KAPSARC Discussion Paper

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Natural Resource Revenue Management Strategies in Developing Countries: A Calibrated Macroeconomic Model for Uganda

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About KAPSARC

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Summary for Eastern Africa Policymakers

Recent natural resource discoveries in Eastern Africa provide an opportunity to boost economic development. However, this opportunity brings with it potential challenges in the form of 'Dutch disease' and, potentially, the 'resource curse'. A companion paper to this report: *Managing Macroeconomic Risks Arising from Natural Resource Revenues in Developing Countries: A review of the Challenges for East Africa* sets out the current state of thinking on the issues of Dutch disease, resource curse, the applicability of the permanent income hypothesis (PIH) in populous, developing economies and the impact of absorptive capacity constraints.

Our focus is oil discoveries in Uganda and their expected impact on government revenues. We analyze alternative policies for spending natural resource revenues using a calibrated dynamic, stochastic, general equilibrium model (DSGE) of the Ugandan economy. These policy scenarios encompass the range of outcomes that are likely to be considered by the Ugandan government and provide a framing for subsequent policy discussions on how best to deploy the windfall.

Using detailed publicly-available information on the upstream oil sector and the fiscal regime, we have derived realistic cost and government revenue profiles across a range of oil price scenarios. These profiles assume that proposed local content regulations neither delay project development nor increase the costs compared to international norms. This enables us to project annual production, fixed and variable costs, and government revenues for three global oil price paths.

The three scenarios illustrate the potential effects of:

– Direct income transfers.

– Front loaded public investment spending.

– Gradual public investment spending.

Within these scenarios, we also assess the impacts of alternative assumptions on the efficiency of public investment arising from constraints on absorptive capacity within the economy.

The results of the three different policy choices can be contrasted to show the tradeoffs between short term welfare benefits at the expense of long term economic performance. No single economic choice can be considered optimal in the absence of considering the political and social consequences of each individual policy choice. For this reason, we make no specific recommendation as to which approach to choose but provide a framework for policy discussions.

Introduction

The recent discovery of significant reserves of oil and gas in East Africa could provide an opportunity to accelerate economic development in the region. Exploration in the Albertine Graben region has discovered some 2.5 billion barrels of recoverable oil, presenting Uganda with the chance to transform its economy. The government expects to receive significant revenues from the oil sector which can be used to implement policies for enhancing economic growth opportunities, promoting long term economic development, alleviating poverty and improving standards of living.

However, this opportunity is not without risks and challenges, an experience often referred to as the resource curse. Dependence on hydrocarbon natural resources for economic growth has been frequently linked to low-income countries experiencing poor macroeconomic performance and growing inequality. The topic has long been an important research area. Papers by Gelb (1988), Sachs and Warner (1999 and 2001) are good examples; van der Ploeg (2011) presents a useful survey of the research. Macroeconomic risks present themselves in two main ways. First, there is a potential deterioration of non-resource tradeable (exporting and import-competing) sectors (the Dutch Disease). The possible adverse consequences of uncertainty and volatility in global oil prices on government revenues constitute the second source of macroeconomic risk, as noted in a recent speech by the Governor of the Bank of Uganda (Mutebile, 2015). These can complicate fiscal planning, often resulting in inefficient, pro-cyclical "stop-go" government expenditures.

The objective of our research is to illustrate the important macroeconomic effects resulting from the expected natural resource development in Uganda. Our modeling approach is similar to Berg et. al. (2012); however, their focus was on public investment effects for Angola and the Central African Economic and Monetary Community (CEMAC) countries. We have developed a DSGE model, calibrated for the Ugandan economy, to simulate and evaluate the result of alternative expenditure policies under different price paths. Our model incorporates a detailed treatment of expected resource revenues based on detailed upstream cost and fiscal revenue estimates based on the assumption that planned local content regulations neither delay development nor impose additional costs.

Governments in many resource-rich countries face two important and related challenges or decisions with regard to the resource rents:

- How much of the resource rents should be spent or saved?
- How should they spend the revenues?

The resources are exhaustible, the rents are affected by the fiscal regime, and the rents vary with global energy prices and the rate of resource extraction. Resource-rich developing countries must make decisions targeting their main goal to generate sustained growth and alleviate poverty.

Meeting these challenges requires understanding the resource endowment of the country as well as technical and economic variables. For example, the types of reserves (gas vs oil), the quality of the crude oil or natural gas, and the technical challenges to production (depth level, onshore vs offshore) affect the costs associated with exploitation of the resource, and therefore the expected rates of return for the oil company and the government's fiscal take. The level of tax rates and the types of fiscal instruments (royalties, cost recovery limits, corporate taxes, depreciation allowances, etc.) affect the ultimate exploitation of the natural resource and the time profile of the extraction (Smith, 2014). These impact not only the extraction profile of the resource, but also the distribution of resource rents among the stakeholders.

To assist policymakers, we have analyzed and compared the macroeconomic and welfare effects of alternative government expenditure policies given the resource potential and revenues under the current fiscal regime in Uganda. Three broad policy options under different oil price scenarios are considered:

1. Income transfers to households.
2. Front-loaded public investment in infrastructure.
3. Gradual public investment in infrastructure.

Our model is based on a single representative household; the direct increase on disposable income in the model associated with the income transfer policy can be interpreted as an increase of the average income and a reduction of poverty in the actual economy. In our analysis, we compared the effects from the traditional prescription of saving resource rents in a sovereign wealth fund with the other spending options of front-loading public investment to increase productivity and cash transfers to alleviate poverty. Furthermore, we have taken into account two specific characteristics of public investment in low-income developing countries:

- The lack of public infrastructure.
- The existence of constraints in absorptive capacity reflecting economic, policy and institutional bottlenecks. These reduce the efficacy of implementing rapid and large increases in public investment.

In the remainder of this report, we provide an overview of Uganda's macroeconomic performance and energy sector indicators, a description of the model used for our analysis, and explanation of the fiscal regime, upstream model, and projections of oil revenues, and a discussion of the data and calibration of parameters. This provides the foundations for the policy simulations analyzing the impact of alternative approaches to managing the fiscal revenues.

Macroeconomic Performance and Energy Sector Indicators

For those not already familiar with the Ugandan economy, Table 1 provides some of the basic macroeconomic indicators for the period 2010 to 2014.

Nominal GDP in 2014 was approximately Ug. Shs 64 trillion ($23 billion). In real terms using 2009/2010 prices, Uganda's GDP was Ug. Shs 51 Trillion. Income per capita in nominal US dollars was $660 in 2014. However, it is worth noting that these data are considered preliminary as a result of recent changes in the GDP benchmark year for prices and differences in reporting between the Bank of Uganda (BOU) and Ugandan Bureau of Statistics. Inflation spiked to 27 percent in 2011. However, the BOU brought inflation down quickly to just over 5 percent by the following year. In 2014, the inflation rate was 4.3 percent.

Uganda's National Development Plan (NDP) and Vision 2040 have targeted an average annual growth rate of 7 percent (MFPED, 2014). Real economic growth was about 5.9 percent on an annualized basis in the 1990s and increased to 6.9 percent in the 2000s. On a per capita basis income growth averaged 3 percent in the 1990s and 3.8 percent in the 2000s. Uganda's growth performance was relatively weak during the period 2012 to 2013. In 2012 per capita income growth actually fell but recovered in 2014 with economic growth at 6.5 percent, and per capita GDP growing by 3.5 percent. Causes of the weak performance included challenging global financial conditions, delays in infrastructural investment projects, and vulnerability to external perceptions of risk. By contrast, recent improvements in growth and per capita incomes have been driven by favorable weather conditions for agricultural production, lower oil prices (and thus a reduced import bill), and prudent macroeconomic policies among other factors.

Encouraged by anticipated oil revenues and government growth objectives, infrastructure investments have increased. According to the 2015/16 budget (MFPED, 2015), the overall fiscal balance (including grants) is projected to amount to a deficit of Ug. Shs 4,220 billion (equivalent to 5.6 percent of GDP) in FY2014/15 and is expected to increase to Ug. Shs 5,700 billion (6.8 percent of GDP) in FY2015/16. The deficit is expected to decline over the medium term, reflecting the completion of the major infrastructure projects and in line with the East African Monetary Union convergence plan. The deficit will be financed through external and domestic sources.

Public debt was just over 30 percent of GDP in 2014. The amount of debt concerns the Ugandan Government, but it is within the range estimated by the public debt management framework of 2013 and East Africa's Monetary Union convergence criteria (50 percent debt-to-GDP ratio) (MFPED, 2015). However, the increase in debt is expected to increase inflation and depreciate the Ugandan shilling considerably. The U.S. dollar was trading at Ug. Shs 3,100 in June 2015, a 20 percent depreciation since November 2014.

