Tanzanian Economic Review, Vol. 13 No. 2, December, 2023: 100–120

COVID-19: How Tax Policy Responses Affected Uganda's Economy

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Abstract
We examined the impact of COVID-19-induced tax policy adjustments on Uganda's gross domestic product. The analysis is based on a Structural Vector Autoregressive (SVAR) model of Ugandan quarterly data (2009 to 2021). We find that a one standard deviation positive tax policy shock has a negative effect on Uganda's GDP. Likewise, a one standard deviation positive shock on the consumer price index has a negative effect on the GDP. Thus, we recommend that instead of fiscal provisions in tax cuts and deferrals to micro small and medium enterprises (MSMEs) and households, the government should focus more on raising expenditure on the private sector MSMEs and households, which would stimulate private demand and productivity and sustain domestic revenue collections, particularly from MSMEs. We also recommend the stabilization of food prices, which are the main drivers of the consumer price index in Uganda, to raise GDP growth. Our results provide new insights into the effects of tax policy responses on GDP amidst a global health crisis that has muted economic activities.

JEL Classification: *B22, C54, E62*

Keywords: *COVID-19, tax policy responses, gross domestic product, SVAR, Uganda*

1. Introduction

Like in many other countries, the COVID-19-induced lockdowns constrained public revenues in Uganda. Before the COVID-19 pandemic, the tax-to-GDP ratio had grown from 11.5 percent in the financial year 2017/18 to 12.4 percent in 2018/19, but it then dropped to 11.6 percent in 2019/20 during the COVID-19 crisis (World Bank, 2020b). Moreover, all major tax heads recorded shortfalls against their respective targets for the year as collections were affected by the adverse effects of COVID-19 on economic activities (MoFPED, 2021). Nevertheless, this emanated from the government's adjustments in the fiscal policy to cope with the adverse effects of the COVID-19 crisis on the economy. The tax policy measures instituted by the government at the time were largely tax exemptions and deferrals to households and private-sector businesses. These included deferred payments to corporate taxes, employment taxes for firms in the formal sectors, presumptive taxes for micro small-scale and medium enterprises (MSMEs), and personal income taxes on firms in severely affected sectors like manufacturing, horticulture, and floriculture and tourism; waiving of interest on tax arrears; tax deductions on donations and items for COVID-19 response; and payment of VAT refunds (World Bank, 2020a).

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 ♦ https://doi.org/10.56279/ter.v13i2.111

The empirical literature on the effects of fiscal policy on Uganda's GDP is trivial. That said, several studies elsewhere have examined the impact of fiscal policy on economic growth (Adegboyo et al., 2021; Agu et al., 2015; M'Amanja et al., 2005; Blanchard & Perotti, 2002). These studies, however, are not flawless. For example, Blanchard and Perotti (2002) argued that when government expenditure increased in the post-war period in the USA due to spending on defence, this induced tax revenues to increase, hurting output. This phenomenon could contradict Uganda's case where tax revenues fell, and government spending increased due to the COVID-19 fiscal stimulus packages to households and private sector businesses (World Bank, 2020a; MoFPED, 2021). M'Amanja et al. (2005) used annual data to study the link between fiscal policy and growth, instead of using quarterly data which is preferable for studying such relationships. This is because when using quarterly data, there's no discretionary within the period response of fiscal policy to shocks in output, unlike in annual data (Blanchard & Peroti, 2002). Agu et al. (2015) adopt a literature review approach to study the effect of fiscal policy on growth, which does not provide an in-depth analysis of the effect of fiscal policy shocks on GDP. On the other hand, Adegboyo et al. (2021) found that tax revenue does not affect economic growth in Nigeria, which conflicts with the economic theory because tax revenue and expenditure are policy levers in fiscal policy for influencing demand, and therefore output.

Another significant aspect that influenced Uganda's GDP during the pandemic was the consumer price index (CPI). Previous studies have found mixed results on this aspect. For instance, Mahmoud (2013) found a positive relationship between CPI and economic growth in Mauritania during the period 1990 to 2013. However, Kyo, (2018) in Japan, found a negative relationship between CPI and economic growth. Similarly, Mandeya and Ho (2021) found that CPI negatively harms economic growth in South Africa.

In this paper, we address the theoretical and methodological gaps noted above and then extend the existing literature by investigating the impact of COVID-19-induced measures on tax policy on economic growth using the SVAR model, and quarterly data from 2009 to 2001. Since none of the aforementioned reviewed studies has attempted to investigate the impact of COVID-19-related fiscal adjustment on economic growth, this presents a novelty to our study.

As aforementioned, the main objective of this paper is to examine the effects of COVID-19-induced tax policy adjustments and consumer price index on Uganda's gross domestic product. To achieve this objective, it employs the structural vector auto-regressive (SVAR) model to estimate the dynamic effects of tax policy shocks on the GDP.

In the follow-up sections, we inspect the recent evolutions in Uganda's real GDP growth in section 2; and make a review of literature in section 3. Section 4 presents the methods and data collection, while the results and discussions from the study investigations are shown in section 5. Finally, section 6 concludes the study.

2. Evolution of the Growth of Uganda's Real Gross Domestic Product

It is important to observe the outlook of the growth of Uganda's economy before and during the COVID-19 crisis to understand the rationale for our study. The adverse effects of the COVID-19 pandemic have negatively affected Uganda's GDP output. According to the World Bank (2020a), the fall in Uganda's real gross domestic product growth in FY.2019/20 was due to COVID-19-related shocks. Before the COVID-19 pandemic, Uganda's GDP had been experiencing a positive trend in GDP growth until it took a nosedive in FY.2019/20, before rebounding in the third quarter of 2020/21. For instance, quarterly GDP sharply declined from 8.7 percent in the second quarter of 2019/20 to 5.8 percent in the fourth quarter of the same period; and later rebounded to 3 percent in the third quarter of FY.2020/21 (Figure 1).

