Fiscal policy, uncertainty and output growth in Uganda: 1980-2020

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Abstract

Does uncertainty necessarily change the way in which fiscal policy affects output growth in Uganda? We provide an empirical response to this fundamental question using the latest datasets and a rigorous econometric practice. Fiscal policy is often manipulated in many countries as one of the means to provide counter-cyclical stimulus over the cycle of uncertainties. Indeed, fiscal policy operations frequently vary with uncertainty sequence and this introduces bidirectional interactions between fiscal policy, uncertainty and output growth. Using the Autoregressive Distributed Lag Model, we show that tax revenue and expenditure are the most affected fiscal policy measures in the presence of uncertainty, while borrowing is the least affected both in the short and long-run. Therefore, unless government macroeconomic frameworks fully incorporate economic uncertainties into projections, the fragility of rising global and domestic uncertainty is bound to cause large and significant divergencies between the anticipated and the actual growth outturn. We therefore recommend the need to use borrowing avenue in the most optimal means to stimulate and sustain growth. While tax revenues have proved to spur growth both in the short and the long-run, the impact is bound to shrink in the face of uncertainty.

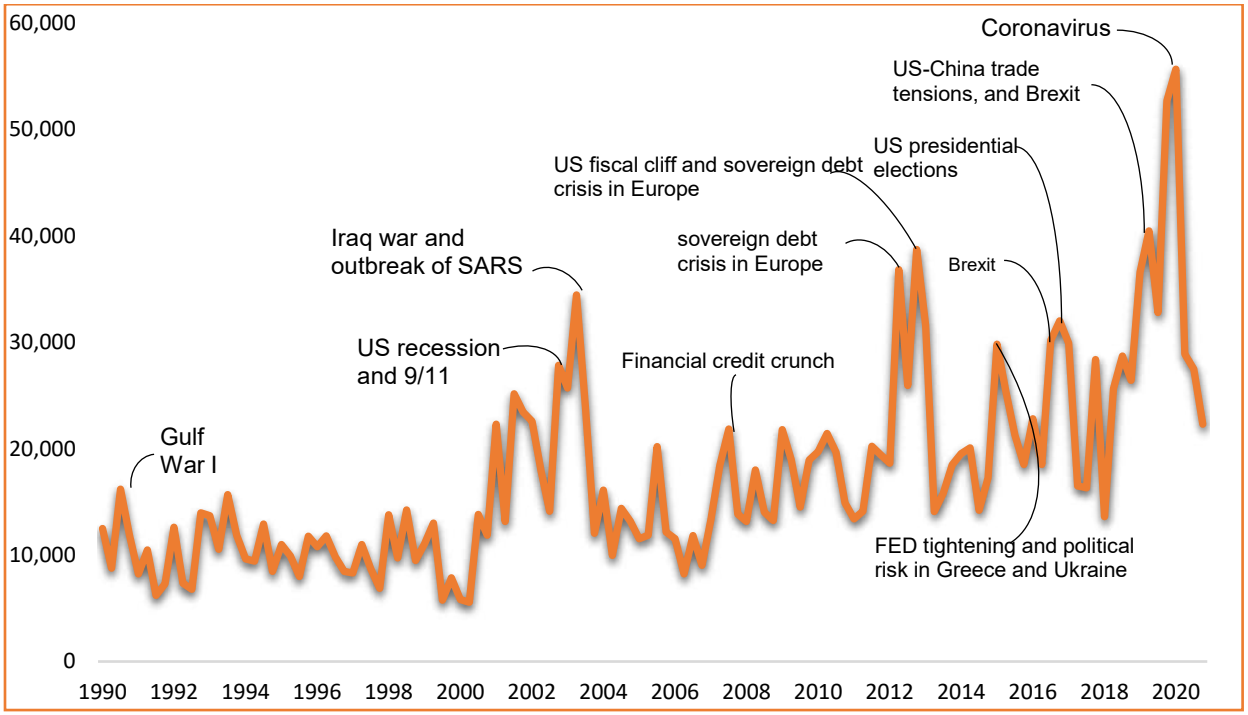
Key Words: Fiscal policy, Uncertainty, Output growth, Uganda

1. Introduction

The contemporary worsening of fiscal balances in many Sub-Sahara Africa countries, Uganda in particular has increased uncertainty about the future fiscal policy response. This has increased to attract the attention of policy makers and researchers in the academia over the years. Ahir, Bloom & Furceri (2020) note that, the current levels of economic policy uncertainty are at extremely elevated levels compared to recent history. Since 2008, economic policy uncertainty has averaged about twice the level of the previous 23 years. This has been amplified by the rising economic policy uncertainty especially with the outbreak of the corona virus disease in 2019 (COVID-19) (see figure 1). With the rising uncertainty, the IMF Managing Director, "Kristalina Georgieva" of Peterson Institute for International Economics, noted that increasing uncertainty is no doubt a theme at the current decade. No wonder that recently, the debate on the role of fiscal discipline on the appropriateness of the stability and growth Pact has become particularly intense (Beckmann & Czudaj, 2020).

In its monetary policy report (2020), the Bank of Uganda (BoU) notes that, fiscal policy plays a significant role not only as a stabilization device but also in influencing the short- and long-term growth prospects of an economy (BOU, 2020). In the short term, counter-cyclical fiscal expansion can help support aggregate demand and growth during downturns. Conversely, fiscal contraction can help cool down an economy that is growing at an unsustainable pace and could face the risk of overheating. Effective coordination of a country's fiscal policy with its monetary policy, rather than a subservience of the latter to the former, plays an important role in the overall macroeconomic management and achievement of the long-term growth target (BoU, 2020). Globally, several factors have triggered world uncertainty ranging from fiscal consolidation, corona virus disease, trade tensions, national elections recessions as well as political wars and conflicts (see figure 1). These have had different impact on output growth across countries.

Figure 1: World Uncertainty Index-1990Q1 to 2020Q4

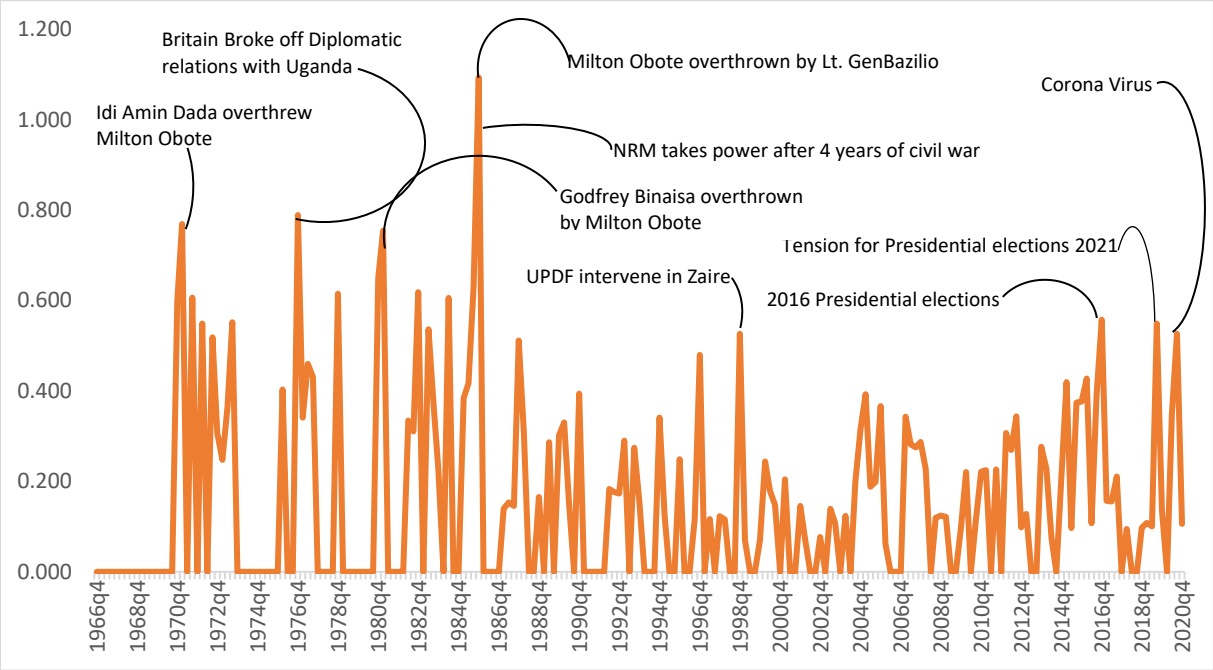


Source: Ahir, H, N Bloom, and D Furceri (2018)

Existing evidence shows that, uncertainty is broadly derived from external shocks and economic recession. Negative external shocks such as war, terrorist attacks and financial crises increase policy uncertainty. Bloom (2009) investigated 17 external shocks in the United States from1962 to 2008, including the Gulf War, the Cuban Missile Crisis, the Asian Financial Crisis, and the 9/11 terrorist attacks. Most of these shocks were negative, and there is empirical evidence that negative information shocks and policy uncertainty shocks occur in quick succession. During economic recession, policymakers make active attempts to promote recovery, whereas less effort is required to maintain the current level of economic growth (Dave, et al., 2020). In the same line or argument, Fed Chairman Jerome Powell summarized the level of uncertainty in his May 21st speech, noting that the world is now experiencing a whole new level of uncertainty, and the outbreak of COVID-19 complicated the whole new outlook." (Dave, et al., 2020). Indeed, there is massive uncertainty about almost every aspect of economic activity including the fiscal policy response and the speed of economic recovery whether permanent or temporary, government intercessions whether fiscal or monetary will become paramount.

