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Surging Investment and Declining Aid: Evaluating Debt Sustainability in Rwanda

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Public Investment and Debt Sustainability in Rwanda

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Abstract

Rwanda is a unique case among its Sub-Saharan African peers in that it has already undergone a large scaling-up of public investment. The Rwandan government has made clear its desire to lower its reliance on foreign aid while still maintaining high public investment levels. We use the model of public investment, growth, and debt sustainability in Buffie et al. (2012) to evaluate the macroeconomic consequences of a possible scaling-down of investment in Rwanda. Using the model, we can gauge the consequences of different financing mechanisms and investment efficiency levels on the economy. We find that with some commercial borrowing and a modest tax adjustment, the authorities may be able to retain their high investment spending while still reducing their reliance on foreign aid.

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I. INTRODUCTION

The Rwandan authorities have set the ambitious goal of achieving middle-income country status (income per capita of just over \$1000) by the end of the current decade. GDP growth has averaged just over 8.5 percent per year over the last 15 years, and attainment of the authorities' goal would require accelerating what is already a high growth rate. There are few, if any, examples of countries that have maintained such a high growth rate for such an extended period.

Recent economic success has been attributed to strong governance, improved macroeconomic policies, structural reforms, and high and rising public sector investment supported by large aid inflows. The Rwandan authorities have also expressed their intent to become less dependent on aid, which adds an additional financing challenge to sustaining high growth.

One possible path to continued growth is through a public investment buildup. Agénor (2010) suggests that, conditional on good governance and sufficiently high efficiency of public investment, increased spending on infrastructure may shift an economy from a low-growth to high-growth equilibrium. Aggressive public investment in recent years has helped Rwanda achieve much of this desired buildup.

The authorities' recent issuance of US\$400 million in 10-year bonds, the country's first foray into the international capital markets, shows that the need for additional financing remains high. In this paper, we aim to show the possible consequences of over-borrowing and outline steps that can be taken to mitigate the risk of unsustainable debt dynamics.

What sets Rwanda apart from many other countries in Sub-Saharan Africa is its already relatively high level of public investment. Without additional financing, either from higher tax receipts or increased borrowing, the authorities will have to lower their level of public investment spending in order to remain fiscally solvent. We model this in a baseline scenario and see that it would lead to sclerotic growth, undoing much of the country's recent success.

To avoid this fate, we use a dynamic general equilibrium model developed by Buffie et al. (2012) to evaluate several plans for a further tax and debt financed public investment buildup in Rwanda in the face of declining aid inflows. The model was designed to model low-income, low-capacity economies like Rwanda. We use it here to highlight the tradeoffs between tax and debt financing of growth fueled by public investment.

The model used in this paper assumes that public capital is complementary to private capital—i.e., that it is productivity enhancing—and that there is a high return to public investment. In the long run, all investment must be paid for by adjusting taxes, but in the medium run investment may be financed by borrowing (from the domestic market, the international commercial market, or on concessional terms). The main challenge facing policymakers is how to structure the fiscal adjustment over time so that the stock of debt does not become unsustainably high.

Several features of the model are designed with low-income countries in mind. Income from remittances, foreign grants as a source of government financing, inefficiencies in the public investment process, and limited household access to capital markets specifically reflect the characteristics of a low-income economy like Rwanda.

The model is used to evaluate the authorities' plans for public investment, as well as present some alternative scaling-up plans with more sustainable debt paths. We also run simulations to assess the impact of decreasing grant aid, and show that increased efficiency of investment has a significant and positive effects on growth and the debt profile.

This paper is organized as follows. Section II describes the recent history of the Rwandan economy and the need for a public infrastructure buildup. Section III describes the features of the model and its calibration to Rwanda. Section IV presents the simulations. Section V discusses the impact of higher efficiency of public investment on debt accumulation and growth. Section VI offers some concluding remarks.

II. BACKGROUND ON RWANDA AND THE NEED FOR PUBLIC INVESTMENT

The Rwandan economy recovered quickly from the setback brought by the genocide of the mid-1990s. The Rwandan genocide in 1994 not only killed more than 800,000 Rwandans, it also cut economic output almost in half. Whereas many post-conflict countries have found it difficult to regain traction following the end of hostilities, this was not the case with Rwanda. By the turn of the century, Rwandan gross domestic product (GDP) had rebounded to the pre-genocide level.

In the last decade, the Rwandan economy has enjoyed sustained, rapid growth, leading to an accelerating decline in poverty. Real GDP growth has averaged more than 8 percent per year, with strong contributions coming from agriculture, industry—particularly construction—and services. Rwanda has also seen an accelerating decline in poverty in the last decade. The headcount poverty rate (measured by the national poverty line) fell from above 60 percent in 2000 to 57 percent in 2005 and below 45 percent in 2010. In the latter period, the drop in the poverty rate was more pronounced in rural areas than urban, and was accompanied by a narrowing of income inequality.

Rwanda's success has been underpinned by a strong commitment to good governance, sound macroeconomic policies, and strong ownership of the structural reform agenda. Rwanda has also enjoyed strong support from donors, who have provided a significant share of budgetary resources, particularly for public investment:

- **Good governance** has been instrumental in ensuring that public resources, including those provided by donors, are put to effective use. Transparency International ranked Rwanda 49th out of 183 countries on its perception of corruption index for 2011, placing it third among sub-Saharan African countries (behind Botswana and Mauritius).

- ***Fiscal and monetary policies*** have focused squarely on maintaining macroeconomic stability. Fiscal deficits have been kept small to allow ample scope for private sector credit growth. At the same time, monetary policy has been successful in keeping inflation low in recent years, despite large international petroleum and food price shocks that had caused inflation to spike in many neighboring countries.
- The Rwandan authorities have been diligent in their pursuit of ***structural reforms*** across a range of areas. In addition to public financial management and banking and financial sector reforms, notable success has been achieved in improving the business environment to foster private sector growth. As a result, Rwanda ranked 32nd out of 185 countries on the World Bank's 2013 ease of doing business index. Rwanda ranked particularly high for the ease of starting a business, getting electricity, obtaining credit, paying taxes, and enforcing contracts.
- The authorities have also put a strong emphasis on homegrown interventions to support ***inclusive growth***, including through increased focus on enhancing access to finance and to improving the provision of social services, particularly to the rural poor.
- Rwanda's success has benefited from substantial ***financial aid*** from donor countries. Donor grants have, for much of the period since the genocide, covered a significant share of government spending. In 2011/12, these inflows, about evenly divided between direct budget support and project grants, amounted to about 10 percent of Rwandan GDP and 40 percent of public expenditure. The Rwandans have been successful in mobilizing and efficiently managing these resources, owing to transparent and improved public financial management practices.