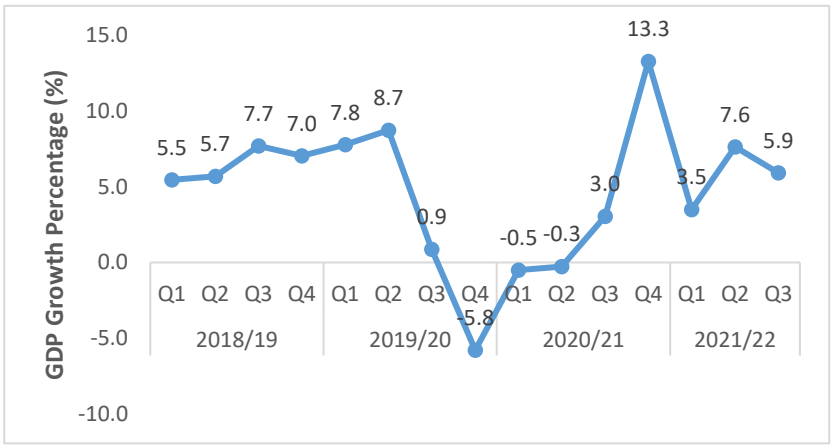

Figure 1: Uganda's Quarterly Gross Domestic Product (FY.2018/19 – FY.2021/22)

Source: Authors' construction using data from the Uganda Bureau of Statistics

3. Review of Literature

Here we present the theoretical underpinnings and empirical literature relating fiscal policy to economic growth.

3.1 Theoretical Literature

The Keynesian, classical, and Ricardian schools of thought have significantly contributed to the relationship between fiscal policy and GDP. Classical theorists believe fiscal policy can foster sustainable long-term growth through carefully designed tax systems and spending programmes (Hemming et al., 2002). For example, the government's expenditure geared toward enhancing the number of factors of production positively impacts output growth (Barro & Sala-I-Martin, 1992; Gerson, 1998). Further, the classical Keynesians expect the effects of fiscal expansions on growth to be positive and negative for fiscal contractions since they are traditionally associated with lower growth and recessions (Hemming et al., 2002). They also argue that the effectiveness of any particular fiscal policy in stimulating growth depends on the magnitude and sign of the fiscal multipliers (ibid.).

Consequently, from the demand side perspective, the Keynesian view hinges on the belief that marginal propensity to consume increases with income but at a lower rate (hence the multiplier effect through increased savings). It holds that the larger the increase in consumption, the larger the multiplier (Hemming et al., 2002). In the Keynesian theory, fiscal expansion, therefore, has a multiplier effect on aggregate demand, and hence on the outcome; implying that the multiplier is greater than one (i.e., marginal propensity to save is greater than the marginal propensity to consume); and it is larger for spending increase than for tax reductions (Hemming et al., 2002).

However, neo-Keynesians have rational thought: they believe that consumers are rational optimisers of their lifetime average income (i.e., permanent income) and thus will not change their consumption in response to changes in current income (Hemming et al., 2002). This, Ricciuti (2021) argues, causes a 'Ricardian equivalence' between taxes and debt, which in its extreme form implies that a reduction in government's savings that is due to a tax reduction is entirely counter-balanced with an increase in private savings; hence the aggregate demand remains unchanged. Riccardo argued that a temporary increase in government spending and/or tax reduction would have a stronger positive effect on growth due to a smaller risk of unsustainable budgetary deficits (ibid.).

On the other hand, from the supply-side perspective, the key factors affecting the potential effectiveness of short-term fiscal policy are the effects of changes in labour income taxes on labour supply, and the effects of changes in profit taxes on savings and investment (Hemming et al., 2002). The neo-classical theorists assume that markets are efficient, and output growth can only be the result of supply-side shocks, and should be uncorrelated to aggregate demand (Hemming et al., 2002). Thus, Lucas and Stokely (1983) argue that under rational expectations, a fully anticipated fiscal policy targeted at aggregate demand, but not at supply, will not affect growth either in the short- or long-run.

3.2 Empirical Literature

A review of empirical literature in different countries and at a regional level shows mixed views on the impact of fiscal policy on economic growth. Several studies in Sub-Saharan African (SSA) countries exhibit both positive and negative effects of fiscal policy on economic growth.

Many studies (e.g., Agu et al., 2015; Yusuf & Mohd, 2021; Mohammed & Ehikioya, 2015; Adeolu et al., 2012; Udo et al., 2022; and Tunji et al., 2020) done in Nigeria using the Ordinary Least Squares (OLS), Error Correction Model, ARDL model, and Generalized Least Squares techniques have found a positive relationship between government expenditure and growth; and a positive effect of taxes on growth. Likewise, a study done in South Africa by Ocran (2009) found a significant positive effect of government consumption expenditure and tax receipts on economic growth. Also, a study done in Ghana by Dodz et al. (2014), using the OLS, found that fiscal policy affected the Ghanaian economy positively. Similarly, Itoro

and Ekere (2018) used a generalized method of moments (GMM) to analyse the effects of fiscal and monetary policies on economic growth in a panel of 47 SSA economies from 1996 to 2016. Their findings show that fiscal and monetary policies affected economic growth positively in the sub-region.

However, a few studies have found otherwise. Adegboyo et al. (2021), using an ARDL model, found that fiscal policies stimulate economic growth, while the short-run results show that fiscal policies have an inconsistent impact on the Nigerian economy. Salako and Oyeleke (2019), using a VECM, found that government expenditure positively and significantly impacted the growth of real economic activities, but the converse was the effect of public revenues on real GDP. Using a VAR-VECM approach, Bodunrin (2016) found much more unique results: that fiscal policy had no significant effect on real GDP in Nigeria. In Kenya, M'Amanja et al. (2005) used the autoregressive distributed lag (ADL) model to investigate the relationship between various fiscal policy measures on growth in annual data for the period 1964–2002, and found that contrary to expectations, productive expenditure had a strong negative effect on growth; while there was no evidence of distortionary effects on growth of distortionary taxes.

There is an overwhelming evidence of a positive impact of fiscal policy on economic growth in SSA countries. However, some isolated studies—particularly in Nigeria—provide inconsistent results on the effects of fiscal policy on economic growth (see, e.g., Salako & Oyeleke, 2019; Bodunrin, 2016). In addition, to the best of our knowledge, there is no study in SSA that has used the SVAR and quarterly data to model fiscal policy shocks on economic growth. Additionally, none of the aforementioned studies considers COVID-19-induced fiscal policy adjustments on GDP.

Elsewhere in Asia, like in SSA countries, there are mixed results of a positive relationship between fiscal policy and economic growth in Indonesia and Malaysia, for example (Ismal, 2011; Sriyana, 2002). Likewise, using an ARDL, Rahimi (2021) found a positive and significant effect of fiscal policy on the economic growth of Afghanistan. Ahmed (2011), on the contrary, found a negative effect of federal tax on economic growth using OLS and annual data from 1982 to 2010 to investigate the role of fiscal policy in enhancing the economic growth of Pakistan.