Macroeconomic Indicators for Uganda					
	2010	2011	2012	2013	2014
Levels					
GDP (Ug. Shs, nominal billions)	38,078	44,044	54,534	58,687	63,904
Real GDP (Ug. Shs, 2009/2010 Prices, billions)	40,988	45,011	46,259	47,887	50,986
GDP (US$, nominal billions)	16	18	20	23	23
GDP per capita (US$, nominal, estimate)	494	525	599	681	660
Fiscal Balance (percent of GDP)	-5.8	-3.0	-3.3	-4.4	-5.2
Public Debt (percent of GDP)	23.6	23.3	24.6	27.4	30.4
Current Account Balance (percent of GDP)	-12.6	0.7	-9.8	-8.7	-10.1
Trade Balance (US$ billions)	-2.2	-2.5	-2.5	-2.1	-2.4
Growth Rates (percent)					
Inflation	3.1	27.0	5.3	6.7	4.3
Real GDP	5.5	9.8	2.8	3.5	6.5
Real GDP per capita, estimate	2.4	6.7	-0.3	0.5	3.5

Table 1 – Macroeconomic Indicators for Uganda
Source: Bank of Uganda (BOU) and Uganda Bureau of Statistics (UBOS)

A summary of energy indicators for Uganda is provided in Table 2, broken down into three main sections:

1. Primary Energy – According to EIA data, estimated primary energy consumption grew from 0.48 million tons of oil equivalent (MTOE) in 1990 to 1.49 MTOE in 2012, equivalent to an annual compound growth rate of 5.2 percent. In per capita terms, the growth rate for primary energy consumption was 1.6 percent in the 1990s and 2.2 percent since 2000. Estimated energy consumption per capita in 2011 was 0.047 tons of oil equivalent.

The importance of electricity and refined petroleum products has grown and will continue to grow in importance. In 1990, they constituted about 30 percent of total primary energy consumption. Today over 50 percent of primary energy consumption is accounted for by electricity and refined petroleum products.

2. Electricity – Power generation is dominated by hydro, but since 2005 the growth in demand and problems with river flows have curtailed its share in the power generation sector. Fossil fuel power generation has grown from zero to 17 percent of total power generation. Total generation is about 3 billion kilowatt hours (kWh); 0.5 billion kWh is produced by fossil fuels. Distillate fuel consumption increased rapidly from 4,500 barrels per day (bbl/d) in 2005 to 12,000 bbl/d in 2008 with; almost the entire increase was accounted for by power plants. Electricity generation and consumption are expected to grow at between 6 percent and 7 percent annually for the foreseeable future.

3. Refined Products – All refined petroleum products are currently imported. The annualized growth rate of refined product consumption was 3 percent in the 1990s. This has more than doubled to over 7 percent since 2000. Current total consumption is about 22,000 bbl/d and the annual growth rate of 7 percent is likely to continue. One of the biggest contributors is motor gasoline which accounts for 6,500 bbl/d.

Uganda has committed to build an oil refinery when domestic oil production commences. This decision is subject to a number of factors which will determine refining margins and the return to investments. These include marketing margins on potential sales to neighboring countries that currently import refined products via ports in the Indian Ocean, refining margins elsewhere in the region, costs of transporting crude oil to the nearest sea-port, and the cost of importing refined products.

Description of the KAPSARC DSGE Model for Uganda

Our model attempts to illuminate important macroeconomic effects resulting from a natural resource boom in a small open economy. We incorporate natural resource production costs and fiscal revenue estimates under different global oil price paths ($60, $75, and $90 per barrel). We have used the model to analyze the impacts of alternative policies in utilizing windfall revenues on major economic variables including:

- Income
- Consumption
- Investment levels
- Real exchange rates
- Government revenues and expenditures
- Economic growth impacts
- Reallocations of resources between economic sectors

The economy is represented by a dynamic stochastic general equilibrium model (DSGE) of a resource-rich small open economy with three different goods: a tradeable good subject to international competition; a non-tradeable good; and the natural resource. Our DSGE model attempts to capture important macroeconomic effects resulting from a natural resource boom in a small open economy.

Energy Indicators			
	Compound Annual Growth Rate (percent)		**Level in Million Tonnes of Oil Equivalent (MTOE)**
	1991-00	2001-12	2012
Primary Energy in Metric Tons of Oil Equivalent (MTOE)			
Production	7.2 percent	3.4 percent	0.61 mtoe
Consumption	4.6 percent	4.5 percent	1.49 mtoe
Consumption per Capita *	1.6 percent	2.2 percent	0.05 toe
Electricity in Billion kilowatt hours (kWh)			
Consumption	8.0 percent	6.6 percent	2.8 billion kWh
Generation	7.2 percent	5.4 percent	3.0 billion kWh
Hydroelectricity	7.2 percent	4.0 percent	2.4 billion kWh
Fossil Fuels	n.a.	n.a.	0.5 billion kWh
Petroleum Products in Barrels per Day (b/d)			
Motor Gasoline	4.9 percent	5.4 peercent	6,400 b/d
Distillate Fuel	2.9 percent	10,8 percent	12,000 b/d
Total	3.0 percent	7.2 percent	22,000 b/d

Table 2 – Energy Indicators
Source: U.S. Energy Information Administration - International Data Browser, accessed July 6th, 2015.
*per capita consumption estimate is for 2011.

The model consists of an infinitely lived representative household and two representative firms producing a tradeable and a non-tradeable good respectively. Production and prices of natural resources are assumed to be exogenous and stochastic. We consider a government that collects revenues from conventional taxation and from the natural resources sector in the form of taxes, royalties, and production sharing contracts.

Household Sector

The preferences of households are represented by a utility function given by:

$$U(C_t) = \frac{C_t^{1-\sigma}}{1-\sigma}, \tag{1}$$

$$C_t = C_{T_t}^{\theta} C_{N_t}^{1-\theta}, \tag{2}$$

where the aggregate consumption (C_t) is given in (2) as a Cobb-Douglas aggregation of the consumption of the tradeable good (C_{Tt}) and the non-tradeable good (C_{Nt}). We assume that labor is inelastically supplied by households (normalized to 1), so utility depends only on consumption.

We normalize the price of the tradeable good to 1, then P_t would be the price of aggregate consumption relative to the tradeable good and P_{Nt} is the relative price of the non-tradeable relative to the tradeable good, that is the real exchange rate that measures the competitiveness of the economy.

Given the prices and the Cobb-Douglas aggregation, the consumer demands of tradeable and non-tradeable are:

$$C_{N_t} = (1-\theta)\frac{P_t}{P_{N_t}} C_t, \tag{3}$$

$$C_{T_t} = \theta P_t c_t. \tag{4}$$

The household's problem is to maximize an intertemporal expected flow of utility subject to the budget constraint and the laws of capital accumulation:

$$\max_{C_t, D_t^H, I_{N_t}, K_{N_t}, I_{T_t}, K_{T_t}} E_0 \sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\sigma}}{1-\sigma}$$

Such that.:

$$D_t^H - (1+r_t)D_{t-1}^H + (1-\tau_t^w)w_t L_t + (1-\tau_t^K)\left[R_{T_t}K_{T_{t-1}} + R_{N_t}K_{N_{t-1}}\right] - T_t = [1+\theta\tau_t^{CT} + (1-\theta)\tau_t^{CN}]P_t C_t + P_t\left[I_{N_t} + \frac{h_N}{2}\frac{I_{N_t}^2}{K_{N_{t-1}}}\right] + P_t\left[I_{T_t} + \frac{h_T}{2}\frac{I_{T_t}^2}{K_{T_{t-1}}}\right], \tag{5}$$

$$I_{N_t} = K_{N_t} - (1-\delta_N)K_{N_{t-1}}, \tag{6}$$

$$I_{T_t} = K_{T_t} - (1-\delta_T)K_{T_{t-1}}, \tag{7}$$

where β is the discount factor (which is the inverse of the discount rate or real interest rate net of depreciation), D_t^H is foreign private debt, r_t is foreign debt interest rate, w_t are wages and L_t is labor, which is normalized to 1. I_{Nt}, K_{Nt}, I_{Tt}, K_{Tt} represent investment and capital stock in the non-tradeable and tradeable sectors respectively, while R_{Nt}, R_{Tt} are the gross return of capital in both sectors. $\tau_t^{CT}, \tau_t^{CN}, \tau_t^{w}$ and τ_t^K are taxes rates on consumption of tradeables, consumption of non-tradeables, labor income and capital income. T_t is a lump-sum government tax if Tt > 0 or a transfer to households if Tt <). δ_N and δ_T are the depreciation rates in both sectors, while h_N and h_T are the parameters governing the capital adjustment cost in both sectors. It should be noted that the household sector has access to international capital markets as a way of incorporating the trade balance in small open economy models. In small open economy models the international interest rate is exogenously determined, making investment too volatile relative to the empirical evidence. This anomaly can be solved by assuming capital adjustment costs, which has become an standard assumption in the literature, see Mendoza (1991). In our model those costs hold even in steady state, reflecting developing countries capacity constraints in the private sector as a capital cost even if there are no changes in net investment.