But Rwanda is still a poor country and faces several challenges to sustaining its good performance of recent years. As a small, landlocked country with limited natural resources, its export sector is still small, with exports covering less than a third of imports. Rwanda's infrastructure, including transportation and energy, remains inadequate. Moreover, the country is overly reliant on donor assistance.

The Rwandan authorities recognize the vulnerabilities that could obstruct the attainment of their goal of transforming Rwanda into a middle-income country by 2020. A second-generation economic development and poverty reduction strategy is being designed to address these challenges. The strategy will focus on:

- facilitating ***economic transformation*** to raise the share of industry and services in economic output;
- supporting ***rural development*** to improve public service delivery and alleviate poverty;

- strengthening *productivity* and youth employment through interventions to strengthen education and training; and
- increasing *accountability of governance* to ensure citizen engagement and ownership,

in the context of continued macroeconomic stability and high levels of public investment.

The authorities recognize that they need to sustain or even increase the rates of public investment while simultaneously lessening their aid dependence. This will require a concerted effort in the coming years to increase domestic resource mobilization through tax policy changes and improvements in tax collection; rationalize and reprioritize government spending to raise its efficiency; attract more foreign investment to diversify the private sector; and judicious recourse to external commercial borrowing that is consistent with debt sustainability.

III. FEATURES OF THE MODEL AND CALIBRATION TO RWANDA

In this section, we will outline the basic structure of the model and highlight some key features that apply to Liberia. A more technical explanation of the paper can be found in Buffie et al. (2012). Briefly, we use a two-sector intertemporal macroeconomic model designed for long-run analysis. It therefore does not include money or any nominal rigidities.

The model allows us to look at the dynamic interactions of public investment, growth, and fiscal policy. An increase in the level of public capital will increase private investment and growth in the long term, but in the medium term, the authorities must decide how to finance investment without debt rising unsustainably.

A. The Model

The model economy is comprised of two sectors, one for traded goods and one for non-traded goods. There is also an imported good (a traded good produced in another country), which can be consumed or used to produce capital. In each sector i (with $i = n, x$, where n is for the non-traded sector and x is for the traded/export sector), representative firms take private capital ($k_{i,t}$), labor ($L_{i,t}$), and effective public capital (z_t) to produce output using Cobb-Douglas technology:

$$q_{i,t} = A_{i,t}(z_{t-1})^{\psi_i}(k_{i,t-1})^{\alpha_i}(L_{i,t})^{1-\alpha_i} \quad (1)$$

The role of public capital in the production function is the core feature of the model. Public capital is not sector-specific and, all else being equal, an increased stock of public capital increases output and raises the return on private capital and labor. An increased flow of public investment therefore boosts growth because of this complementarity of public and private capital.

Firms maximize the following objective function, where the choice variables are the labor and capital used as production inputs:

$$\max p_{i,t}q_{i,t} - w_t L_{i,t} - r_{i,t}k_{i,t-1} \quad (2)$$

The price of output in each sector is denoted by $p_{i,t}$, the wage by w_t , and the rental rate of capital by $r_{i,t}$. Note that the wage—unlike the rental rate of capital—is not sector-specific, as labor is mobile across sectors.

The economy is populated by two types of consumers: savers and non-savers. Each type i consumes a constant elasticity of substitution (CES) basket of goods given by equation (3), with a price index given by equation (4):

$$c_t^i = \left[(\rho_x)^{1/\epsilon} (c_{x,t}^i)^{\epsilon-1/\epsilon} + (\rho_m)^{1/\epsilon} (c_{m,t}^i)^{\epsilon-1/\epsilon} + (\rho_n)^{1/\epsilon} (c_{n,t}^i)^{\epsilon-1/\epsilon} \right]^{\epsilon/\epsilon-1} \quad (3)$$

$$P_t = \left[\rho_x (P_{x,t})^{1-\epsilon} + \rho_m (P_{m,t})^{1-\epsilon} + \rho_n (P_{n,t})^{1-\epsilon} \right]^{1/1-\epsilon} \quad (4)$$

The parameter ϵ governs the intra-temporal elasticity of substitution. The parameters ρ_x , ρ_m , and ρ_n govern the distribution of goods in the basket and sum up to one.

Non-savers are constrained by an inability to access capital markets and must therefore consume all of their earned income in the period in which it is earned. Their hand-to-mouth behavior creates non-Ricardian outcomes that we observe in a low-income country like Liberia. Non-savers are subject to the following budget constraint:

$$(1 + h_t)P_t c_t^h = w_t L_t^h + \frac{a}{1+a} (R_t + T_t) \quad (5)$$

The constraint says that consumption (c_t , and the superscript h stand for “hand-to-mouth”) after taxes (a value-added tax give by h_t) must be equal to labor income plus remittances and transfers. The parameter a governs the ratio of savers to non-savers in the economy.

Savers behave like standard utility-optimizing agents. They are able to smooth consumption over time by investing in traded or non-traded capital, or by borrowing in domestic or international debt markets. Their maximization problem is given by:

$$\max \sum_{t=0}^{\infty} \beta^t \frac{(c_t^s)^{1-1/\tau}}{1-1/\tau}$$

subject to a budget constraint and two capital accumulation equations:

$$\begin{aligned}
P_t b_t^s - b_t^{s*} &= r_{x,t} k_{x,t-1}^s + r_{n,t} k_{n,t-1}^s + w_t L_t^s + \frac{R_t}{1+a} + \frac{T_t}{1+a} \\
&\quad - \frac{1+r_{t-1}^*}{1+g} b_{t-1}^{s*} + \frac{1+r_{t-1}}{1+g} P_t b_{t-1}^s \\
&\quad - P_{k,t} (I_{x,t}^s + I_{n,t}^s + AC_{x,t}^s + AC_{n,t}^s) \\
&\quad - P_t c_t^h (1+h_t) - Y_t^s - \Phi_t^s
\end{aligned} \tag{6}$$

$$(1+g)k_{x,t}^s = I_{x,t}^s + (1-\delta)k_{x,t-1}^s \tag{7}$$

$$(1+g)k_{n,t}^s = I_{n,t}^s + (1-\delta)k_{n,t-1}^s \tag{8}$$

Domestic bonds are denoted by b_t^s and foreign bonds by b_t^{s*} ; the interest rates on each are given by r_t and r_t^* , respectively. Capital adjustment costs are given by $AC_{i,t}$ for each sector. Portfolio adjustment costs linked to foreign liabilities are given by Y_t^s , which captures the degree of financial account openness. Profits of domestic firms are represented by Φ_t^s , and finally, the rate of depreciation of capital is given by δ .