Separately, many studies done in Europe and the USA (Ritcher et al., 2015; Stoilova & Todorov, 2021; Mukhtarov et al., 2018; Hamdi & Sbia, 2013) found a positive relationship between government spending and economic growth, and a negative link with taxes. However, Hamza and Milo (2021) used a VAR and found that total public expenditure significantly affects GDP. In the USA, Fu et al. (2003) found that an increase in the size of the federal government led to slower economic growth, but tax revenues are the most consistent indicator of fiscal policy. However, this was contrary to what Blanchard and Perotti (2002) found: a positive and negative impact of government spending and taxes, respectively, in the USA.

The bulk of the empirical literature reviewed focuses on the effect of public expenditure and economic growth, but a few on both fiscal tools. However, by and large, many studies attempted to examine the impact of fiscal policy on economic growth, but only a few use SVAR and quarterly data to examine the impact of fiscal policy on economic growth. To the best of our knowledge, only one study done in the USA by Blanchard and Perotti (2002) has attempted to use the SVAR to model fiscal policy effects on output; but there are none on Uganda.

4. Methods and Data

4.1 Methods

4.1.1 Model Specification and Empirical Strategy

Our study is motivated by the work of Blanchard and Perotti (2002), who used the structural vector autoregressive (VAR) to model the impacts of fiscal policy on output. To undertake our investigation, we estimated an unrestricted reduced form vector auto-regressive (VAR) model in levels with a dummy variable for COVID-19 exogenously determined in the model (for dummies in VARs, see Kronborg, 2021). The VAR model is expressed as follows:

$$y_t = \Gamma_0 + \Gamma_1 t + \Gamma_2 Z_t + \tilde{y_t}, \tilde{y_t} = \Pi_1 \tilde{y}_{t-1} + \cdots + \Pi_p \tilde{y}_{t-p} + u_t, u_t \sim N(0, \Sigma) \quad (1)$$

Where y_t is a $K \times 1$ vector in logarithms of quarterly endogenous variables, including the gross domestic product, tax shock, domestic tax revenues, government expenditure and the consumer price index at time *t;* while Z_t is an $n_Z \times 1$ vector of the exogenous variable, in this case the dummy variable capturing the COVID-19 period. COVID-19 is a dummy variable denoting 1 at time *t* period during the COVID-19 pandemic, and 0 otherwise. The VAR model appropriates p lags of its endogenous variables; and the matrices and vectors $(\Gamma_0, \Gamma_1, \Gamma_2, \Pi_1, \ldots, \Pi_p, \Sigma)$ are coefficients of the estimated VAR.

Further, note that we generated a new variable 'Tax shock', emanating from an interaction of the domestic tax revenue variable with a dummy variable COVID-19 to integrate the period the government of Uganda undertook tax reliefs to private sector MSMEs and households during the COVID-19 period.

On the other hand, we adopted a VAR model because it identifies the contemporaneous effects of fiscal policy shocks on GDP, and it is best suited for studying fiscal policy because budget variables are prone to exogenous fiscal shocks concerning output (Blanchard & Perotti, 2002). Relatedly, we include government expenditure in the model because both government expenditure and taxes affect GDP; and since they are not independent, estimating the effects of one requires including the other (ibid.).

That said, we first carried out pre-estimation diagnostic tests to check for stationarity of the variables and the order of integration, preferably [I (1)]. To do this, we used an ADF unit root test in levels and differences. We then estimated an unrestricted VAR in levels with 4 lags as the rule of thumb for quarterly data. A

further check for optimal lags to use in the model selected 4 lags as asterisked by Akaike Information Criterion (AIC), Hannan Quin (HQ), Schwarz Information Criterion (SIC), and the Final Prediction Error (FPE) in Table A3. After post-estimation residual diagnostic tests for serial correlation, normality and stability were done on the estimated VAR model to determine the significance and stability of the model.

Second, once the unrestricted reduced form VAR model satisfied the post-estimation necessary conditions, we then imposed short-run restrictions on the endogenous variables in the VAR model, thereafter augmenting it into a SVAR model with short-run restrictions imposed on the contemporaneous relations on the endogenous variables to estimate their dynamic effects on GDP. Further, the SVAR model was chosen because it is useful for identifying purely exogenous structural shocks to obtain the responses of the endogenous variables on GDP. Therefore, imposing restrictions on the reduced form VAR in (1) augments it into an SVAR, expressed as follows:

$$\beta_0 y_t = \beta_1 y_{t-1} + \cdots + \beta_p y_{y-t} + \varepsilon_t, , \varepsilon_t \sim N(0, I_K) \quad (2)$$

Where β_0 is a non-singular $K \times K$ matrix, $\beta_1 = \beta_0 \Pi_1$, $\beta_2 = \Pi_2$ and $\varepsilon_t = \beta_0 u_t$; denoting the structural shocks in the model uncorrelated with time t.

Finally, we ran accumulated impulse response functions using the Monte Carlo standard errors with 100 repetitions of a Cholesky decomposition to trace the contemporaneous effects of fiscal policy shocks on the model.

4.2 Data

The study used quarterly data spanning 12 years from 2009Q1 to 2021Q1, producing 49 observations. The data points of the GDP were inadequate, hence the scope covers up until the first quarter of 2021. We used quarterly data because it is essential in the identification of fiscal shocks (Blanchard & Perotti, 2002). Also, in part, the study scope is crucial because it captures the timeframe when COVID-19-induced tax policy adjustments were carried out by the government of Uganda. The data on domestic tax revenue and total government expenditure were obtained from Uganda's Ministry of Finance Planning and Economic Development (MoFPED), while the GDP was obtained from the Uganda Bureau of Statistics (UBoS), and the Consumer Price Index (CPI) was obtained from the Central Bank of Uganda (CBU) (see Table A2 for details). The data variables were transformed into natural logarithms. As such, *LDTR* is the natural logarithm of domestic tax revenue; *LGEXP* is the natural logarithm of total government expenditure; LGDP is the natural logarithm of gross domestic product; and *LCPI* is the natural logarithm of the consumer price index.

Further, data on domestic tax revenues were used as a proxy for Uganda's tax policy; and government expenditures were sectoral allocations, which also composed socioeconomic transfers to households during the pandemic. In addition, the choice of the study variables was informed by economic apriori and empirical literature from other studies, except for *LCPI* which introduces novelty to our

study. For example, most empirical literature (Blanchard & Perotti, 2002, 2016; Salako & Oyeleke, 2019; Ritcher et al., 2015; and Stoilova & Todorov, 2021), showed that the expected sign for *LGDP* is negative when reacting to the effect of domestic tax revenue shocks, and positive to government expenditure shocks.

