $$Y_{j,t} = Y_t \left(\frac{P_t}{P_{j,t}} \right)^{\varphi}$$

Equation (21) demonstrates that the demand for intermediate good j is a decreasing function of its relative price and increasing in relation to the aggregate output of the economy.

The general price level is obtained by substituting equation (21) in (19):

$$Y_t = \left\{ \int_0^1 \left[Y_t \left(\frac{P_t}{P_{j,t}} \right)^{\varphi} \right]^{\frac{\varphi-1}{\varphi}} dj \right\}^{\frac{\varphi}{\varphi-1}}$$

$$P_t = \left(\int_0^1 P_{j,t}^{\frac{\varphi-1}{\varphi}} dj \right)^{\frac{\varphi}{\varphi-1}} \quad (22)$$

Firm producers of intermediate goods (wholesalers)

The wholesaler firms solve the problem in two steps. In the first step, firm take as given the prices of production factors: wages (W) and return to capital (R). They determine the quantities of those inputs that will minimize their costs. In the second stage, firms determine the optimal price of good j and they determine the quantity that will be produced in accordance with this price.

First Step

The objective of the first step is to minimize the cost of production in Eq. (23):

(23) $$\min_{L_{j,t} K_{j,t}} W_t L_{j,t} + R_t K_{j,t}$$

Subject to the following technology[20]

[20] As in the case of the utility of the households, the production function must have some properties: to be strictly increasing ($F_K > 0$ and $F_L > 0$) ; to be strictly concave ($F_{KK} < 0$ and $F_{LL} < 0$); and to twice differentiable. It is also assumed that the production function has constant returns to scale, $F(zK_t, zL_t) = zY_t$. Still, this function must fulfill the calls Inada conditions: $\lim_{K \to 0} = \infty$; $\lim_{K \to \infty} = 0$; and $\lim_{L \to \infty} = 0$

(24) $Y_{j,t} = A_t K_{j,t}^{\propto} L_{j,t}^{1-\propto}$

Where $\propto$ the share of capital in output is, A is the productivity, whose law of motion is:

(25) $\log A_t = (1-\rho_A)\log A_{ss} + \rho_A \log A_{t-1} + \epsilon_{A,t}$

Where $\epsilon_{A,t}$ is an exogenous shock and ρ_A is autoregressive components of the productivity shock. Using the Lagrangian function to solve the previous problem of wholesaler firm:

(26) $\mathcal{Y} = W_t L_{j,t} + R_t K_{j,t} - \mu_t\left(A_t K_{j,t}^{\alpha} L_{j,t}^{1-\alpha}\right)$

The first order conditions are:

(27) $\frac{\partial \mathcal{Y}}{\partial L_{j,t}} W_t - (1-\propto)\mu_t A_t K_{j,t}^{\alpha} L_{j,t}^{1-\alpha} = 0$

(28) $\frac{\partial \mathcal{Y}}{\partial K_{j,t}} = R_t - \alpha\mu_t A_t K_{j,t}^{\alpha-1} L_{j,t}^{1-\alpha} = 0$

From equations (27) and (28), we arrive at:

(29) $W_t = \mu_t(1-\propto)\frac{Y_{j,t}}{L_{j,t}}$

(30) $R_t = \mu_t \propto \frac{Y_{j,t}}{K_{j,t}}$

And from equations (29) and (30),

(31) $\frac{W_t}{R_t}\left[\frac{(1-\propto)}{\propto}\right]\frac{K_{j,t}}{L_{j,t}}$

Second Step

In the second step, the wholesale firm maximizes its profit by choosing the price of its good j:

(32) $\max_{P_{j,t}} P_{j,t} Y_{j,t} - W_t L_{j,t} - R_t K_{j,t}$

Substituting (21), (29) and (30) in (32):

$$\max_{P_{j,t}} P_{j,t} Y_t \left(\frac{P_t}{P_{j,t}}\right)^{\varphi} - \mu Y_t \left(\frac{P_t}{P_{j,t}}\right)^{\varphi}$$