The budget constraint simply says that income (from labor, capital, remittances, transfers, bond holdings, and firm profits) must not exceed expenses (on debt accumulation, investment, investment adjustment, and portfolio adjustment).

An important feature of the model, designed specifically to match low-income economies, is the process by which public capital is accumulated. It is best understood as a two-step process. In the first step, the government allocates money to be invested in public capital, which evolves according to a standard accumulation equation:

$$z_t = I_{z,t} + (1-\delta)z_{t-1} \tag{9}$$

In the second step, some of that public capital is allocated for productivity-enhancing infrastructure (z_t^e), which we have been calling effective public capital:

$$z_t^e = \bar{s}\bar{z} + s(z_t - \bar{z}) \tag{10}$$

The parameter s governs the efficiency of public investment; that is, the rate at which public capital is turned into productivity-enhancing infrastructure. This parameter takes a value between zero and one, implying that one dollar spent on public investment yields less than one dollar's worth of public infrastructure. Note that it is this z_t^e which enters into the representative firm's production function.

In low-income countries, as written in Hulten (1996) and Pritchett (2000), the productivity of infrastructure is high while the return on public spending is low. This feature of the model

accounts for this fact, since the return on investment can be quite low if the efficiency of that investment is also low.

The government is also subject to a budget constraint, which allows us to specify the size of the fiscal adjustment required for a given investment buildup. The budget constraint equates government financing from domestic debt, external commercial debt ($d_{c,t}$), concessional debt (d_t), and taxes with expenditures on debt service, investment, transfer spending (T_t), and grant aid (G_t), which is exogenous:

$$\begin{aligned} P_t \Delta b_t + \Delta d_{c,t} + \Delta d_t &= \frac{r_{t-1} - g}{1 + g} P_t b_{t-1} + \frac{r_{d,t-1} - g}{1 + g} d_{t-1} \\ &+ \frac{r_{dc,t-1} - g}{1 + g} d_{c,t-1} + P_{z,t} I_{z,t} + T_t - h_t P_t c_t - G_t \end{aligned} \quad (11)$$

The path for concessional debt and public investment spending is exogenous to the model. For a given initial level of taxes and transfer spending, the budget constraint can be re-written as a gap between spending and revenues:

$$\begin{aligned} GAP_t &= \frac{1 + r_{d,t}}{1 + g} d_{t-1} - d_t + \frac{r_{dc,t-1} - g}{1 + g} d_{c,t-1} \\ &+ \frac{r_{t-1} - g}{1 + g} P_t b_{t-1} + P_{z,t} I_{z,t} + T_o - h_o P_t c_t - G_t \end{aligned} \quad (12)$$

In the long run, for debt to be sustainable, the gap must be covered by adjustments in taxes and transfers. In the short and medium term, though, the gap may be closed with additional borrowing. If the fiscal adjustment occurs too slowly, however, the interest payments on accrued debt will rise faster than revenue and the path of debt explodes. This is the core dilemma facing policymakers—timing the fiscal adjustment so that it is not too painful, but not so slow that debt is unsustainable.

B. Calibration to Rwanda

Two parameters govern the dynamics of debt in the model. First is the return on public investment, which is the marginal product of effective public capital net of the depreciation rate. There is no estimate of this parameter for Rwanda, so we set it at 25 percent, based on estimates for Sub-Saharan Africa, though there is considerable variation across countries.

The second key parameter is the efficiency of public investment, or the rate at which public investment is converted into productivity-enhancing capital. Pritchett (2000) estimates that around half of government investment spending does not actually create capital. We use this estimate to inform our baseline, which assumes that 60 percent of investment spending goes towards productive public capital formation.

By increasing the efficiency of investment, it is possible to lower the debt path and increase the growth dividend for a given level of investment spending, or alternatively achieve the same growth dividend with reduced reliance on new tax revenue or commercial borrowing. In one scenario below, we will increase this parameter over time to demonstrate the effect of increased investment efficiency.

Because we are using a general equilibrium model, it is important to carefully consider how our steady state is parameterized as the simulations we show are all deviations from the model's initial equilibrium. We use the latest data and medium-term macroeconomic framework underlying the joint IMF-World Bank debt sustainability analysis (DSA) for Rwanda to calibrate the level of initial debt-to-GDP ratios (commercial, domestic, and concessional), remittances, and grants. Based on the underlying data, we assume a per capita potential growth rate of 4.7 percent and an initial public investment level of 13 percent of GDP.

Because the model divides consumers into those who can smooth consumption across time and those who cannot, the calibrated level of savers to non-savers is very important. It controls the degree to which domestic interest rates react to fiscal policy. Because there is not a reliable estimate of this value for Rwanda, we use the estimate from Buffie et al. (2012). It is possible that the proportion of savers is higher than what we assume here due to widespread adoption of microfinance. However, it is likely that the informal nature of microfinance institutions in rural areas and the limited degree to which rural workers are able to save means that many users would still be considered non-savers.²

For the rest of the parameters, no data are available for Rwanda-specific estimates. We use the values presented in Buffie et al. (2012), which are estimates taken from the literature for Sub-Saharan African.

Table 1: Model Calibration for Baseline Scenarios

Parameter	Value	Definition
τ	0.34	Intertemporal elasticity of substitution
ϵ	0.50	Intratemporal elasticity of substitution across goods
α_x	0.40	Capital's share in value added – traded sector
α_n	0.55	Capital's share in value added – non-traded sector
α_k, α_z	0.50	Cost share of non-traded inputs in the production of capital
$\delta_x, \delta_n, \delta_z$	0.05	Capital depreciation rates
ρ_x	0.32	Distribution parameter – traded goods
ρ_n	0.44	Distribution parameter – non-traded goods
g	0.047	Trend per capita growth rate
r_o	0.02	Initial real interest rate on domestic debt

² Recall that the purpose of including non-savers into the model is to break Ricardian equivalence. Poor rural workers who save a small fraction of their income in informal microfinance institution are unlikely to behave in a non-Ricardian manner.