4.2.1 Descriptive Statistics of Data

Table 1 shows the descriptive statistics of the main variables used for our study. Transforming the study variables naturalized them, hence we observe a uniformity and small variation amongst them. Therefore, during the period 2009q1 to 2021q1, the GDP averaged 10 percent, tax revenues averaged 7 percent, government expenditure averaged 8 percent, while consumer price index averaged 6 percent. The Jacque-Bera confirms the normality of all the pre-estimated variables at a 5 percent level of significance. Additionally, the graphical exposition of these variables is shown in Figure A1.

Table 1: Descriptive Summary Statistics of the Series (2009q1–2021q1)

	LGDP	LDTR	LGEXP	LCPI
Mean	10.16581	7.110268	8.118630	6.061241
Median	10.16806	7.123347	8.070092	6.082354
Maximum	10.49208	8.048651	9.052109	6.332327
Minimum	9.858525	6.000272	7.178418	5.627011
Std. Dev.	0.165841	0.548160	0.506578	0.209572
Skewness	0.098007	-0.279629	0.013253	-0.630710
Kurtosis	2.028425	1.965704	2.267695	2.226506
Jarque-Bera	2.005692	2.822680	1.096321	4.470173
Probability	0.366834	0.243816	0.578012	0.106983
Sum	498.1245	348.4031	397.8128	297.0008
SumSq. Dev.	1.320156	14.42302	12.31782	2.108180
Observations	49	49	49	49

4.2.2 Correlation Matrix

We explored the direction and the strength of the linear relationship between the pairs of our data variables used in the study. The correlation matrix presented in Table 2 indicates that the study variables are significantly positive and highly correlated with each other, and the off-diagonal elements are one.

Table 2: Correlation Matrix

	LGDP	LDTR	LGEXP	LCPI
LGDP	1.000000	0.883240	0.886421	0.889754
LDTR	0.883240	1.000000	0.946213	0.966775
LGEXP	0.886421	0.946213	1.000000	0.928556
LCPI	0.889754	0.966775	0.928556	1.000000

4.2.3 Unit Root Test

We conducted an Augmented Dickey-Fuller (ADF) unit root test of our study variables in levels and at first differences with the Schwarz Info Criterion (SIC)

for automatic lag length selection and 4 maximum lags to examine the stationarity properties of the data. The results shown in Table 3 indicate that all the study variables are stationary after the first difference; therefore, they are integrated into order one I(1), satisfying the necessary condition to proceed with the VAR model.

Table 3: Unit Root Results for the Variables Using the Augmented Dickey-Fuller Test

Variable	Unit Roots in Levels		Unit Roots in 1st Difference		Order of Integration
	Constant *(t-Statistic)*	Constant, Linear Trend *(t-Statistic)*	Constant *(t-Statistic)*	Constant, Linear Trend *(t-Statistic)*	
LGDP	-0.220850	-3.207235*	-4.054043***	-3.985715**	I(1)
LGEXP	-0.477677	-6.801951**	-6.761247**	-6.680750**	I(1)
LDTR	-1.888404	-0.847562	-3.288854**	-3.815888**	I(1)
LCPI	-2.492759	-2.037716	-3.065802**	-4.747312*	I(1)

Note*:* *** p<0.01, ** p<0.05, * p<0.1

5. Results and Discussions

In this section, we present the estimated SVAR model and the impulse response functions established amongst the variables' interactions, and later the robustness checks of the VAR model.

5.1 The Estimated SVAR Model Results

As per the results presented in Table 4, the coefficients [C(2), C(3) and C(11)] for the short-run restrictions imposed on the SVAR model show that tax policy shocks and the consumer price index have a negative effect on GDP. On the other hand, government expenditure has a positive effect on GDP. We further investigate these results using accumulated impulse response functions on the SVAR model.

Table 4: Estimated Structural Vector Auto-regressive Model

	Coefficient	Std. Error	z-Statistic	Prob.
C(2)	-0.101640	0.167206	-0.607872	0.5433
C(4)	0.072510	0.455350	0.159240	0.8735
C(5)	0.739181	0.404308	1.828264	0.0675
C(7)	0.443204	0.244425	1.813251	0.0698
C(8)	1.181872	0.224879	5.255593	0.0000
C(11)	-0.073987	0.041711	-1.773821	0.0761
C(1)	0.032283	0.003403	9.486833	0.0000
C(3)	0.036210	0.003817	9.486833	0.0000
Log-likelihood	435.0265			
Estimated A Matrix:				
1.000000	0.000000	0.000000	0.000000	0.000000
0.101640	1.000000	0.000000	0.000000	0.000000
-0.072510	-0.739181	1.000000	0.000000	0.000000
-0.443204	-1.181872	0.009462	1.000000	0.000000
0.073987	0.042042	0.003655	-0.027836	1.000000

Estimated B Matrix:				
0.032283	0.000000	0.000000	0.000000	0.000000
0.000000	0.036210	0.000000	0.000000	0.000000
0.000000	0.000000	0.098208	0.000000	0.000000
0.000000	0.000000	0.000000	0.052702	0.000000
0.000000	0.000000	0.000000	0.000000	0.008682

5.2 Impulse Response Results

The impulse responses of the Cholesky decomposition over the study scope are presented in Figures 2, 3 and 4. Figure 2 shows the short-run tax policy shock impulse responses to other endogenous variables in the model. Crucial to note is that a 1 standard deviation positive tax shock has a 0 effect on GDP in periods 1 and 2; but then a more pronounced negative effect on GDP is realised in the subsequent periods.

This result is consistent with the findings of several studies (e.g., Blanchard & Perroti, 1999; Mukhtarov et al., 2018; Hamdi & Sbia, 2013; Ritcher et al 2015; Stoilova & Todorov, 2021; Ahmed, 2011), which argue that an increase in tax revenues leads to a reduction in GDP. However, in the aforementioned studies, taxes were raised leading to a reduction in GDP contrary to Uganda's case where tax reliefs provided to firms and households reduced its GDP. This could have been due to inertia in the effectiveness of the tax reliefs to stimulate Uganda's economy that was already grappling with the adverse effects of the COVID-19 pandemic.