The first order conditions that define the optimal behavior of the household are:

$$\frac{\frac{\partial U}{\partial C_t}}{[1+\theta\tau_t^{CT}+(1-\theta)\tau_t^{CN}]P_t} =$$

$$\beta E_t \frac{\frac{\partial U}{\partial C_{t+1}}}{[1+\theta\tau_{t+1}^{CT}+(1-\theta)\tau_{t+1}^{CN}]P_{t+1}}(1+r_{t+1}), \tag{8}$$

$$q_{N_t} = P_t\left(1+h_N\frac{I_{N_t}}{K_{N_{t-1}}}\right), \tag{9}$$

$$q_{T_t} = P_t\left(1+h_T\frac{I_{T_t}}{K_{T_{t-1}}}\right), \tag{10}$$

$$q_{N_t} = E_t\frac{1}{(1+r_{t+1})}\cdot$$
$$\left\{(1-\tau_{t+1}^{K})R_{N_{t+1}}+P_{t+1}\frac{h_N}{2}\frac{I_{N_{t+1}}^2}{K_{N_t}^2}+q_{N_{t+1}}(1-\delta_N)\right\}, \tag{11}$$

$$q_{T_t} = E_t\frac{1}{(1+r_{t+1})}\cdot$$
$$\left\{(1-\tau_{t+1}^{K})R_{T_{t+1}}+P_{t+1}\frac{h_T}{2}\frac{I_{T_{t+1}}^2}{K_{T_t}^2}+q_{T_{t+1}}(1-\delta_T)\right\}, \tag{12}$$

jointly with constraints (5-7), and where q_{Nt} is the ratio of Lagrange multipliers discounting constraints (9) and (8), and discounting (10) and (8) in the case of q_{Tt}.

Several methods have been proposed to make dynamic small open economy models stationary, including endogenous discount factor, convex portfolio adjustment costs, complete asset markets and debt elastic interest rate premium. Following Schmitt-Grohé and Uribe (2003) we induce stationarity by assuming a debt-elastic interest rate risk premium. In particular we consider that the interest rate depends on the debt/GDP ratio according to:

$$r_t = r^* + \left(e^{a\frac{D_{t-1}}{Y_t}}-1\right) \tag{13}$$

Representative firms

We consider two different sectors: tradeable and non-tradeable. This structure is necessary to address the potential reallocation effects associated with the Dutch Disease. We assume competitive firms in both sectors use of labor and private capital to produce goods. Public capital provides a positive externality. We assume constant returns to scale in the private inputs. The production function for non-traded and traded goods will respectively be:

$$Y_{N_t} = A_{N_t}K_{T_{t-1}}^{\gamma}L_{T_t}^{1-\gamma}K_{G_{t-1}}^{\phi}, \tag{14}$$

$$Y_{T_t} = A_{T_t}K_{T_{t-1}}^{\alpha}L_{T_t}^{1-\alpha}K_{G_{t-1}}^{\pi}, \tag{15}$$

Where there are exogenous scale factors that could be deterministic or stochastic. Notice that labor and private capital are sector-specific inputs, while the stock of public capital is a positive externality affecting both sectors. The optimal conditions from profit maximization are:

$$w_t = (1-\gamma)P_{N_t}A_{N_t}K_{T_{t-1}}^{\gamma}L_{T_t}^{-\gamma}K_{G_{t-1}}^{\phi}, \tag{16}$$

$$R_{N_t} = \gamma P_{N_t}A_{N_t}K_{T_{t-1}}^{\gamma-1}L_{T_t}^{1-\gamma}K_{G_{t-1}}^{\phi}, \tag{17}$$

$$w_t = (1-\alpha)A_{T_t}K_{T_{t-1}}^{\alpha}L_{T_t}^{-\alpha}K_{G_{t-1}}^{\pi}, \tag{18}$$

$$R_{T_t} = \alpha A_{T_t}K_{T_{t-1}}^{\alpha-1}L_{T_t}^{1-\alpha}K_{G_{t-1}}^{\pi}. \tag{19}$$

Natural resource sector

As in most developing countries, oil production in Uganda is conducted by international oil companies which have the requisite investment capital and technical expertise. We assume that the only channel of influence on the domestic economy would be through the revenues the government collects from the oil sector. In practice, for most developing countries undergoing resource booms, the windfalls accruing domestically primarily flow into government coffers via taxes, royalties, production sharing agreements and the like. The extractive industry sector is typically capital intensive and based on imported capital equipment and foreign direct investments. Local wages constitute a small fraction of the value added in the sector. The effects of the Dutch Disease are thus strongly influenced by how governments, as the major domestic recipients of resource rents, spend their resource windfalls.

The usual approach for modeling government oil revenues assumes stochastic processes for the international price of oil, as well as for oil production [see for instance Berg et al. (2013)]. A distinguishing feature of our approach is the detailed treatment of the fiscal regime and upstream economics in the projection of production costs and government revenues. We use public information on commercial oil reserves and on the fiscal regime to obtain projections of annual oil production and government oil revenues for a given oil price. The procedure to calculate extraction costs and government revenues is presented in the next section of this paper.

Government

The government collects revenues from taxes on consumption, labor and capital income, as well as from the natural resource sector (NRR_t). The government can also issue debt (D_t^G) in international markets and this public debt could be negative, meaning that the government is saving abroad. This feature is useful to simulate sovereign wealth fund saving policies. Government spending consists of transfers to the households, public consumption (C_t^G) and public investment (I_t^G). We use the same Cobb-Douglas aggregation specified in equation (2). The government budget constraint is:

$$D_t^G + [\theta\tau_t^{CT} + (1-\theta)\tau_t^{CN}]P_tC_t + \tau_t^W w_t L_t + \tau_t^K\left[R_{T_t}K_{T_{t-1}} + R_{N_t}K_{N_{t-1}}\right] + NRR_t + T_t = (1+r_t)D_{t-1}^G + P_tI_{G_t} + P_tC_{G_t} \quad (20)$$

The government invests in public capital accumulation according to a rule that includes absorptive capacity constraints:

$$\psi\left(I_{G_t} - I_{G_{ss}}\right) + I_{G_{ss}} = K_{G_t} - (1-\mu)K_{G_{t-1}}, \quad (21)$$

where ψ represents the share of increase of public investment that is effectively transformed into productive public capital. As Pritchett (2000) points out, the difference between investment spending and effective capital accumulation is an important issue for developing countries. Sudden increases of public investment face important bottlenecks in developing countries due to the lack of administrative capacity. Dabla-Norris et al. (2012) and Gupta et al. (2014) found that only 40-60 percent of public investment is transformed into effective public capital.

Market clearing and current account

Tradeable and non-tradeable markets have to clear at each period. As Walras Law holds in general equilibrium, it is only required to impose market clearing conditions in one of the markets, and the equilibrium in the other market will follow. The conditions for the market clearing in the non-tradeable market are:

$$Y_{N_t} = \frac{P_t}{P_{N_t}}(1-\theta)\left[C_t + I_{T_t} + \frac{h_T}{2}\frac{I_{T_t}^2}{K_{T_{t-1}}} + I_{N_t} + \frac{h_N}{2}\frac{I_{N_t}^2}{K_{N_{t-1}}} + I_{G_t} + C_{G_t}\right]. \quad (22)$$

Proposition. In equilibrium the current account equals the change in net foreign assets.

Proof. By taking the household budget constraint given in (5) and substituting the input prices obtained in (16-19), we can use the government budget constraint given in (20) to obtain the external equilibrium equation of the non-natural resources foreign trade:

$$\underbrace{D_t - D_{t-1}}_{\text{net international asset position}} = \overbrace{r_tD_{t-1} + \underbrace{P_t\left[C_t + I_{T_t} + \frac{h_T}{2}\frac{I_{T_t}^2}{K_{T_{t-1}}} + I_{N_t} + \frac{h_N}{2}\frac{I_{N_t}^2}{K_{N_{t-1}}} + I_{G_t} + C_{G_t}\right] - \left[P_{N_t}Y_{N_t} + Y_{T_t} + NRR_t\right]}_{\text{trade balance}}}^{\text{current account balance}}. \quad (23)$$

We impose equilibrium in the labor market as follows:

$$L_{Nt} + L_{Tt} + 1.$$

Competitive equilibrium

A *competitive equilibrium* for this economy is a set of paths of allocations, prices and policies that satisfy the following conditions:

i. $\{C_t, D_t^H, I_{N_t}, K_{N_t}, I_{N_t}, K_{N_t}\}$ solve the household's problem given prices $\{P_t, P_{N_t}, r_t, w_t, R_{N_t}, R_{T_t}\}$ and policies $\{\tau_t^{CT}, \tau_t^{CN}, \tau_t^{w}, \tau_t^{K}, T_t\}$.

ii. $\{L_{Nt}, K_{Nt}\}$ solve the non-tradeable firm's problem given prices $\{P_{Nt}, w_t, R_{Nt}\}$ and the policy $\{K_{Gt}\}$.

iii. $L_{Tt}, K_{Tt}\}$ solve the tradeable firm's problem given prices $\{w_t, R_{Tt}\}$ and the policy $\{K_{Gt}\}$.

iv. The government budget constraint holds at each period.

v. All the markets clear.

