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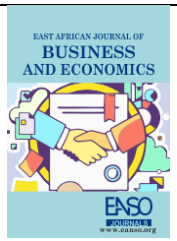

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Original Article

Asymmetric Analysis of the Impact of Taxation on Unemployment in Uganda

James Mukoki[1], Ibrahim Mukisa[1], Kurayish Ssebulime[2] & Edward Musoke[1]*

[1] Makerere University, P. O. Box 7062 Makerere Uganda.
[2] National Planning Authority, P. O. Box 21434, Kampala, Uganda.
* Correspondence ORCID ID: https://orcid.org/0000-0002-3043-7479; Email: james.mukokison@gmail.com

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ABSTRACT

Uganda, like most developing countries, has one of the highest tax rates not only in Africa but also in the world. This explains the numerous challenges faced in mobilizing sufficient revenues to fight poverty and improve people's economic welfare. We, therefore, use a more recent nonlinear autoregressive distributed lag model (NARDL) to analyze the impact of higher taxes on the unemployment rate in Uganda. Results indicate that total Unemployment in Uganda is a negative function of both an increase in tax and a negative change in tax. Specifically, if taxes increase, then unemployment decreases by almost 3.9%, and if taxes decrease, then unemployment increases by about 4.9%. Also, the unemployment level decreased by 0.06% with a decrease in the gross capital formation (GFKF). Finally, unemployment also decreases with a rise in GDP and decreases with a decrease in GDP. In a nutshell, Uganda lacks the possibility of making the economy more productive and thus only relies on taxing an already overtaxed economy. Overtaxing an economy kills the possibility of ever building a formidable capital base that can stimulate economic growth and reduce poverty and unemployment. The government, therefore, should cut taxes and level the playing field regarding tax policies for foreign and home-grown investors. Finally, policymakers should also aim to unlock the potential of the informal sector not only to create jobs but also to widen the tax base.

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INTRODUCTION

In public finance and, more lately, public sector economics in particular, taxation occupies a central role in business operation, national building, prosperity, and growth (Bartkus, 2017; Bikas & Jurevičiūtė, 2016). In developing countries like Uganda, taxation is a major funding source for economic activities. According to the Tax Justice Network of Africa (TJNA), a tax is defined as a fee that is levied by the government and collected through its tax bodies on any transaction of a commercial nature or productive activities to raise funds to fund government priorities (Pohwani et al., 2019). On the other hand, the International Labor Organization (ILO) defined labor force participation as the fraction of the total labor force that is actively working. In contrast, they defined the Unemployment rate as the proportion of the population without work but actively looking for work and readily available for hire (Balleer et al., 2020).

According to the National Budget framework paper FY 2020/21-FY 2024/25, Uganda runs a double-sided tax regime; the first is geographical for residents, and the second is source-based for non-residents (MFPED, 2020b). For the case of residents operating within the boundaries of Uganda, either employed or doing business, they are subjected to some sort of tax provided the activities engaged in drive income (MFPED, 2020a). The unique feature of this tax system is that it is uniform national, and every Ugandan who is liable to pay the tax to the national tax body is obliged to register and secure a certificate of registration. The same applies to foreigners hoping to operate in Uganda (NDP III, 2020). The legal mandate of tax collection is the jurisdiction of the Uganda Revenue Authority (URA). This was created through an act of parliament under article (i) of the constitution of Uganda. Through the URA Act cap 196, the tax body administers various taxes under several acts such as Income Tax Act Cap 340 (ITA), Value Added Tax Act Cap 349, Customs Tariff Act Cap 337, East African Customs Management Act, Excise Tariff Act Cap 338, Stamp Duty Act 2014 and finally the various Finance Acts (MFPED, 2020b).

Through the Income Tax Act (ITA), Uganda is home to several taxes. Among these include the income tax that is imposed on the incomes of the corporations operating in Uganda, also known as direct tax. This form of tax is operationalized when making payments such as employment income, dividend income interests, and other professional fees. In the case of non-residents, this tax is levied directly on the incomes earned from sources within the country, such as dividends, interest, and royalties (NDP II (2015/16 – 2019/20), n.d.). Under this tax, there is a withholding tax of 15% on payments and 6% on goods (GoU, 2018). According to the Budget speech FY 2020/21, to eliminate double taxation and allocate taxing rights, Uganda has signed double taxation treaties (DTTs) with several countries, including South Africa, Zambia, Mauritius, UK, Italy, Denmark, India, Netherlands, and Norway (MFPED, 2020a). Other than the direct income tax, the government also levies indirect taxes on consumption goods and services, such as value-added tax (VAT), import duty, export duty, and excise duty. Over the years, the standard rates of VAT have hovered around 18%. This rate varies depending on exemption options for different commodities or services (Mawejje & Munyambonera, 2016). Such persistently high taxes that seem not to be commensurate with service delivery have stimulated a raging debate among the international development partners, between those fronting tax cuts versus debt forgiveness as a solution to the low levels of growth and poverty ravaging most of the low-income countries (LIC) (Pohwani et al., 2019), this debate continues to date even though rich countries have in the past written off debts to poor countries but to avail (Oryema et al., 2017).

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Some of the tax rates in Uganda are among the highest in the world. For instance, a 10 to 45% tax rate kicks in at 475 USD of income, not to mention the 18% value-added tax (VAT) added on everything that one buys (MFPED, 2020d). Traditionally, a standard income tax rate in Uganda has hovered around 30% (Ssewanyana & Okidi, 2008; Terefe & Teera, 2018), although this may vary with the level of income earned by the taxpayer. Such high tax rates make it extremely impossible to build capital in low-income countries, and Uganda is no exception. This then implies less is built in terms of physical capital, such as infrastructure like roads, rails, factories, and electricity, and human capital, such as quality high-tech schools. Worse still, Uganda has the lowest wage workers in the world. Besides, there is no minimum wage in the country, which implies that workers are left at the mercy of the employers, resulting in exploitation. Such brutal, oppressive tax regimes scare away potential job creators such as big multilateral corporations (Davies et al., 2021). These alarming tax rates in Uganda have killed any prospects of economic development.

One of the reasons for such high tax rates is the need to raise enough resources to repay loans, however, tax increases cannot raise any resources if the economy is killed (Mawejje & Munyambonera, 2016; Terefe & Teera, 2018). Thus, such high tax rates have locked Uganda into an unending vicious circle of gruesome poverty and economic depression, which has resulted in high youth unemployment. Thus, if countries such as Uganda do not cut back or reverse their tax rates, economic growth will be difficult, and unemployment, disease, poverty, and hunger will be rampant and, in some cases, permanent. Therefore, the present study was promised on these grounds to investigate the impact of tax rates on unemployment rates in Uganda.