A close examination of Uganda's trajectory indicates that, uncertainty spikes have been above average during periods of negative external shocks. Such negative shocks include war, financial crises, presidential elections to mention but a few as seen in figure 2. Just like the global experience, many events throughout history sparked uncertainty in Uganda's economy. More than usual, uncertainty in Uganda increased in response to the spill over effects of the Great Recession, the Idi Amin Dada's overthrowing Milton Obote, Britain's act of breaking off diplomatic relations with Uganda, Milton Obote overthrowing Godfrey Binaisa, Lt. Gen Bazilio overthrowing Milton Obote II, NRM power capture after 4 years of civil war, Uganda's 2016 presidential elections, among other evets. The last wave of uncertainty arose from the tension for Presidential elections 2021 and the rapid global spread COVID-19 disease (see figure 2).

Figure 2: World Uncertainty Index for Uganda-1966Q4 & 2020Q4



Source: IMF World Uncertainty Data

On the other hand, an examination of the government fiscal framework for Uganda indicates that, the country is committed to pursue fiscal policy that maintains macroeconomic stability and supports inclusive job-rich growth. While this approach is professed ideal at preserving debt sustainability as demonstrated in the country's third National Development Plan (NDP III), the country is faced with severe fiscal constraints largely due to two major factors: (i) rising expenditure pressures due to the existing and Post COVID-19 high priority spending requirements amounting to about 5.37 trillion; and (ii) the falling revenues as a result of COVID-19 impacts on the economy.

In particular, the domestic revenue mobilization through Tax Revenue and NTR has not grown enough to meet the expenditure growing pressures. Therefore, raising revenue through the traditional financing options is highly constrained. Further expansion of domestic financing is awful due to the obvious implications on private sector credit. Expansion of external debt is not possible due to boarder line sustainability implications of the current debt, yet alone the crowding out effect of the growing interest rate payments. As a result, budget cuts have been implemented and any further budget cuts are likely to cause more severe fiscal constraints. For the past decade, revenue to GDP ratio has remained below 15%, yet public expenditure and lending are now more than 20% of GDP (see table 1).

Table 1: Central government fiscal framework (as % of GDP) for Uganda-2010-2020

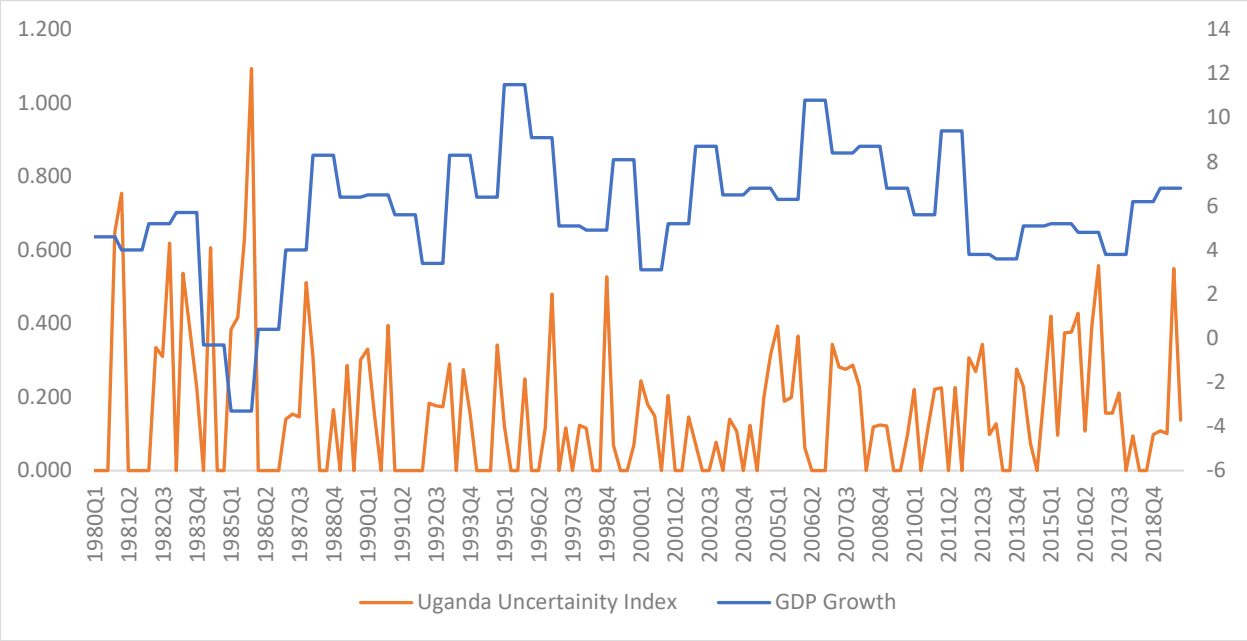
	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Revenues & Grants	12.7	15.5	13.1	12.8	12.6	14.4	15.2	15.4	16.2	15.2
Revenues	10.5	13.6	11.2	11.3	11.6	13.2	13.8	14.3	14.4	13.7
URA	10.3	10.9	10.3	11	11.4	12.4	13	13.5	13.6	13.2
Non-URA	0.2	2.7	0.9	0.3	0.2	0.8	0.8	0.8	0.8	0.5
Oil Revenue	0	2.5	0.7	0	0	0.2	0.1	0.1	1.8	1.5
Grants	2.1	1.9	1.9	1.4	1	1.2	1.4	1	0	0.1
Budget Support	1.1	1.1	1	0.3	0.3	0.3	0.4	0.3	0.3	0.3
Project Support	1	0.8	0.9	1.1	0.7	0.9	1	0.8	1.5	1.2
Expenditure and lending	16.7	19.1	15.6	16.2	16.6	18.7	20.1	19.3	22.5	19.3
Current Expenditures	10.5	12.7	9.1	9	9.5	10	11	11	10.4	10.9
Development Expenditures	6.1	6.1	6.1	6.5	7	6.8	7.1	7.4	9.8	8.5
Overall Fiscal Bal. (excl. Grants)	-6.1	-5.5	-4.4	-4.9	-5	-5.6	-6.7	-4.5	-8	-5.4
Overall Fiscal Bal. (incl. Grants)	-4	-3.6	-2.5	-3.5	-4	-4.4	-5.3	-3.5	-6.2	-3.9

Source: MoFPED

Nonetheless, the government of Uganda is still committed to ensuring that the fiscal deficit remains with in sustainable levels over the medium to long-term. The country's macroeconomic framework for the period 2020-2025 highlighted in the third National Development Plan (NDPIII) adopted a fiscal deficit path. In NDPIII, the debt to GDP ratio is projected to remain below 50%, the ratio of interest payments to domestic revenue to remain at less than 15% and the EAC convergence criteria to be achieved in FY2024/25. In this country's macroeconomic framework, fiscal deficit was projected to gradually decline to below 3% of GDP by FY2024/25, while expenditure to GDP to average at 19.6% by 2025. Yet, as seen in table 1, expenditure to GDP ratio exhibits a time varying trend and in 2019/20, it had already hit 19.3%. Domestic revenue to GDP was projected at 12.9% of GDP in FY2020/21 and at 15.3% in FY2024/25. Domestic revenue to GDP was projected to increase by 0.52 percentage points per fiscal year and total revenues and grants to increase from 13.7% to 15.4% of GDP between FY 2020/21 and FY 2024/25 and subsequently reducing the country's deficit and reliance on debt thus keeping debt at sustainable levels.

