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ORIGINAL ARTICLE

Influence of consumption tax on spending capacity of households in Sub-Saharan Africa: Evidence from Nigeria and Kenya

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ABSTRACT

Due to the incapacity of families in Sub-Saharan African nations to satisfy basic necessities for home maintenance, this study is required to enable policy shifts in the area of consumption tax. The study looks at the impact of consumption taxes on the purchasing power of families in Sub-Saharan Africa, with an emphasis on Nigeria and Kenya. The datasets used for this inquiry range from 1994 to 2022. Among the factors are purchasing power parity (PPP), value added tax (VAT), and exchange rate. We obtained the statistics from the World Bank, the Central Banks of Nigeria and Kenya, the Federal Inland Revenue Service, and the Organization for Economic Co-operation and Development (OECD). The study used the autoregressive distributed lag (ARDL) model established by Pesaran et al. (2001). The findings reveal that the inclusion of VAT on the prices of products and services significantly harms households throughout Nigeria compared to those in Kenya. VAT has a significant negative impact on consumer purchasing power in Nigeria but has an immaterial negative impact on household spending capacity in Kenya. The influence of the currency rate is positive and beneficial in Nigeria, whereas it is negative but intangible in Kenya. Due to economic disparity, the report suggests policy reforms in favour of families. It is also suggested that the government develop additional work possibilities, diversify the economy, and give subsidies for basic housing necessities.

KEYWORDS

VAT; households; spending capacity; exchange rate; ARDL

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1. Introduction

The implementation of value added tax (VAT) tends to have severe consequences on the consumption pattern of families especially in emerging economies. Most households make a sudden switch in their spending pattern with the consciousness of what they earn in order to avoid living above their income. On the other hand, economies that are vulnerable to this situation become automatically destabilized in few months or even years before adjusting to the economic reality of the time. While business and households are doing their best to adapt to the changes, the government is equally increasing revenue for a more effective execution of social obligations. Carroll (2010) noted that VAT as important enough to affect any nation's all-around economic health. According to Terfa et al. (2017), the enforcement of VAT should be accompanied by additional initiatives to compensate consumers in order not to adversely affect their purchasing behavior, particularly in cases where revenue taxation is also an issue for most income earners. Lower taxes will be justified by lawmakers as promoting the purchasing of specific commodities, such as items for arts and culture and native industries that require labour like the tourism industry, as well as supporting families with low incomes and addressing adverse environmental effects.

The criticism of VAT is because the financial burden gets on individual end-users of items. Many opponents believe it is a harmful tax, indicating that those with limited resources pay a greater proportion of what they earn than wealthy individuals (Terfa et al., 2017).

Users pay taxes irrespective of their financial situation or job position when spending taxes pertain to all buying decisions (Bunn et al., 2021). Defensive players contend that tying tax rates to earnings is an unjust norm, and that the value added tax is a tax that is disproportionate in that those who have higher incomes pay more because they utilize more of their income in the household commodities. Whenever distinct types of commodities face taxes at varying costs, the actual progressive nature or repressiveness of a system that charges VAT can be compromised. Taxes on goods and services are important generator of income for authorities worldwide. If you buy an item from a supermarket or a different vendor, you will almost certainly have to pay tax on it. Utilization taxes, like many other taxation strategies, are not standardized around the world. Even though they account for at least a third of earnings in a majority of the thirty-seven nations that comprise the Organization for Economic Co-operation and Development (OECD), this is not universal (Bunn et al., 2021). The United States is a deviation in that it does not have a single national tax on consumption, and utilization income taxes account for less than 20% of the overall revenue from taxes throughout all tiers of governance (Bunn et al., 2021). Nevertheless, the VAT continues to be the primary utilization taxation strategy in the OECD nations (Acosta-Ormaechea and Morozumi, 2021). VAT is also known as the GST, which stands for the Goods and Services Tax, in a number of nations. Australia, Canada, and New Zealand are among the countries included (OECD, 2020).

VAT has consistently been a significant tax in the framework of taxation, and over the years there has been considerable research curiosity in the broader economic and monetary implications of VAT (Qin et al., 2023). In Nigeria, most people believe that the government fails in its social obligations,

as a result, enterprises frequently have to pay tax for absolutely nothing (Abumere, 2023). However, Otemu (2020) confirmed that while VAT boosts government revenue for social responsibilities, at the same time, household consumption suffers a major decline. Bank-Ola (2021) believes that VAT is detrimental to business activity but Omodero and Eriabie (2022) proved that VAT is an acceleration driver to business climate in Nigeria. There is also the issue of establishing an enduring value added tax framework in Kenya owing to its existence of an underground economy and VAT responsiveness to a variety of economic drivers (Wawire, 2017). Past studies have shown that VAT depresses the welfare of households in Kenya (Muindi and Mukorera, 2022; Omondi, 2020). Kadenge (2021) confirmed that decrease in savings due to VAT, Mwangi (2020) discovered that VAT did not affect tourism industry in Kenya.

In considering other economies, Hammour and Mckeown (2022) supported the findings of Omodero and Eriabie (2022) by confirming that VAT helps to improve business activities. However, Schechtl (2022) confirmed that VAT impoverished large households and families with a single parent experience a lot of hardship due to incidence of VAT on goods and services. Permadi and Wijaya (2022) also witnessed that VAT increased government revenue but makes foreign purchases to decline. Lanterna and Liberati (2023) assert that VAT is applied for reallocation drives in Italy. These varying views have not addressed the issue of VAT consequences on buying strength of families in emerging economies as seen in Sub-Saharan Africa. This study compares the role of VAT in two economies in the Sub-Saharan Africa in order to establish the capacity of families to purchase essential goods and services in Sub-Saharan Africa especially where frequent fluctuation of exchange rates has become an unavoidable phenomenon in the recent times. As a result, the primary goal of this research is to determine the impact of VAT and exchange rates on families' capacity to acquire necessary products and services in Sub-Saharan Africa. This study's components are as follows: introduction, literature review phase, methodology, data analysis and interpretation, and finally conclusion.