$r_{dc,o}$	0.06	Real interest rate on external commercial debt
$R_{z,o}$	0.25	Initial return on public investment
b_o	0.053	Initial public domestic debt to GDP ratio
d_o	0.119	Initial external concessional debt to GDP ratio
G_o	0.086	Initial grants to GDP ratio
R_o	0.026	Remittances to GDP ratio
$I_{z,o}$	0.134	Initial ratio of public investment to GDP
s	0.60	Efficiency of public investment
h_o	0.18	Initial consumption VAT rate
a	1.50	Ratio of savers to non-savers

IV. SIMULATIONS

A. Baseline Scenario: Declining Grants, Declining Investment

Our baseline scenario (depicted in Figure 1) is one in which public investment and external grants both decline over the next decade. Public investment starts at 13.4 percent of GDP before falling to 6.8 percent after 10 years. Similarly, external grants start at 8.6 percent of GDP and then fall to 2.9 percent. This scenario is roughly in line with the macroeconomic framework underlying the DSA for Rwanda; generally, public investment and grant aid are both declining in the medium term. There is still a fiscal gap that must be closed, and we assume that tax revenues will rise via a VAT increase to satisfy the government budget constraint.

The decline in grant inflows leads to a depreciation of the exchange rate and temporarily increases the competitiveness of the export sector.³ Investment actually increases in the short run on the strength of the traded goods sector. Non-traded output, however, falls sharply, as does private consumption. In the long run, as the exchange rate stabilizes, traded output and investment both fall, and per capita GDP growth slows to just above 3 percent, which is consistent with what is assumed in the DSA's macroeconomic framework.

This scenario falls well short of the authorities' wish to accelerate growth and reach middle-income country status. It amounts to a sustained contraction in public investment with negative effects on the private sector, while the fiscal adjustment required by the decline in grants cuts sharply into private consumption.

This scenario already lays bare the first challenge to sustaining growth in Rwanda. It indicates that the attainment of per capita growth of even 3 percent would require the government to increase taxes, cut spending, or borrow money to fully offset the declining grant inflow. Financing an investment boom under these conditions will require either substantial borrowing or politically difficult changes to current tax and transfer policies.

³ This is basically the opposite of Dutch disease, where a country that receives a surge of aid inflows or natural resource revenue sees its manufacturing sector suffer due to the strength of its currency.

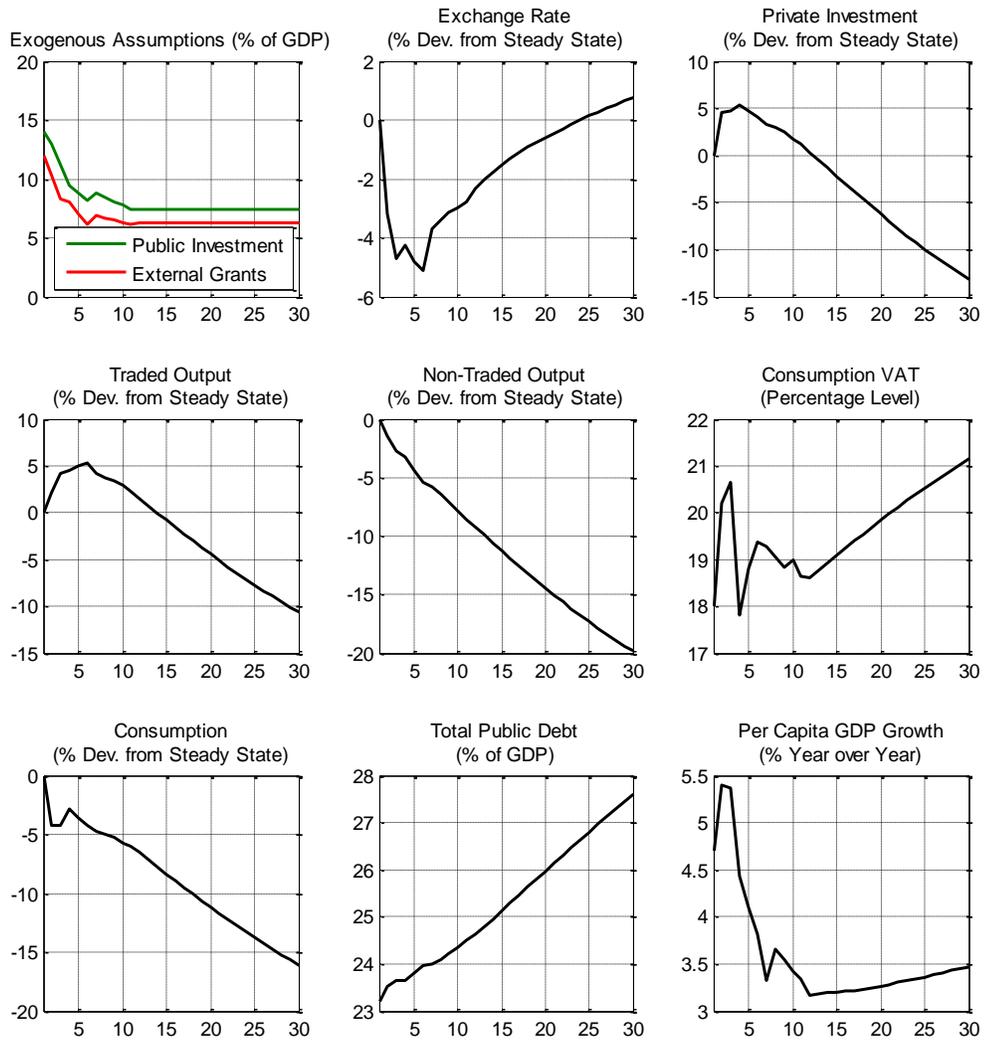


Figure 1: Baseline Scenario (Declining Investment, Declining Grants)