Further scrutiny of the government fiscal framework for Uganda indicates that, government is committed to frontloading spending during the NDP III period. During this period, the deficit is projected to average 5.3%, peaking at 7.8% in 2020/21, before narrowing to a modest 2.9% in 2024/25. The primary deficit was projected to average 2.7% over the period, reducing from a peak of 5.2% in 2020/21 and settling at 0.6percent in 2024/25. However, the analysis shows that, external financing was to remain the main source of financing for the deficit over the period 2020-2025. Both external and domestic financing were projected to decrease over the same period. External financing was projected to average at 3.8% of GDP and at the same time, domestic financing was to average not more than 1.0% of GDP. Contrary, non-concessional borrowing was projected to increase from 1.6% of GDP in 2020/21, peaking at 3.1% in 2024/25.

Figure 3: Trends in Uganda's uncertainty and output growth-1980Q1 & 2019Q4



Source: Author using IMF uncertainty data and WD Indicators

The situation as presented above leaves two key questions unanswered for the case of Uganda: (1) what is the fiscal policy reaction in the face of uncertainty, and (2) how is output growth affected by fiscal policy induced by uncertainty for the case of Uganda. With the recent Covid-19 pandemic, the level of uncertainty has more than doubled as seen in figure 1 and 2 and how this can affect output growth is yet to be documented with rigour empirical evidence. Literature indicates that the recent Covid-19 pandemic is set to become one of the most economically costly pandemics in recent history (Dave, et al., 2020). Yet, the macroeconomic effects of the pandemic are majorly felt through rising economic policy uncertainty globally and nationally. For example, between February and June 2020, the country registered severe pessimism expressed in terms of investor sentiment as evidenced by the downward movements in Uganda's Business Tendency Index which fell from 52.68 to 48.8 percent mark during the COVID-19 period between February and June 2020. This is an indication that investors in the Ugandan economy anticipated less favorable business prospects and reduced their activity to minimize the perceived risks in the economy. In fact, all the sub-components of the Business Tendency Index declined by June 2020.

To date, a number of reports have attempted to quantify the impact of the pandemic on the key macro-economic indicators including inflation, fiscal health, public health, external sector indicators, and monetary and financial sector indicators but with less empirical reasoning. Indeed, literature shows that, the past two decades have seen a surge of empirical research uncovering the relationship between various measures of fiscal policy and economic growth but with less effort to link the association with uncertainty. Fiscal policy is with no doubt, important in ensuring efficiency in resource allocation, regulation of markets, stabilization of the economy, and harmonization of social conflicts to facilitate output growth (Karimi, 2010). But how does output growth behave in the face of uncertainty and the uncertain fiscal response is not very clear especially for the case of Uganda. The existing empirical findings are mixed, with some researchers finding the relationship between fiscal policy and growth positive (Nurudeen, 2012,

Arebbeyen, 2011) (Karimi, 2010), negative, or indeterminate (Mansorouri, 2011). This paper therefore seeks to answer this question using the latest data sets and rich econometric methodology.

The rest of the paper is organized as follows: In section 2, we present the literature review, while the theoretical framework, methodology and data sources are presented in section 3. In section 4 we present the results and findings while in section 5 we provide the conclusion and recommendations.

2. Literature review

There has been a considerable amount of empirical research on the relationship between fiscal policy and economic growth, covering different fiscal measures, different sets of countries and using cross-sectional, panel, and time-series regression methods. In a meta-analysis of 41 studies exploring the impact of fiscal policies on long-run growth, Nijkamp and Poot (2004) found that 17 percent of studies showed positive relationships between different measures of fiscal policy and economic growth; 29 percent showed negative relationships; and 54 percent were inconclusive. While they found indications of strong effects of education and infrastructure spending on growth, there was no similar impact of fiscal variables in general. This is not surprising considering mixed effects of different fiscal aggregates, as well as the composition of spending and financing methods used.

Devarajan et al. (1996) studied the relationship between expenditure composition and growth for 43 developing countries for the period 1970-1990 and found no significant effect of total public spending on economic growth. But contrary to the commonly-held view, Bhagat et al., (2013) found that public consumption had a significant positive effect on economic growth, while public investment had a significant negative effect. This negative effect also held for each of the components of government investment, including transportation and communication. In addition, Alloza (2017) estimates the effects of fiscal policy as measured by government spending during different periods of the business cycle and levels of uncertainty as proxied by stock market volatility. He finds that government spending has a larger effect on the economy during booms and during periods of low uncertainty. In contrast, Owyang, Ramey, and Zubairy (2013) find that the data does not show higher multipliers during times of slack in the US. Johannsen (2014) uses a theoretical model to show that the effects of fiscal policy uncertainty are larger when the zero lower bound is binding.

Using a similar methodology, M'Amanja & Morrissey (2005) examined the Kenyan case for 1964-2002, also finding a positive growth effect of public investment. Haque and Kim (2003) used fixed- and random effects models to analyze panel data for 15 developing countries for 1970-1987, finding that investment in transportation and communication has a positive impact on economic growth. Likewise, Easterly and Rebelo (1993) used cross-section and panel data of different samples for more than 100 countries and concluded that investment in transportation and communication has a positive and strong effect on growth. Using panel data for 28 developing countries for 1981-1991, Dessus and Herrera (2000) found that public capital accumulation has a positive long run growth effect. Findings with respect to growth effects of other categories of government expenditure are varied.

Using panel data on 120 developing countries, Bernardin et al., (2015) found that spending on human capital (i.e. education and health) is associated with higher economic growth. Nijkamp &

Jacques Poot (2002) investigated the relationship between the sectoral allocation of public spending and economic growth, using a sample of 21 low- and medium-income countries from 1965 to 1984. They concluded that 'human development' capital investment has the highest output elasticity; investment in infrastructure capital had a positive but much smaller output elasticity, while military capital showed a negative output elasticity in half the countries in the study.

Al-Jarrah (2005) examined the causal relationship between defense spending and economic growth for 1970-2003 in on Saudi Arabia using time-series methodologies. He found evidence of bi-directional causalities, wherein higher defense spending lowered economic growth in the long run. This is consistent with many empirical studies for developing countries.4 Using annual data for 1970-2001, Al-Obaid (2004) investigated the long-run relationship between total government expenditure and real gross domestic product in order to assess the validity of "Wagner's law" – the hypothesis that public spending tends to rise with economic growth. The cointegration test showed a positive long-run relationship between the share of public spending in GDP and GDP per capita, consistent with Wagner's prediction.

Using OLS regressions, Al-Yousif (2000) showed that how the size of the government is measured can influence estimates of its relationship with economic growth. If the size is measured as the percentage change in government expenditure, then size is positively related to growth, but if it is measured as a ratio of government expenditure to GDP, the relationship is negative. Kireyev (1998) tested the relationship between growth in non-oil GDP and public spending using annual data for 1969-1997. His results suggested a significant and positive relationship between public spending and growth in non-oil GDP, wherein a one percent increase in public expenditure causes about half a percent increase in non-oil GDP. In contrast, Ghali (1997) used vector autoregression (VAR) and Granger causality analysis to analyze data for 1960-1996. He found no evidence that public expenditure increased output growth.

Guloba (2018) investigated Uganda's Fiscal Policy for the period 2000-2016 and its implications for Public Investment Management in Uganda. The paper carries out project absorptive capacity and overall fiscal trend analysis to ascertain whether budgeted projects translated into intended outturns. It was found that weak Public Investment capacity led to less than budgeted public investment outturn which reduced the intended fiscal policy impact. As such, for Uganda to achieve its fiscal objectives there is need to balance its expansionary fiscal policies with the ability to absorb fiscal resources. Bose et al. (2003) simultaneously examined public expenditure by sector (education and health) and type (investment and consumption) for 30 developing countries. They found evidence that human capital investments in health and education as well as overall capital spending have a positive impact on growth. However, when they incorporated a government budget constraint, only total capital spending and investment spending on education have positive growth effects.

The synthesis of empirical literature shows that, there is scanty of literature that has attempted to model the join impact of uncertainty and fiscal policy on output growth. Arcabic, Vladimir; Cover (2016) investigated the effectiveness of fiscal policy under different uncertainty regimes in the U.S using the threshold vector autoregressive model (TVAR) to endogenously estimate different uncertainty regimes. They found that fiscal policy shocks have a much larger effect on the economy during periods of high uncertainty and that during periods of average or low uncertainty government spending shocks tend to crowd out private sector investment spending, but during

periods of high uncertainty, after a one-year delay, government spending shocks "crowd-in" private sector investment expenditures.