Fiscal Regime, Upstream Economic Model, and Projection of Oil Revenues in Uganda

We depart from the existing literature in using more detailed procedures in estimating trajectories for production costs and government revenues in the case of Uganda.

Government revenues are the sum of :

- Royalties
- State share of profit from sale of oil
- Corporate income tax
- Remittance tax
- After tax cash flow of state participation
- Surface and training fees

We use public information on the crude oil quality, past exploration and future estimated development capital expenditures as well as existing upstream legal and fiscal terms. This enables us to project annual production profiles, technical costs, oil price differentials, and calculate government revenues for a given global oil price path with a reasonable degree of confidence.

The Upstream Economic Model uses inputs from four main sources. The first is a scenario of oil price assumptions, transport costs and crude quality differentials. The second is the set of projected annual production profiles by cluster. The third incorporates the associated technical cost estimates for exploration, development, and operations by clusters. The fourth are the upstream fiscal terms.

Price differential and transport cost

Ugandan crude oil will sell at a significant discount to the world price (the Brent crude oil price is usually taken as a proxy for global crude oil prices), based on its waxy properties and its location. Uganda's crude is characterized as a light sweet crude, but with high wax content. The API gravity ranges from 33 to 37. The pour point is relatively high at 39C in part due to the wax content, which means the oil must be heated for transportation and this is reflected in the high transportation cost. The Lake Albert area is quite far from the loading port on the Kenyan coast (approximately 1300 km).

Thus, if the global crude oil price is projected to be \$75/barrel, we assume that the Ugandan crude will be valued in the economic model at \$55/barrel. This \$20/barrel discount is the sum of a \$14/barrel transport cost plus a \$6/barrel quality discount.

Production profiles by cluster

There are currently three contractual areas in the Lake Albert region. We will refer to these clusters as Kingfisher, Kaiso Tonya and Buliisa. They are operated, respectively, by Chinese National Offshore Oil Company (CNOOC), Tullow Oil Plc, and Total

S.A. We modeled the production profiles of these areas as three independent technical clusters of eighteen oil fields. According to Tullow Oil Plc (Tullow, 2014), the expected gross production over 26 years would be 1.3 billion barrels of oil, excluding enhanced oil recovery (EOR), with a peak of 230,000 bbl/d

Technical costs

We estimate \$3 billion in past exploration expenditures from data provided by the Petroleum Exploration and Production Department, Ministry of Energy and Mineral Development of Uganda. They were split among the three clusters according to the number of exploration wells drilled per cluster as provided by the IHS EDIN database. We estimate \$8 billion in development costs, a figure derived from Tullow Plc data released to investors. We used an industry cost estimating software tool (IHS Que\$tor) to generate the development capital expenditure schedule over five to six years as well as the fixed and variable operating costs of the fields. These totaled \$8 billion over the production life of the three clusters.

Upstream fiscal terms

We estimate the terms of the production sharing contract, fiscal regime instruments, and the level of national oil company participation from a fiscal model produced by GlobalData. The fiscal regime instruments are summarized in Table 3. These inputs yield the pre-tax net revenue profiles and the profile for fiscal revenues or "government take".

The government of Uganda is in the process of signing a contract with RT Global Resources, a Russian firm, to construct and operate an oil refinery (Bloomberg News, 2015). The exact provisions of the contract are still being negotiated. The refinery will have an initial output of 30,000 bbl/d growing to 60,000 bbl/d. There are ongoing feasibility studies for joint pipelines through Kenya (New Vision, 2015). Currently, our model assumes that all the crude oil will be exported. Cost estimates for the

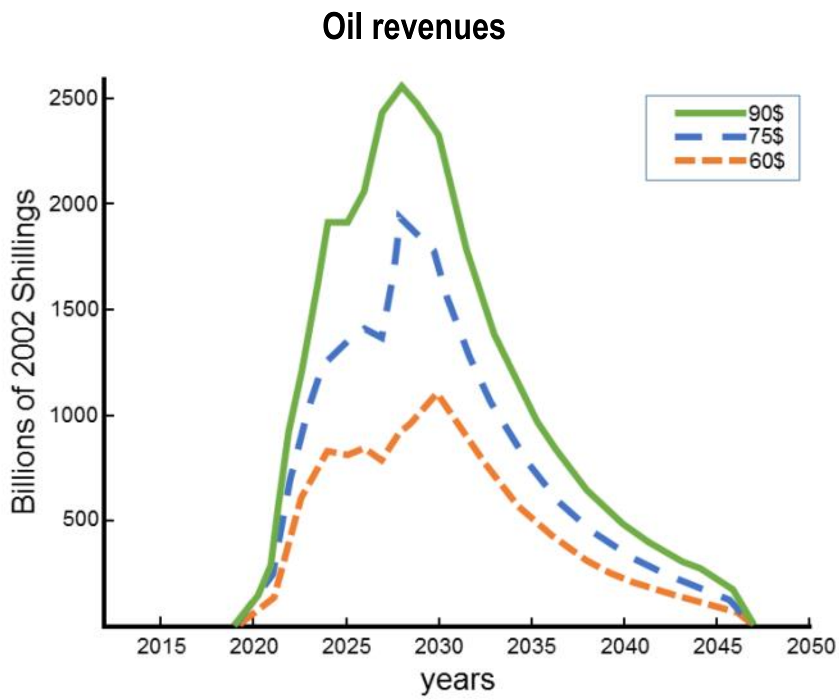

Figure 1 – Expected government oil revenues profile.
Source: KAPSARC

INSTRUMENT	RATE OR AMOUNT
National oil company or state participating interest	15 percent with carried E&A and development cost reimbursed during production
Royalty rate	5 percent for first 2,500 bbl/d rising to 12.5 percent for 7,500+ bbl/d
Cost oil recovery limit	60 percent
Profit sharing based on average production	40 percent for first 5,000 bbl/d rising to 65 percent for 40,000+ bbl/d
Corporate income tax rate	30 percent
Depreciation for tax purposes	6 percent straight line for both cost oil and corporate income tax
Branch remittance taxes	15 percent
Surface rental for 350 km^2	\$2.5-\$7.5/ km^2 during exploration and \$500/ km^2 during production
Training fees exploration period	\$50,000 per year
Training fees production period	\$150,000 per year
VAT	Not applicable yet
Withholding tax on services	Not applicable yet
Impact of local currency fluctuation on depreciation	Not applicable yet

Table 3 – Fiscal Regime Instruments, Values, and Assumptions
Source: Compiled from GlobalData fiscal model and data from the Ministry of Energy and Mineral Development of Uganda.

refinery and associated revenues from domestic and regional trade are not publically available. Figure 1 shows the expected profile of the oil revenues for different oil prices ($60/bbl, $75/bbl, and $90/bbl). The revenues are expressed in 2012 real shillings by transforming nominal $ into real shilling by applying the average depreciation of the shilling and the average growth rate of the Ugandan GDP deflator

Model Calibration

The purpose of our analysis is to conduct simulations on the alternative use of expected revenues from oil production in Uganda. Thus, we calibrate the model parameters according to the Ugandan economy as of 2012, the most recently available macroeconomic data. The values of the calibrated parameters and variables are shown in Tables 4a and 4b.

The risk free interest rate r^* is taken from the IMF (2014) analysis on global real interest rates. The parameter (α) governing the risk premium is obtained from equation (13), where the debt/GDP ratio and the interest rate (r) are from the 2012 update of the IMF/World Bank joint analysis of debt sustainability for Uganda.

From equation (8) in the steady state:

$$\beta = \frac{1}{1+r} \, ,$$

and given the interest rate we obtain the discount factor (β). The intertemporal elasticity of substitution (σ) comes from the estimates for African developing countries by Ostry and Reinhart (1992). This study also estimates the discount factor, obtaining a value of 0.945, very close to our calibrated value.

The share of tradeable goods (θ) in the Cobb-Douglas consumption aggregator described in equation (2) is obtained from the Ugandan data on current expenditure. We calibrate the share as the average of expenditure of tradeable goods over total expenditure from the available data (2005-2009).