It lies in the following first order condition,

$$(1-\varphi) Y_t \left(\frac{P_t}{P_{j,t}}\right)^{\varphi} + \varphi\mu_t Y_t \left(\frac{P_t}{P_{j,t}}\right)^{\varphi} P_{j,t}^{-1} = 0$$

$$\mu_t = \left(\frac{\varphi-1}{\varphi}\right) P_{j,t} \quad (33)$$

Substituting (33) into (29) and (30), and knowing that these firms have the same technology- $P_{j,t} = P_t \; e \; Y_{j,t} = Y_t$ - the results for prices of the factors of production are:

(34) $\frac{W_t}{P_t} = \left(\frac{\varphi-1}{\varphi}\right)(1-\propto)\frac{Y_t}{L_t}$

(35) $\frac{R_t}{P_t} = \left(\frac{\varphi-1}{\varphi}\right) \propto \frac{Y_t}{K_t}$

Pricing a la Calvo

The wholesale firm choose how much to produce in each period, but following a rule ala Calvo (Calvo, 1983) that says they fail to choose the price of their good in all periods. At each period t, a fraction $0 < 1 - \theta < 1$ of firms are randomly selected and allowed to choose the price of their good for period t, $P_{j,t}^*$. The remaining firms (the ratio θ of firms) keeps the price of the previous period $\left(P_{j,t} = P_{j,t-1}\right)$ for the product.

Thus, solving equation (31) to $L_{j,t}$:

$$L_{j,t} = \left[\frac{(1-\propto)}{\propto}\right]\frac{R_t K_{j,t}}{W_t}$$

And substituting this result in the production function (equation (24)):

$$Y_{j,t} = A_t K_{j,t}\left\{\left[\frac{(1-\propto)}{\propto}\right]\frac{R_t}{W_t}\right\}^{1-\propto}$$

Getting:

(36) $K_{j,t} = \frac{Y_{j,t}}{A_t}\left\{\left[\frac{\propto}{(1-\propto)}\right]\frac{W_t}{R_t}\right\}^{1-\propto}$

And,

(37) $L_{j,t} = \frac{Y_{j,t}}{A_t}\left\{\left[\frac{\propto}{(1-\propto)}\right]\frac{W_t}{R_t}\right\}^{-\propto}$

The wholesale firm has a probability θ to keep the price of the previous period for the good and the probability $(1-\theta)$ to choose the price optimally. Once fixing the price in period t, there is the probability θ that this price will remain fixed in period t+1, a probability θ^2 that this price will remain fixed in period t+2, and so on. This firm should take into account these probabilities when choosing the price of its own good in it capacity to perform this adjustment.

Thus, the problem of the firm able to adjust the price of the good is:

(38) $$\max_{P_{j,t}^*} E_t \sum_{i=0}^{\infty} (\beta\theta)^i \left[P_{j,t}^* Y_{j,t+i} - P_{t+i} R_{t+i} K_{j,t+i} - P_{t+i} W_{t+i} L_{j,t+i}\right]$$

Where θ is the factor of rigidity in the adjustment of prices and $P_{j,t}^*$ is the optimal price set by the firm with the ability to adjust the price of your product. Equation (38) is the discounted profit of the firm during the period which the price $P_{j,t}^*$ is in progress.

Substituting (21), (36) and (37) in (38):

$$\max_{P_{j,t}^*} E_t \sum_{i=0}^{\infty} (\beta\theta)^i Y_{t+1} \left(\frac{P_{t+i}}{P_{j,t}^*}\right)^{\varphi} \left\{P_{j,t}^* - \frac{P_{t+i}}{A_{t+i}} \frac{W_{t+i}}{(1-\alpha)} \left[\left(\frac{1-\alpha}{\alpha}\right) \frac{R_{t+i}}{W_{t+i}}\right]^{\alpha}\right\}$$