Relatedly, Popiel (2020) investigated Fiscal policy, uncertainty and US output using a standard structural vector autoregression (SVAR) model. The results revealed that there is no systematic relationship between fiscal policy uncertainty and output. Moreover, Popiel (2020) shows that, a time-varying parameter version of the model showed that, the lack of consistency across specifications is not driven by changes in the transmission of uncertainty shocks over time. In Uganda, our investigation has not yielded any empirical evidence that has attempted to model the join impact of uncertainty and fiscal policy on output growth. Therefore, in this study, we provide an empirical examination of the interacted impact of uncertainty and fiscal on output growth using the latest datasets and a rigorous econometric methodology. We study the transmission mechanism of the impact of uncertainty through government borrowing, spending and tax revenue on output growth in the framework of Autoregressive Distributed Lag model (ARDL).

3. Methodology and data sources

3.1 Theoretical framework

The endogenous growth theory provides the most appealing analytical framework for analyzing the effects of induced fiscal policy by uncertainty on output growth. The endogenous growth theory advocates for the stimulation of the level and growth rate of output within the model using fiscal policies. This is in contrast with a neoclassical growth theory, in which policy can only have a transitory effect on growth since long-term growth is mainly driven by policy-invariant and exogenous factors. The endogenous growth theory provides a framework to analyze how growth is affected by policy making it the preferred framework in the public finance literature (Barro, 1991 and Sala-i-Martin, 1994).

Specifically, models of fiscal policy effects on growth are usually built on the basis of Barro, (1991) framework and subsequently Barro and Sala-i-Martin (1992, 1995). This study draws inspiration from these studies by employing a Cobb-Douglas production function in which government expenditure, tax revenue and government borrowing enter as inputs. The novel feature of the public-policy endogenous growth models of Barro and Sala-i-Martin (1995)(Barro, 1991) is that, fiscal policy can determine both the level of the output path and the steady-state growth rate. In the endogenous growth model, if the incentives to save or to invest in new capital are affected by fiscal policy, this alters the equilibrium capital-output ratio and therefore the level of the output path, but not its slope with transitional effects on growth as the economy moves onto its new path.

In the endogenous growth model, fiscal policy becomes one of the main determinants of the observed differences in growth experiences. Specifically, this study adopts and extends the endogenous growth model developed by Solow (1956) by integrating the role fiscal policy in the production function as control variables. In its structural form, the endogenous growth model attributes growth in national output to three sources namely; increase in the stock of physical capital, increases in the size of labour force, and a residual representing all other factors. Solow (1956) uses the aggregate production function which is continuous and homogenous of degree one.

$$Y = F(L, K, T) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots i$$

Where Y is aggregate real output, K is stock of capital, L is labour and T is Technical change. Taking technical change as constant, equation *i* can be re-written as:

$$Y = Af(K, L)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots ii$$

Equation *ii* can be expressed in growth term to obtain equation *iii* as below:

$$\frac{dY}{Y} = \frac{\left[A.\frac{dY}{dK}\right]dK}{Y} + \frac{\left[A.\frac{dY}{dN}.\frac{N}{Y}\right]dN}{Y} + \frac{dA}{A}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots iii$$

This can be written for estimation purposes as:

$$\frac{\Delta Y}{Y} = \alpha_0 + \frac{\alpha_1 I}{Y} + \frac{\alpha_2 \Delta N}{Y}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots iv$$

Where

$\alpha_0 = dA/A$
$\alpha_1 = A.dY/dK$
$\alpha_2 = A * dY/dN * N/Y$
$I = dK$ =Change in capital (Investment)
I/Y =Ratio of investment to income
$\Delta N/Y$ =Ratio of change in population to income

The constant (α_0) is assumed to capture the growth in productivity, α_1 is the marginal productivity of capital and α_2 is the elasticity of output with respect to population. Therefore, with this background, the model can be formed as:

$$Gy_t = \alpha_0 + \alpha_1 Gk_t + \alpha_2 Gl_t + v_t\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots v$$

Where

Gy =Growth rate of real GDP
Gk =Growth rate of capital
Gl =Growth rate of labour
v =Disturbance term

The coefficients (α_s) are estimated. Since the study examines how induced fiscal policy (proxied by tax revenue, government expenditure and borrowing as the main fiscal policy instruments) affects output growth, we introduced these to the growth model as control variables. To capture how uncertainty induces fiscal policy, we created an interaction term between fiscal policy instruments and uncertainty. Given this adjustment, equation *v* is modified as follows:

$$Gy_t = \alpha_0 + \alpha_1 Gk_t + \alpha_2 Gl_t + \alpha_3 (Gge * Uncer)_t + \alpha_4 (Ggb * Uncer)_t + \alpha_5 (Gtr * Uncer)_t + v_t \ldots vi$$

Where Gy_t is the growth rate of output-a measure of economic growth, Gk_t is the growth rate of capital stock and $Gl_t$is the growth rate of labour force which are the initial variables predicted by

Solow (1956) to affect economic growth. While Gge_t in equation vi is the growth rate of government expenditure as a percentage of GDP, $Ggb_t$is the growth rate of government borrowing proxied by external debt stock a percentage of GDP and $Gtr_t$is the is growth rate of tax revenue measured as a percentage of GDP and $Uncer_t$ is the measure of uncertainty that is interacted with all the fiscal policy variables to capture how uncertainty induces the impact of fiscal policy on output growth at apoint in time.

The equation argues the existence of a potential long run association between output growth and four inputs; that is; capital stock, Labour force and government expenditure *(Gge_t).* Tax revenue *(Gtr_t)* is expected to have a negative effect on GDP growth while government borrowing (Ggb_t) is expected to have a either negative or a positive effect on output growth. The constant (α_0) captures the growth in productivity, α_1 is the marginal productivity of capital and α_2 is the elasticity of output with respect to population.

3.2 Empirical Model estimated and Data Sources

In this study, we adopt the Autoregressive Distributed Lag model (ARDL) developed by Pesaran and Shin (1995) due to the statistical behaviour of the variables used in the analysis. The ARDL method allows for a mix of I (0) and I (1) variables in the same cointegration equation. In addition, the ARDL method allows for the estimation of the long-run effects jointly with the short-run effects and the method is appropriate to account for the effects of shocks in the model. The estimated model is based on equation vii.

$$\begin{aligned} GDPG_t = \alpha_0 \ &+ \ \alpha_1 GDP_{t-1} \ + \ \alpha_2 Gk_{t-1} \ + \ \alpha_3 Gl_{t-1} \ + \ \alpha_4 (Gge_{t-1} * Uncer_{t-1}) \\ &+ \ \alpha_5 (Ggb_{t-1} * Uncer_{t-1}) + \alpha_6 (Gtr_{t-1} * Uncer_{t-1}) + \sum_{i=1}^{n} \partial_1 \Delta (GDPG)_{t-1} \\ &+ \sum_{i=0}^{n} \partial_2 \Delta (Gk)_{t-1} + \sum_{i=1}^{n} \partial_3 \ \Delta (Gl)_{t-1} + \sum_{i=0}^{n} \partial_4 \Delta (Gge_{t-1} * Uncer_{t-1}) \\ &+ \sum_{i=0}^{n} \partial_5 \Delta (gb_{t-1} * Uncer_{t-1})_{t-1} + \sum_{i=0}^{n} \partial_6 \Delta ((Gtr_{t-1} * Uncer_{t-1})_{t-1} \\ &+ u_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . vii \end{aligned}$$

From equation vii, u_t, β, and ∂ are the white-noise error term, the short-run coefficients and the long-run coefficients of the model respectively. Δ Is the first difference operator, t denotes time period, and n is the maximum number of lags in the model. This model is estimated using Eviews10 and the maximum lag of each regressor (k) is obtained by minimizing the Akaike Information Criteria.

The data used in the estimation include: GDP growth, total tax revenue as a ratio of GDP, general government expenditure as a ratio of GDP, total government borrowing as a ratio of GDP, Labourforce growth and capital stock. These data sets were obtained from different sources. Data of fiscal measures were obtained from the Ministry of Finance Planning and Economic Development, data on uncertainty was obtained from the IMF while data on capital stock and Labourforce growth were obtained from the world Development Indicators of the world bank. The definition of variables is contained in table 1.