Data on variables as the stock of capital, labor force or labor and capital income does not exist for most developing countries and Uganda is not an exception. The lack of data is accentuated if we divide the economy into two different sectors, tradeables and non-tradeables. Sectoral production functions have to be calibrated or estimated including public capital as a separate input. We assign parameter values according to the general macroeconomic literature, setting the capital share in both sectors at 1/3—the typical income share of private capital. This means assigning a value of 2/3 for labor income.

The empirical evidence on the contribution of public capital to productivity and economic growth that can be found in the literature is inconclusive. De la Fuente (2010) exhaustively reviews the empirical literature concluding that there is evidence of a positive but small contribution of public capital in developed economies. However, developing economies may have the potential for a larger impact of public capital, as those economies are in the first stages of economic development. Given the low stock of public infrastructure, the potential impact from investments in the basic transport and communication network is likely to be large. We use a 0.135 elasticity for public capital, the estimated value obtained by Ram (1996) using data of developing countries.

The lack of data also affects the calibration of adjustment costs. We estimate values for and implying that, in steady state, the adjustment cost is 15 percent of capital. We use standard values for annual capital depreciation, 10 percent for private capital and 5 percent for infrastructure. The scale of production is settled on 1 for both sectors. Finally, we assume the absorptive capacity parameter to 1 for the benchmark case, although we will change it to analyze the impact of absorptive capacity constraints.

In addition to the structural parameters of the economy, we have to set the fiscal policy variables

PARAMETERS		
σ	Inverse of intertemporal elasticity of substitution	1/0.451
β	Discount factor	0.938
θ	Percent of traded goods on aggregate consumption	0.5633
$r*$	Risk free world interest rate	0.51 percent
α	External debt risk premium	0.17965
h_N, h_T	Capital adjustment cost	30
α	Private capital elasticity tradeable sector	1/3
Y	Private capital elasticity non-tradeable sector	1/3
Φ, Π	Public capital elasticity in both sectors	0.135
δ_N, δ_T	Private capital depreciation rate	0.1
μ	Public capital depreciation rate	0.05
A_N, A_T	Scale productivity parameter both sectors	1
Ψ	Absorptive capacity	1

Table 4a – Parameter Values used in the Model
Source: KAPSARC

EXOGENOUS POLICY VARIABLES (at the initial steady state)		
τ_t^{CT}, τ_t^{CN}	Consumption taxes on tradeable and non-tradeable	11.23 percent
τ_t^{W}	Labor income tax	3.66 percent
τ_t^{K}	Capital income tax	3.66 percent
C_G	Public consumption share of GDP	13.3 percent
I_G	Public investment share of GDP	5.6 percent
D^G	Public foreign debt over GDP	32.9 percent

Table 4b – Calibrated Exogenous Policy Variables in Initial Steady State
Source: KAPSARC

at the initial state of the economy. Tax rates are calibrated according to the available data on tax revenue performance of the Ugandan Revenue Authority, spanning fiscal years from 2005/06 to 2011/12. The consumption tax rate is assumed to be homogeneous between tradeable and non-tradeable goods and it is calibrated as the ratio of consumption tax revenues plus taxes on imports over household final consumption expenditure. Data on revenues from income taxation does not distinguish between labor and capital income taxes. Therefore, we assume the tax rate is the same for both income sources. We calibrate the tax rate as the ratio of income tax revenues to GDP.

Policy simulations

The purpose of the paper is to analyze the impact of different policies regarding the expected government revenues from the exploitation of recent oil discoveries in Uganda. We perform several simulation exercises to compare alternative policies. As discussed in the introduction and in the companion paper Managing Macroeconomic Risks Arising from Natural Resource Revenues in Developing Countries: A review of the Challenges for East Africa, the traditional policy advice of international economic organizations, particularly the IMF, for natural resource-rich countries has been based on the PIH, advocating for the preservation of the natural resource wealth by saving the natural resource revenues externally in a (sovereign) wealth fund (SWF). This would allow a sustainable constant consumption flow equal to the present value of the resource wealth. This policy would provide fiscal sustainability as well as the preservation of the resource wealth for future generations preventing intergenerational inequality. This type of policy would also mitigate the real exchange appreciation associated with the Dutch Disease and address the issue of resource rent volatility.

However, the PIH-based policy advice has been increasingly questioned as inappropriate and too restrictive in the case of developing countries, as it ignores intrinsic characteristics such as poverty, human and physical capital scarcity and credit constraints. Thus, the IMF and other organizations (see for instance Berg et al, 2013) have started to recognize that some level of front-loaded spending (particularly public investment) would be advisable in the case of developing countries.

Along these lines, we consider two different front-loaded spending/investment policies: one in which oil revenues are spent in the form of transfers to households versus an alternative policy in which the resource revenues are invested in public infrastructure. The rationale for household transfers in developing countries is immediate poverty alleviation by increasing present consumption (and thus welfare). Public investments have a longer lasting but lagged impact on poverty alleviation through the increase of productivity. However, those two policies can lead to Dutch disease symptoms, eventually damaging the non-tradeable sector, especially agricultural employment. This issue is particularly important in developing countries like Uganda, as the tradeable sector includes agriculture, the main provider of employment and income for households in rural areas.

In our first simulation exercise we explore the differences between an income transfer policy, a front-loaded public investment policy and a gradual public investment policy. The gradual public investment policy consists of saving the oil revenues abroad (i.e. in a SWF) and allocating the returns plus 10 percent of the fund to public investment. We simulate these alternatives under a scenario of $75/barrel oil price along the whole period of oil production. The comparison of policies is qualitatively invariant to the assumption of the international oil price. The results of the policy simulations are shown in Figure 2.

The distinct policy impacts can be explained by the different mechanisms through which those policies affect the economy. We can describe them through

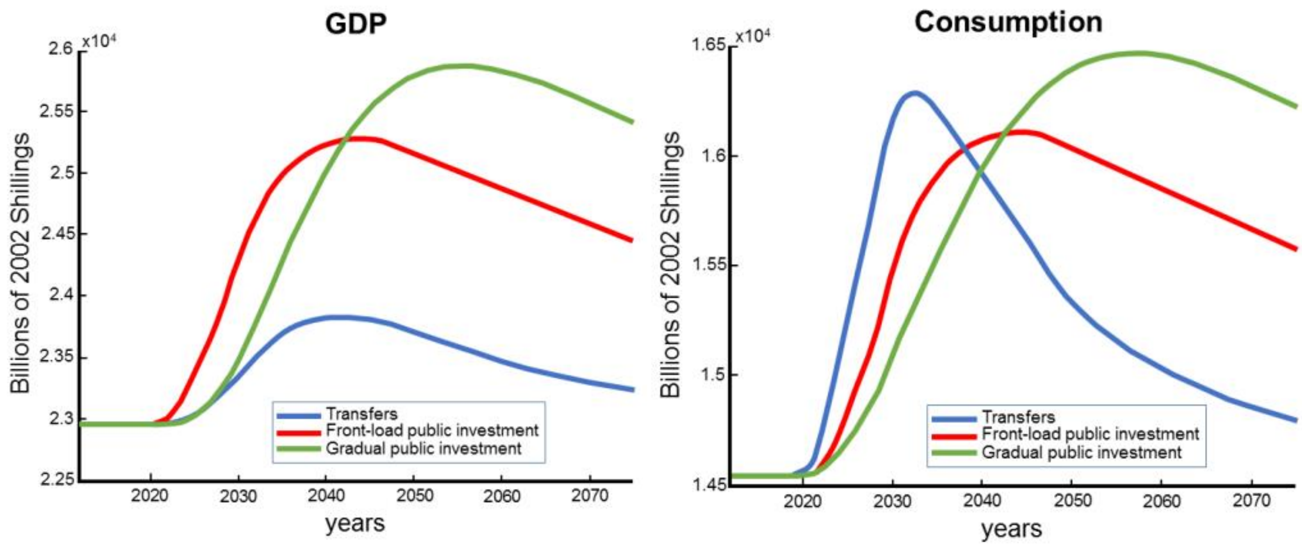

Figure 2 – GDP and consumption under different policies
Source: KAPSARC

the demand side mechanism—spending effect—and a supply side mechanism—productivity effect. Thus, transfers and front-loaded public investment would have the same spending effect, as in both cases government oil revenues are immediately spent, although through different channels. In the case of gradual public investment, this channel is quantitatively less important as we are spreading expenditure over a longer time span. A majority of the oil revenues are saved abroad in a SWF. In our simulation 10 percent of current revenues plus the return on the SWF are spent on public infrastructure. The productivity effect only applies to public investment policies, either front-loaded or gradual. The increase in efficiency of the utilization of labor and private capital in production is lower under the gradual policy but lasts longer.