AN OVERVIEW OF THE FISCAL SECTOR AND UNEMPLOYMENT IN UGANDA

The last decades have seen major changes in Uganda's taxation structure. For instance, there has been a rise in the share of domestic tax revenue from 50% ten years ago to approximately 54% in FY 2017/18, 55.5% in FY 2019/20, and 53.5% in FY 2020/21 (MFPED, 2020d). The share of non-tax revenue has averaged 3% for the same period, and the share of international trade tax has continuously reduced from 48% to 42% in 2019. This decline may be explained by an increase in the contribution to the tax envelope from the domestic taxes (MFPED, 2020b). According to the Budget speech FY 2018/19, the overall tax revenue was reported at UGx 16,358.76 billion, of which UGx 15,938.80 billion was tax (TR) and UGx 419.96 billion was non-tax revenue (NTR). From July 2018 to April 2019, direct taxes stood at 4,191.44 billion, surpassing the target of UGx 3,921.74 billion. Other direct taxes that registered surpluses were PAYE at UGx 132.64 billion and Corporation tax at UGx 186.54 billion. On the other hand, deficits were reported in withholding tax at UGx 0.80 billion, tax on bank interest at UGx 26.45 billion, presumptive tax at UGx 5.48 billion, rental tax at UGx 5.37 billion, other income tax at UGx 6.61 billion and casino tax at UGx 4.73 billion (BoU, 2020; MFPED, 2020a). The improved performance in income taxes observed in this period can be ascribed to increased contributions from the private sector due to increased recruitment and commensurate improvements in the salaries of workers. For the case of corporate income tax, it was mainly attributed to recovery in arrears and improved profitability of firms (MFPED, 2020b).

Turning to the indirect taxes (VAT and Excise Duty) levied on consumption goods and services. For the period FY 2018/19, there was a short of UGx 19.26 billion from a target of UGx 3,268.21 billion (MFPED, 2020a). Whereas VAT was above target by UGx 84 billion at UGx 2,134.02 billion, excise duty fell below target by 104.07 billion. Tax evasion on OTT was reported as the main reason for this shortfall, particularly due to non-compliance through the use of Virtual Private Networks (VPNs) (BoU, 2020; MFPED, 2020c). The total resource envelope has continuously improved in recent years. For instance, according to the Budget speech for FY 2020/21, the total resource envelope was UGx 45,493.7 Billion, out

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of which domestic resources accounted for UGx 25,585.6 Billion, internal and external financing accounted for UGx 3,560.3 Billion and UGx 9,515.3 Billion, the general budget support was UGx 2,906.7 Billion, while domestic refinancing and Appropriation in AID amounted to UGx 7,486.1 Billion and UGx 215.6 Billion respectively. Despite the above hiccups, Uganda has seen tremendous improvements in its revenue mobilization efforts. For instance, the revenue-to-GDP ratio currently stands at 15.8%, up from 155 reported in FY 2017/18.

On the side of employment and labor force participation, Statistical evidence from the State of the Economy Report 2020 (Ainomugisha et al., 2020; MFPED, 2020d) indicates that the national unemployment rate decreased to 9.2% in 2019 from 12% reported in 2016, while labor force participation rate rose by 1.2 million to 10 million people from 8.8 million persons in the same period, where only 1.3 worked in the formal jobs while the rest were concentrated in the informal sector. According to the Uganda National Household Survey (UBOS, 2018), Kampala city had the highest rates of unemployment at 21%, West Nile at 35, and unemployment was highest among the youth (15-24) at 17% and lowest for those aged 31-64 at 5%.

EMPIRICAL LITERATURE

To date, much of what we know about the taxation versus employment nexus and its impact on public expenditure lies in macroeconomics (Kotlikoff et al., 1984; Shin et al., 2012), through the traditional Keynesian model of economic growth, where taxes affect households consumption through reducing the disposable income available for household consumption if the taxes are high, disable income reduces and thus consumption reduces, and given the fact that under these models income is either consumed or saved, thus a high tax on incomes reduces savings to (Kotlikoff et al., 1984). Empirically there have been several studies investigating the impact of taxes on different macroeconomic various, and these among others include (Almunia et al., 2015; Mawejje & Munyambonera, 2016; Ssewanyana & Okidi, 2008; Terefe & Teera, 2018) in Uganda and (Alloza, 2020; Ameyaw et al., 2015; Bartkus, 2017; Bikas & Jurevičiūtė, 2016; Bilek et al., 2021; Davies et al., 2021; Ewa et al., 2020; Hamoudi, 2019; Hoppe et al., 2020; Hysa, 2019; Levell et al., 2020; Lyeonov & Michalkova, 2021; Merima et al., 2012; Park & Park, 2018; Pohwani et al., 2019; Sahebe et al., 2020; Sari & Mulyati, 2018) conducted elsewhere as discussed below.

In a study by Terefe and Teera (2018) among East African countries, the authors empirically examined the significant determinants of tax revenue using panel data from 1992 to 2015, applying the panel cointegration approach. Two estimation techniques based on FGLS and the dynamic panel data GMM model are applied in the long run. Several interesting findings are revealed in the long run. For instance, per capita GDP, Foreign Aid, trade openness, and the shares of agriculture, industry, and service had positive associations with tax revenue, while inflation, exchange rate, and urbanization had negative contributions to the tax revenue among the study countries. In the case of the short run, the PVECM's one-period lagged tax revenue together with urbanization had negative effects on tax revenue, while the two periods' lagged values for urbanization and the exchange rate had a positive impact. Although this was a macro-level study, the authors ignored the impact of unemployment on tax revenue. In an earlier study by Merima et al., (2012) the author made use of perception and attitude data from the Afrobarometer to explore the determinants of tax compliance behavior among the EAC member states and South Africa as an extension. Their results indicated that the difficulty of tax evasion and satisfaction with public service are significant determinants of tax compliance attitudes among the citizens of the four countries. Closely related findings are found in (see., Bartkus, 2017; Bilek et al., 2021; Hamoudi, 2019; Hysa, 2019). Despite the fact that perception is best studied based on structural equation models and path analysis, none is applied in the above studies.

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In a microsimulation study of the Ugandan tax system and poverty status based on Uganda's national household survey of 1999/00 (UNHS I) from 1999 to 2003, Ssewanyana and Okidi (2008) found that increasing VAT worsens the tax burden of the poor households and that this constitutes the most significant portion of tax burden incurred by the poor followed by excise duties and graduated tax. In another study by Mawejje and Munyambonera (2016) to analyze tax revenue performance in Uganda, the authors estimated sectoral elasticities of output growth and public expenditure by applying a simple analytical model for tax revenue performance and ARDL bounds test framework. Their results indicate that rampant dependence on agriculture and the informal sector affects the performance of the tax system. Further, they also find that development spending, industrial growth, and trade openness have a positive relationship with tax performance. A closely related study to this is by Alloza (2020), who examines the impact of taxation on income mobility in the USA using a panel data set of married households from 1967 to 1996. After controlling for exogenous variation in marginal tax rates using counterfactual rates in legislated changes in the tax structure, his results indicate that a 1% rise in tax rates reduces income difference between different deciles by 0.5 percentage points. In addition, a 7% reduction in marginal rates causes a tenth average movement in income distribution. Lastly, his findings point to the importance of human capital on the impact of taxes on income mobility. These findings collaborate with those of (Ameyaw et al., 2015; Sari & Mulyati, 2018), who analyzed the impact of tax evasion on taxation.