Table 1: Definition of variables and sources of data

Variable and symbol	Definition	Source of data
GDP growth (Gy_t)	Growth in gross domestic Product measured in percentages and this is the dependent variable in this study.	World Bank
Uncertainty ($Uncer_t$)	Uncertainty refers to essentialist or epistemic situations involving imperfect information that arises due to stochastic or partially observable environments, as well as due to ignorance, sluggishness, or both.	IMF
Capital Stock (Gk_t)	Capital stock consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories	World Bank
Labourforce (Gl_t)	Labour force is the total labour pool that is available in any country at a point in time and includes those who are either in employment or those that are unemployed	World Bank
Government expenditure (Gge_t)	Government expenditure refers to the purchase of goods and services, which include public consumption and public investment, and transfer payments consisting of income transfers such as pensions and social benefits as well as capital transfer.	World Bank
Government borrowing (Ggb_t)	Government borrowing is essentially the total amount of money that the central government borrows to fund its spending on public services and falls under capital receipts in the Budget document. In other word, government borrowing is the amount of money that the government borrows to spend on public services	World Bank
Tax revenue (Gpr_t)	Tax revenue refers to the income that is gained by governments through taxation and is the result of the application of a tax rate to a tax base.	MoFPED/GoU

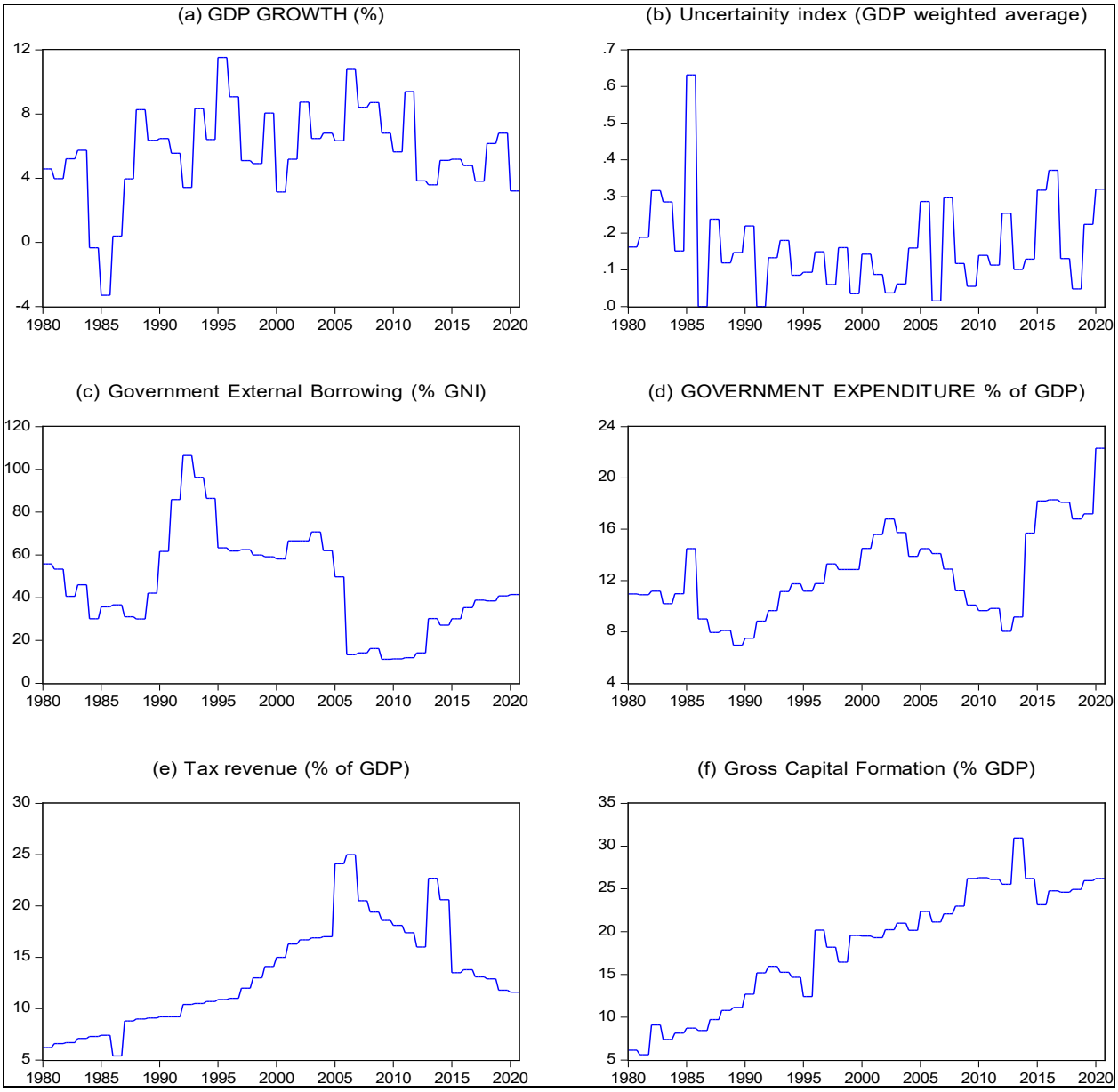
4. Results and findings

4.1 Trends analysis

Figure 4 presents plots of gross domestic product growth, Uganda's uncertainty index, government borrowing, expenditure, tax revenue and capital formation. Figure 4(a) shows that, gross domestic product has steadily increased over time since 1988 to date, but suddenly jumped between 2008 and 2009 as the economy was recovering from the financial crisis at the time. Between 2012 and 2019, GDP growth fluctuated between 3.5% and 6.5% and in 2020, the country registered the

lowest growth rate in GDP at 3.2% for the last 2 decades generally driven by the Covid-19 containment measures.

Figure 4: The trend of selected variables



Source: Output from EViews10

On the other hand, figure (b) shows that, uncertainty spikes have been above average during periods of negative external shocks. Such negative shocks include war, financial crises, presidential elections to mention but a few as seen in figure 2. Just like the global experience, many events throughout history sparked uncertainty in Uganda's economy. More than usual, uncertainty in Uganda increased in response to the spill over effects of the Great Recession, the Idi Amin Dada's overthrowing Milton Obote, Britain's act of breaking off diplomatic relations with Uganda, Milton Obote overthrowing Godfrey Binaisa, Lt. Gen Bazilio overthrowing Milton Obote II, NRM power capture after 4 years of civil war, Uganda's 2016 presidential elections, among other evets.

The last wave of uncertainty arose from the tension for presidential elections 2021 and the rapid global spread COVID-19 disease (see figure 2).

4.2 Stationarity analysis

The augmented Dickey Fuller (ADF) and Phillips Peron tests were utilized to ascertain the time series characteristics of the variables including: GDP growth, total tax revenue as a ratio of GDP, general government expenditure as a ratio of GDP, total government borrowing as a ratio of GDP, Labourforce growth and capital stock. The results presented in annex A1 indicate that, GDP growth, uncertainty and labourforce growth are stationary in levels while capital stock and all other fiscal policy measures used in the analysis haven unit root at the level. However, these become stationary after the first differences. The implication of this is that, neither the ordinary least squares estimation technique nor the Vector Error Correction (VEC) method could be utilized to estimate the model. Therefore, the study adopted an Autoregressive Distributed Lag model (ARDL) to examine the potential existence of cointegration among the variables.

4.3 The F-Bounds Cointegration analysis

In this study, we adopt the Autoregressive Distributed Lag model (ARDL) developed by Pesaran and Shin (1995) due to the statistical behaviour of the variables used in the analysis. This method allows for an empirical examination of variables that both I (0) and I (1) in the same cointegration equation. Similarly, the ARDL method allows for the estimation of the long-run effects jointly with the short-run effects and the method is appropriate to account for the effects of shocks in the model. The cointegration results are presented in table 2 and the main conclusion from this analysis consequently is that the variables are cointegrated.

Table 2: F-Bounds Cointegration test Results

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	3.766816	10%	2.75	3.79
k	5	5%	3.12	4.25
		2.5%	3.49	4.67
		1%	3.93	5.23
Actual Sample Size	163		Finite Sample: n=80	
		10%	2.867	3.975
		5%	3.335	4.535
		1%	4.375	5.703

Source: Output from EViews10

The results presented in the table 2 indicate that the computed *F*-statistic is 3.76 while the Pesaran lower and the upper asymptotic critical values are 3.12 and 4.25 respectively. Since the lower

bound critical value assumes that all the regressors are I(0), while the upper bound critical value assumes that they are I(1), the null hypothesis of no cointegration was rejected since the computed test statistic exceeds the lower critical bounds value and below the upper critical bounds value. consequently, the main conclusion from the above analysis is that the variables are cointegrated and we thus proceed to estimate the ARDL model to ascertain the short and long run impact of fiscal policy induced by uncertainty on Uganda's output growth.