The result also contradicts the Ricardian theory, which argues that a temporary increase in tax cuts has a stronger positive effect on growth due to a smaller risk of unsustainable budgetary deficits (Ricciuti, 2021). More so, the contradiction with our study could be attributed to the tax shock dominating the tax relief to private sector MSMEs and households in the short-run. Also, our results vindicate the outlook of Uganda's GDP shown in Figure 1. The study findings further shows that a 1 standard deviation positive tax shock results have a positive effect on government expenditure and domestic tax revenues, which are persistent throughout the periods.

The Cholesky decomposition impulse responses in Figure 3 show that a 1 standard deviation positive shock in the consumer price index leads to a negative effect on GDP. This outcome is expected because of the inverse relationship between prices and GDP. Then, a positive shock in the consumer price index leads to a negative effect on government expenditure: this was also expected because a rise in prices would induce the government to cut expenditure to curb a rise in the cost of living.

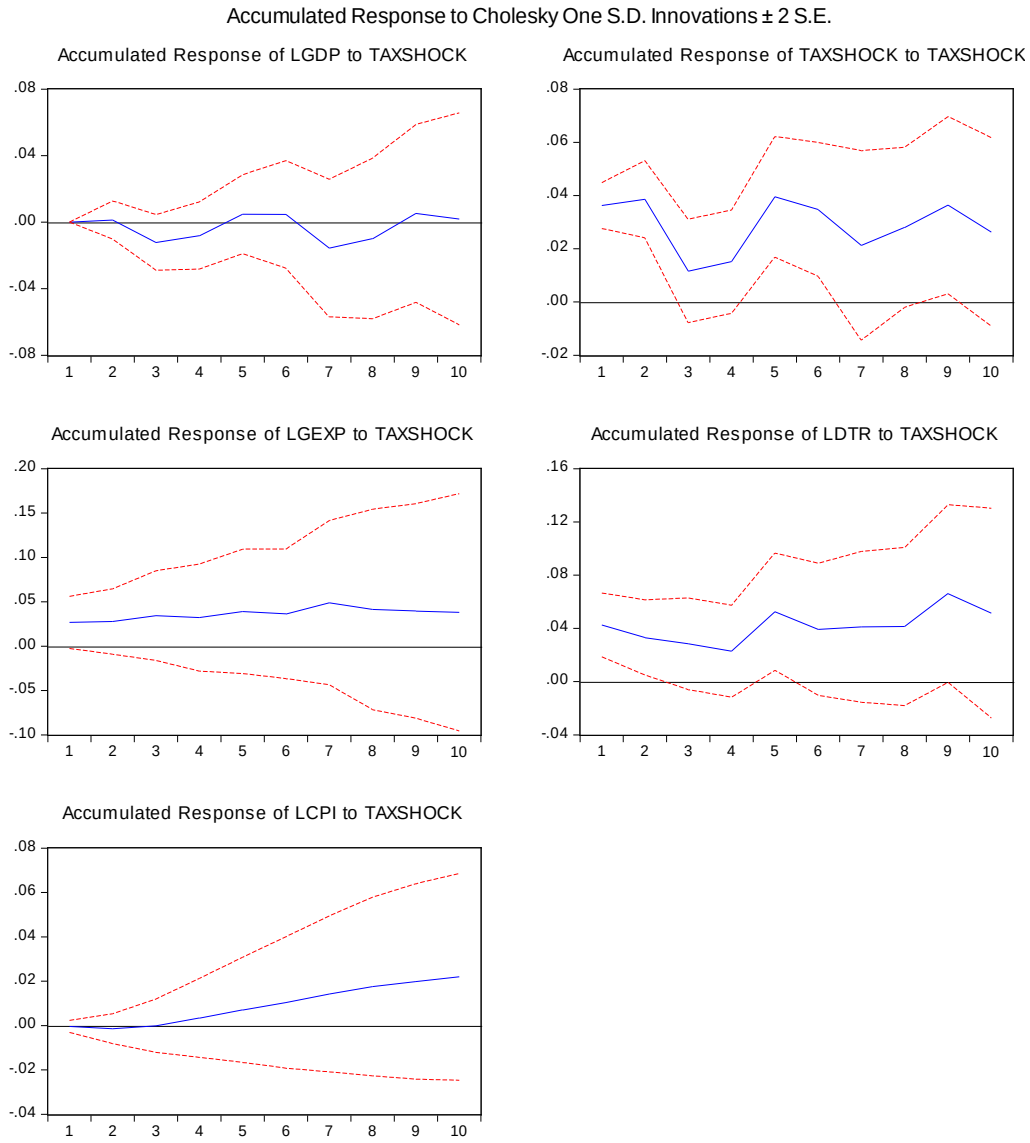

Figure 2: Impulse Responses of Tax Policy Shocks Using the Cholesky decomposition

Source: Estimated Structural VAR Model Impulse Response Functions

This finding is in tandem with those of Kyo (2018), and Mandeya and Ho (2021), who found a negative relationship between CPI and economic growth in Japan and South Africa, respectively. However, it differs from that of Mahmoud (2015), who found a positive relationship between CPI and economic growth in Mauritania.