The impact of taxes has even been extended to study the FDI both at the intensive and extensive margin by Davies et al. (2021). In their study to examine the firm-level investments across countries in Europe between 2007 and 2015, their results indicate that indeed taxes particularly operate on an extensive margin. That is, the firm's decision on whether to invest is affected by taxes compared to how much to invest. Further, they also found that there was significant variability among firms with limited investments from countries with high taxes. Closely related results can be found in Lyeonov and Michalkova (2021) on the Impact of Tax Effects on profit optimization carried out in Ukraine and on the impact of tax relief on public finance by Bikas and Jurevičiūtė (2016) in Lithuania.

MATERIALS AND METHODS

Conceptual Framework on Taxation

All that we know about the impact of taxation on unemployment is through an indirect channel (Campbell, 1993; Kotlikoff et al., 1984; Shin et al., 2012). From the Keynesian consumption function, high taxes reduce the disposable income available to the consumer to spend on consumption. At a macro level, higher income taxes lead to layoffs of workers common mostly during economic and financial crises. Such layoffs contribute to high unemployment levels. However, from the above empirical literature, there seems to be no specific model that explains the direct link between taxation and employment. We thus conceptualize the link between taxation and unemployment following the (1993) model of fiscal sociology and Pohwani et al.'s study on taxation and unemployment in Pakistan.

The assumption here is that increased taxes raise the unemployment rates of the country with varying levels of magnitude. For instance, a raise in taxes means that the cost of production increases, thus increasing prices for the goods produced. In the face of such persistently increasing taxes, producers and owners of firms are forced to cut down on their production. This leads to fewer job openings and, hence, multiple worker layoffs, resulting in an increasing unemployment rate. The direction of the impact can run either way, but for the sake of this exposition, we focus on unidirectional links. To capture the complete picture of the impact of taxation on unemployment, it is imperative first to understand factors that mediate, moderate, and control variables operating on different stages of this delicate interaction. In this sequential conceptualization, the type of crisis mediates the impact of political response to the crisis by

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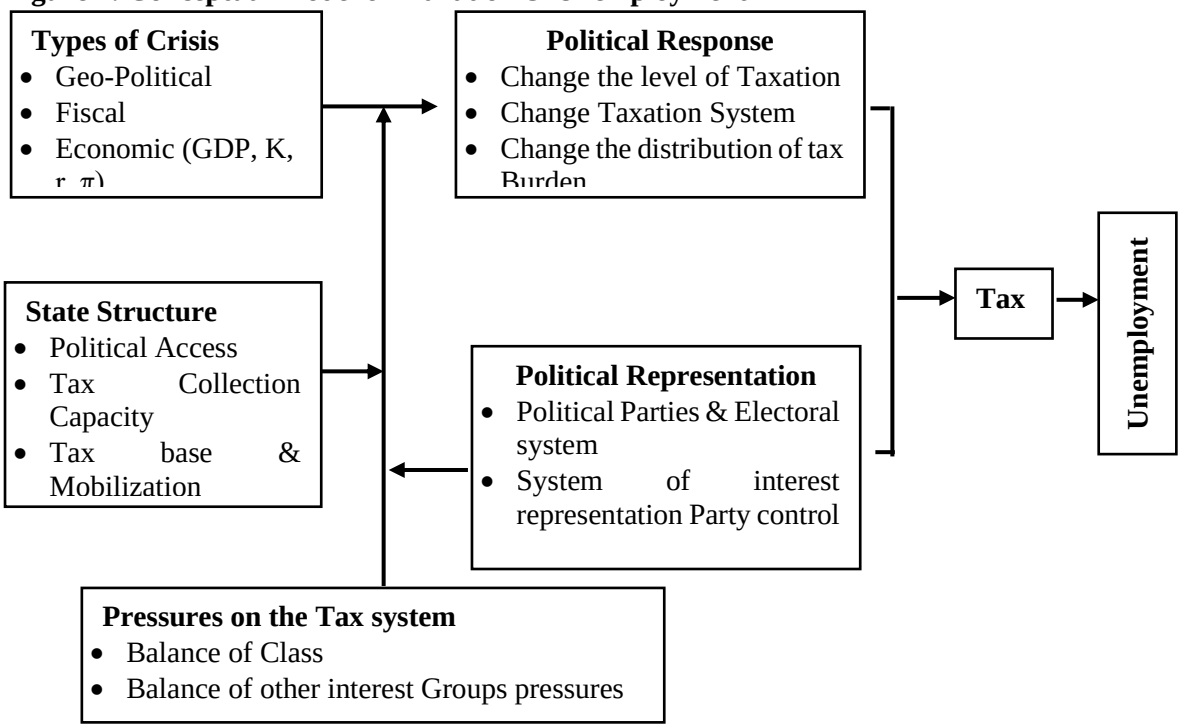
policymakers through altering taxation measures that result in either a high or low unemployment rate. On the other hand, several other mediator variables (e.g., social class groups) influence how taxation impacts unemployment. For instance, castes and social groups in society always want to take advantage of influencing tax policy direction since different groups have varying levels of taxation tolerance and interests regarding tax preference (either progressive or regressive). Thus, in today's society, political connections greatly determine taxation policy direction; a case in point is the over-the-top tax (OTT) in Uganda.

Lastly, systems of political representation, e.g., type of political dispensation, mediate the impact of social groups and class on political response. According to (993), the quality and arrangement of institutions also mediate the impact of social groups on policymakers' responses to any fiscal-related crisis in the economy.

Figure 1: Conceptual Model on Taxation & Unemployment



Source: Modified from Campbell, (1993)

METHODS AND MATERIALS

Data Source

This study uses data from (1970-2018) mainly from the World Bank's Development Indicators and Bank of Uganda of Uganda (BoU). These two sources provide a host of very informative information on the key macroeconomic variables, as discussed in *Table 1* below. Data on taxation, unemployment, savings, labor force participation, and capital formation are derived from World Develomen Indicators (WDI) and Bank of Uganda (BoU). This information is derived from government budget documents and budget framework papers, and other official government documents, such as the national statistical abstract from UBOS and country reports from both the IMF and the World Bank. Information about taxes from the World Bank is highly preferred to local sources due to its consistency, unlike local sources that contain a lot of missing data points. In our estimation technique, the large sample considered and the length of the series proposed neutralizes the problem of missing values in the data set. The definitions, measurements, and sources of the study variables are discussed in *Table 1* below.

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Table 1: Variables Description and Data Sources

Variable name	Symbol	Definition/measurement	Source
		Growth variables	
Unemployment	Un-EM	The total people number of unemployed in Uganda in a given year	World Bank (WDI)
Tax	Log tax	This is the tax less subsides in local currency	World Bank (WDI)
Capital	GFKF	This is the real gross fixed capital formation (% of GDP)	World Bank (WDI)
(GDP-growth)	GDP	Percentages increase in GDP per year	World Bank (WDI)/ Bank of Uganda

Note: *Due to various types of taxes, it was difficult to rely on a single value*

Source: Author's compilation from the literature review.