4.4 Empirical Analysis

To ascertain the short and long run impact of fiscal policy induced by uncertainty on Uganda's output growth, the ARDL general to specific approach was utilized. Following the estimation of the mode, the short run coefficients without uncertainty are presented in table 3 while coefficients with the introduction of uncertainty are presented in table 4. Interesting to note, among the three fiscal policy measures adopted in this study, government borrowing is the least affected in the face of uncertainty both in the short and long-run. Tax revenue and government expenditure are the most affected fiscal policy measures in the presence of uncertainty.

Table 3: Short-run dynamics without uncertainty

Dependent Variable: GDP GROWTH: Method: ARDL: Selected Model: ARDL (1, 0, 1, 1, 0, 0) selected based on Akaike Information Criterion

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP_GROWTH (-1)	0.811436	0.043303	18.73844	0.0000
TAX_REVENUE	0.098130	0.039196	2.503573	0.0133
GOV_BORROWING	-0.056376	0.020220	-2.788151	0.0060
GOV_BORROWING (-1)	0.071757	0.019805	3.623163	0.0004
GOV_EXPENDITURE	-0.301795	0.109226	-2.763040	0.0064
GOV_EXPENDITURE (-1)	0.185993	0.110132	1.688818	0.0933
CAPITAL_FORMATION	0.162734	0.085129	1.911612	0.0578
POPULATION_GROWTH	0.221648	0.671894	0.329885	0.7419
C	0.694974	2.744320	0.253241	0.8004
@TREND	0.025102	0.013744	1.826430	0.0697
R-squared	0.801413	Mean dependent var		5.678608
Adjusted R-squared	0.789732	S.D. dependent var		2.815681
S.E. of regression	1.291131	Akaike info criterion		3.408301
Log likelihood	-267.7765	Hannan-Quinn criter.		3.485358
F-statistic	68.60497	Durbin-Watson stat		1.913834
Prob(F-statistic)	0.000000			

Source: Output from EViews10

Our findings indicate that in the short-run, a percentage point increase in the tax revenue increases output growth by approximately 0.098 percentage points keeping all other factors constant. However, the introduction of uncertainty into tax revenue, a percentage point increase in the tax revenue reduces output growth by approximately 0.366 percentage points. Further, a percentage point increase in government borrowing has a negative instantaneous impact on output growth but the impact becomes positive after a lag of one year keeping all other factors constant. The findings

indicate that, a percentage point increase in government borrowing reduces output growth by approximately 0.05 percentage points in the same year but increases growth in output by approximately 0.072 percentage points after one year. With the introduction of uncertainty into government borrowing, a percentage point increase in borrowing only increases output growth by approximately 0.066 percentage points.

On government expenditure, just like government borrowing, a percentage point increase in expenditure has a negative instantaneous impact on output growth but the impact turns positive after a lag of one year keeping all other factors constant. The findings indicate that, output growth reduces by nearly 0.30 percentage points within the first year and increases by about 0.18 percentage points after a lag of one year due to a percentage point increase in government expenditure keeping all other factors constant. However, with uncertainty, a percentage point increase in government expenditure reduces output growth by approximately -0.43 percentage points Ceteris Paribas.

Table 4: Short-run dynamics with uncertainty

Dependent Variable: GDP GROWTH: Method: ARDL: Selected Model: ARDL (1, 1, 0, 0, 0, 0) selected based on Akaike Information Criterion

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP_GROWTH (-1)	0.815813	0.044261	18.43172	0.0000
UNCERTAINIY_TAXREVENUE	-0.196056	0.138809	-1.412416	0.1598
UNCERTAINIY _TAXREVE (-1)	-0.366198	0.100143	-3.656749	0.0004
UNCERTAINIY _GOVBORROWING	0.066130	0.034984	1.890300	0.0606
UNCERTAINIY _GOVEXPENDITURE	-0.433692	0.128830	-3.366379	0.0010
CAPITAL_FORMATION	0.139817	0.065197	2.144521	0.0336
POPULATION_GROWTH	0.430989	0.581094	0.741686	0.4594
C	3.074974	2.156270	1.426061	0.1559
@TREND	0.024906	0.010158	2.451858	0.0153
R-squared	0.802373	Mean dependent var		5.678608
Adjusted R-squared	0.792107	S.D. dependent var		2.815681
S.E. of regression	1.283817	Akaike info criterion		3.391185
Log likelihood	-267.3816	Hannan-Quinn criter.		3.460536
F-statistic	78.15590	Durbin-Watson stat		1.889378
Prob(F-statistic)	0.000000			

Source: Output from EViews10

Therefore, in the short-run, the impact of uncertainty on output growth is transmitted mostly through government expenditure and tax revenue. This can be argued that, in the presence of uncertainty such as the current covid-19 pandemic, economic activities and supply value chains are disrupted globally, government is not assured of the amount of tax revenue collection, the revenue body revises its targets downwards and so are government entities on downsizing their fiscal budgets. Overall, government expenditure shrinks and so is the general expenditure multiplier, this eventually affects output growth negatively. Our findings further indicate that, the impact of government borrowing on output growth is least affected in the face of uncertainty. This can be argued that, in the presence of uncertainty, the pubic sector remains the only less risky entity for both domestic and international lenders to extend credit to. Thus, even when the business

environment is less friendly to all economic agents, the government entity remains less vulnerable to accessing credit. This therefore explains why uncertainty affects more tax revenue collections and government expenditure.

To ascertain the long-run dynamics of the joint impact of fiscal policy and uncertainty on output growth, the ARDL model produced the long-run coefficients with and without uncertainty as presented in tables 5 and 6 respectively. Interestingly, the long-run dynamics shows that, all the three fiscal policy measures adopted in this study have a significant positive impact on output growth without uncertainty (see table 5). The growth of capital stock also has a significant impact on output growth while the impact of population growth fails the statistical significance.

Table 5: Long run dynamics without uncertainty

Levels Equation
Case 4: Unrestricted Constant and Restricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TAX_REVENUE	0.520407	0.213589	2.436484	0.0160
GOV_BORROWING	0.081567	0.030350	2.687587	0.0080
GOV_EXPENDITURE	0.614126	0.268728	2.285305	0.0237
CAPITAL_FORMATION	0.863020	0.443722	1.944956	0.0536
POPULATION_GROWTH	1.175450	3.649649	0.322072	0.7478
@TREND	0.133123	0.069556	1.913888	0.0575

However, in the presence of uncertainty, the impact of tax revenue on output growth remains positive but statistically inconsequential even at 10 percent level of significance. The impact of government borrowing on growth remains positive and enlarges while the impact of government expenditure turns negative and upsurges in absolute magnitude (see table 6). The impact of growth rate of capital stock on growth remains positive but reduces in absolute magnitude from 0.86 to 0.76 percentage points respectively. This is in line with studies such as (Benati, 2013; Aizenman & Marion, 1993; Ssebulime & Bbaale, 2019; Popiel, 2020; Arcabic, Vladimir; Cover, 2016; Muvawala et al., 2020) among others.

Table 6: Long run dynamics - with uncertainty

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNCERTAINIY_TAXREVENUE	0.923743	0.653704	1.413091	0.1596
UNCERTAINIY _GOVBORROWING	0.359035	0.196158	1.830333	0.0691
UNCERTAINIY _GOVEXPENDITURE	-2.354627	0.711733	-3.308300	0.0012
CAPITAL_FORMATION	0.759102	0.372443	2.038171	0.0432
POPULATION_GROWTH	-2.339952	3.049014	-0.767445	0.4440

Source: Output from EViews10

Therefore, among the three fiscal policy measures adopted in this study, government borrowing is the least affected in the face of uncertainty both in the short and long-run. The implication of this finding is that in the frugality and judiciousness of rising global and domestic uncertainty, the projected growth and growth outturn in bound to diverge significantly over time, unless government macroeconomic frameworks fully incorporate economic uncertainties into their projections. Uganda's government is thus bound to utilize borrowing avenue in the most optimal means possible to stimulate and sustain growth. While domestic tax revenues have proved to spur growth both in the short and the long-run, the impact is bound to shrink in the face of uncertainty. The findings are inline with studies such as (Benati, 2013; Aizenman & Marion, 1993; Ssebulime & Bbaale, 2019; Popiel, 2020; Arcabic, Vladimir; Cover, 2016; Muvawala et al., 2020) among others.