Arriving at the following first order condition:

$$0 = E_t \left(\sum_{i=0}^{\infty} (\beta\theta)^i Y_{j,t+i} \left\{1 - \varphi + \varphi \frac{P_{t+i} W_{t+i}}{P_{j,t}^* A_{t+i} (1-\alpha)} \left[\left(\frac{1-\alpha}{\alpha}\right) \frac{R_{t+i}}{W_{t+i}}\right]^{\alpha}\right\}\right)$$

$$P_{j,t}^* = \left(\frac{\varphi-1}{\varphi}\right) \frac{E_t \sum_{i=0}^{\infty} (\beta\theta)^i Y_{j,t+i} \frac{P_{t+i} W_{t+i}}{A_{t+i}(1-\alpha)} \left[\left(\frac{1-\alpha}{\alpha}\right) \frac{R_{t+i}}{W_{t+i}}\right]^{\alpha}}{E_t \sum_{i=0}^{\infty} (\beta\theta)^i Y_{j,t+i}} \quad (39)$$

Combining the pricing rule of equation (22), and the assumption that all firms with the ability to adjust define equal value and that firms without this ability retains the same price, the overall price level is obtained by the equation:

(40) $$P_t = \left[\theta P_{t-1}^{1-\varphi} + (1-\theta) P_t^{*1-\varphi}\right]^{\frac{1}{1-\varphi}}$$

4.3 Government

The government sector in this paper is divided into three subsectors: fiscal authority, social sector, and the monetary authority.

4.3.1 Fiscal authority

The government collects taxes and issues bonds to finance its spending on goods and services. The result of the social sector is transferred to the rest of the government. So if social spending shows a deficit (or surplus), this is financed (or appropriated) from the remainder of the government. Therefore, the change in public debt is given by the rule as expressed in Eq. (41):

(41) $$\frac{B_{t+1}}{R_t^B} - B_t = P_t G_t - BAL_t - TAX_t$$

As could not be otherwise, the expense of the government is sensitive to the size of the public debt (current debt (B_t) relative to its steady-state level), B_{ss} :

(42) $G_t - G_{ss} = \chi(B_t - B_{ss})$

Where χ is the sensitivity of the government spending relative to the size of the public debt.

And tax revenue is obtained by the following equation:

(43) $TAX_t = \tau_c P_t(C_T + I_t) + \frac{\tau_l}{\phi_t^l} W_t L_t + \frac{\tau_k}{\phi_t^k} R_t K_t$

4.3.2 Social expenditure

The social expenditure balance, BAL_t, is the difference between the total collected from social security contributions and taxes of active workers, $\tau_p W_t L_t$, and the Social Expenditure, $Soc.Exp._t$ [21].

Thus,

(44) $BAL_t = \tau_p W_t L_t + TAX_t - Soc.Exp._t$

4.3.3 Monetary authority

The Central Bank of Uganda appears in this work following a simple Taylor rule (1993) with the dual goal of output growth and maintenance of price stability:

(45) $R_t^B = a(Y_t - Y_{ss}) + b(\pi_t - \pi_{ss}) + R_{ss}^B$

Where (a) and (b) are the sensitivities of the basic interest rate in relation to output and inflation rate, respectively. The inflation rate is defined as:

(46) $\pi_t = \frac{P_t}{P_{t-1}} - 1$

Equilibrium condition of goods market

To complete the model it is necessary to use the equilibrium condition in the goods market. Wherein aggregate production Y_t is demanded by households (C_t and I_t) and Government (G_t):

[21] Social Expenditure include: Pension transfers, education and health expenditure

(47) $Y_t = C_t + I_t + G_t$

5. Calibration

The calibrated the model parameter using past economic literature on Uganda's monetary and fiscal assumption. The model equilibrium is a set of twenty one equations representing the behaviour of twenty one endogenous variables (See table 2): ($Y, C, CR, CNR, I, G, K, L, R, R^B, W, B, TAX, BAL, P,\ \pi, S^C, S^L, \phi^L, \phi^K$)

Consequently, it is necessary to assign values somehow for the structural parameters of the model $\alpha, \beta, \delta, \theta, p_A,\ p_{sc,}\ p_{sl}, p_l, p_k$ σ, φ, ψ, W, χ, a, b, Soc. Exp., $\tau_c, \tau_{l,} \tau_k, \tau_p$.