2. Literature review

2.1. Conceptual issues

Taxation is one of the main sources of earnings for the governments' regular operations and also contributes a substantial part in distributing wealth within a society. To carry out these responsibilities, an effective tax scheme must be balanced towards the requirements that follow:

Cost-effectiveness, prosperity, income sufficiency, earning equilibrium, brevity, and inexpensive managerial abilities and regulations expenses are all desirable (Jekins et al., 2000). In response to the OECD, taxation of income is more detrimental to the global economy than usage taxation; therefore, a growth-focused fiscal overhaul ought to move the load from revenue taxes to spending taxes. Tax overhauls have a tendency to favour taxes on consumer goods, particularly VAT, which is considered to have greater earnings possibilities, become less distortive, productive, economically productive, and have a broader base (Muriithi and Moyi, 2003; Bird, 2005; Keen and Lockwood, 2010). VAT revenue increases could be achieved by deepening the scope of taxation with a lesser amount waiver and possibly attaining a standardized rate arrangement with smaller decreases in rates might prove more successful in growth fostering than earnings increases achieved by raising the normal rate, which is the rate utilized for the majority of taxed utilization, given that the later

type of boost is more probable to forego productivity advancements. According to Matthews (2010), as the VAT rate rises, the effective functioning of the VAT mechanism decreases.

However, as Kaisa et al. (2019) contend, VAT is a fundamentally retrogressive taxation. According to Kaisa et al. (2019), the VAT implementation raises inequalities in income while leaving uneven consumption unchanged. In other words, it has a detrimental effect on poor households and has increased family wage disparity to the catastrophic level, such that households spend more of their meagre income on consumable goods and services, with little or no savings to be budgeted. Nevertheless, social disparities will increase because nutrition is a requirement, and when taxes are levied on basic needs, the less fortunate segments of the population become more susceptible (Iqbal et al., 2019).

VAT is charged in Kenya according to the VAT Act of 2013 and the VAT Laws of 2017. VAT is a value-added tax that is calculated using the inputs and outputs system. VAT is levied at varying rates on five kinds of supplies: 16% on specific taxable goods and services, 8% on native fuel deliveries (effective September 2018), 0% on zero-rated merchandise and exports, free commodities, and products that are not subject to VAT (Okello et al., 2023). There are certain goods and services that are VAT exempt in Nigeria and Kenya. Focusing on Kenya, milk, eggs, meat, rice, maize, bread, beans, unprocessed vegetables, tubers, infant food formula, medicines, fertilizers, sanitary towels, and pharmaceuticals are among the most common VAT exempt goods in Kenya. A number of monetary activities are spared from VAT: the administration of current, deposit, or savings accounts, as well as the distribution of statements of accounts. Both debit and credit cards that are issued. ATM withdrawals (but not the purchase of machines) and software to operate them. Management, preparation, clearance, and revocation of payments in cheques (Wangare, 2022).

Among the most significant VAT modifications in Kenya are the decrease in the number of the rate bands from fifteen to three barely two years after they were implemented, the reexamination of the baseline rate, the lessening of the total amount of free and zero-rated commodities and services, the implementation of the mandatory registration limit and its subsequent examination, and others as well. The vast majority essential products utilized by families with low incomes that were previously granted exemption, zero-rated, or subject to tax at cheaper rates are now assessed taxes on at an ordinary rate of 16%. As a result, commodity prices have risen. These kinds of expenditures may have had an impact on the welfare of Kenyan family units, particularly low-income households who spend a greater proportion of their income on consumption.

In Nigeria, the VAT rate was raised from 5% to 7.5%, effective 1 February 2020, as stated in the Finance Act, 2020. Thus, the updated list of VAT exempt commodities include: petroleum-based products, the apparatus for green power, baby diapers and toiletries are made from foundational components. Ingredients that are used in the manufacture of medicinal goods, food for animals made in the United States, armed forces gadgets, weaponry, firearms, and outfits made in the United States, natural gas provided to electricity-generating business enterprises by gas-producing business entities, seeds from the and plantings for agriculture (KPMG, 2020). The Nigerian Finance Act, 2021 gives the Federal Inland Revenue Service (FIRS) a fresh mandate to nominate individuals as VAT drivers for the aim of collecting and submitting VAT to the FIRS. In support of this, the FIRS has just released a general notification assigning MTN and airtel as VAT drivers and mandating the two companies to collect/withhold VAT on taxable purchases received by them.

The newly appointed VAT representatives have been obligated to begin removing VAT with effect from 1 January 2023. Failure to gather or remove VAT from pertinent vendors would result in an administrative charge of 150% of the sum not gathered in addition to an interest rate of five percent above the CBN financial policy rate.

2.2. Theoretical review

The theories underpinning this study include: absolute income hypothesis (AIH) propounded by Keynes (1936), Ricardian equivalence hypothesis (REH) by Barro (1974) and neoclassical theory by Friedman (1978). The impact of taxation on household spending is debatable in both empirical and theoretical finances. There are different schools of reflection on this topic from a theoretical standpoint. The total financial status theories, proposed by Keynes (1936), maintains that families present spending is an undeviating role of their current income available for spending. Consequently, a boost in fiscal spending raises wages, jobs, and general demand, resulting in a boost in consumption in households (the crowding-in result). According to Keynes (1936), usage is an especially dependable and foreseeable factor in overall demand. According to Keynes (1936), in order for a society to emerge from a downturn and experience sustained growth in the future, the federal government must increase the overall demand by boosting spending or cutting taxation. As asserted by Schechtl (2022), consumptive taxes are economic policy instruments that may contour the distribution of wealth and possibly undermine societal policy's equitable desired outcomes and given the disparities in financial resources and consumption levels of society, various family types may be harmed in different ways.

Barro (1974) proposed the Ricardian equalization theory which contends that the decision about the type of fiscal strategy in the overall economy (which refers to revenue taxes, spending by the government, or cash transfers) is agnostic to the distributions made for consumption by homeowners. Barro (1974) additionally asserts that an upsurge in spending by governments has no effect on the consumption of families despite the method of funding because household members are deemed to be foresighted and do not consider the authorities spending as their own wealth.

On the opposite side, Friedman (1978) upholds that the conventional actual industry process structure under the theory of neoclassicism was based on the premise that a rise of governmental expenses reduces private or household spending, and that the state may pay for its expenses from multiple avenues. In the normal commercial process framework, the detrimental financial influence outweighs the beneficial switch effect, causing household spending to fall. According to Christiano and Eichenbaum (1992), this kind of occurrence is known as the influence of crowding out or the substitutability theory between public and households spending. A number of research studies (Bouakez and Rebei 2007; Linnemann 2006), used neoclassical views on fiscal regulation and spending to demonstrate crowding-in effects. Thus, neoclassical scholars (Christiano and Eichenbaum 1992; Friedman 1978) of economics contend that increased government expenditure funded by taxation mitigates long-term earnings for households. Further, they contended that higher taxes cause a damaging financial impact, which reduces household spending.