4.5 Diagnostic checks

Several diagnostic checks were conducted on the estimated ARDL model to determine its accuracy and reliability. Considered in this study were the goodness of fit, multicollinearity test, heteroskedasticity, serial correlation and normality tests. In regards to the goodness of fit, the R-squared in both models (with and without uncertainty) is significantly high (0.801) and (0.801) respectively and the Adjusted R-squared is also high at (0.789 and 0.792) respectively. The joint F-Statistic is significant at 1 percent in both models. The implication of this is that the model is statistically feasible and dependable in explaining variations in output growth. About the multicollinearity test as a key convention in the Classical Linear Regression, there was no perfect linear relationship among the explanatory variables (see Annex A2). Multicollinearity test is vital in time series analysis because when the explanatory variables are highly correlated, they should not be used in the same model as regressors.

The Heteroskedasticity test confirmed that residuals are homoscedastic (see Annex A3). The P values were all above 5 percent, and therefore, we couldn't reject the Null hypothesis, hence residuals are homoscedastic. Table Breusch-Godfrey Serial Correlation LM Test also confirmed that the residuals are not serially correlated (see Annex A4). The Breusch-Godfrey Serial Correlation LM Test P values were all above 5 percent, and therefore we couldn't reject the Null hypothesis of no serial correlation. The normality test as seen in Annex A5 showed that residuals are normally distributed, since the P values were above 5 percent, and thus the Null hypothesis that residuals are normally distributed couldn't be rejected. The stability diagnostics as presented in Annex A6 shows that the coefficient of the short-run lies within the critical limits and indicates stability in the coefficients over the sample period. The straight lines represent critical bounds at 5% significance level. These diagnostic results thus confirm that, the estimated ADRL Model passed the major econometric diagnostic tests and thus the results are not being affected by multicollinearity, heteroscedasticity, autocorrelation, non-normality of residues and model instability.

5. Conclusions and recommendations

In conclusion, the study examined the joint impact of fiscal policy and uncertainty on economic growth in Uganda. The study was meant to answer two questions: (1) what is the fiscal policy reaction in the face of uncertainty, and (2) how is output growth affected by fiscal policy induced by uncertainty for the case of Uganda. This was undertaken by dissecting the transmission mechanism of uncertainty through fiscal policy to economic growth. Using the ARDL approach,

the study found out that, among the three fiscal policy measures adopted in this study, government borrowing is the least affected in the face of uncertainty both in the short and long-run. Tax revenue and government expenditure are the most affected fiscal policy measures in the presence of uncertainty.

Further, the study established that, the short-run impact of uncertainty on output growth is transmitted mostly through government expenditure and tax revenue. This argument we provide for this finding is that, in the presence of uncertainty such as the current covid-19 pandemic, economic activities and supply value chains are disrupted globally, government is not assured of the amount of tax revenue collection, the revenue agency revises its targets downwards and so are government entities in downsizing their fiscal budgets, government expenditure shrinks and so is the general expenditure multiplier, this eventually affects output growth negatively. Our findings further indicated that, the impact of government borrowing on output growth is least affected in the face of uncertainty because, in the presence of uncertainty, the public sector remains the only less risky entity for both domestic and international lenders to extend credit to. Thus, even when the business environment is less friendly to all economic agents, the government entity remains less vulnerable to accessing credit. This therefore explains why uncertainty affects more tax revenue collections and government expenditure than government borrowing.

Consequently, the study establishes that, in the fragility of rising global and domestic uncertainty, the projected growth and growth outturn are bound to diverge significantly, unless government macroeconomic frameworks fully incorporate economic uncertainties into their projections. We therefore recommend that, government should utilize the borrowing avenue in the most optimal means possible to stimulate and sustain growth. While domestic tax revenues have proved to spur growth both in the short and the long-run, the impact is bound to shrink in the face of uncertainty. Government should design stringent measures and policies geared towards efficient use of borrowed funds especially for public investments with great potential to crack the production capabilities of the country.

6. DECLARATION

6.1 Availability of data and material

This paper was undertaken for the period 1980-2020 and it used secondary annual data. Data used in the estimation include: GDP growth, total tax revenue as a ratio of GDP, general government expenditure as a ratio of GDP, total government borrowing as a ratio of GDP, Labourforce growth and capital stock. These data sets were obtained from different sources. Data of fiscal measures were obtained from the Ministry of Finance Planning and Economic Development and available at *'http://finance.go.ug/funding-release'*, data on uncertainty was obtained from the IMF while data on capital stock and Labourforce growth were obtained from the World Development Indicators of the world bank available at *(https://data.worldbank.org/country/uganda?view).* All the data analyzed are available on request from the corresponding author.

6.2 Competing interests

The Authors declare that they have no competing interest in this publication whatsoever.

6.3 Source of Funding

Not Available

6.4 Authors' contribution

SK is the main author of the manuscript, he initiated the research idea, undertook literature review, developed the theoretical framework, collected and analyzed the data from the different sources. MI and JM are co-authors of this manuscript. They approved the research idea, supported the theoretical underpinning of the research paper, undertook quality assurance and supported the empirical data analysis and generation of policy implications. All authors read and approved the final manuscript.

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6.6 Authors Information

SK is a Senior Development Planner and a PhD in Economics student at Makerere University Kampala. He is a young professional in research with strong bias in Fiscal, Monetary and Labour Economics. He is specializing in Labour economics and has a number of research projects in the pipeline. MI is a seasoned research fellow, and lecturer at the school of economics at Makerere University while JM is the Executive Director of the National Planning Authority of Uganda.

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ANNEXES

A1: Stationarity test

Null Hypothesis: Uncertainty has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.678969	0.0053
Test critical values:	1% level	-3.472259	
	5% level	-2.879846	
	10% level	-2.576610	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: UNCERTAINITY has a unit root

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.814193	0.0001
Test critical values:	1% level	-3.470679	
	5% level	-2.879155	
	10% level	-2.576241	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GDP Growth has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.288975	0.0170
Test critical values:	1% level	-3.470679	
	5% level	-2.879155	
	10% level	-2.576241	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GDP_GROWTH has a unit root

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.443095	0.0109
Test critical values:	1% level	-3.470679	
	5% level	-2.879155	
	10% level	-2.576241	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: Tax Revenue has a unit root

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-1.487884	0.5373
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: TAX_REVENUE has a unit root

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.738161	0.4102
Test critical values:	1% level	-3.470679	
	5% level	-2.879155	
	10% level	-2.576241	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: Government Expenditure has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.688740	0.8455
Test critical values:	1% level	-3.470679	
	5% level	-2.879155	
	10% level	-2.576241	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: Government Expenditure has a unit root

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.859324	0.7989
Test critical values:	1% level	-3.470679	
	5% level	-2.879155	
	10% level	-2.576241	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: Government Borrowing has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.120719	0.2369
Test critical values:	1% level	-3.471719	
	5% level	-2.879610	
	10% level	-2.576484	

Null Hypothesis: Capital Formation has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.235490	0.6583
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

Null Hypothesis: Population Growth has a unit root

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-4.459660	0.0003
Test critical values:	1% level	-3.471987	
	5% level	-2.879727	
	10% level	-2.576546	

*MacKinnon (1996) one-sided p-values.

A2: Multicollinearity test results

	GDP_GROWTH	UNCERTAINITY	GOVERNMENT_EXPENDITURE	POPULATION_GROWTH	GOV_BORR	CAPITAL FORMATION	TAX REVENUE
GDP_GROWTH	1						
UNCERTAINITY	-0.43196	1					
GOVERNMENT_EXPENDITURE	-0.05315	0.21582	1				
POPULATION_GROWTH	-0.19210	0.16385	0.181801	1			
GOV_BORR	0.03178	-0.19837	0.012651	-0.181706	1		
CAPITAL_FORMATION	0.26673	-0.13421	0.451222	0.146081	-0.32886	1	
TAX_REVENUE	0.40080	-0.19819	0.254410	-0.155463	-0.35903	0.785452	1