The main calibration procedure adopted here is to obtain the values of parameters from other relevant works in the literature. Doshi *et al*. (2016) analysed the dynamic properties of a DSGE model for Uganda under alternative parameterizations and identified "allowable ranges" of values for some of the key parameters in the literature. This study retains some of the parameters used by Doshi *et al.* (2016) such as the discount factor (β); the share of capital in output (α); the rate of capital depreciation (δ); Consumption tax (Tc); Corporate tax (Tκ); labour tax (Tι); and the elasticity of substitution between intermediate good (φ).

The coefficient of relative risk aversion (σ) was obtained from Ostry and Reinhart (1992). The sensitivity of the basic interest rate on the product (a) and on the inflation rate (b) were obtained from Taylor (1993). The sensitivity of government spending relative to public debt (χ) was obtained from Costa Junior and Sampaio (2014).

Table 2: Model Parameters Calibrated

Parameters	Definition of Parameter	Value	Source
β	Discount Factor	0.938	Doshi et. al. (2016)
δ	Rate of Public Capital Depreciation	0.05	Doshi et. al. (2016)
σ	Coefficient of Risk Aversion	1/0.4551	Ostry and Reinhart (1992)
ψ	Marginal disutility of Labour	1.5	Cavalcanti and Vereda (2010)
Tc	Consumption Taxes	0.1123	Doshi et. al. (2016)
Tκ	Corporate Taxes	0.0366	Doshi et. al. (2016)
Tι	Labour Taxes	0.0366	Doshi et. al. (2016)
Tp	Rate of contribution of pension	0.0169	MoFPED (2016) and URBRA (2016)
W	Proportion of Poor household	0.197	World Bank (2016)
SOC. EXP	Total Social expenditure (Domestic and External)	0.789	MoFPED (2016)
α	Share of Capital in Output	0.333	Doshi et. al. (2016)
θ	Index of Price stickiness	0.666667	Alidou (2014)
a	Central Bank response to Output	0.5	Taylor (1993)
b	Central Bank response to Inflation	1.5	Taylor (1993)

φ	Elasticity of Substitution between Intermediate goods	30	Doshi et. al. (2016)
χ	Sensitivity of Government spending relative to the size of debt	0.1	Costa Junior and Sampaio (2014)

Source: Authors' own calculation.

6. Results

In this section, we analyse the effects of increase of tax rates on labour income, corporate profits and Consumption. Note that the transition dynamics of selected variables, following a permanent increase in tax rate, shows percentage deviations from initial steady state. The impulse response function are illustrated in the appendix.

6.1 Impact of income tax increase

The immediate effect of an income tax increase is a reduction of overall household consumption driven by a reduction of wages. In this case, the short term consumption of both the poor and the non - poor households' decreases (figure A1). However, the decrease among the poor households is stronger, as labour income is the main determinant of their consumption. The cumulative decrease in consumption due to income taxation is 4.48 percentage point larger for poor households than that of non-poor household. This is largely because the non-poor households are able to smooth the effect of income tax increase on consumption over a longer time horizon - due to positive long-run wealth effect. The positive wealth effect moderates the impact of an increase in income tax on total consumption.

Also an increase in the income tax leads to reallocation of production inputs from labour to capital, leading to an increase of a capital demand and a decrease of labour utilisation (figure A2). Inflation rises as a result of a higher marginal cost of labour (figure A3). Given that the Bank of Uganda places more weight on inflation than on GDP, the nominal interest rate rises (figure A3). The increase in interest rate initially decreases investment[22] (Figure A2). In addition, the fall in GDP implies a fall in employment (hence, an increase in unemployment) (figure A2). Unemployment suggest a reduced wage claims by workers (figure A2). Nevertheless, the increase in the income tax results in lower debt and a higher long run government expenditure (figure A4).

6.2 Impact of corporate tax increase

The immediate effect of an increase in the corporate tax rate is the reallocation of production inputs from capital to labour, which results in a higher labour demand/employment and a lower capital utilisation (figure A2). The higher demand for labour leads to an increase on wages[23], which more than compensates for the decrease in consumption of the non- poor

[22] The decrease last for one year only

[23] Cumulative growth of 0.9 percentage point

households (figure A1)[24]. The marginal cost increases as a result of the rise in rental rate (figure A3). This is followed by an increase in inflation and the nominal interest rate (figure A3). The interest-rate-sensitive consumption of non-poor households' decreases (figure A1). The consumption of poor households decreases slightly due to loss of labour income (figure A1). Investment initially decreases then increases significantly in the medium term because of decrease in the discounted rental rates (figure A2)[25]. On the fiscal side, government revenue increases and public debt decreases in the same proportion as the increase in government spending (figure A4).