Unit Root Test

A series is said to be stationary if the statistical properties, such as the mean, variance, and covariance of the distribution, are constant over time (Andren, 2007; Greene, 2002; Gujarati, 1995). In other words, when the time series exhibits no trend, then it is said to be stationary. However, a non-stationary time series will exhibit some trends. A test of stationary is thus deemed important in time series regression analysis because if the series are non-stationary, then the regression results will be spurious (Baltagi, 2021; Dougherty, 2001; Woolridge, 2000), meaning the results do not make sense. Therefore, to make any meaningful regression analysis, we have to make the series stationary. We thus apply the differencing method to stabilize the mean of the series by removing changes in the level of the time series to eliminate any possibility of trendiness. Below we carry out the unit root test of Stationarity by applying the Augmented Dickey-Fuller (ADF) test at both levels and first difference, checking for trend and intercept statuses. The Akaike information Criteria (AIC) is used to determine the optimal lag length as shown in *Table 2* below.

Table 2: Unit Root Rest for Stationarity (Augmented Dickey-Fuller)

Variables	Level		1st Difference		Integration
	Intercept	Intercept & trend	Intercept	Intercept & trend	
Unemployment	0.0221	0.0844	0.0004	0.0021	I(0)
Tax	0.6614	0.1335	0.0000	0.0000	I(1)
Capital formation	0.0001	0.0001	0.0000	0.0099	I(0)
GDP	0.0029	0.0133	0.0000	0.0000	I(0)

Source: Author's Computations from Study Data

The null hypothesis is that the time series has a unit root (meaning that the series is non-stationary) against the Alternative hypothesis that the time series has no unit root (meaning the series is stationary). If the probability of the unit root is less or equal to 5%, then reject the null and conclude that the series has no unit root and is thus stationary (Hayashi, 2000). From the results above, unemployment and capital formation series are stationary at the same level, while GDP and taxes are stationary at the first difference.

Notice that the error correction model result has two parts. First, there are the long-run components for the dependent variable and the short–run component with the difference operator in front of them. In this case, the best parsimonious model determined by the optimal lag selection criterion is ARDL (3, 2, 4, 2, 2, 4, 4), that is to say 3 lags for unemployment, 2 lags of GFKF-Positive, 4 lags for GFKF-Negative, 2 lags for GDP-Positive, 2 lags for GDP-Negative, 4 lags for Tax-Positive and finally 4 lags for Tax-Negative. The error correction from the cointegration equation CointEq (-1)* = -0.5174, which shows the speed of adjustment takes on the correct sign, and it is statistically significant, confirming further there is cointegration in this model.

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Table 3: ARDL Error Correction Regression for Cointegration Test

Selected Model: ARDL (3, 2, 4, 2, 2, 4, 4)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.989126	0.187523	5.27468	0.0001
D(TOTALUN(-1))	0.751841	0.119275	6.303402	0.0000
D(TOTALUN(-2))	0.533827	0.119487	4.467662	0.0003
D(GFKF_POS)	-0.006709	0.007099	-0.945145	0.3578
D(GFKF_POS(-1))	-0.02769	0.009512	-2.91113	0.0097
D(GFKF_NEG)	-0.043938	0.009154	-4.80001	0.0002
D(GFKF_NEG(-1))	-0.065183	0.010111	-6.446702	0.0000
D(GFKF_NEG(-2))	-0.053988	0.007159	-7.541739	0.0000
D(GFKF_NEG(-3))	-0.024949	0.007265	-3.433989	0.0032
D(GDP1_POS)	0.224693	0.03911	5.74516	0.0000
D(GDP1_POS(-1))	0.212068	0.047558	4.45918	0.0003
D(GDP1_NEG)	-0.130336	0.04606	-2.829719	0.0116
D(GDP1_NEG(-1))	0.304111	0.040727	7.467008	0.0000
D(LTAXUS_POS)	-0.214384	0.153448	-1.397111	0.1804
D(LTAXUS_POS(-1))	1.419216	0.211312	6.7162	0.0000
D(LTAXUS_POS(-2))	0.642324	0.126763	5.067135	0.0001
D(LTAXUS_POS(-3))	0.380386	0.093341	4.075255	0.0008
D(LTAXUS_NEG)	-0.009656	0.409342	-0.023589	0.9815
D(LTAXUS_NEG(-1))	1.296955	0.539396	2.404457	0.0279
D(LTAXUS_NEG(-2))	4.107944	0.617287	6.654833	0.0000
D(LTAXUS_NEG(-3))	1.667052	0.480606	3.468649	0.0029
CointEq(-1)*	-0.517436	0.068751	-7.526238	0.0000

Source: Author's Computations from Study Data

Table 4: Asymmetric Long-Run Bound Test of Cointegration

F-Bounds Test	**Null Hypothesis: No levels of relationship**			
Test Statistic	**Value**	**Significance**	**I(0)**	**I(1)**
	Asymptotic: n=1000			
F-statistic	5.981071	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43
t-Bounds Test	**Null Hypothesis: No levels of relationship**			
Test Statistic	**Value**	**Significance**	**I(0)**	**I(1)**
t-statistic	**-5.01132**	**10%**	**-2.57**	**-4.04**
		5%	-2.86	-4.38
		2.50%	-3.13	-4.66
		1%	-3.43	-4.99

Source: Author Computations Study Data

From the bound test results above, we see that the F-statistic (5.981) is higher than all the Pesaran upper bound critical values for both level and first difference at all levels of significance, i.e., (1%, 5%, and 10%) when asymmetry is taken into account then the variables under study here became cointegrated. And there is a long-run relationship between the variables (Eichhorn & Gleißner, 2016; Shin et al., 2014).

Estimation Strategy

The motivation for this study is to decompose the impact of taxes into their respective positive and negative effects and also analyze the impact of these effects on unemployment in Uganda. This is done through the application of the Nonlinear Autoregressive Distributed lag Model (NARDL), which was developed by (Shin et al., 2014). Initially, a linear function is given as in Eq (1).

$$y = f(X_1, X_2, X_3) \quad [1]$$

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By including both positive and negative effects, the function changes into a nonlinear function form, as shown below. This implies considering Asymmetry (Bahmani-Oskooee & Aftab, 2017).

$$y = f(X_{1t}^{+}, X_{1t}^{-}, X_{2t}^{+}, X_{2t}^{-}, X_{3t}^{+}, X_{3t}^{-}) \qquad [2]$$

In this case, Y is unemployment, $X1$ is taxes, $X2$ is GDP, and $X3$ capital formation. Based on the simple one-variable case estimation Eq (3). This equation gives an asymmetric long-run regression model where the effects of the regressor on the outcome variable are decomposed by the NARDL model into positive and negative effects, as shown below as done by (Shin et al., 2014). Now, a simple exposition of the NARDL model is given below.