2.3. Empirical review

2.3.1. Studies in Kenya

Omondi (2020) discovered that Kenya's VAT adjustments reduced the well-being of households

because the underpaid cost elasticities for all ten food products proved to be negative. For instance, leaf tea, sweeteners, legumes vegetables, white-bread, grains, cooking oil, herbs, beverage, grain, indicating that buyers could react to cost increases by reducing their spending on the products. The findings revealed that families were under-consuming these foodstuffs and needed either price cuts or revenue reimbursement to purchase additional items; which was a further sign of an overall decrease in living standards as a consequence of VAT modifications in Kenya, the final outcome of which was an upsurge in overall pricing dimensions. The tax updates were shown to have considerably enhanced VAT collection efficacy while also contributing to broadening of Kenya's VAT compliance disparity.

Muindi and Mukorera (2022) investigated the efficiency of fiscal management in Kenya by looking at the clogging in consequences of fiscal procedures on consumer spending. Taxation proved to have no effect on household spending in the short-term. However, fiscal management, on the other hand, was shown to have imbalanced implications for the consumption of households in the long-term. Kadenge (2021) studied the impact revenue taxes, excise duties, customs duties, and VAT on economic performance. According to the study, indirect taxation raised consumption while decreasing savings in Kenya. Omar (2020) studied the impact of zero-rated VAT on the monetary health of Mombasa County's small and medium-sized businesses. The research conducted found a direct effect of value-added taxes on the cash flow of small and medium-sized companies in Mombasa County in Kenya. The increase in the VAT could be linked to a decline in the financial results of SMEs. The study additionally demonstrated that zero-rated items, exempted commodities, and standard rated products all helped directly to the profit margin and overall customer service excellence.

Mwangi (2020) examined the impact of the value added tax act of 2013 on the tour value chain in Kenya's tourism industry. Despite the inclusion of VAT, the analysis uncovered a beneficial connection between the travel value chain and goods related to tourism. Regardless of the addition of VAT, the results revealed immediate proof of an advantageous correlation between the trip's value chain and the price of taxi service. It was discovered that regionally renovated and modified tour taxis had a particularly powerful association with the travel business chain in Kenya's tourism sector.

2.3.2. Studies in Nigeria

Aminu (2019) researched the manner in which the federal government could carry out a VAT rate hike to guarantee that the ultimate rate of 15% can be attained in an arrangement that matches family units and the entrepreneurial society while also generating the greatest amount of income for the state. In order to accomplish this research's goal, a recursively evolving simulation was applied and the formulation was developed and replicated for a 10-year period. It was determined that the most advantageous strategy was to raise the rate by 2.5% per year for a period of four years. The alternative produces most favorable results in terms of expansion, capital, intermediate purchasing, and expenditures by the government, and consumption among households. Otemu (2020) investigated whether the VAT increased government revenues and facilitated purchasing habits in Nigeria. The results indicated that, while value-added tax contributed considerably to fiscal revenue, it also minimized the consumption habits in Nigeria. Bank-Ola (2021) investigated the consequences of value added tax on Nigerian economic expansion from 1999 to 2019. The

evaluation found that VAT had a major and detrimental impact on business activity in short-term periods, but a beneficial but unimportant impact on financial growth in the course of time. The rise in inflation had an enormous beneficial impact on economic expansion in the longer term, while borrowing costs had an immense adverse impact.

Odu (2022) discovered that VAT possessed an essential impact on overall revenues from taxes following a two-year slide and that it clarified variations in all tax earnings more and more as time progressed. The investigation also found that, given the one-year latency, VAT had an important and adverse impact on gross domestic product, or VAT had an optimistic factor, pointing to the fact that VAT grew throughout the years. Omodero and Eriabie (2022) found that local VAT returns and combine revenue from VAT had beneficial and powerful causation outcomes for product quality applying pairwise granger causal association examinations. While checking for relationships among the research's factors, findings also revealed the presence of significant connections among the variables investigated. The study came to the conclusion that value-added tax was an acceleration driver in Nigeria's business climate. Idris and Sebastine (2023) used ordinary least squares and co-integration methods for estimation to determine the causal connection between indirect taxation and consumption among households. The investigation discovered a beneficial yet unimportant connection between value-added tax and consumer spending.

2.3.3. Other economies

Mgammal et al. (2023) investigated the impact of the contemporary VAT on Saudi non-monetary publicly traded enterprises. The findings revealed that a substantial rise in VAT (along with other unobserved factors in the investigation) had a significant positive/negative effect on the inter-industry fluctuation in business financial indicators, and this was even more pronounced with the COVID-19 cataclysm. Irawati et al. (2022) calculated and analyzed the impact of the e-invoice 3.0 implementation and chargeable individual conformity to VAT revenue expansion. The researchers used a non-probability sampling approach in conjunction with convenience sampling as the method to obtain the data collection sample. The findings revealed that implementing e-invoice 3.0 and taxable individuals' conformity at the same time had an advantageous and substantial impact on VAT earnings. The author makes recommendations for the Pasar Rebo Primary Tax Office in Jakarta to keep upgrading its operations by delivering details and campaigns that pertain to the application of e-invoice 3.0 to taxable persons in order to strengthen their adherence to regulations and also to raise the total tax collected, which might impact on VAT returns. Kim et al. (2022) examined the effects of preconceived credibility patterns on customer satisfaction reactions to ways of paying when owners of small enterprises offer a reduction helps using data from roughly 7300 taxpayers gathered through the national survey of tax and advantages of South Korea. The findings showed that customers' supportive willingness to pay VAT was substantially increased by their sense of confidence in the authorities. This research also found that when price reduction amounts were larger credibility had a bigger influence on collaborative adherence to VAT.

Hammour and Mckeown (2022) applied an ex-post facto methodology to examine the influence of VAT on products and services as well as on customer purchasing habits in the UAE. The research looked at how buyers in the UAE changed their purchasing habits after VAT was implemented. A polling instrument was used to collect data for the evaluation, which looked at the people's consumption habits. A total of 240 individuals from the UAE were chosen at random for the

purpose of the investigation. Parts of people in the UAE had taken in the extra expense of VAT with no alteration to how they shop, but they will most likely adjust in the near future if the VAT rate rises, whereas families with lower incomes and those with a value above or comparable to 5 were particularly affected by VAT. In addition, data from Chinese listed companies shows that transforming corporate taxation to VAT had motivated organizations to increase their creativity in production and achievable breakthroughs. Furthermore, the magnitude of research and development expenditure falls somewhere in between the two extremes of the relationship between business tax changes to VAT and general creative results and the relationship between corporate taxes shifts to VAT and firm-specific inventiveness production (Cao et al., 2022).