6.3 Impact of consumption (VAT and Excise) tax increase

An increase in consumption tax rate results in a rise in consumer prices lasting approximately 4 years (figure A3). Consequently, as goods and services become more expensive, poor-households will reduce consumption, while non-poor households initially decrease consumption but eventually increase it two years due to wealth effects (figure A1). However, the total effect is a decrease in consumption of both poor and non-poor households (figure A1). Lower demand for goods, implied by the consumption tax increase, results in a decrease of the demand for labour, a lower capital utilisation, a temporary decrease in output and a fall in wages. Inflation and interest rates initially rise as a result of a higher marginal cost, but eventually fall in the medium term. The short term increase in interest rate decreases investment sharply in the short-run. Nevertheless, the increase in the consumption tax results in higher government revenue, lower debt and a higher government expenditure (figure A4). Overall, the effects of the increase in consumption taxation are largely similar although larger than those following a rise in income taxation.

7. Conclusions

This paper develops a closed economy DSGE model calibrated for Uganda with a comprehensive fiscal block. The model is motivated by recent fiscal actions and announcements in Uganda and is primarily aimed at simulating the impact of fiscal consolidation, through a tax increase, on households and the real sector. Specifically, the paper examines the impact of income tax, corporate tax and consumption tax (VAT and Excise tax) on households and the real macroeconomic aggregates.

The paper finds significant distributional effects of increasing the tax rate in Uganda to reduce debt. In particular, the paper finds that an increase in the tax rate is associated with an increase in inequality, declines in wage income and in the wage share of income, and increases in long-term unemployment. The result also suggest that consumption taxes are relatively efficient in reducing the short to long term debt ratio when compared to income

[24] Cumulative growth of 0.03 percentage point

[25] The decrease in rental rates takes two years

and corporate tax rate. However, consumption tax also wipes the fiscal gains out through a decline in output.

The adverse effects of consumption tax increase is typical if fiscal authorities engage in repeated rounds of tax rate hikes in an effort to get the debt ratio to converge to the official target. For Uganda, rapid fiscal consolidation may exacerbate poverty especially in the lagging regions of eastern and northern Uganda (Ssewanyana and Kasirye 2013). This problem could be addressed by setting and monitoring debt targets in cyclically adjusted terms.

However, whether fiscal consolidation will achieve its objectives of reducing debt, while maintaining the same level of welfare will depend on how the burdens of taxation and the benefits of social spending are distributed. One way is to differentiate the consumption taxes by retaining the current rate for durable and non-durables consumed by the poor and adjusting the rate upwards for those consumed by the non-poor[26] [27]. This ensure that the poor are shielded from the adverse effect of a tax increase as the government reduces it debt ratio.

It should be noted, however, that the effectiveness of such a policy will also depend on the allocative and technical efficiency of the government budget apparatus, for it is possible to allocate larger shares of social spending and tax exemption with limited welfare gains. Also, the drive to minimise the impact of inequality-increasing tax should be rational and evidence driven. For instance, it is possible to reduce inequality, while increasing poverty.

Another recurrent policy suggestion is to earmark the savings of an increased consumption tax to some valued purpose such as provision of universal primary/secondary education. However, policy makers should note that earmarking may constrains spending on the prioritised item, in which case it impedes efficient resource allocation. In this case, there is need to consider the nature of public expenditure driven by an increase in revenue emanating from consumption taxes. Indeed, accompanying consumption tax reform with targeted protection of the poorest consumers will automatically limit the impact on those likely to have the highest marginal propensity to consume.

Overall, the results from this paper also concur with Lakuma and Lwanga (2017) who suggest that there is limited space to increase tax rates in the medium term and consolidation should largely depend on expanding the tax base, particularly by improving tax administration, reducing exemption and reducing the size of the informal sector.