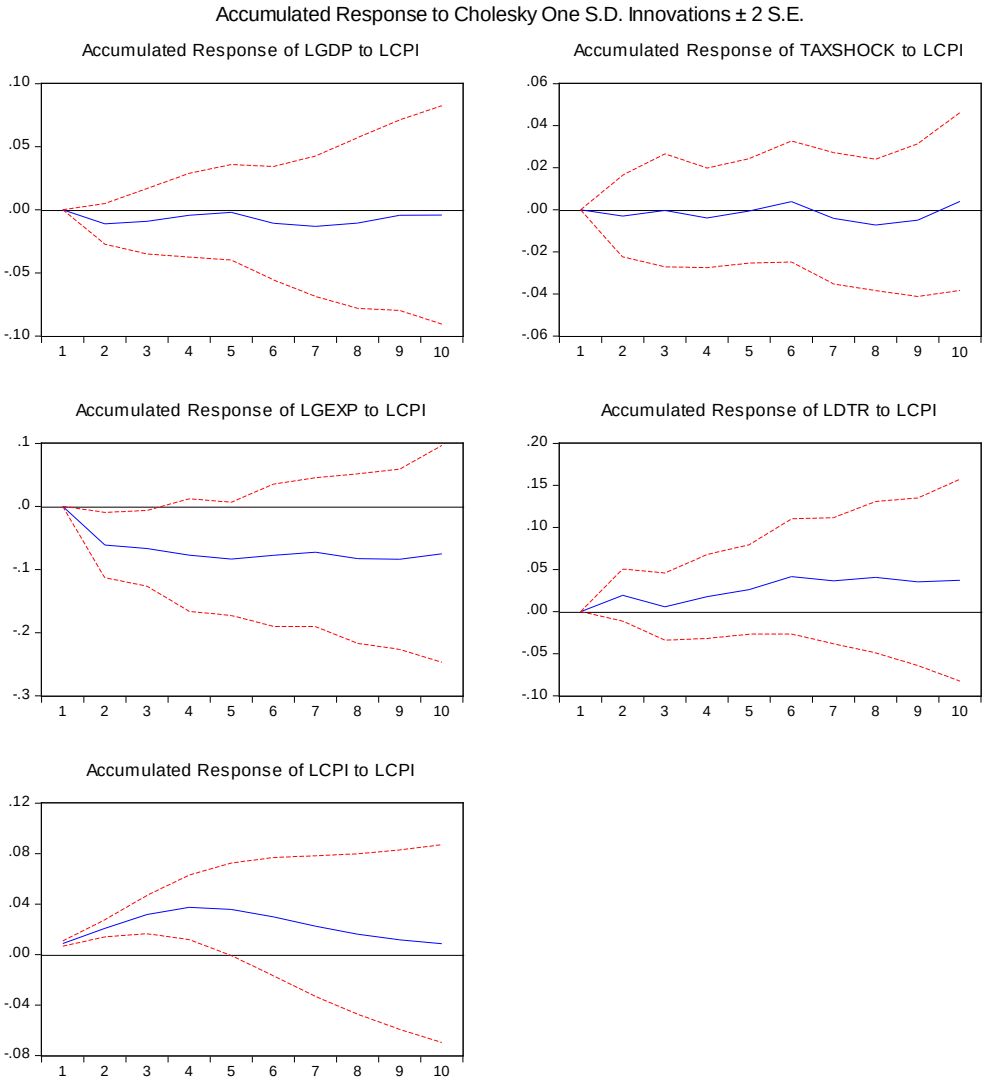

Figure 3: Impulse Responses to Consumer Price Index Shocks Using the Cholesky Decomposition

Source: Estimated Structural VAR Model Impulse Response Functions.

From Figure 4, a 1 standard deviation positive shock on government expenditure has a substantial negative effect on GDP throughout the periods; but the consumer price index responds positively to a 1 standard deviation positive shock on government expenditure; even though an upward trend is observed from period 3 onwards. However, a 1 standard deviation positive shock on government expenditure does not affect domestic tax revenues since it is close to zero throughout the periods; but a positive shock in the government expenditure has a downward negative effect on government expenditure.

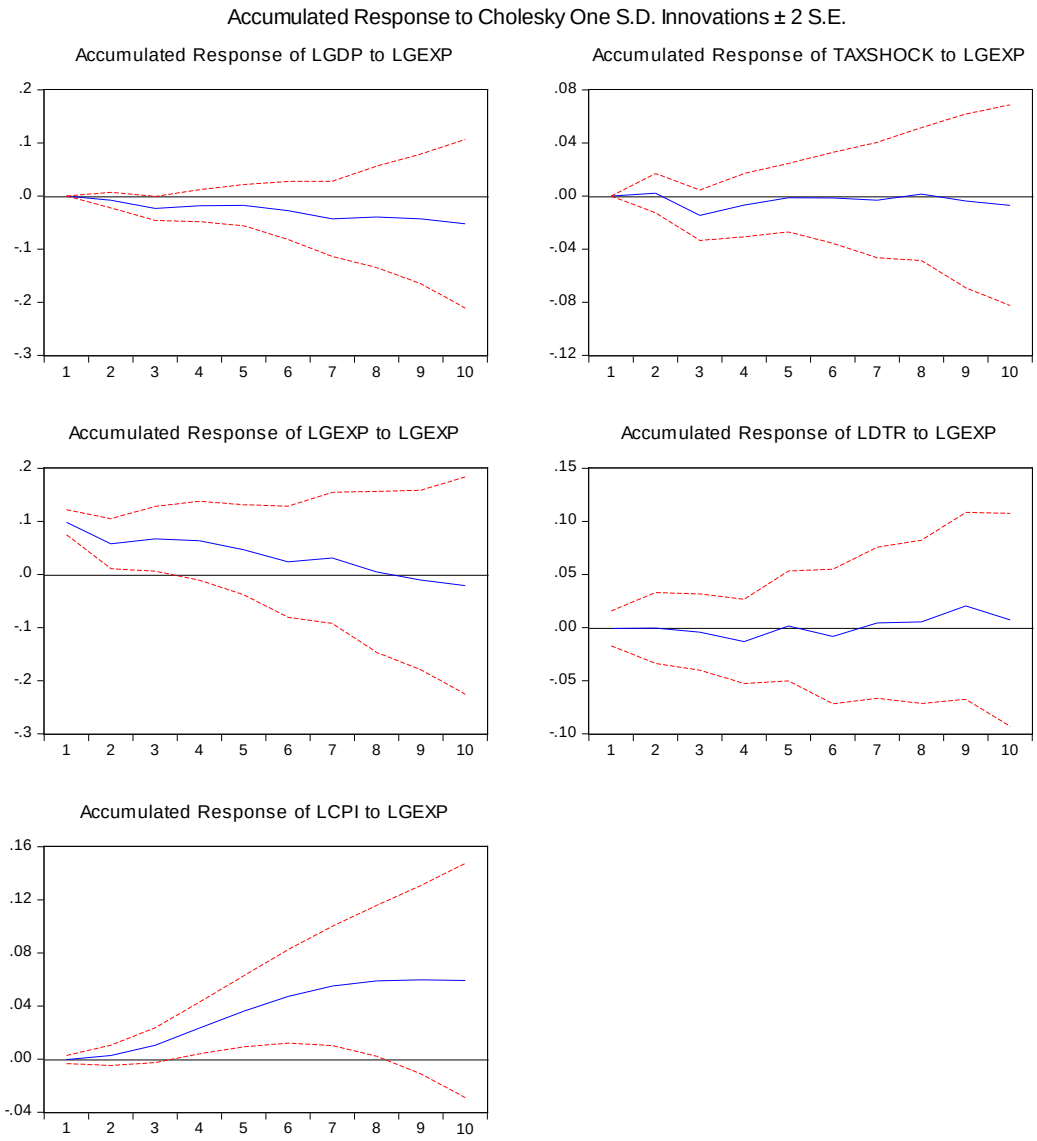

Figure 4: Impulse Responses to Government Expenditure Shocks Using the Cholesky decomposition