Permadi and Wijaya (2022) sought tangible proof of factors influencing VAT receipts from a variety of perspectives, such as the VAT rate itself, financial variables, revenue management elements, and legal parameters. The investigation relied on supplementary data and examined Asian countries from 2015–2019. According to the research findings, embedded taxes, the service industry category, and the efficiency of governments all had a noticeable beneficial effect on VAT returns, while foreign purchases had an enormous detrimental effect. At the same time, VAT earnings are unaffected by common rates, budgetary shortfalls, c-efficiency, illicit activity administration, or the applying of statute.

Schechtl (2022) investigated the modification in impoverished conditions across various types of households when utilization taxes were taken into consideration. The investigation used statistics from eleven OECD member nations to determine implicit indirect tax rates based on national accounts and prevalence of poverty before and after taxes on consumption were deducted. The findings revealed substantial distinctions between the family categories. Big family members and households with just one parent encountered the greatest rise of hardship in the majority of nations. Finally, the level of consumption tax was found to be positively related to an overall rise in hunger across different nations.

Andoh (2021) investigated two distributional facets of Ghana's value added tax: the dispersion of VAT costs and advantages among various family units, as well as fluctuations in commodity costs throughout various expenditures on consumption items. The study proved that the VAT system shifted from being innovative to detrimental, with lower-income families increasing the amount they spend on telecommunications, transportation, and other essentials regardless of rising costs. The research also found that each increment to the VAT rate results in a rise in the cost of all consumer items and services. The amount of the shift, nevertheless, differs between commodities. The costs for post and telecommuting, amenities (energy, gases and water), lodging, dining, and conveyance were discovered to be usually greater than usual. While meals and drinks that were not alcoholic accounted for the biggest portion of the overall expenses for both the wealthy and the less fortunate, the second category paid more in comparison to the former.

Alhussain (2020) sought to pinpoint the implications of VAT on Saudi banks by comparing modifications to the amount of assets, liabilities, deposits from customers, profits retained, total revenue from operations, overall operational expenditures, and net income from operations before and after the imposition of VAT. The examination observed a slight reduction in overall assets, total liabilities, deposits from customers, and current account balances as well as a major reduction in earned income and entire operating costs following the enactment of VAT. Bogari (2020) used

qualitative and quantitative strategies to evaluate the social and financial impacts of the introduction of a value-added tax in the kingdom of Saudi Arabia. The research looked at 287 Saudi nationals employed in both the public and private sectors. According to the findings, the enforcement of the value-added tax raised the nation's financial capacity but had an adverse societal effect and encountered multiple difficulties.

Zahid et al. (2019) investigated the implications of the overall taxes on sales on family consumption and welfare systems in Pakistan, with an emphasis on Pakistan's indirect tax amendments. According to modelling and inequality avoidance outcomes, consumers food prices must be separated which is not attainable in Pakistan. Nevertheless, societal disparities will worsen because food is vital, and when taxes are levied on essentials; the poorest members of the community become less secure. Benjasak and Bhattrai (2019) discovered that combine net social assistance modifications resulting from a 10% VAT rate are greater than those from a 0% VAT rate. Consequently, raising VAT from 7% to 10% was a beneficial course of action based on an economy-wide benefits assessment because the utility produced by governmental services for families exceeds the amount paid for a decline in utility caused by tax increases. Singh (2019) examined the importance of VAT to boosting government revenues in Ethiopia and compares it to various kinds of taxation. According to the investigation, VAT had the most amount of government earnings among taxes that were indirect. The discovery bolstered the contention that VAT is not merely an avenue for income but also a successful governance tool.

Mariscal and Werner (2018) investigated the impact of the VAT on distribution of earnings. The investigation took into account two tax changes implemented in Mexico that raised the percentage of VAT for an array of municipalities while leaving other cities untouched to discover the implications. There was an overview of the price rises of harmed and excluded towns prior to and thereafter the statute was modified. The outcomes indicated that the impact on costs was minimal and that the fiscal burden was actually borne by both industries and customers. In the context of social services, the study discovered that the VAT was innovative in both absolute and relative terms with regard to total consumption household members. The study also demonstrated that when prices became high and constant, exactly the same modification to the VAT rate increased its transfer to the rise and caused a welfare impairment for an ordinary household size.

Gelardi (2013) applied graphical representations to convey and assess how much consumers in the United Kingdom and Canada changed their purchasing habits after the introduction of value added taxes in the two nations. The visual illustrations included both sales quantity and the proportional variation compared to the previous year on monthly schedules. As soon as the newly imposed taxes were implemented, there was nothing or very little substantial behavioural change. Whenever tax rates were significantly changed, however, buyers adapted their behaviour to take benefit of those modifications by adopting choice behaviour.

3. Research methods

The primary goal of this study is to examine the effect of VAT on households' ability to purchase goods and service in emerging economies using information from Nigeria and Kenya. The secondary for of data collected cover a period from 1994 to 2021. The reason is because Nigeria implemented VAT collection in the year 1993 but it actually became effective from

1994. Keynes (1936) proposed that spending by the government has a beneficial connection with spending capacity of households, whereas income from taxes possesses an adverse correlation with families' purchasing power. Authorities may either boost spending or reduce taxation to stimulate household spending (expansionary fiscal responsibility strategy). As controlling factor, the approach incorporated additional indicator such as exchange rate due to the constant fluctuations affecting consumption patterns of households. The following describes the time series econometric model applied for the purpose of this study:

$$\ln PPP_t = \beta_0 + \beta_1 \ln VAT_t + \beta_2 \ln XGR_t + \varepsilon_t \quad (1)$$

where; "ε" is the error term, "t" is the time dimension, which is the data from 1994 to 2021, and "ln" is natural logarithm. The logged households' purchasing power is abbreviated as lnPPP, the logged value added tax is abbreviated as lnVAT, while the exchange rate is shown as lnXGR. To get started, unit root examination must be used to determine the equilibrium features of the series as well as the direction of the method of estimation. It is important to remember that the estimation approach used depends on whether the time series data are stationary at the level or at the first difference. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are two different unit root tests proposed by Dickey and Fuller (1979) and Phillips and Perron (1988). In contrast to the null hypothesis in the ADF and PP unit root tests, the alternative hypothesis states that there are no unit roots.