[26] Examples of non –durables consumed by the poor are: rent, electricity, water, paraffin, charcoal, firewood, matches and toothpaste among others

[27] Durables consumed by the poor: clothes, shoes and blanket among others.

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Appendices

Figure A 1: Impulse-response functions for tax shocks on Households, Consumption and Income

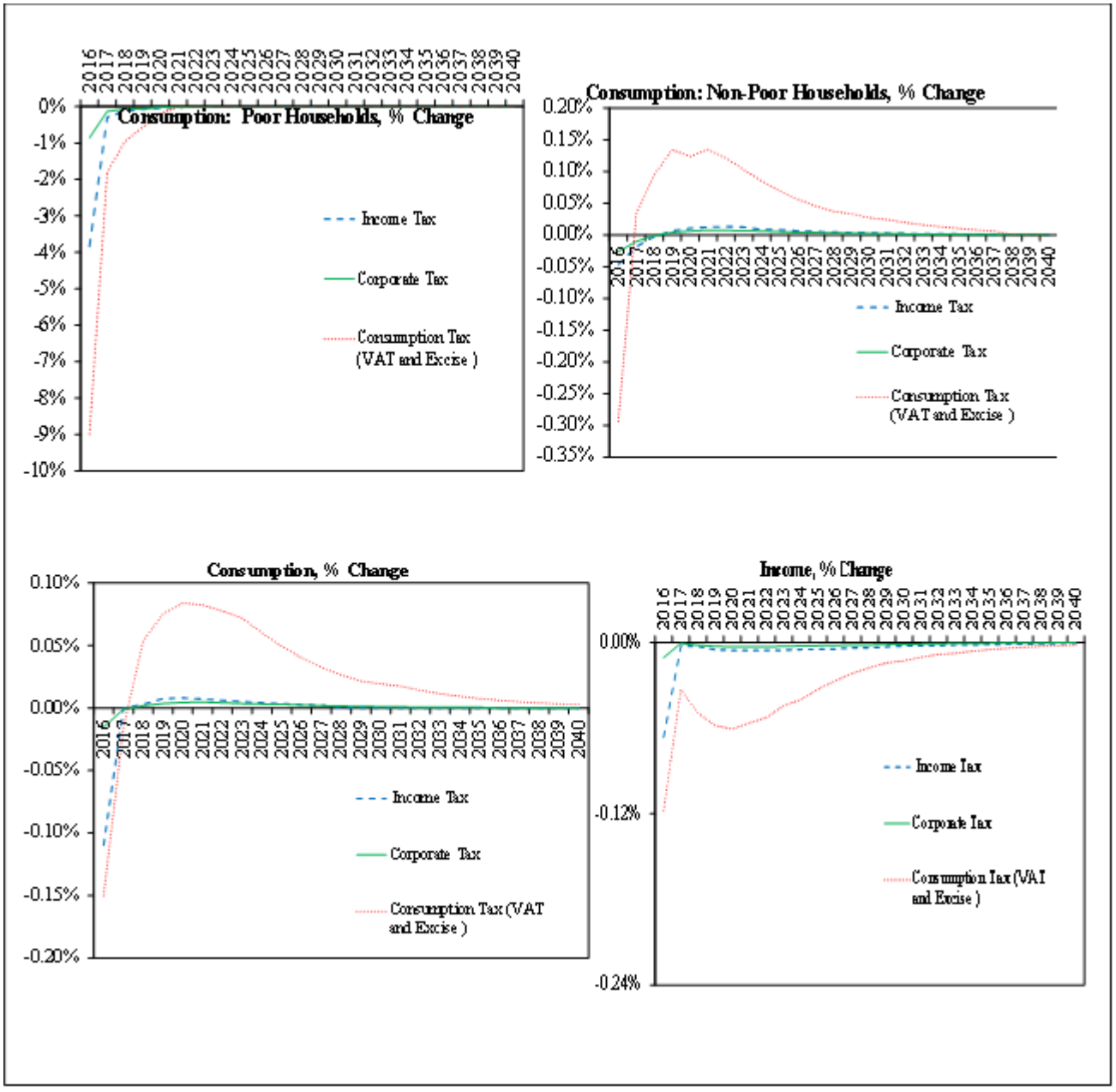

Figure A 2: Impulse-response functions for tax shocks on employment, wage, investments and capital