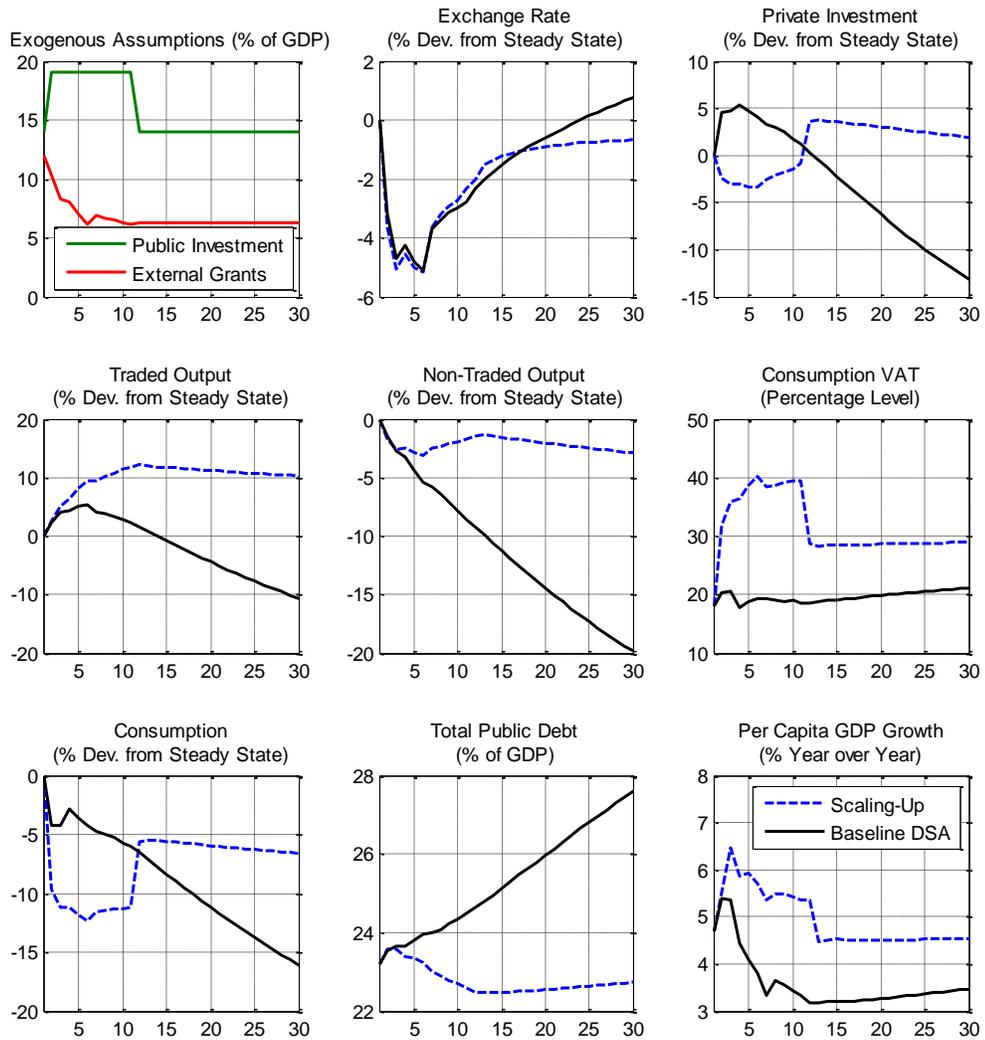


Figure 2: Public Investment Buildup Financed with an Unconstrained Tax Adjustment

B. Public Investment Buildup Financed with an Unconstrained Tax Adjustment

In this section, we simulate a public investment scaling-up, where investment rises by 5 percentage points to 18.4 percent of GDP, then stays elevated for 10 years before returning to its initial level. We continue to assume that the flow of grant aid declines as it does in the baseline scenario. For this simulation, the fiscal gap is closed entirely by increasing the consumption VAT and not by any additional borrowing (Figure 2).

Once again, the decline in grants causes a depreciation of the real exchange rate that boosts the competitiveness of traded goods sector. Traded output rises by just over 12 percent from its initial level and stays elevated over the next three decades. Non-traded output declines but only modestly, so that the net impact on growth is positive. Per capita GDP growth increases to around 6.5 percent when the investment surge starts, and stays elevated at around 5.5 percent until investment returns to its initial level. After that, per capita growth returns to 4.5 percent.

The size of the fiscal adjustment required, however, is very large and most likely untenable. In order to close the fiscal gap, the consumption VAT must rise to 40 percent during the investment surge. Because investment never falls below its initial level while the flow of grant aid continues to decline, the VAT stays elevated at nearly 30 percent, even after the investment surge is over.

The drastically high fiscal adjustment takes a heavy toll on both private investment and consumption. Consumption declines by 13 percent as the VAT rate rises and never returns to its initial level. Private investment declines as well, though it eventually recovers and rises by 2-3 percent in the long run. It is questionable that the growth dividend that comes from the investment surge outlined here would be worth the welfare cost of such a large drop in consumption.

This scenario demonstrates the acute need for borrowing in order to finance any public investment buildup. If Rwanda is to finance a public investment surge in the face of an expected decline in grant inflows, the domestic economy clearly does not have the capacity to finance it. Outside borrowing must also be considered to lessen the domestic adjustment need.

C. Public Investment Buildup Financed with Commercial Borrowing

One possible source of financing is external commercial debt. In this scenario, we assume that commercial debt is used to close the fiscal gap with no tax adjustment (Figure 3).⁴

⁴ Concessional loans are typically negotiated at interest rates below equivalent market-rate (i.e. commercial) loans.

On impact, the investment surge coupled with a corresponding increase in commercial debt causes a sharp appreciation of the exchange rate. This causes traded output to fall by about 5 percent initially (though this effect is short-lived as output eventually recovers) and non-traded output to rise by about 6 percent. The rise in public investment brings private investment up by about 9 percent after 10 years, and it remains above its initial level over the course of three decades. Because the fiscal gap is closed with borrowing rather than with taxes, consumption dips only slightly over the long term.

The initial drop-off in traded output causes GDP growth to fall in the first year of the investment buildup, but growth remains above six percent in subsequent years. Once the investment buildup is over, growth falls back to just below its initial level. The effect of investment on debt is large and sustained, however, as total debt-to-GDP peaks at just under 90 percent after 10 years. Repayment over the next two decades brings the stock of debt down to 75 percent of GDP, which is still unsustainably high.

This scenario demonstrates clearly that an investment buildup of the size we are considering here will likely require some combination of fiscal adjustment and additional borrowing. In the next section, we consider what kind of hybrid financing scenario might be required to ensure debt stays on a sustainable path.

D. Public Investment Buildup Financed with Commercial Borrowing, Concessional Loans, and Constrained VAT Adjustment

In the following scenario (depicted in Figure 4), we consider an investment buildup financed with all types of financing: an increase in concessional borrowing equal to 3 percent of GDP⁵, an increase in the VAT rate from 18 percent to 23 percent, and additional commercial borrowing to close any remaining financing gap.

As in the previous scenario, increased foreign exchange inflows (this time through commercial and concessional debt) cause the exchange rate to appreciate, temporarily bringing down output in the traded goods sector while giving a boost the non-traded goods sector. Public capital again increases the return to private investment, and over time, both traded and non-traded output rise.

In the long run, however, non-traded output declines below its initial level, likely because of the drop in consumption caused by the VAT increase. In this scenario, the VAT rate hike is permanent and has a lasting effect on private consumption. Because a portion of the fiscal gap is closed through taxation rather than borrowing, the stock of debt does not rise quite as much, peaking at around 74 percent of GDP. Additionally, because a portion of the debt is concessional rather than commercial, the debt is repaid faster, falling to 57 percent after 30 years, which is still unsustainably high.

⁵ Concessional loans are extended for the first 10 years to finance the buildup, then repaid at 1 percent of GDP in years 11-30.