The sample used in the research period (1994–2021) additionally encompasses a number of shocks, such as the global economic meltdown, price level changes, COVID-19 pandemic and VAT reforms in both countries under study. The significant inflationary effects are expected to have a significant impact on macroeconomic situation which implies that the conduct of unit root tests which is very expedient.

The co-integration test was performed using the autoregressive distributed lag (ARDL) model proposed by Pesaran et al. (2001). The ARDL model has some advantages over other co-integration strategies that are frequently discussed in the literature. To begin, the ARDL approach does not require a strictly integrated order of variables. For instance, it is suitable in the case where datasets are in both order zero and one. Second, the model provides more accurate estimation results, particularly for small sample attributes. Third, the ARDL model is a useful tool because it considers the effects of endogenous independent variables. Therefore, using the baseline model in Equation (2) as a starting point, the ARDL model can be stated as follows:

$$\Delta \ln PPP_t = \sigma_0 + \sum_{i=0}^{p} \alpha_{1i} \Delta \ln PPP_{t-i} + \sum_{i=0}^{p} \alpha_{2i} \Delta \ln VAT_{t-i} + \sum_{i=0}^{p} \alpha_{3i} \Delta \ln XGR_{t-i} + \delta_1 \ln PPP_{t-i} + \delta_2 \ln VAT_{t-i} + \delta_3 \ln XGR_{t-i} + \mu_t \quad (2)$$

where: PPP, VAT and XGR remain as earlier described. Δ is the difference operator and ε denotes the left-over term. Equally, α symbolizes the drift, $t-1$ denotes the lag lengths, $\alpha_1 - \alpha_3$ are coefficients to be estimated while denotes natural logarithms and μ_t is the error term.

The ordinary least squares (OLS) technique is used as an initial step before the bound test is employed for testing for a long-term balance connection between the parameters. The different

assumption that the variables have an extended association is used to test the null assumption that there is no co-integration between them. The null hypothesis, which claims that there is no long-term connection, could be communicated as follows:

H_0: $\alpha_1 = \alpha_2 = \alpha_3 = 0$ (long run co-integration does not exist);

In this case, the alternative hypothesis would be as follows:

H_1: $\delta_1 \neq \delta_1 \neq \delta_1 \neq 0$ (H_0 is not correct).

where, α_1, α_2 and α_3 remain as defined earlier. Finally, the technique known as ARDL employed AIC to select the most suitable model and the right length for the lag level. This position is taken in case the lag selection parameters choose different lags, AIC will be preferred.

Based on the outcome of the bound test which shows that the F-statistics for both Nigeria and Kenya are greater than the critical values at 5 percent, the short run ARDL approach is hereby specified to understand the short run dynamics of VAT influence on spending ability of households in Nigeria and Kenya. As a result, Equation (3) indicates the short run model:

$$\ln PPP_t = \alpha_0 + \sum_{i=1}^{v} \alpha_1 \Delta \ln PPP_{t-i} + \sum_{i=0}^{v_1} \alpha_2 \Delta \ln VAT_{t-i} + \sum_{i=0}^{v_3} \alpha_3 \Delta \ln XGR_{t-i} + \mu_t \quad (3)$$

Table 1 shows the details and sources of data gathering for this study.

Table 1. Data information and sources.

Variables	Variable code	Variable meaning	Measurement	Source
Dependent	lnPPP	Purchasing power parity which represents the spending capacity of households	Estimated in billions of $	World Development Indicators database, World Bank for Nigeria. https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD?locations=NG. World Economics for Kenya. https://www.worldeconomics.com/GrossDomesticProduct/Real-GDP-PPP/Kenya.aspx.
Independent	lnVAT	Value added tax	Estimated in local currency of countries used	NIG. Federal Inland Revenue Service. https://www.firs.gov.ng/tax-statistics-report/. OECD. https://stats.oecd.org/Index.aspx?DataSetCode=REVNGA KEN. Central Bank of Kenya. https://www.centralbank.go.ke/statistics/government-finance-statistics/. OECD. https://stats.oecd.org/Index.aspx?DataSetCode=REVKEN
Moderating factor	lnXGR	Exchange rate	Nigeria naira end period exchange rates /1$ and Kenya Shilling End Period Exchange Rates\1$	NIG. World Bank. https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=NG. KEN. Central Bank of Kenya. https://www.centralbank.go.ke/statistics/exchange-rates/

Source: World bank, FIRS, Central Bank of Kenya, Central Bank of Nigeria.

4. Results

4.1. Descriptive analysis

This subsection provides descriptive data for each of the parameters utilized in this investigation. The average, median, mode, deviation from the mean, variance, and lowest and highest numbers are among the characteristics presented in **Table 2**.

Table 2. Descriptive statistics.

	NIG PPP	NIG VAT	NIG XGR	KEN PPP	KEN VAT	KEN XGR
Mean	3.88	9.42	4.76	11.8	11.6	4.52
Median	4.04	10.1	4.89	11.7	11.5	4.58
Maximum	5.03	13.2	5.99	12.4	12.9	4.95
Minimum	2.02	6.17	3.08	11.3	10.4	3.95
Std. Dev.	0.83	2.46	0.88	0.36	0.83	0.30
Skewness	−0.45	0.02	−0.92	0.33	0.20	−0.36
Kurtosis	2.13	1.38	2.92	1.77	1.54	2.04
Jarque-Bera	1.82	3.07	3.96	2.28	2.67	1.67
Probability	0.40	0.21	0.14	0.32	0.26	0.43
Sum	108	263	133	329	325	126
Sum Sq. Dev.	18.8	163	21.0	3.61	18.7	2.49
Observations	28	28	28	28	28	28
Correlation matrix						
PPP	1.00			1.00		
VAT	−0.52	1.00		0.99	1.00	
XGR	0.91	−0.38	1.00	0.95	0.94	1.00

Source: Authors' calculation, 2023.