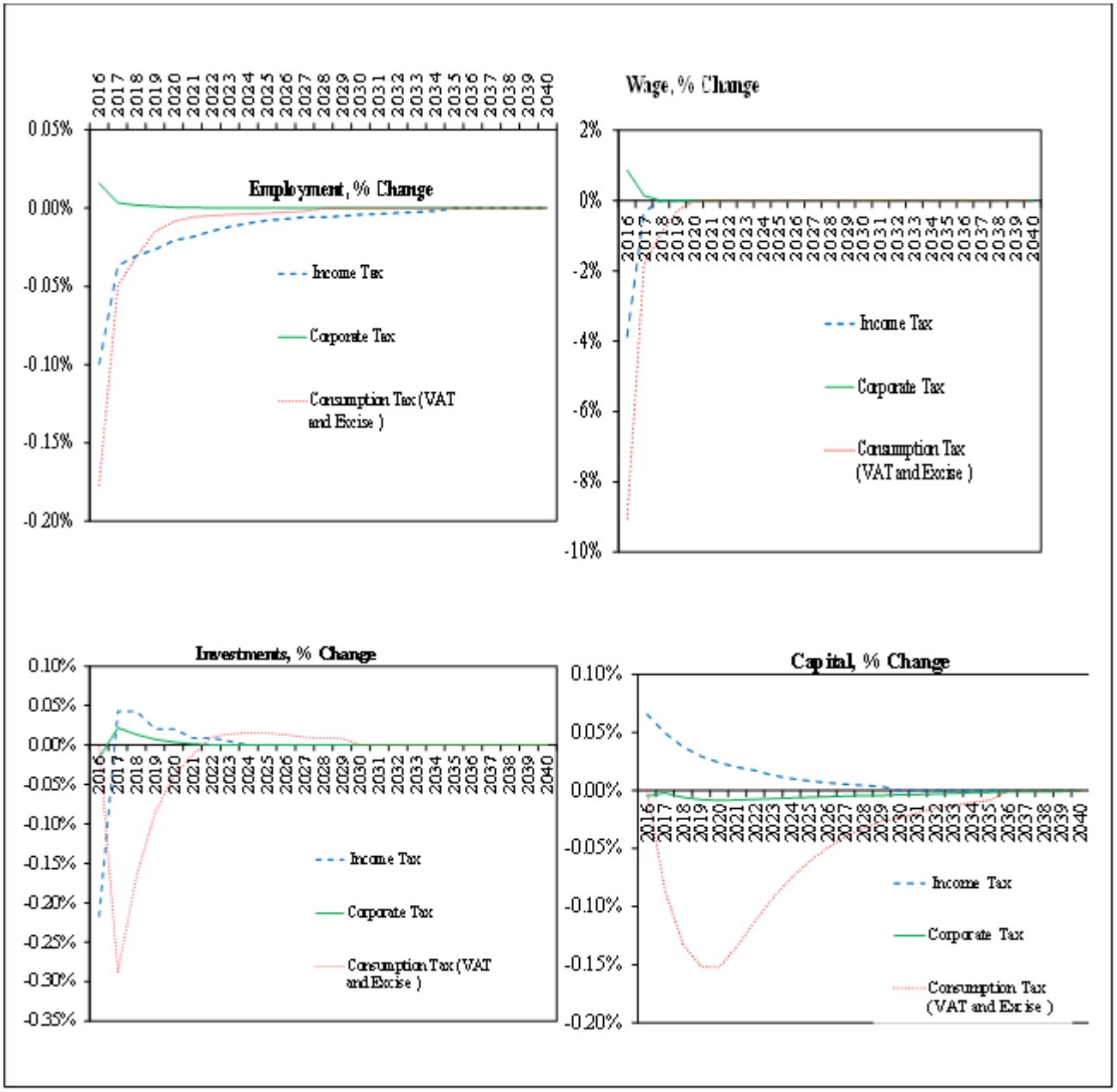

Figure A 3: impulse-response functions for tax shocks on interest rates, prices, rent and inflation