Per capita GDP growth rises in this scenario as well, though not as much as in the prior scenario. There is a trade-off between debt and growth in this case, as the stock of debt is only brought down via increasing tax revenue, which drags down private consumption and GDP growth.

This scenario offers almost every reasonable method of financing available, yet a relatively modest increase in public investment (increasing by 5 percentage points of GDP) causes debt to rise to possibly unsustainable levels while arguably having a negative welfare effect on

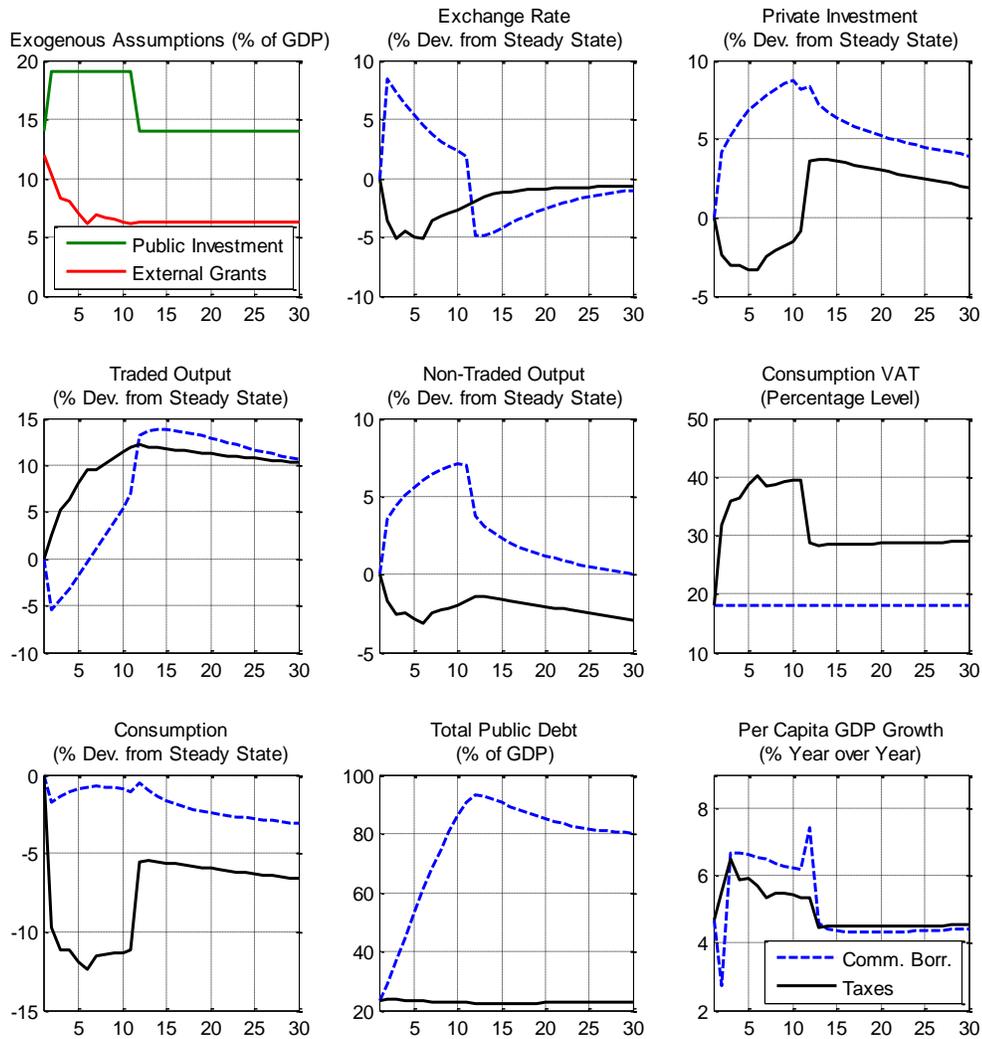


Figure 3: Public Investment Buildup Financed with Commercial Borrowing

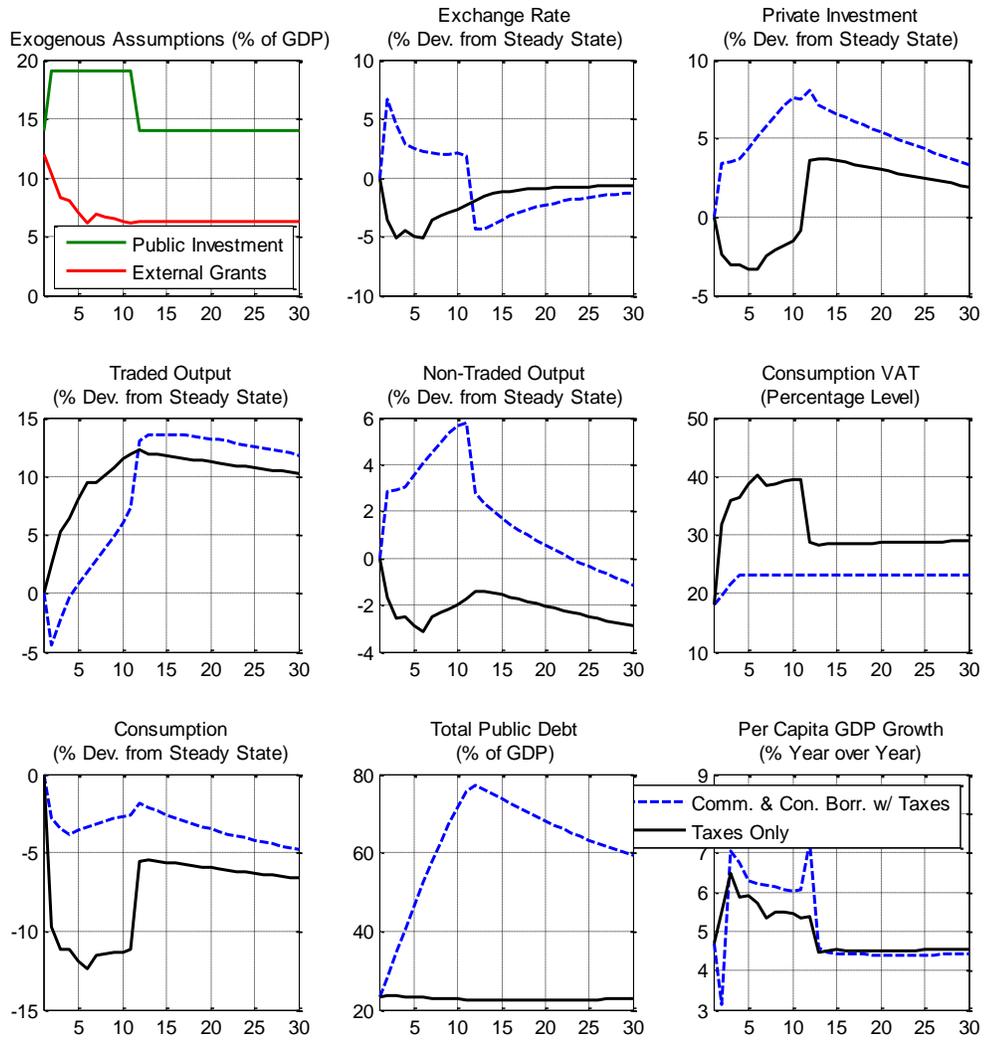


Figure 4: Public Investment Buildup Financed with Commercial Borrowing, Additional

Concessional Loans, and Constrained VAT Adjustment (Hybrid Financing)

consumers. This demonstrates the difficult task facing the authorities if they wish to achieve middle-income country status by the end of the decade.