The major aim of this study is to confirm the effect of VAT on households' welfare or buying capacity of essential commodities and services for the upkeep of the family members. In **Table 2**, the study describes the nature and suitability of data employed for this investigation and thereafter the type of relationship that exists among them. The most important of the outcomes in **Table 2** is the Jarque-Bera which actually factors in all other parameters to confirm the normality of the datasets employed for a study. The rule is that the probability value of all the datasets used as proxies for the variables selected for the study must be above 5% degree of relevance. Looking at Table 2, the Jarque-Bera *p*-values of all the variables are above 0.05 level of materiality. Thus, it is established that all the datasets used in this study are normally apportioned and are appropriate for this study. Considering the correlation matrix, it is shown that VAT in Nigeria has a fair negative relationship with PPP while the exchange is positively and strongly correlated with PPP. That means despite the exchange rate fluctuation, people still consume what essential products while the imposition of VAT affects consumption decision of families negatively. In the case of Kenya, all the variables indicate strong and positive correlation with one another.

4.2. Unit root check for firmness of datasets

In light of the stochastic characteristics of period stream statistics, and to minimize erroneous findings from irregular datasets, the enhanced Dickey-Fuller and Phillip Peron unit root examination were performed; outcomes are shown in **Table 3**.

Table 3. Unit root test results.

Variables	ADF T-statistic	Critical Value @ 5%	P-value	PP T-statistic	Critical Value@ 5%	P-value	Order of integrat-ion	Remarks
NIGERIA								
lnPPP	−3.552	−2.992	0.015	−3.229	−2.976	0.029	I(0)	Stationary
lnVAT	−5.786	−2.986	0.000	−12.57	−2.981	0.000	I(1)	“
lnXGR	−4.998	−2.981	0.000	−4.997	−2.981	0.000	I(1)	“
KENYA								
lnPPP	−4.401	−2.981	0.002	−4.398	−2.981	0.002	I(1)	Stationary
lnVAT	−4.709	−2.981	0.001	−4.762	−2.981	0.001	I(1)	“
lnXGR	−5.048	−2.981	0.000	−5.050	−2.981	0.000	I(1)	“

Source: Authors' calculation, 2023.

The augmented Dickey-Fuller and Phillip Peron checks show that the parameters are built of order zero I(0) and I(1), implying that they were unchanging at threshold and after first differencing at the 5% level. Because none of the indicators are of order two, we can perform the autoregressive distributive lag (ARDL) inquiry. For the reason that none of the parameters are integrating to order 2, that is I(2), the ARDL co-integration technique will be employed for the regression calculation. The ADF and PP findings suggest that the ARDL method to co-integration is more suited to evaluating the data than other strategies such as the Johansen co-integration strategy since the outcomes reveal a mix of I(0) and I(1).

4.3. ARDL Co-integration bound test

The ARDL bound test was used to determine the occurrence of a long-term connection, and the findings are shown in **Table 4**. As a consequence, the F-statistic metrics for Nigeria and Kenya are 3.78 and 1.63, respectively. They did not exceed both the lower limit (3.79) and the higher limit (4.85) at the 5% level of relevance, as determined by Pesaran et al. (2001). As a result, we are unable to reject the null assumption, which claims that there is no the long-term link between the factors that were studied, because none has been proven.

Table 4. Bound test result.

Critical value	I(0)	I(1)
NIGERIA		
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36
KENYA		
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36

Note: Nigeria: F-statistic = 3.777; K = 2; Kenya: F-statistic = 1.631; K = 2.

Furthermore, the Johansen Co-integration Test in **Tables A1** and **A4** have also confirmed that there is absence of long run co-integration in the series for both countries.

4.4. Lag length selection criteria

Table 5 shows the results of the ARDL limit assessment's most suitable delays. Validating the appropriate lag results in a more trustworthy outcome while avoiding a serial relationship and an impartial outcome. As indicated in **Table 5**, the best lag to utilize is one, and this is supported by every criterion in both Nigeria and Kenya.

Table 5. VAR lag order selection criteria.

Endogenous variables: LNPPP						
Exogenous variables: C LNVAT LNXGR						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
NIGERIA						
0	−4.505	NA	0.106	0.600	0.747	0.641
1	44.19	81.81*	0.002*	−3.215*	−3.020*	−3.161*
2	44.87	1.084	0.002	−3.189	−2.946	−3.122
3	44.89	0.034	0.003	−3.112	−2.819	−3.030
KENYA						
0	46.65	NA	0.002	−3.358	−3.213	−3.316
1	65.29	31.54*	0.001*	−4.715*	−4.521*	−4.659*
2	66.25	1.553	0.001	−4.712	−4.469	−4.642

** indicates lag order selected by the criterion;*
LR = Sequential modified LR test statistic (each test at 5% level); FPE = Final prediction error;
AIC = Akaike information criterion;
SC = Schwarz information criterion;
HQ = Hannan-Quinn information criterion.

4.5. ARDL short-run estimation

Following the outcome in **Table 4** confirming the occurrence of no long run relationship, we are obliged to present the short run ARDL estimation in **Tables 6** and **7** for the two countries under study.

Table 6. Nigeria: ARDL short-run estimation.

Dependent variable: D(LNPPP)				
Variable	**Coefficient**	**Std. error**	**T-statistic**	**Prob.**
D(LNPPP(−1))	0.263	0.105	2.485	0.021***
D(LNVAT(−1))	−0.010	0.004	−2.168	0.041***
D(LNXGR(−1))	0.079	0.037	2.149	0.042***
C	0.055	0.016	3.366	0.002

**** Significant at 5% level; F-statistic 4.169(0.017); Durbin-Watson 2.187; Std. error of regression 0.052; R-squared 0.362; Adj. R2 0.275.*

The result in **Table 6** provides the effect of VAT on the buying strength of households in Nigeria. The PPP at lag 1 has a significant positive impact on itself suggesting that all things being equal, households are expected to purchase all essential goods and services necessary for family upkeep. The result in **Table 6**, has shown a deleterious powerful effect of VAT [−2.168(0.041)] on purchasing capacity of families in Nigeria. Similarly, **Table A3** confirms that VAT also affects households' spending pattern negatively and substantially. This outcome suggests that the existence of VAT causes increase in the prices of goods and services and it becomes very excruciating since the majority of households in Nigeria are impoverished confirming the findings of Schechtl (2022). However, people have learnt to live with the realities of exchange rate fluctuation, hence the favourable outcome as indicated in **Tables 6** and **A3**. Other outcomes such as Durbin-Watson and standard error of regression are appropriate. In the case of Durbin-Watson of 2, the study does not have autocorrelation and the prediction is error free as indicated by the standard error of regression which is below the value of 1. However, the outcome of the analysis in **Table 7** for Kenya has given the impression that VAT has an intangible negative effect on PPP as well as the exchange rate while the PPP at lag l poses a positive effect but not significant.