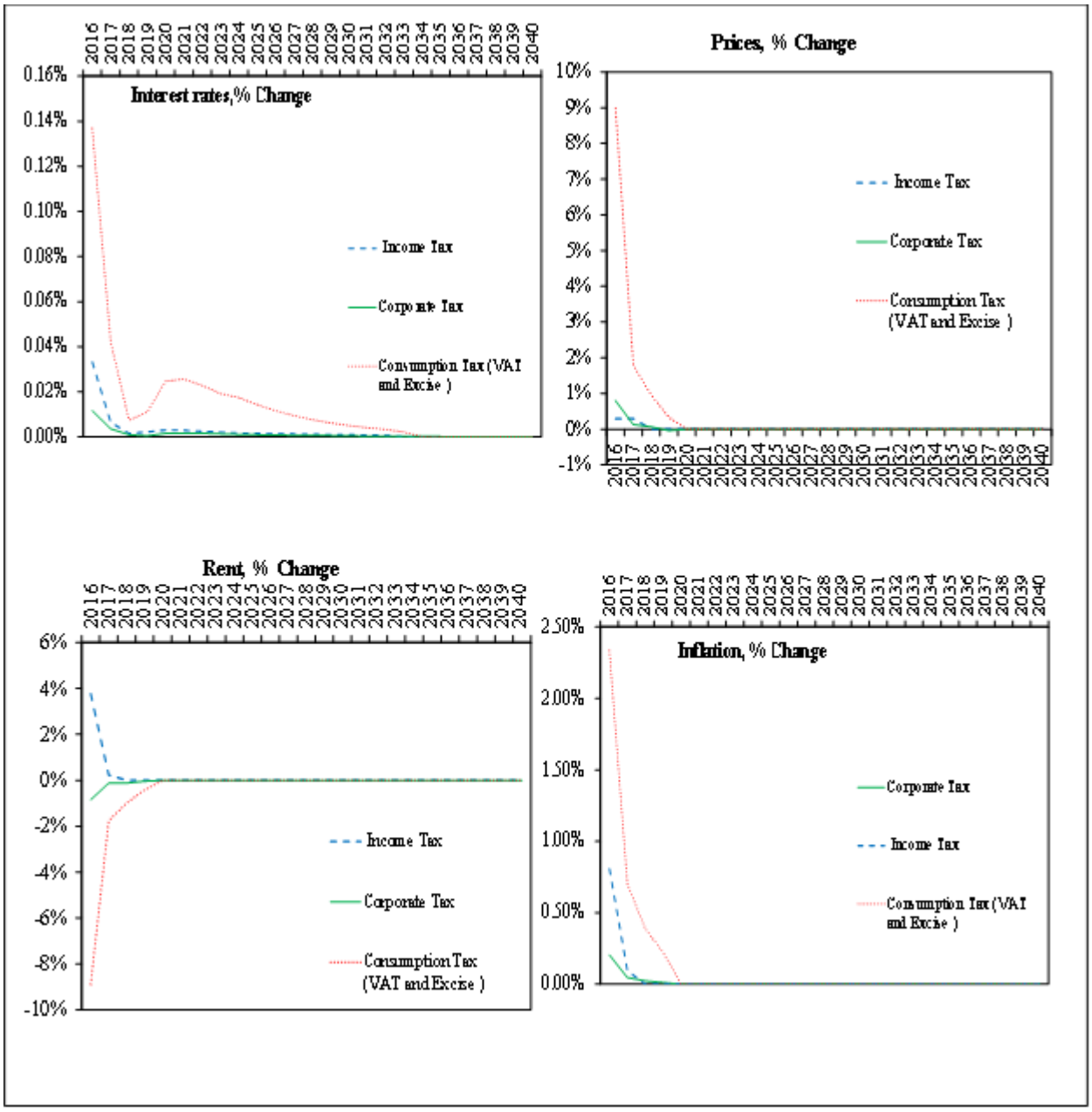

Figure A 4: Impulse-response functions for tax shocks on Govt. Exp., Tax revenue and Capital Income