E. Public Investment Buildup with Hybrid Financing and Reduced Grant Inflows

The authorities have stated their intent to become an aid-independent economy. Under the baseline assumption, grant aid starts out at 8.6 percent of GDP, then declines gradually to just around 3 percent by the end of the decade. In this scenario (depicted in Figure 5), we examine the effect of rapidly declining aid inflows by assuming that foreign grants decline to 3 percent of GDP in the first year of the simulation.

Because this represents a drastic shock to the government's budget constraint, in this scenario, we assume that the level of public investment stays constant at its initial level. The loss in grant aid is compensated for with additional commercial borrowing and a five percentage point increase in the VAT rate. We compare this to a scenario in which grants fall modestly (as assumed in the current DSA) and public investment remains constant as a share of GDP.

Two competing effects are acting on the real exchange rate. The loss of grant aid draws the real exchange rate down, but the influx of foreign money from commercial borrowing pushes it back up. The net effect is a modest fall in the exchange rate in the first five years of the simulation, followed by a long-term rise back to its original level. This currency movement leads to growth in the traded goods sector and contraction in the non-traded goods sector. On balance, the economy grows, although very slightly, and the growth is short-lived. Per capita GDP growth increases by about half a percentage point in year two of the simulation, then gradually declines over the next three decades.

Because the government budget constraint must be balanced, the lost aid is paid for with additional concessional borrowing, and the debt burden rises substantially in this scenario. Total debt as a share of GDP rises to 70 percent by the end of the simulation (still unsustainably high), which is a heavy cost when considering that there is almost no growth dividend. Note that this is the same level of debt-to-GDP achieved in the previous simulation, which includes a substantial scaling-up of investment (compared to none in this scenario). Additionally, since the government raises the VAT rate to make up for lost grant aid, there is a sharp decline in consumption, which contracts by five percent immediately and continues to decline over the duration of the simulation.

A simple cost-benefit analysis would suggest that this is a highly undesirable scenario. Total debt rises to near unsustainable levels for an insignificant boost in growth, with the population enduring large and sustained contractions in consumption and, in the long term, private investment.

V. THE EFFECT OF INCREASED EFFICIENCY ON DEBT AND GROWTH

If the authorities were able to increase the amount of public investment that gets translated into productive public capital, it could offer a way to sustain growth without increasing the debt to impractically high levels. In this last scenario (depicted in Figure 6), we examine the

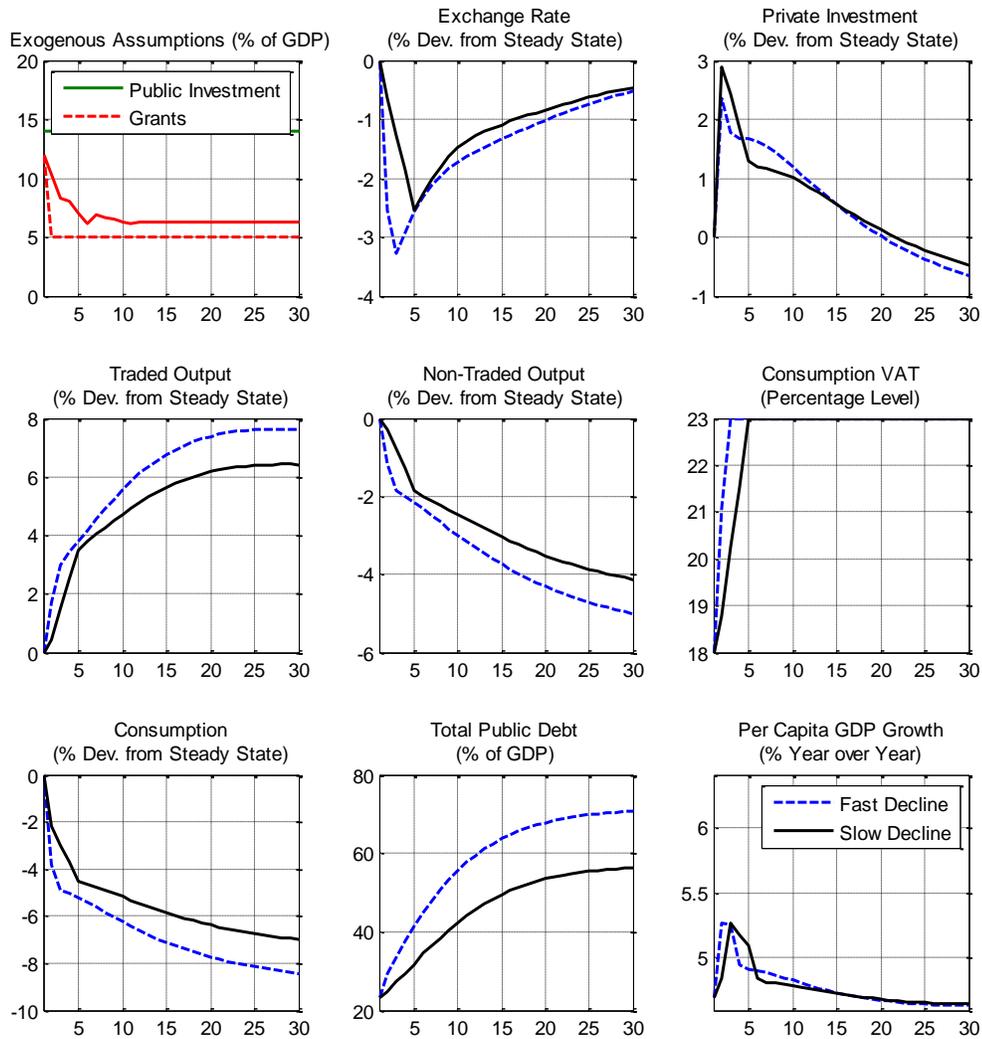


Figure 5: Public Investment Buildup with Hybrid Financing and Reduced Grant Inflows