Source: Estimated Structural VAR Model Impulse Response Functions

5.3 Robustness Checks

We checked the robustness of our unrestricted reduced VAR model to ensure that the estimated residuals are white noise and satisfy the classical regression model assumptions, and the results are reliable and valid. Specifically, we carried out residual tests on the estimated model, including serial correlation, heteroskedasticity, normality, and the stability of the model. We used the LM test

to check the null hypothesis of no serial correlation of the VAR residuals, and the results indicate that we fail to reject the null hypothesis at a 5% level of significance: thus, there is no serial correlation in the residuals (Table 4). We also confirmed homoscedastic residuals at a 5% level of significance in Table A5 after failing to the null hypothesis of no heteroskedasticity. The multivariate test for normality using the orthogonalized Cholesky (Lutkephol), developed by Jarque and Bera (1987), confirms that the null hypothesis of residuals is multivariate normal at a 5 percent level of significance (Table A6). In addition, the graphical exposition of the VAR residuals is normally distributed around the zero mean as realized in Figure A2. Lastly, the AR inverse roots test in Figure A3 shows that all the roots lie within the unit circle, hence the model is stable.

6. Conclusion

The empirical literature on the effects of fiscal policy on Uganda's GDP is little. More so, globally, research on the impact of tax policy responses on economic growth during the COVID-19 crisis is still novel; yet it is essential for policy purposes. This study sought to bridge this gap by examining the impact of the COVID-19-induced tax policy adjustments on Uganda's gross domestic product from 2009q1 to 2021q1. We conclude that the COVID-19-induced tax policy adjustments on Uganda's economy had a negative effect on GDP in the short-run. This could be due to inertia in the reaction of the tax policy adjustments of tax cuts and deferrals in the forms of relief to the private sector MSMEs and households in raising GDP; hence, the tax shock overtook the tax relief, resulting in a spontaneous reduction in the growth of Uganda's economy. In that regard, we recommend that to stimulate GDP growth in a crisis like COVID-19, instead of fiscal provisions in tax cuts and deferrals to MSMEs and households, the government should raise the expenditures of the private sector MSMEs and households. This would, in turn, stimulate private demand and productivity to sustain domestic revenue collections, particularly from MSMEs. We also found that the consumer price index has a negative effect on Uganda's GDP, thus we recommend the stabilization of food prices in the country since this is the main driver of the consumer price index in Uganda. This is critical to cool down the CPI upward pressures and raise GDP growth.

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Appendices

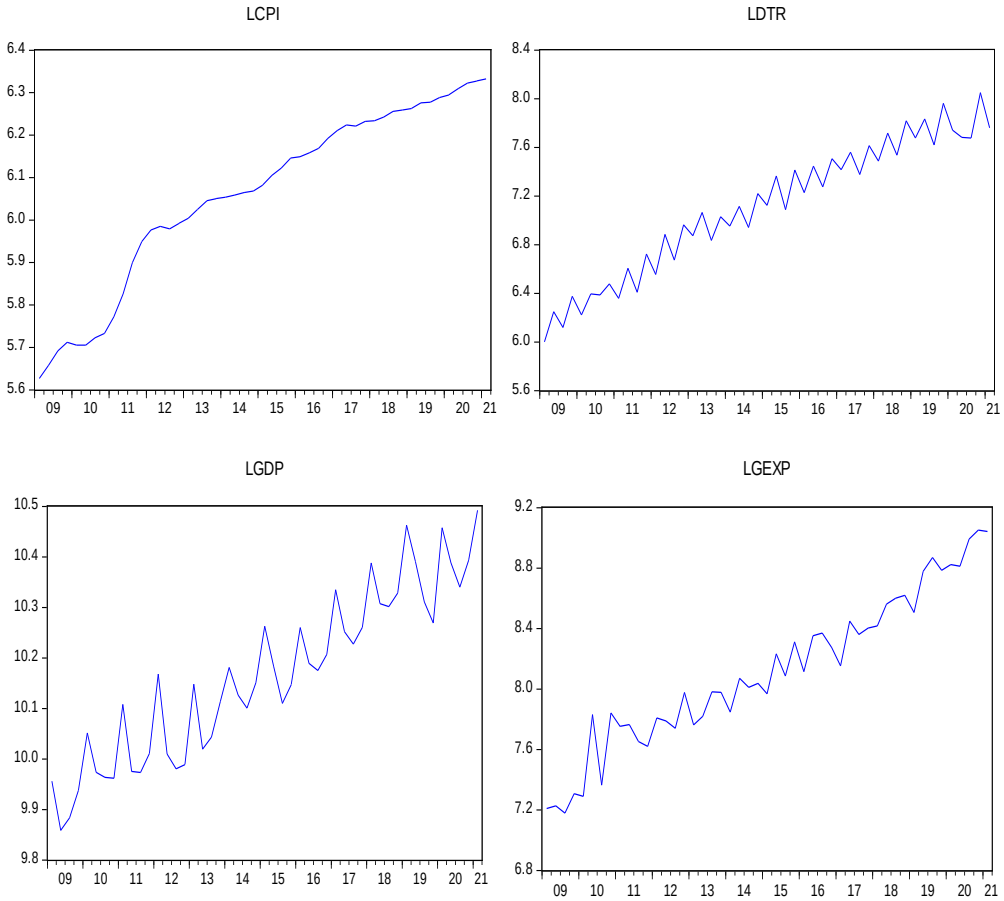

Figure A1: Graphical Exposition of the Series

Table A2: Study Variables Definitions and Sources

Variables	Description	Sources
Gross Domestic Product (LGDP)	GDP at constant prices measured in Uganda Shillings Billions.	Ministry of Finance Planning and Economic Development.
Domestic Tax Revenues (LDTR)	Domestic tax revenues collected by the tax body, are measured in Uganda Shillings in Billions.	Ministry of Finance Planning and Economic Development.
Government Expenditure (LGEXP)	Total expenditure of government on the different programmes in the various sector of the economy.	Ministry of Finance Planning and Economic Development
Consumer Price Index (LCPI)	Consumer Price Index, (2009/10=100) on all items index (weight = 1000).	Bank of Uganda.