$$y_t = \beta_0 + \beta_1 X_t^{+} + \beta_2 X_t^{-} + \upsilon_t \qquad [3]$$

Where y the target is variable, which is total unemployment in our case, X is the regressor of interest, and β_1 is the change in y per unit change in X (i.e., captures the direction and magnitude of Y's reaction to change in X). To capture the effects of asymmetry, NARDL decomposes X into two parts: first, the partial sum of positive changes in X, denoted by, and second, the partial sum of negative changes in X, denoted as X^{-}, both the negative and positive effects are included in the model as separate explanatory variables. According to (Shin et al., 2014), the above specification leads to three unique outcomes. First is the relationship, which is indicated by the significance of the coefficient, secondly the sign of the coefficient, which shows the direction and the magnitude of the coefficient due to changes in Xt, where;

$$\left.\begin{aligned} X_t^{+} &= \sum_{j=1}^{t} \Delta X_j^{+} = \sum_{j=1}^{t} \max(\Delta X_j, 0) \\ X_t^{+} &= \sum_{j=1}^{t} \Delta X_j^{-} = \sum_{j=1}^{t} \min(\Delta X_j, 0) \end{aligned}\right\} \qquad [4]$$

Following (Bahmani-Oskooee & Harvey, 2017; Nagar et al., 2019; Shin et al., 2014) modeling framework, the NARDL cointegration approach assumes that the response of the dependent variable. y_t increases (+) and decreases (-) with each independent variable X_{it} and this effect change is asymmetric. Accordingly, therefore, the non-linear model for this study takes the following form. Estimation of non-linear ARDL models was advanced by Shin et al. (2011)

$$\Delta Y_t = \beta_0 + \sum_{i-1}^{p-1} \gamma_i \Delta Y_{t-1} + \sum_{i=0}^{q} \delta_i^{+} \Delta X_{1t-i}^{+} + \sum_{i=0}^{q} \delta_i^{-} \Delta X_{1t-i}^{-} + \sum_{i=0}^{q} \lambda_i^{+} \Delta X_{2t-i}^{+} + \sum_{i=0}^{q} \lambda_i^{-} \Delta X_{2t-i}^{-} + \sum_{i=0}^{q} \alpha_i^{+} \Delta X_{3t-i}^{+} + \sum_{i=0}^{q} \alpha_i^{-} \Delta X_{3t-i}^{-} + \rho Y_{t-1} + \varphi_1^{+} X_{1t-1}^{+} + \varphi_1^{-} X_{1t-1}^{-} + \varphi_2^{+} X_{2t-1}^{+} + \varphi_2^{-} X_{2t-1}^{-} + \varphi_3^{+} X_{3t-1}^{+} + \varphi_3^{-} X_{3t-1}^{-} + \upsilon_t \qquad [5]$$

The variables are still defined as before; the first part with summations indicates the short-run terms, and the second part constitutes the long-run terms. NARDL short-run terms coefficients are; $\gamma_i, \delta_i^{+}, \delta_i^{-}, \lambda_i^{+}, \lambda_i^{-}, \alpha_i^{+}, \alpha_i^{-}, \phi_i^{+}, \phi_i^{-}$, NARDL long run coefficients with asymmetric terms; ρ, φ_1^{+}, φ_1^{-}, φ_2^{+}, φ_2^{-}, φ_3^{+}, φ_3^{-}, while υ_t is the disturbance term (white noise). The coefficients in the long run are used in testing the hypothesis, as shown below.

Wald Test For Long-Run Asymmetry

To analyze the long–run asymmetric effects of Xs on Y, we run the Wald test. In this case, if a long-run relationship exists (Bounds Test), we proceed to test if this difference in the asymmetric coefficients is statistically significant (Shin et al., 2014), and the hypothesis below is tested.

$$\left.\begin{aligned} H_0 &= \frac{-\varphi_i^{+}}{\rho} = \frac{-\varphi_i^{-}}{\rho} \\ H_A &= \frac{-\varphi_I^{+}}{\rho} \neq \frac{-\varphi_I^{-}}{\rho} \end{aligned}\right\} \qquad [6]$$

From the above, if we reject the null hypothesis, it means we have long-run asymmetry, in other words, the magnitude of change in Y when X increases is not the same as when X decreases. Similarly, in the short run asymmetric effects of X on Y are represented by;

$$\sum_{i=0}^{q} \delta_i^{+} = \sum_{i=0}^{q} \delta_i^{-} \qquad [7]$$

Following from above, if the long-run and short-run symmetry is rejected, we then conclude that the impact of X on Y is asymmetric (Bahmani-Oskooee & Alse, 1993).

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Asymmetric Dynamic Multipliers

The dynamic multipliers in this case help to show how the changes in the outcome variable Y_t adjust to its new long-run equilibrium following positive or negative shocks in X_t. Following (Nagar et al., 2019), the cumulative dynamic multiplier effects of X_t^+ and X_t^- on Y are evaluated as;

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial X_t^+} \quad , \; m_h^- = \sum_{j=0}^{h} \frac{\partial Y_{t+j}}{\partial X_t^-} \; , for \; h = 0, 1, \ldots \ldots \qquad [8]$$

$$where \; if \; h \to \infty, \; then \quad m_h^+ \to \frac{-\varphi_i^+}{\rho} \quad and \quad m_h^- \to \frac{-\varphi_i^-}{\rho}$$

RESULTS AND DISCUSSION

Descriptive Statistics

In the interpretation of the long-run form and bounds test results obtained, it is important to note that there are four useful pieces of information about the results below. First is the Asymmetric Error correction model result reported in *Table 6* above. Second is the long-run model result, the error correction term, which is the residual definition of the long-run model, which shows the speed of adjustment, and finally, the F-Bounds test statistic, which shows that all our study series are cointegrated of order zero and one. The analysis results in *Tables 3* and *6* are generated from equation (5).

Concerning the long-run components, we find that unemployment levels in the past periods (lagged terms) have a negative association with the current period total unemployment level and are reduced by 0.517 units. In addition, the results from *Table 6*, indicate that both positive (LTAXUS_POS (-1)) and negative (LTAXUS_NEG (-1)) shocks in the taxes hurt the total unemployment rate in the country and that unemployment reduces by 2.058 and 2.567 units for positive and negative changes respectively, this result is similar to that by (Pohwani et al., 2019) in Pakistan and (Mawejje & Munyambonera, 2016) in Uganda. Turning to the gross fixed capital formation, we find mixed effects. For instance, the findings show that a positive shock (GFKF_POS (-1)) in gross fixed capital formation has a negative causal effect on total unemployment, reducing total unemployment by about 0.0312 units, while a negative shock (GFKF_NEG (-1)) in gross fixed capital formation has a positive causal effect on total unemployment, increasing total unemployment by almost 0.0166 units. For GDP, the long-run components show that both positive (GDP1_POS (-1)) and negative (GDP1_NEG (-1)) shocks in GDP have a negative causal impact on the total unemployment rate in Uganda, reducing the total employment rate by about 0.0414 and 0.3890 units respectively. The explanation for this result is that poor countries like Uganda rarely reduce their taxes but keep on increasing them and creating new ones. A case in point is the recently instituted OTT tax on social media usage. Such as tax kills the potential for online businesses to thrive.