Figure 2 also shows how the transfers policy provides an immediate and significant rise in consumption, reaching a maximum increase around 2028, following the peak in government revenues, decreasing afterwards. Front-loaded public investment provides a slower and smaller increase of consumption, although it is sustained for longer as the productivity effect ratchets up over time. Gradual public investment further delays the consumption increase, but it is more sustained and higher over time than both the transfers and front-loaded public investment policies. The impact of these simulations on GDP growth differ from the impact on consumption growth in that the transfers policy is dominated by investment (front loaded or gradual) across the entire simulation period. The transfers policy produces the lowest and most short-lived impact on GDP. Public investment policies increase non-oil GDP significantly as public capital investment improves productivity. The gradual policy leads to a higher and longer-lasting but delayed effect compared to the front-loaded spending policy.

All three policy scenarios cause the economy to exhibit real exchange rate appreciation. The steepest and highest upward shock on the real exchange rate is caused by the front-loaded investment policy. The exchange rate appreciation caused by transfers starts slightly later and has a lower peak. The real exchange rate appreciation caused by the front-loaded investment policy adjusts downwards after the peak faster than the real exchange rate trajectory caused by the transfers policy, reflecting the productivity increase induced by the front-loaded investment. The impact on exchange rate appreciation is most muted in the gradual investment policy scenario, as is shown in figure 3.

The real exchange rate reflects the reallocation process from the tradeable sector to the non-tradeable sector, as can be seen in Figures 4 and 5. These depict the response of labor and sectoral value added.

The transfers policy causes value-added in the tradeable sector to shrink more during the period of the resource extraction to 2030, while the decrease lasts for a shorter initial period under the two public investment policies. Between the two investment policies, tradeable sector value added increases faster (after the initial fall associated with the resource rent windfall) but peaks earlier and lower under the front-loaded investment. The subsequent increase in productivity under the gradual

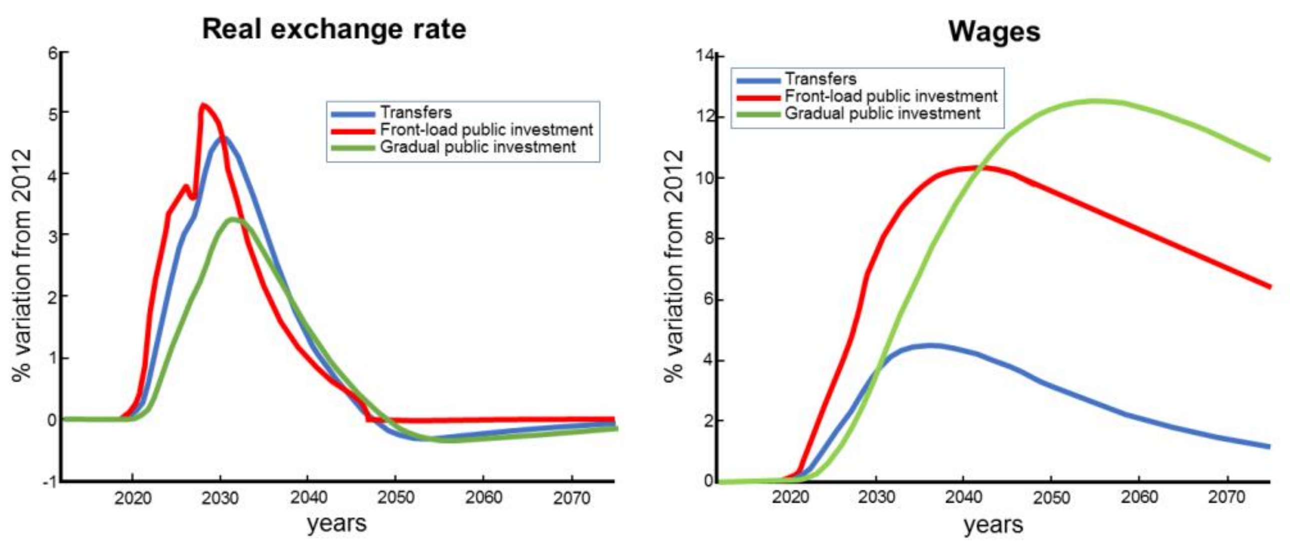

Figure 3 – Real exchange and wages under different policies.
Source: KAPSARC

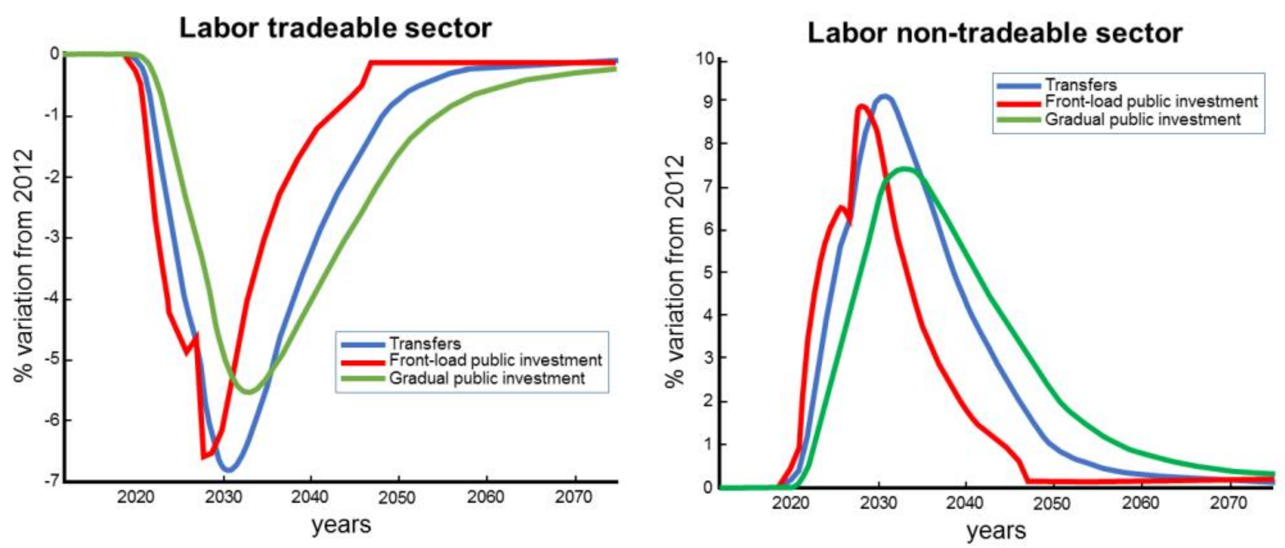

Figure 4 – Real exchange and wages under different policies.
Source: KAPSARC

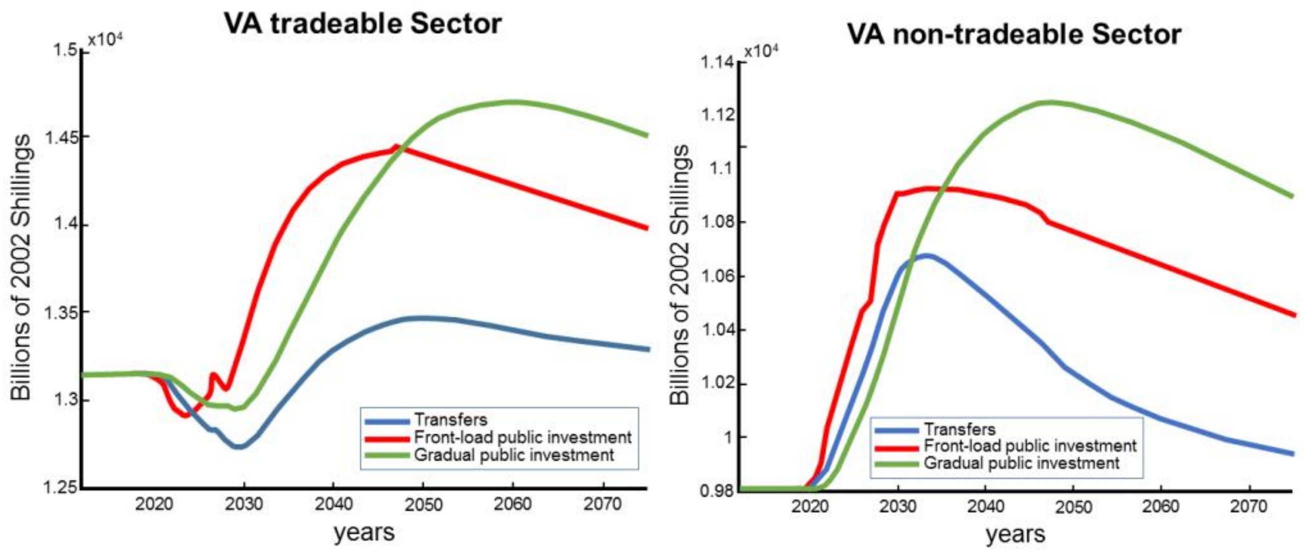

Figure 5 – Value added in tradeable and non-tradeable sector under different policies
Source: KAPSARC

investment policy alleviates the effects of Dutch Disease. Value-added in the non-tradeable sector booms most sharply under the front-loaded investment policy. Transfers cause non-tradeable sector value added to peak later and lower than the front-loaded investment policy while the gradual investment policy has a later but significantly higher peak over the longer run. The effect on both non-tradeable value-added and wages is larger when oil revenues are allocated to gradual public investments because of the increase in productivity.