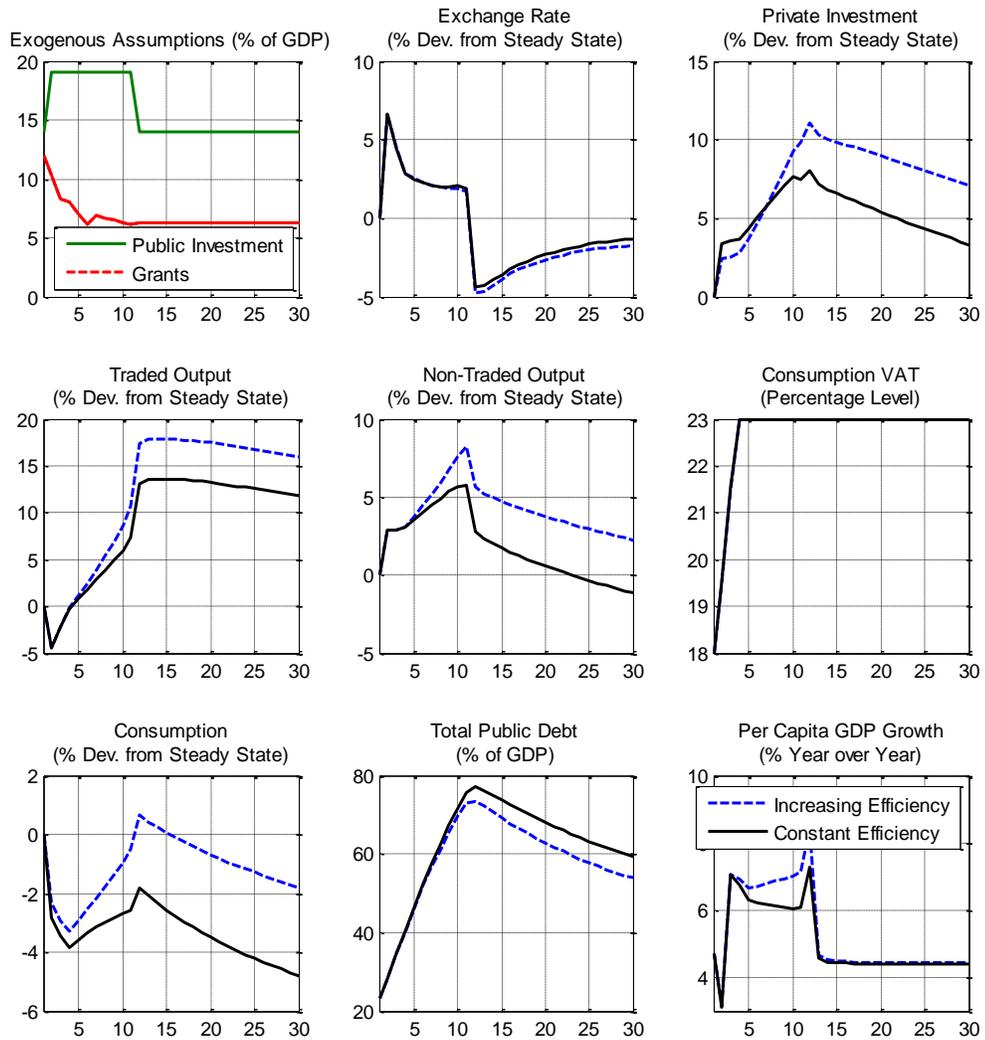


Figure 6: Public Investment Buildup Financed with Commercial Borrowing and Increased Efficiency of Investment

effect of increasing the efficiency of investment over time. We assume that by the end of 10 years, investment efficiency will have increased linearly from 60 to 100 percent (not a realistic goal, but useful as a heuristic).

A reminder of what it means to increase the efficiency of investment: for every dollar of spending directed to public infrastructure, higher efficiency means that a greater share of the dollar is turned into productive (productivity-enhancing) public capital that enters as an input to firm production.

Increased efficiency moderately raises per capita GDP growth, so that it peaks near eight percent around year 12. It also modestly reduces the debt burden by about five percentage points in years 12 through 30.

The most significant gain, however, is that private investment increases more and the sharp contraction in private consumption is significantly reduced. Traded output increases by about an additional five percentage points and non-traded output rises by about four percentage points; as a result, private investment is higher in the long run as well. Private consumption contracts by only three percent in the short term, then never falls by more than two percent again (compared to a long-term decline of five percent when efficiency does not increase).

Table 2: Growth Dividend from Different Investment and Financing Options

	Growth Dividend	Growth Dividend Relative to Baseline
Baseline Scenario: Declining Grants, Declining Investment	-5.1 %	0.0 %
Public Investment Buildup Financed with an Unconstrained Tax Adjustment	9.0 %	14.1 %
Public Investment Buildup Financed with Commercial Borrowing	11.7 %	16.8 %
Public Investment Buildup Financed with Commercial Borrowing, Additional Concessional Loans, and Constrained VAT Adjustment (Hybrid Financing)	11.6 %	16.7 %
Public Investment Buildup with Hybrid Financing and Reduced Grant Inflows	2.1 %	7.2 %
Public Investment Buildup Financed with Commercial Borrowing and Increased Efficiency of Investment	18.7 %	23.8 %

Table 2 presents the effect of each of the preceding investment strategies on real GDP growth over 10 years (the proposed investment horizon). The first column shows the cumulative sum of year-on-year GDP growth above or below the assumed initial value of 4.7 percent. The

second column shows the cumulative sum of year-on-year GDP growth above or below the baseline simulation. The difference between row six and row three shows the benefit of increasing investment efficiency – it is worth about half a percentage point of GDP every year for 10 years.

VI. CONCLUDING REMARKS

The DGE simulations of the investment-financing growth nexus for Rwanda highlight the challenges the country faces in seeking to accelerate economic growth over the medium-term because of the very costly investments that would be needed. Without any additional financing, it is clear that Rwanda's recent gains may be short-lived. It is clear that some additional public investment is needed, but in the face of declining aid flows, how is this investment to be paid for?

We considered higher consumption taxes, external commercial borrowing, and a combination of the two. External commercial borrowing would certainly reduce the need for the repression of consumption through higher taxation but at the risk of the buildup of unsustainable debt. This risk would be reduced (although it would still be present) to the extent that commercial debt could be replaced by concessional debt. However, for any given level of investment or combination of financing, the surest way to secure sustainable high growth would be through the improved efficiency of public investment.

VII. REFERENCES

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