Turning now to the short-run components, the study finds that both the first and second lags of the total unemployment rate in the past period have a positive causal effect on total unemployment in the present period, and they raise total unemployment by 0.7518 and 0.5338 units for the first and second lags respective. Turning to the gross fixed capital formation (GFKF), we find that when GFKF increases at level (D (GFKF_POS)) by 1-unit, total unemployment decreases by about 0.07 units, while it decreases by 0.03 units in the past periods. On the other hand, when GFKF decreases at this level, total unemployment also decreases by about 0.04 units. Further, the results indicate that a one unit reduction in the first, second and third lags of Gross Fixed Capital Formation (GFKF) i.e. D(GFKF_NE (-1)), D(GFKF_NE (-2)), D(GFKF_NE (-3)), leads to reduction in the total unemployment by 0.07, 0.05 and 0.02 units respectively.

The impact of GDP on total unemployment is diverse. An increase in GDP growth rates by 1 unit at a level increases total unemployment by about 0.22 units, while an increase in the first lag

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GDP in the past period raises total unemployment by 0.21 units. A decrease in GDP growth rates, on the other hand, has mixed effects. For instance, a decrease in GDP growth rates at level D(GDP1_NEG) decreases total unemployment by 0.13 units, while a decrease in the first lag of GDP growth rates D(GDP1_NEG(-1)) increases total unemployment by 0.30 units.

Results from *Table 7* above show that an increase in taxes at the level reduces the total unemployment rate by 0.21 units, whereas an increase in the first, second, and third lags of taxes in the past period significantly increases the total unemployment rate by 1.42, 0.64 and 0.38 units in that order. Conversely, we see that a reduction in the first, second, and third lags of taxes is associated with a reduction of about 1.30, 4.10, and 1.67 units in total unemployment and the effect is significant for the reduction in the second and third lags of taxes.

The levels equation is used to calculate Asymmetric Cointegration components. We see that the total unemployment in Uganda is a negative function of positive change in gross capital formation GFKF_POS and a positive function of a negative gross capital formation GFKF_NEG, specifically if GFKF decreases (GFKF_POS) then total unemployment decreases by about 0.06%. If Gross fixed capital formation decreases (GFKF_NEG), total unemployment also increases by about 0.035%. On the other hand, unemployment is a negative function of both positive and negative changes in GDP, particularly if GDP increases (GDP_POS). Unemployment decreases by about 0.08%, and if GDP decreases, then unemployment also decreases by about 0.75%. Lastly, we find that total unemployment is a negative function of both an increase in tax (LTAXUS_POS) and a negative LTAXUS_NEG change in tax. Specifically, if taxes increase (LTAXUS_POS) then unemployment decreases by almost 3.97% and if taxes decrease (LTAXUS_NEG) then unemployment increases by about 4.96%, this result collaborates with that by (Pohwani et al., 2019) on the impact of taxes on unemployment in Pakistan and (Bahmani-Oskooee & Aftab, 2017) on asymmetric effects on exchange volatility on trade flows between the US and Malaysia.

To test whether the difference between coefficients of the POS and NEG is statistically significant, we turn to the Wald test above from Eq (6). From these results, since the chi-square p-value is statistically significant for taxes and GDP, we have evidence for long-run asymmetry concerning taxes and GDP to total unemployment. This implies that there is a non-linear relationship between unemployment rates, taxes, and GDP (Nagar et al., 2019). However, there seems to be no evidence for a long-run association between unemployment and gross capital formation. This approach is similar to that used by (Shin et al., 2014). Other approaches can be found in (Bahmani-Oskooee & Alse, 1993; Bahmani-Oskooee & Harvey, 2017)). Results from the Wald test of additive short-run asymmetry show a short-run association between taxes and unemployment but no short-run association between unemployment and GDP and GFKF. In the short run, the Wald test works by adding the POS and NEG coefficients of the study variables (Shin et al., 2014). Considering consumption (Bartkus, 2017) finds that increasing taxes tends to lower consumption to income ratio when income variability is taken into account, and the income reduction is much higher in the case of higher income scenarios.

Table 5: Summary Statistics

Variables	UNEMP	GFKF	GDP	TAX
	%	%	%	m'$
Mean	2.144642	6.880176	5.820900	647059753.7
Maximum	3.624000	40.92827	11.52324	2644451115
Minimum	0.821100	-7.949508	-3.30638	2300000
Std. Dev.	0.814789	9.733296	2.512148	748000000
Skewness	0.291889	1.531086	-0.942833	1.339366
Kurtosis	2.060993	5.869959	6.084546	3.440785

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Table 6: NARDL Long Run Form and Bounds Test

Conditional Error Correction Regression					
Variable		**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C		0.989126	0.399202	2.477755	0.024
Long Run Components	TOTALUN(-1)*	-0.51744	0.103253	-5.01132	0.0001
	GFKF_POS(-1)	-0.03117	0.021549	-1.44638	0.1663
	GFKF_NEG(-1)	0.016567	0.020963	0.790323	0.4402
	GDP1_POS(-1)	-0.04144	0.064471	-0.64274	0.529
	GDP1_NEG(-1)	-0.38902	0.113448	-3.42904	0.0032
	LTAXUS_POS(-1)	-2.05824	0.467226	-4.40523	0.0004
	LTAXUS_NEG(-1)	-2.56744	0.664639	-3.86291	0.0012
Short-run components	D(TOTALUN(-1))	0.751841	0.184611	4.072561	0.0008
	D(TOTALUN(-2))	0.533827	0.150038	3.557957	0.0024
	D(GFKF_POS)	-0.00671	0.010296	-0.65162	0.5234
	D(GFKF_POS(-1))	-0.02769	0.015103	-1.83347	0.0843
	D(GFKF_NEG)	-0.04394	0.014149	-3.10538	0.0064
	D(GFKF_NEG(-1))	-0.06518	0.018281	-3.56564	0.0024
	D(GFKF_NEG(-2))	-0.05399	0.013398	-4.02967	0.0009
	D(GFKF_NEG(-3))	-0.02495	0.010752	-2.32043	0.033
	D(GDP1_POS)	0.224693	0.058005	3.873651	0.0012
	D(GDP1_POS(-1))	0.212068	0.060334	3.514911	0.0027
	D(GDP1_NEG)	-0.13034	0.075527	-1.72569	0.1025
	D(GDP1_NEG(-1))	0.304111	0.06503	4.676491	0.0002
	D(LTAXUS_POS)	-0.21438	0.201855	-1.06207	0.3031
	D(LTAXUS_POS(-1))	1.419216	0.298301	4.757659	0.0002
	D(LTAXUS_POS(-2))	0.642324	0.161779	3.970372	0.001
	D(LTAXUS_POS(-3))	0.380386	0.123354	3.083696	0.0067
	D(LTAXUS_NEG)	-0.00966	0.533322	-0.01811	0.9858
	D(LTAXUS_NEG(-1))	1.296955	0.843732	1.537165	0.1427
	D(LTAXUS_NEG(-2))	4.107944	0.891014	4.610413	0.0002
	D(LTAXUS_NEG(-3))	1.667052	0.582186	2.863438	0.0108

Source: Author Computations Study Data

Table 7: NADRL Model Summary Statistics

R-squared	0.950619	Mean dependent variable	2.237569
Adjusted R-squared	0.872191	SD dependent variable	0.797759
SE of regression	0.285202	Akaike info criterion	0.599755
Sum squared resid	1.382781	Schwarz criterion	1.723901
Log-likelihood	14.50550	Hannan-Quinn criteria.	1.018826
F-statistic	12.12088	Durbin-Watson stat	2.043747
Prob(F-statistic)	0.000001		

Note: *The R-squared of (0.951) and F-statistic of (12.121), show that taxes and other regressor can collectively explain the impact on total unemployment in Uganda.*

Source: Author Computation

From the residual diagnostics test results, regardless of whichever statistic you look at the F-statistic =0.4570 is well above the cutoff of 5%, so this tells us that we cannot reject the null hypothesis of homoscedasticity. Secondly, we see that the p-value for the Jarque-Bera of (0.3532) is well above the 5% level, which is indicative that the data more than proceed from a normal distribution. Finally, the residuals also show that there is no serial correlation and that the model fits well the data.