Table 7. Kenya: ARDL short-run estimation.

Dependent Variable: D(LNPPP)				
Variable	**Coefficient**	**Std. error**	**T-statistic**	**Prob.**
C	0.044	0.011	4.104	0.000
D(LNPPP(−1))	0.144	0.238	0.604	0.551
D(LNVAT(−1))	−0.048	0.067	−0.726	0.475
D(LNXGR(−1))	−0.098	0.093	−1.058	0.301

**** Significant at 5% level; F-statistic 0.586(0.631); Durbin-Watson 1.84; Std. error of regression 0.025; R-squared 0.074; Adj. R2 −0.052.*

The result in **Table 7** partially supports the findings of (Muindi and Mukorera, 2022; Omondi, 2020). Thus, LNVAT effect on households in Kenya is not too excruciating as seen in the case of Nigeria. Both LNVAT and LNXGR have negative insignificant effect on households. **Table A6** demonstrates that LNPPP has a considerable negative influence on value added tax when LNVAT is the response variable. The conclusion is that if families are unable to purchase necessary products and services, the government will get little revenue through VAT. Further findings in **Table A6** demonstrated that LNPPP, LNVAT, and LNXGR had a positive and substantial effect on themselves at lag 1.

4.6. Diagnostic tests for confirmation of results

The diagnostic tests results in **Table 8** have shown that there is no serial correlation in the analyses above which implies that our datasets do not have autocorrelation.

Table 8. Diagnostic tests results.

Test type:	F-statistic	P-value
Breusch-Godfrey serial correlation LM test-NIGERIA	0.192	0.827
-Kenya	0.538	0.592
Ramsey RESET test for stability of model-NIGERIA	0.129	0.723
-Kenya	0.703	0.489

Authors' calculation, 2023.

Similarly, the stability of our model is also tested using Ramsey RESET test and the result confirms that the study model is stable. All the tests were done at 5% level of significance and the outcomes exceed 0.05 implying that the model is suitable and free from bias.

5. Conclusion and recommendation

The study used Nigeria and Kenya as case studies to assess the influence of consumption taxes on the spending ability of families in Sub-Saharan Africa. The value added tax (VAT) is the principal consumer tax analyzed in this study, and because exchange rate changes impact household purchases in these emerging nations, it has been used as a moderating variable in this research. According to the findings, VAT has a greater negative impact on the purchasing power of Nigerian families than it does on Kenyan households. The causes are related to Nigeria's degree of poverty and unemployment, as well as the government's inability to satisfy social commitments. Although the consequence in Kenya is equally painful but moderate, governments in Sub-Saharan African nations are required to reassess VAT implementation due to its regressive eccentric and negative impact on underprivileged families. The rationale for this is that the implementation of VAT on goods does not take household income into account, and consequently disproportionately affects low-income earners in developing nations. As a result, this study suggests that all Sub-Saharan African countries implement policies as soon as possible to lower the burden of VAT on individuals and to completely exclude home items and services from VAT. Given the aforementioned, it is imperative that the government provide additional work possibilities through the construction of industries and craft centers. Economic diversification will also be conducted to increase government revenue, while subsidies to essential items that households utilize on a regular basis might be

provided.

Author contributions

Conceptualization, COO and EJ; methodology, COO; software, OE; validation, BMO, EJ and OE; formal analysis, COO; investigation, BMO, EJ and OE; resources, BMO, EJ and OE; data curation, EJ; writing—original draft preparation, COO; writing—review and editing, BMO, EJ and OE; visualization, COO; supervision, EJ and OE; project administration, EJ; funding acquisition, COO, BMO, EJ and OE. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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Appendix

1. Nigeria

Table A1. Nigeria: Johansen Co-Integration Test.
Series: LNPPP LNVAT LNXGR

Lags interval (in first differences): 1 to 1				
Hypothesized		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical value**	**Prob.****
None	0.358	23.72	29.79	0.213
At most 1	0.290	12.17	15.49	0.149
At most 2	0.118	3.253	3.841	0.071
Unrestricted cointegration rank test (maximum eigenvalue)				
Hypothesized		**Max-eigen**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical value**	**Prob.****
None	0.358	11.54	21.13	0.593
At most 1	0.290	8.919	14.26	0.293
At most 2	0.117	3.253	3.841	0.071

Trace test indicates no co-integration at the 0.05 level;
Max-eigenvalue test indicates no co-integration at the 0.05 level;
** denotes rejection of the hypothesis at the 0.05 level;*
***MacKinnon-Haug-Michelis (1999) p-values.*

LNPPP = C(1)*LNPPP(−1) + C(2)*LNPPP(−2) + C(3)*LNVAT(−1) + C(4)*LNVAT(−2) + C(5)*LNXGR(−1) + C(6)*LNXGR(−2) + C(7);

LNVAT = C(8)*LNPPP(−1) + C(9)*LNPPP(−2) + C(10)*LNVAT(−1) + C(11)*LNVAT(−2) + C(12)*LNXGR(−1) + C(13)*LNXGR(−2) + C(14);

LNXGR = C(15)*LNPPP(−1) + C(16)*LNPPP(−2) + C(17)*LNVAT(−1) + C(18)*LNVAT(−2) + C(19)*LNXGR(−1) + C(20)*LNXGR(−2) + C(21).

Table A2. Nigeria: Vector auto-regression estimates.

	LNPPP	LNVAT	LNEXG
LNPPP(−1)	1.089	−5.188	−1.125
	(0.142)	(4.536)	(0.774)
	[7.685]	[−1.144]	[−1.454]
LNPPP(−2)	−0.181	1.228	1.183
	(0.118)	(3.785)	(0.645)
	[−1.533]	[0.325]	[1.833]
LNVAT(−1)	−0.012	−0.024	0.009
	(0.006)	(0.185)	(0.032)
	[−2.044]	[−0.131]	[0.289]
LNVAT(−2)	0.008	0.377	−0.026
	(0.006)	(0.186)	(0.032)
	[1.363]	[2.028]	[−0.809]
LNEXG(−1)	0.093	1.041	0.784
	(0.038)	(1.224)	(0.209)
	[2.426]	[0.851]	[3.753]
LNEXG(−2)	−0.027	1.211	−0.0226
	(0.045)	(1.439)	(0.245)
	[−0.610]	[0.842]	[−0.092]
C	0.154	11.02	1.315
	(0.139)	(4.464)	(0.761)
	[1.100]	[2.469]	[1.727]
R-squared	0.996	0.694	0.903
Adj. R-squared	0.995	0.597	0.873
F-statistic	858.8	7.189	29.61
Akaike AIC	−2.904	4.027	0.489

Table A3. Nigeria: Vector auto-regression estimates with t-statistic and p-values.