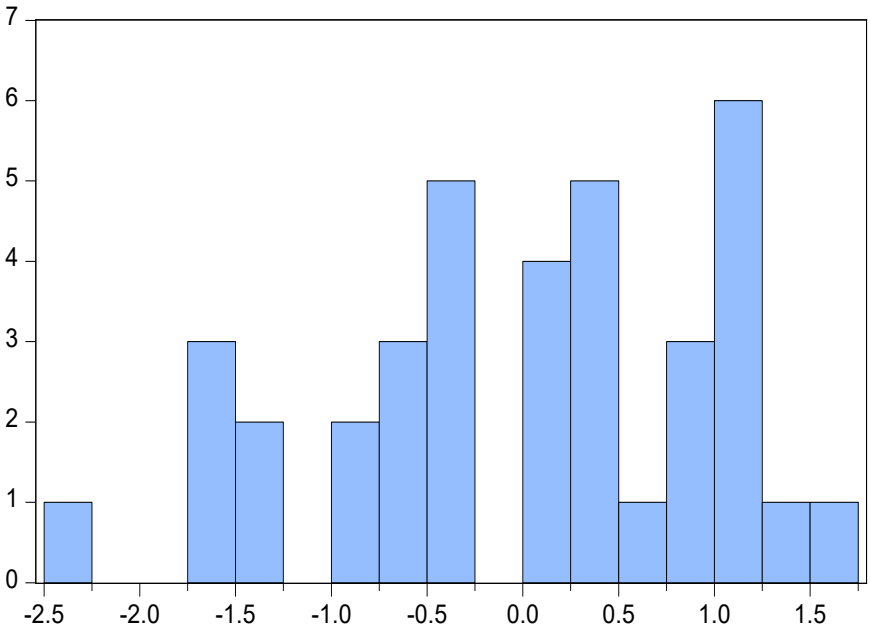
A3: Heteroskedasticity Test

F-statistic	0.319766	Prob. F(8,154)	0.9576
Obs*R-squared	2.663389	Prob. Chi-Square(8)	0.9537
Scaled explained SS	10.28966	Prob. Chi-Square(8)	0.2453

A4: Breusch-Godfrey Serial Correlation LM Test

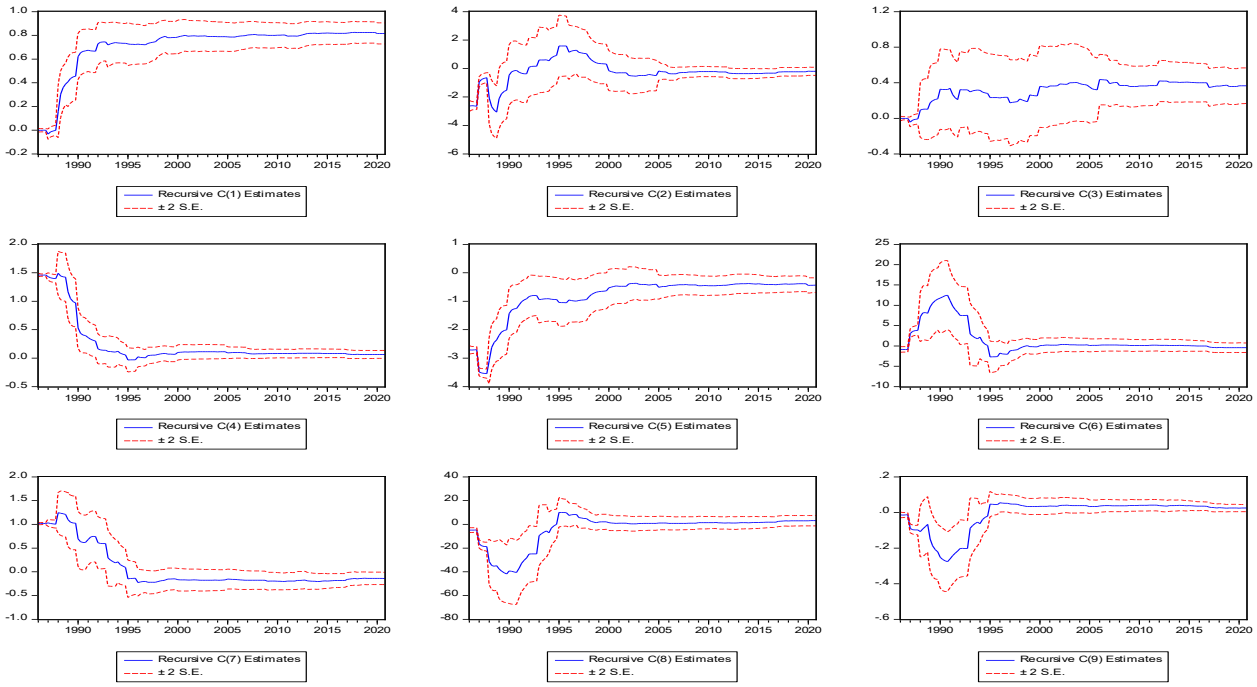
F-statistic	0.451664	Prob. F(2,152)	0.6374
Obs*R-squared	0.962978	Prob. Chi-Square(2)	0.6179

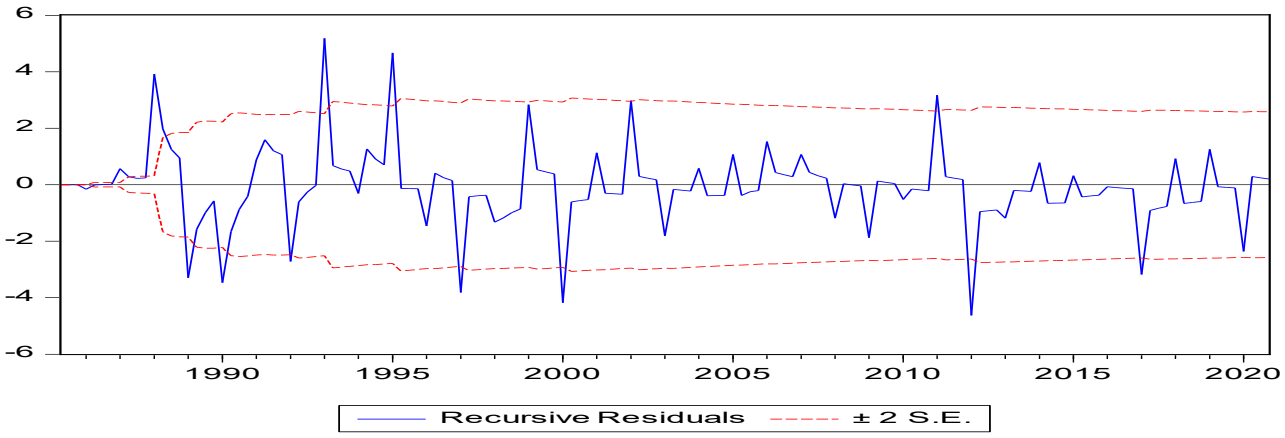
A5 Normality test

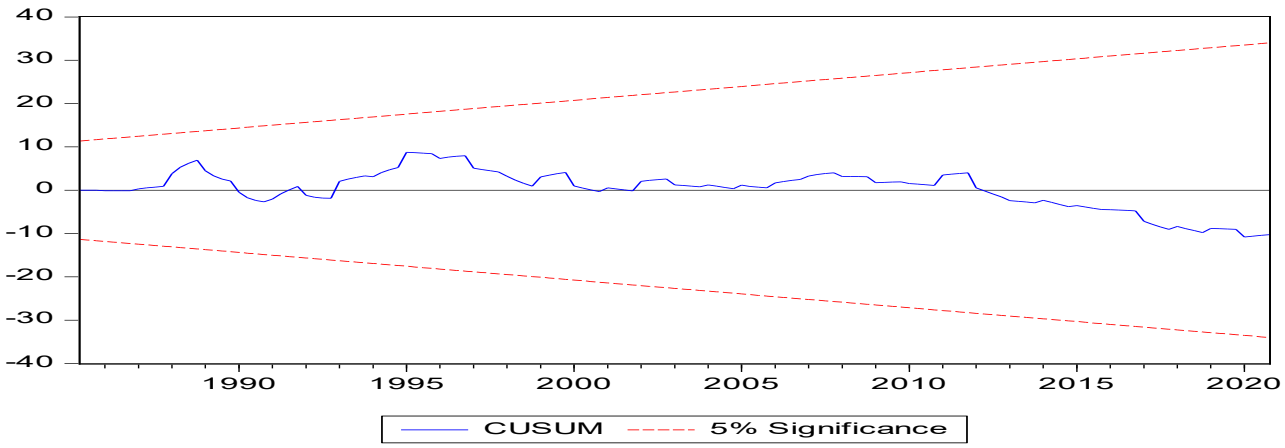


Series: Residuals	
Sample 1984 2020	
Observations 37	
Mean	-2.62e-13
Median	0.225163
Maximum	1.696298
Minimum	-2.270717
Std. Dev.	0.999410
Skewness	-0.393438
Kurtosis	2.256117
Jarque-Bera	1.807660
Probability	0.405016

A6: Stability diagnostics




6
4
2
0
-2
-4
-6
1990
1995
2000
2005
2010
2015
2020
Recursive Residuals
± 2 S.E.


40
30
20
10
0
-10
-20
-30
-40
1990
1995
2000
2005
2010
2015
2020
CUSUM
5% Significance