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Table 8: Levels Equation and Asymmetric Cointegration

Unrestricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
GFKF_POS	-0.06024	0.046409	-1.29792	0.2116
GFKF_NEG	0.032018	0.037754	0.848069	0.4082
GDP1_POS	-0.08008	0.118547	-0.67554	0.5084
GDP1_NEG	-0.75182	0.179219	-4.19498	0.0006
LTAXUS_POS	-3.97777	0.846778	-4.69753	0.0002
LTAXUS_NEG	-4.96185	1.267871	-3.91353	0.0011
***EC** = TOTALUN - (-0.0602*GFKF_POS + 0.0320*GFKF_NEG -0.0801*GDP_POS-0.7518*GDP_NEG - 3.9778*LTAXUS_POS -4.9619*LTAXUS_NEG)*				

Source: Author Computations

Table 9: Wald Test for Long-Run Asymmetry

Variables	**Taxes**		**GFKF**		**GDP**	
Test Statistic	**Value**	**Probability**	**Value**	**Probability**	**Value**	**Probability**
t-statistic	-0.5841	0.0425	0.7928	0.4327	-0.8434	0.0241
F-statistic	0.3412	0.0325	0.6285	0.4327	0.7114	0.0141
Chi-square	0.3411	0.0292	0.6285	0.4279	0.7114	0.0190
***Note**: The degrees of freedom considered are (1, 39)*						

Source: Author computations

Table 10: Residual Diagnostic Test for NARDL Model

Testing for	**Test applied**	**P-value**	**Results**
Goodness of Fit	R-Square Test	0.950619	Data normally distributed
Normality	Jarque–Bera Test	0.3532	The model fit is good
Heteroscedasticity	Breusch–Pagan–Godfrey Test	0.4570	No Heteroskedasticity
Serial Correlation	Breusch-Godfrey Serial Correlation LM Test:	0.8344	No Serial Correlation

Source: Author computations

Stability Test

Using the Cumulative sum (CUSUM) graph *Figure 2* and the Cumulative sum of square (CUSUMQ) graph *Figure 3* below we can see that since the blue curve/line lines within the 5% boundary, this is a clear indicator that this model is stable.

Figure 2: CUSUM graph of model stability

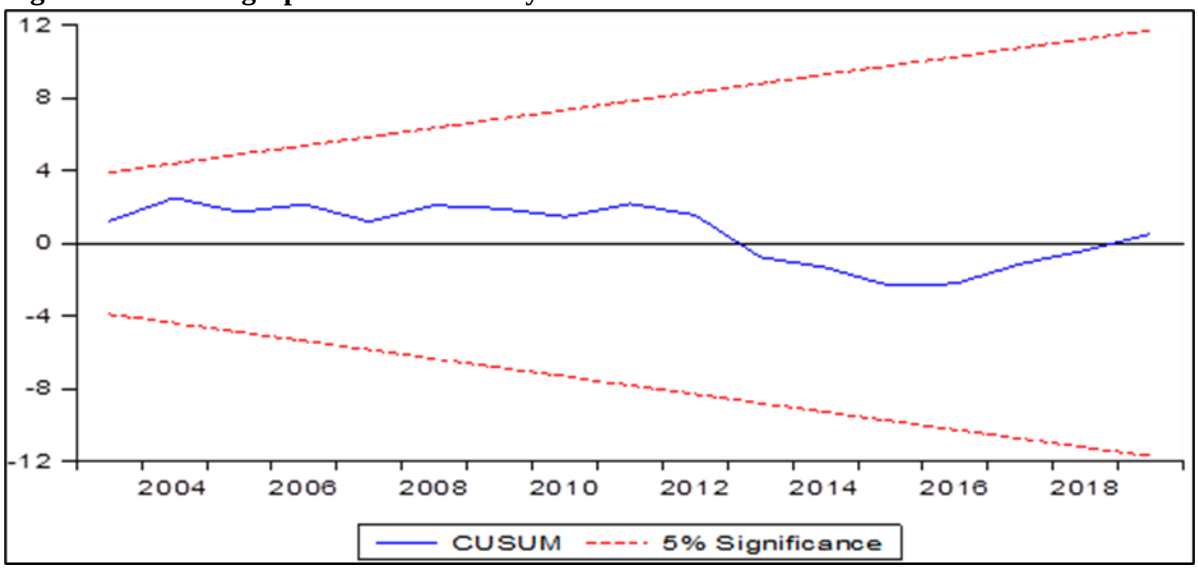

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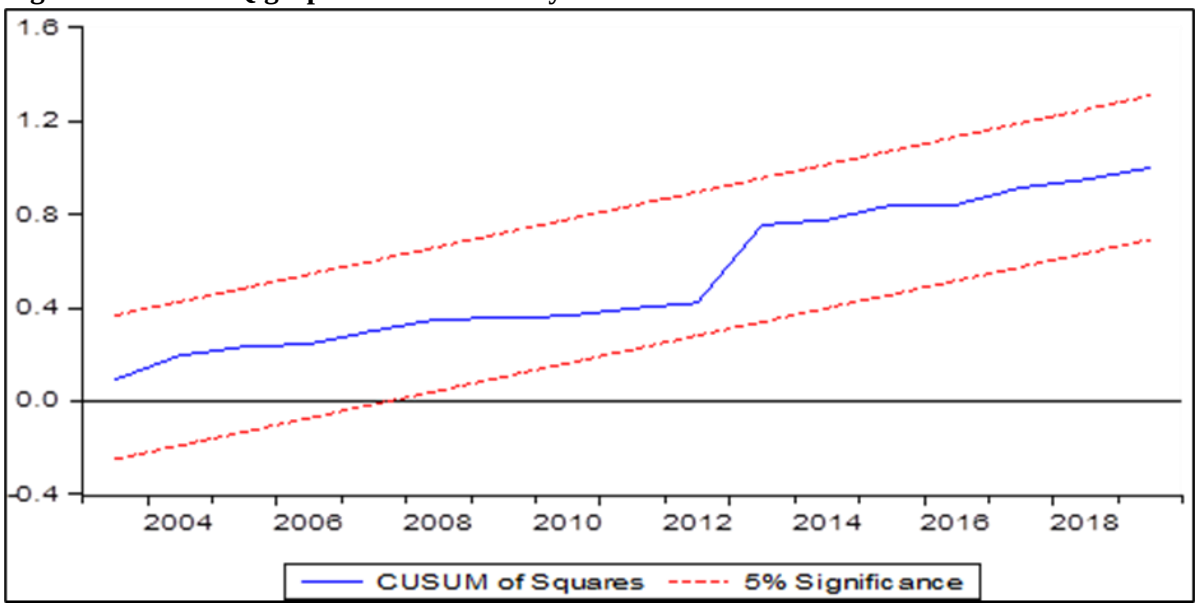
Figure 3: CUSUMQ graph of model stability