Public investment policies, both front-loaded or gradual, offset part of the real exchange appreciation, allowing for larger and more sustainable increases in consumption. The fall in the tradeable sector value-added is initially larger with the gradual policy, as the productivity increase is delayed because of the slower pace of public investment. However, the gradual approach enables a subsequent recovery which is compatible with a larger expansion of the value added in the non-tradeable sector. A gradual investment policy also allows for larger and more sustainable increases in wages and the value-added in the non-tradeable sector. The initial decrease of employment in the tradeable sector is larger with the front-loaded investment policy as the effect of real exchange appreciation dominates the productivity effect on job creation, but the comparison is reversed soon afterwards. Labor in the tradeable and non-tradeable sector has mirror responses as it treats aggregate labor as inelastic—set to 1 in the model.

Absorptive Capacity

As outlined in the companion report Managing Macroeconomic Risks Arising from Natural Resource Revenues in Developing Countries: A review of the Challenges for East Africa, an important issue for developing countries is the lack of institutional capacity to deal efficiently with large increases in government spending. This is particularly important in the case of public investment, as it requires appraisal, selection, and monitoring the implementation of infrastructure projects. Institutional capacity constraints decrease public investment effectiveness, reducing the effective public capital stock to below its potential. To assess the potential impact of absorptive capacity constraints, we perform a simulation exercise comparing two different scenarios of front-loaded public investment policies: one in which the country has full capacity to absorb any increase of public investment (ψ = 1); and the other scenario in which only 50 percent of the increase of public investment is effectively transformed into productive public capital ($\psi = 0.5$).

Figure 6 shows how absorptive capacity constraints have a considerable impact on GDP, consumption, tradeable and non-tradeable value added and wages, but virtually no impact on the real exchange rate and on tradeable and non-tradeable employment. Public investment policies produce the same spending effect which triggers the Dutch Disease symptoms of an appreciating real exchange rate and the reallocation of labor from the tradeable to the non-tradeable sector. Absorptive capacity does not significantly affects these variables. However, the differences in aggregate and sectoral value added, and hence in GDP and welfare, are explained by the impact of absorptive capacity constraints on productivity which measures the efficiency of public investments in building productive public capital stock.

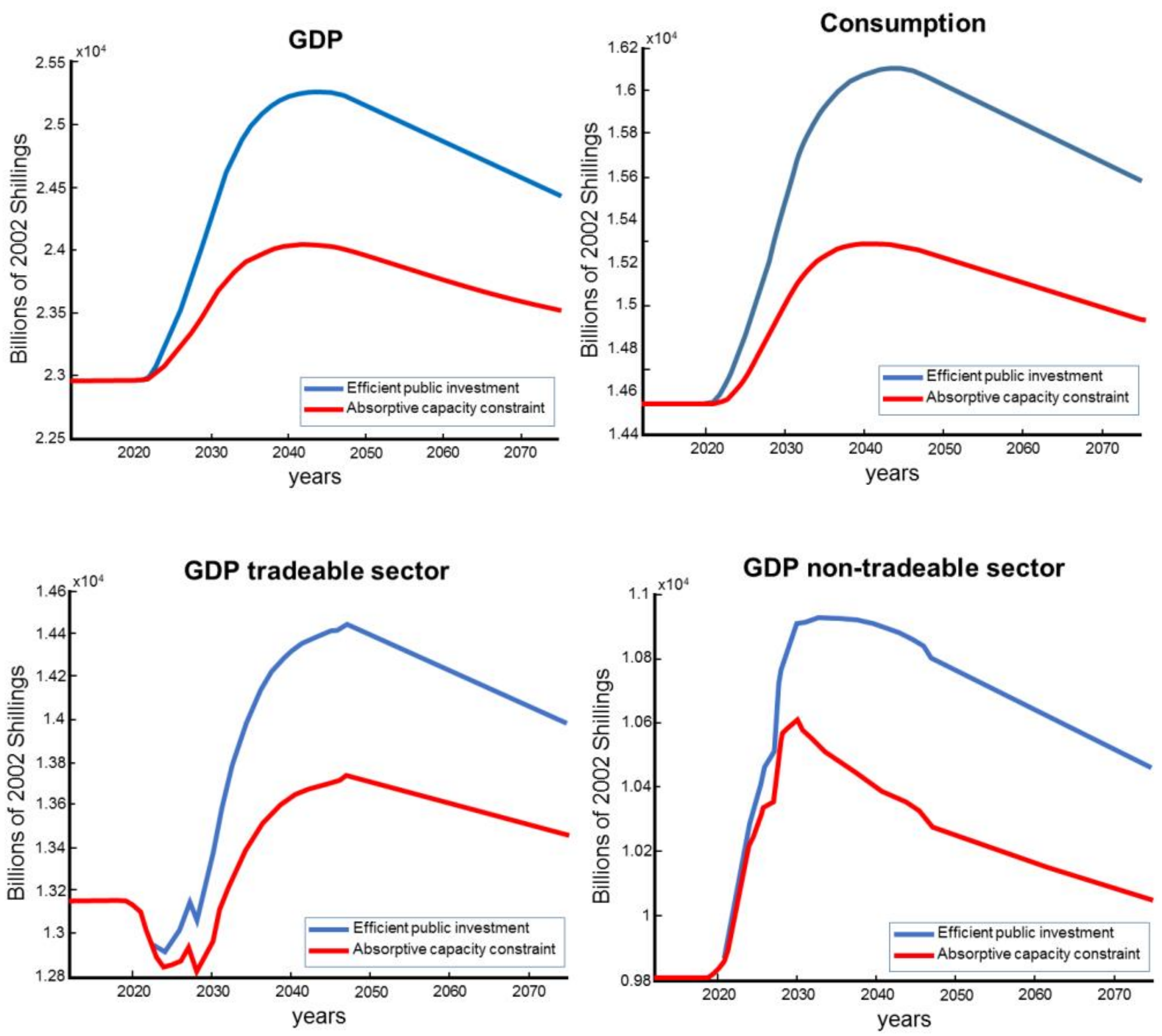

Figure 6 – Absorptive capacity constraints in public investment policies
Source: KAPSARC