Table A3: Lag Order Selection Criteria of the Estimated VAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	199.4480	NA	1.52e-10	-8.419911	-8.018430	-8.270243
1	338.6675	235.1262	9.59e-13	-13.49633	-12.09115	-12.97249
2	407.9304	101.5856	1.41e-13	-15.46357	-13.05469	-14.56557
3	460.3827	65.27392	4.76e-14	-16.68367	-13.27109	-15.41150
4	510.5330	51.26477*	2.02e-14*	-17.80147*	-13.38518*	-16.15512*

Table A4: VAR residual serial correlation using LM test.
Null Hypothesis: no serial correlation

Lags	LM-Stat	Prob
1	35.47868	0.0799
2	20.90621	0.6978
3	34.34716	0.1007
4	24.27515	0.5035
5	19.15749	0.7895

Table A5: VAR Residual White Heteroskedasticity Tests: No Cross Terms

Chi-sq	df	Prob.
625.4842	615	0.3759

Table A6: VAR Residual Normality Tests, Orthogonalized: Cholesky (Lutkephol)
Hypothesis: Residuals are Multivariate Normal

Component	Skewness	Chi-sq	Prob.	Kurtosis	Chi-sq	Prob.	Jacque-Bera	Prob.
1	-0.30222	0.685027	0.4079	3.26304	0.13	0.718	0.8148	0.6654
2	0.55953	2.348061	0.1254	4.18163	2.62	0.105	4.9660	0.0835
3	-0.32418	0.788239	0.3746	2.44565	0.58	0.447	1.3644	0.5055
4	-0.48207	1.742972	0.1868	3.75963	1.08	0.298	2.8249	0.2435
5	-0.14900	0.166519	0.6832	2.88453	0.02	0.874	0.1915	0.9087
Joint		5.730818	0.3333		4.44	0.489	10.161	0.4264

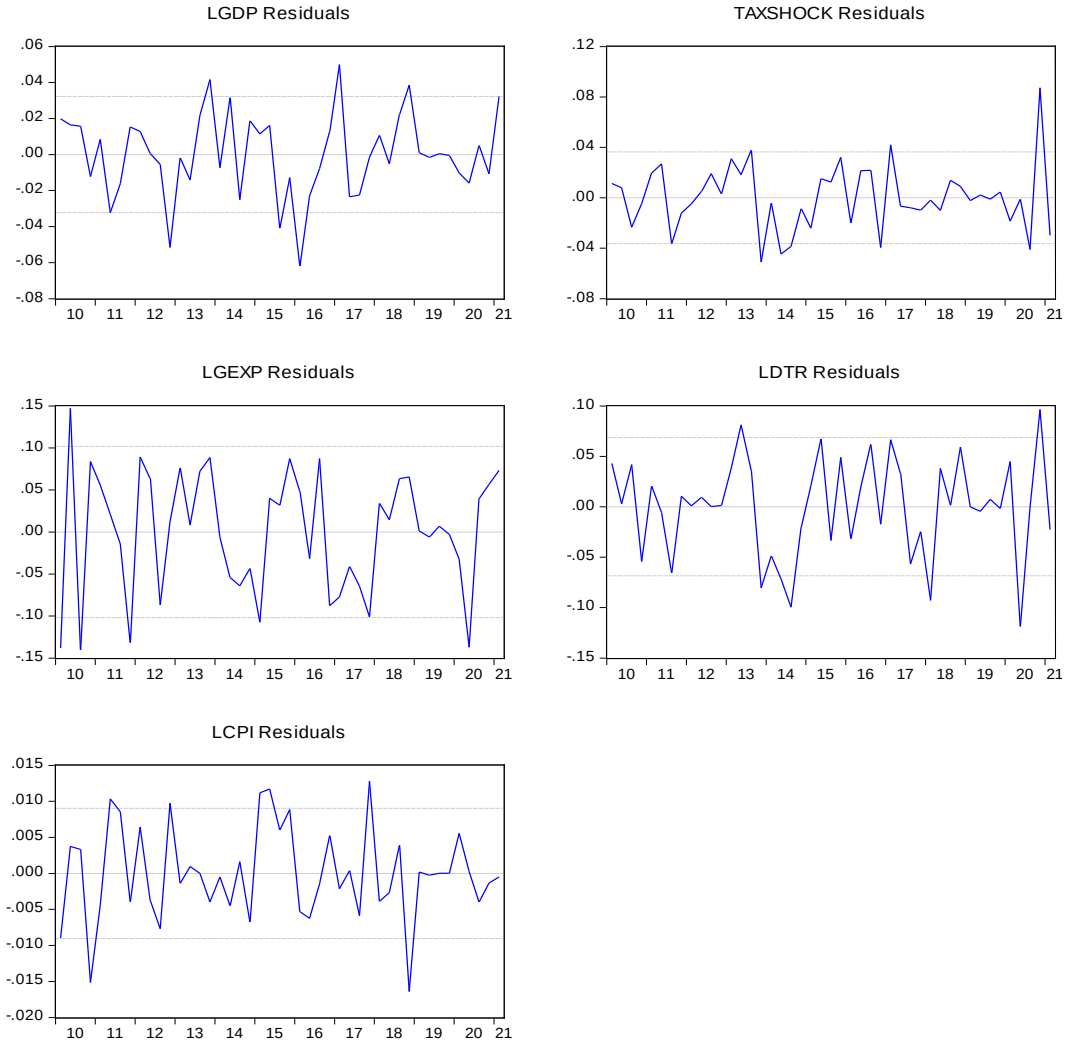

Figure A2: Graphical Exposition of the Estimated VAR Residuals

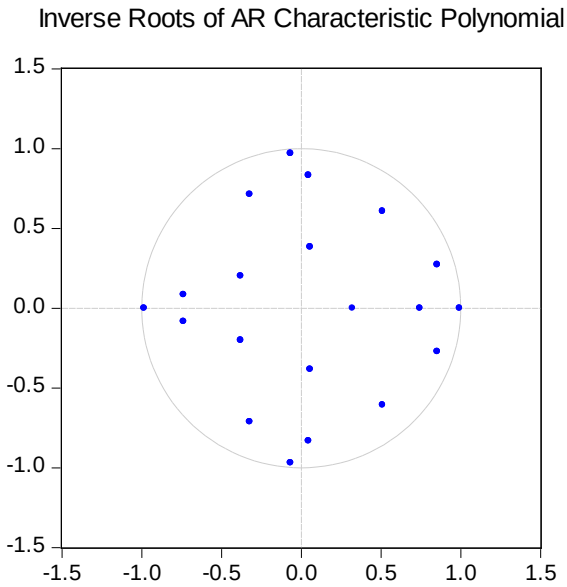

Figure A3: Model Stability Using the AR Inverse Roots Test