Dynamic Multiplier Graphs for Diagnostic

Graphs of asymmetric cumulative dynamic multiplier help to show the pattern of adjustment of the department variable (total unemployment) to its new long-run equilibrium following a positive (Y_POS) and (Y_NEG) unitary shock in the regressor. In this, the cumulative dynamic multipliers' effects are evaluated by Eq. (8). This leads to the multiplier graph below.

Figure 4: Dynamic multiplier graph

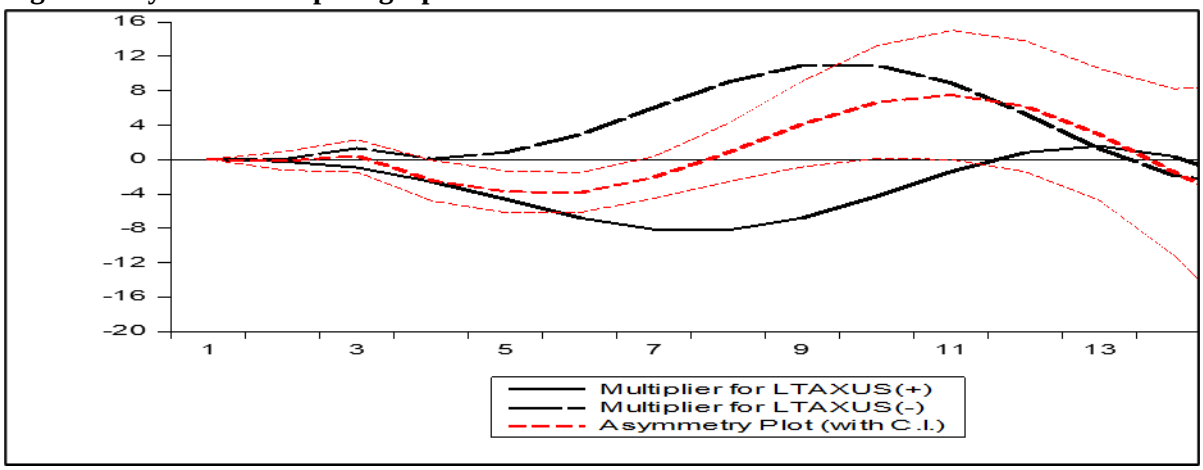


Figure 4 above lays down five key important pieces of information first, the black continuous line shows how total unemployment adjusts over the horizon due to the positive shocks (POS) in taxes, GDP, and fixed capital formation, the dashed black line shows the adjustment of total unemployment over the horizon due to a negative shock in the taxes, GDP, and GFKF. Secondly, the small dashed red line in the middle of the asymmetric plot reflects the difference between the dynamic multipliers of the positive and Negative changes in taxes, GDP, and GFKF.

CONCLUSIONS AND POLICY DIRECTION

Tax rates in Uganda are among some of the highest not only within the East African region but also around the world, this explains the difficulty that the country faces in the course of raising tax revenue for public expenditure, not to mention the rampant corruption within the tax system that greatly affects tax compliance. Our study results from *Tables 3* (NARDL Error Correction model for cointegration), *Table 6* (NARDL Long-run form & Bounds test), and *Table 8* (Levels

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equation & Asymmetric cointegration equation), all reveal very interesting findings on the role of taxes, economic growth (GDP) and gross fixed capital formation (GFKF) on total unemployment in Uganda both in the short-run and in the long-run. For instance, through the application of the NARDL model, we were able to decompose the impact of an increase and a decrease in the taxes on total unemployment. Taking into account the study results obtained especially on the impact of taxes, several policy issues can emerge. First and foremost, given the fact that taxes tend to affect consumption more at higher income levels, the government cannot afford to raise taxes in such circumstances as this will affect consumption and capital accumulation. This implies that the government should cut taxes and create jobs to stimulate the economy to build capital for investment to widen the tax base. In other words, the government should reduce its overreliance on a tax-based fiscal consolidation framework common in most low-income countries like Uganda.

Higher taxes in Uganda also stem from the government's need to demonstrate compliance in servicing its debt obligations. In this view, the government should reduce the level of borrowing to reduce the pressure on the fiscal system. Money should only be borrowed for investment in projects that unlock Uganda's productivity potential, avoid crowding out of private investment, and encourage prudent use of funds. As a policy to leverage the country's population dividends and also reduce unemployment rates in Uganda, more efforts are needed in skills development through embracing vocational training and other employment creation initiatives that can be driven by improving coverage and advancement in ICT in the country. As a solution to increasing taxes, the government should intensify its policy on export-oriented trade to reduce the deficit in the international trade volumes, export-driven manufacturing should be also intensified and the policy on industrial zones and Build Uganda Buy Uganda (BUBU) should be fully operationalized.

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AUTHORS' CONTRIBUTIONS

MJ is the main author of this article; he booted the idea of the topic to be researched, and he also carried out a rigorous literature review to establish gaps in the case of military expenditure regarding Uganda. Thirdly he collected data from different sources and analysed it based on the developed theoretical framework. MI, KS and EM, they co-authored this manuscript, they provided invaluable advice and approved the research idea, proofread the work, and ensured quality assurance.

Authors' information: MJ & EM are Assistant lecturer at the School of Statistics at Makerere University, and are also currently a Ph.D. students at the School of Economics (SoE) at the same University. MI is a senior lecturer at the School of Economics (SoE) at Makerere University, he also doubles as a Postgraduate program coordinator at the School of Economics (SoE) at the College of Business and Management Sciences (CoBAMS). Lastly KS is the head of Manpower planning at the National Planning Authoirity in Uganda, he is also a PhD student at Makerere Uniuversity.

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AVAILABILITY OF DATA AND MATERIALS

All the data (1970-2019) used in the study were sourced from three specific sources. Data on Economic growth came from the World Bank accessed at https: //data.worldbank.org/country/Uganda? View and

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the Bank of Uganda accessed at https: //www.bou.or.ug/bou/rates statistics /statistics .html. Data on the military expenditure of both Uganda and the neighbours, type, and frequency of conflict came from SIPRI accessed at https://www.sipri.org/databases/milex, other variables on inflation, labour force participation, trade openness, and capital formation were sourced from the World Bank Development Indicators (WDI). Most importantly all the datasets utilized in this study's analysis are available from the corresponding author.

COMPETING INTERESTS

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

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