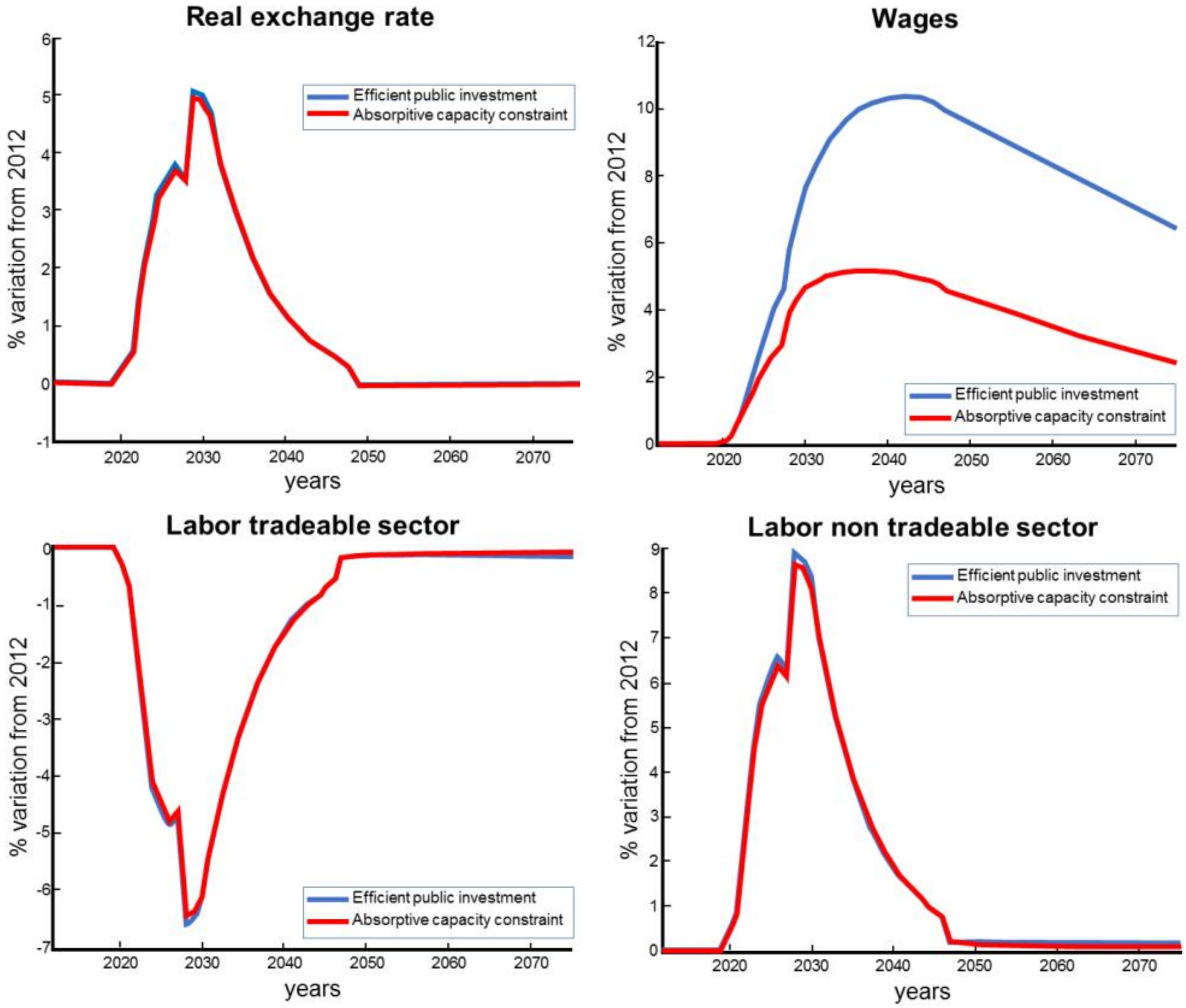

Figure 6 – Absorptive capacity constraints in public investment policies
Source: KAPSARC

Welfare analysis

Our policy simulations provide different dynamic responses in terms of the time paths of the relevant variables in the economy. When comparing the different policies it often occurs that no single policy prevails as optimal over the whole time span of resource extraction. This was illustrated by the response of consumption in Figure 1: the transfers policy increases consumption more in the long run, but under both the front-loaded and gradual public investment policies the increase in consumption can be sustained for longer periods. It is, therefore, helpful to have a measure to compare the policies in terms of overall welfare. We introduce a measure to compute the intertemporal welfare gains associated with each policy.

The intertemporal welfare associated to any implemented policy can be computed as the intertemporal flow of utility derived from consumption under that particular policy:

$$\sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\sigma}}{1-\sigma}$$

If we can measure the welfare gain associated to a given policy as the percentage of consumption we might compensate the consumer for not implementing the policy, that is, for not enjoying the same welfare. In terms of our model, implementing the policy leads the economy to remain at the initial steady state without any oil revenues. So the welfare gain could be computed as:

$$\sum_{t=0}^{\infty} \beta^t \frac{\left(C_{ss}(1+x)\right)^{1-\sigma}}{1-\sigma} = \sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\sigma}}{1-\sigma}$$

Apart from the significant welfare differences between oil price scenarios for each policy, when we focus on the policy comparison the main difference is between transfers and both the front-loaded and gradual public investment policies. This indicates that allocating oil revenues for households transfers increases welfare more than using those revenues for public investment under the calculated value of the discount factor. This result comes from the low value of the discount factor that typically emerges from the calibration process of macro-economic models of low income developing countries. Thus, the lower the discount factor β the higher the valuation of present consumption relative to the future consumption. That is, as individuals become more impatient, the transfers policy is significantly more welfare improving than either of the public investment policies. The higher "impatience" (or lower discount factor) reflects poverty and the lower life expectancy of individuals in developing countries. Thus, in the context of developing countries, there is a bias in favor of the front-loaded expenditure policies. To investigate how the value of the discount factor influences the eventual welfare ranking of policies, we run the simulations where $\beta = 0.96$. This is the standard value for developed economies, corresponding to a 4.2 percent real interest or discount rate. Table 5 shows the welfare gains of the different policies analyzed for different oil price scenarios under these circumstances.

In Table 6 we compare the welfare gain of policy alternatives when we increase the discount rate to 6.6 percent (in the $75/barrel oil price scenario. The results show how the previous welfare rankings of the policy alternatives are reversed when individuals care less about the future relative to the present. Thus, transfers followed by the front-loaded investment becomes more attractive in welfare terms as the discount rate increases. The gradual investment policy delivers the least welfare gain under high discount rates. Conversely, a low enough discount rate (i.e. a high enough value of) can lead the gradual public investment policy to exceed the welfare gains of the other two policy alternatives. When absorptive capacity constraints are included the present value of both public investment policies reduces in welfare terms relative to the policy of income transfers to households.

POLICIES	OIL PRICE SCENARIOS		
	90$	75$	60$
Household transfers	4.82 percent	3.51 percent	2.22 percent
Front–load public investment	4.39 percent	3.20 percent	2.02 percent
Gradual public investment	4.06 percent	2.97 percent	1.88 percent

Table 5 – Policy welfare gains (percent of steady-state consumption) based on developed economies' time preference
Source: KAPSARC

In Table 6 we compare the welfare gain of policy alternatives when we increase the discount rate to 6.6 percent (β = 0.938) in the $75/barrel oil price scenario. The results show how the previous welfare rankings of the policy alternatives are reversed when individuals care less about the future relative to the present. Thus, transfers followed by the front-loaded investment becomes more attractive in welfare terms as the discount rate increases. The gradual investment policy delivers the least welfare gain under high discount rates. Conversely, a low enough discount rate (i.e. a high enough value of β) can lead the gradual public investment policy to exceed the welfare gains of the other two policy alternatives. When absorptive capacity constraints are included the present value of both public investment policies reduces in welfare terms relative to the policy of income transfers to households.

POLICIES	DISCOUNT FACTOR β	
	β = 0.96 (discount rate = 4.2 percent)*	β = 0.938 (discount rate = 6.6 percent)*
Household transfers	3.33 percent	3.51 percent
Front–load public investment	4.22 percent	3.20 percent
Gradual public investment	4.01 percent	2.97 percent

Table 6 – Policy welfare gains (percent of steady-state consumption) for different values of the discount factor
Note: the discount factor is the inverse of the discount rate net of depreciation
Source: KAPSARC

Conclusions

Expected revenues from the oil sector can provide Uganda with significant increases in GDP, consumption and welfare during the coming decades. By incorporating detailed industry estimates of costs and returns on upstream oil recovery in Uganda, the Uganda-calibrated DSGE model provided realistic estimates to possible trajectories for total consumption, GDP, sectoral value added, employment and wages. The trajectories of the various macro-economic variables over the simulation period depend on the policies implemented.

Along with the benefits associated with the expansion of the economy, there is also the expected negative impact on tradeable sectors. This is particularly the case for agriculture, resulting from the appreciation of the real exchange rate normally observed in resource-rich developing economies undergoing resource booms. The spending shock following the increase in government revenues pushes demand up, raising wages and firm profits and therefore damaging international competitiveness through real exchange rate appreciation. The delayed spending under gradual public investment policies mitigates this Dutch Disease phenomenon, reducing the impact on real exchange rate appreciation and value added in the tradeable sector.

In terms of sustainability of economic growth in developing countries undergoing resource booms, the ability to regain competitiveness in the tradeable goods sector in the post-boom period is critical. The policy simulations rank the severity of the Dutch Disease symptoms, with the gradual investment policy achieving better results than the two other policy alternatives—faster spending via transfers and front-loaded investments. However, the choice facing policymakers is more nuanced than simply choosing the policy that delivers the highest overall welfare gain or best protects against Dutch Disease. Political and social considerations require that they identify the policy that meets the reasonable aspirations of the population in the context of all of the other economic growth policies that are necessary to lift a developing economy out of poverty.

In a companion paper to this report, we shall detail the welfare gains (in $ per capita per annum) that the natural resources in Uganda can deliver to the population. This analysis will be critical in setting the reasonable expectations of oil development and bring into sharp focus the need to do more than wait for resource rents to accrue to the treasury if Uganda's Vision 2040 is to be met.

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About the team

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About the Project

KAPSARC is engaged in a long-term research project examining the dynamics of natural resource-driven growth in Eastern Africa. The principle research question we are seeking to answer is, how can natural resources be developed in a way that promotes inclusive economic development? We are answering this question through a comprehensive framework that examines macroeconomic issues of natural resource development, the impact of local content policies, and understanding the expectations of the stakeholders in East Africa's oil and gas sectors.

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