	Coefficient	Std. error	t-statistic	Prob.
C(1)	1.089	0.142	7.685	0.000***
C(2)	−0.181	0.118	−1.532	0.130
C(3)	−0.012	0.005	−2.044	0.045**
C(4)	0.008	0.006	1.363	0.178
C(5)	0.093	0.038	2.426	0.018**
C(6)	−0.027	0.044	−0.610	0.544
C(7)	0.153	0.139	1.100	0.275
C(8)	−5.188	4.537	−1.144	0.257
C(9)	1.229	3.786	0.325	0.746
C(10)	−0.024	0.185	−0.131	0.896
C(11)	0.377	0.186	2.028	0.047**
C(12)	1.041	1.224	0.851	0.398
C(13)	1.211	1.439	0.842	0.403
C(14)	11.02	4.464	2.469	0.016**
C(15)	−1.125	0.774	−1.454	0.151
C(16)	1.183	0.646	1.833	0.072*
C(17)	0.009	0.031	0.289	0.773
C(18)	−0.026	0.032	−0.809	0.421
C(19)	0.784	0.209	3.753	0.000***
C(20)	−0.022	0.245	−0.092	0.927
C(21)	1.315	0.761	1.727	0.089*
Equation: LNPPP = C(1)*LNPPP(−1) + C(2)*LNPPP(−2) + C(3)*LNVAT(−1) + C(4)*LNVAT(−2) + C(5)*LNXGR(−1) + C(6)*LNXGR(−2) + C(7)				
Observations: 26				
R-squared	0.996	S.E. of regression		0.051
Adjusted R^2	0.995	Durbin-Watson stat		2.038
Equation: LNVAT = C(8)*LNPPP(−1) + C(9)*LNPPP(−2) + C(10)*LNVAT(−1) + C(11)*LNVAT(−2) + C(12)*LNXGR(−1) + C(13)*LNXGR(−2) + C(14)				
Observations: 26				
R-squared	0.694	S.E. of regression		1.619
Adjusted R^2	0.597	Durbin-Watson stat		2.022
Equation: LNXGR = C(15)*LNPPP(−1) + C(16)*LNPPP(−2) + C(17)*LNVAT(−1) + C(18)*LNVAT(−2) + C(19)*LNXGR(−1) + C(20)*LNXGR(−2) + C(21)				
Observations: 26				
R-squared	0.903	S.E. of regression		0.276
Adjusted R^2	0.873	Durbin-Watson stat		2.092

2. Kenya

Table A4. Kenya: Johansen Co-Integration Test.
Series: LNPPP LNVAT LNXGR

Lags interval (in first differences): 1 to 1				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical value**	**Prob.****
None	0.520	24.91	29.79	0.165
At most 1	0.186	5.816	15.49	0.717
At most 2	0.016	0.438	3.841	0.508
Unrestricted cointegration rank test (maximum eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-eigen Statistic**	**0.05 Critical value**	**Prob.****
None	0.520	19.08	21.13	0.0943
At most 1	0.187	5.378	14.26	0.6935
At most 2	0.017	0.437	3.841	0.5081

Trace test indicates no cointegration at the 0.05 level;
Max-eigenvalue test indicates no cointegration at the 0.05 level;
** denotes rejection of the hypothesis at the 0.05 level;*
*** MacKinnon-Haug-Michelis (1999) p-values.*

Table A5. Kenya: Short run model using vector auto-regression (VAR) estimation.

	LNPPP	LNVAT	LNXGR
LNPPP(−1)	0.858	1.443	0.811
	(0.252)	(0.917)	(0.534)
	[3.408]	[1.573]	[1.518]
LNPPP(−2)	−0.078	−1.689	−0.593
	(0.257)	(0.936)	(0.545)
	[−0.305]	[−1.803]	[−1.088]
LNVAT(−1)	−0.015	0.796	−0.006
	(0.067)	(0.244)	(0.142)
	[−0.217]	[3.253]	[−0.042]
LNVAT(−2)	0.097	0.193	−0.027
	(0.078)	(0.285)	(0.166)
	[1.241]	[0.678]	[−0.164]
LNXGR(−1)	−0.042	−0.213	0.859
	(0.092)	(0.334)	(0.194)
	[−0.464]	[−0.638]	[4.419]
LNXGR(−2)	0.114	0.475	−0.104
	(0.089)	(0.326)	(0.189)
	[1.273]	[1.455]	[−0.546]
C	1.365	1.885	−1.061
	(1.222)	(4.455)	(2.592)
	[1.116]	[0.423]	[−0.409]
R-squared	0.997	0.991	0.975
Adj. R-squared	0.996	0.988	0.967
F-statistic	951.3	363.4	123.6
Akaike AIC	−4.455	−1.869	−2.952

LNPPP = C(1)*LNPPP(−1) + C(2)*LNPPP(−2) + C(3)*LNVAT(−1) + C(4)*LNVAT(−2) + C(5)*LNXGR(−1) + C(6)*LNXGR(−2) + C(7);

LNVAT = C(8)*LNPPP(−1) + C(9)*LNPPP(−2) + C(10)*LNVAT(−1) + C(11)*LNVAT(−2) + C(12)*LNXGR(−1) + C(13)*LNXGR(−2) + C(14);

LNXGR = C(15)*LNPPP(−1) + C(16)*LNPPP(−2) + C(17)*LNVAT(−1) + C(18)*LNVAT(−2) + C(19)*LNXGR(−1) + C(20)*LNXGR(−2) + C(21).

Table A6. Kenya: Vector auto-regression (VAR) estimation with t-statistic and p-values.

	Coefficient	Std. error	T-statistic	Prob.
C(1)	0.858	0.252	3.408	0.001***
C(2)	−0.078	0.257	−0.305	0.762
C(3)	−0.015	0.067	−0.217	0.828
C(4)	0.097	0.078	1.241	0.219
C(5)	−0.042	0.092	−0.464	0.644
C(6)	0.114	0.089	1.273	0.208
C(7)	1.364	1.222	1.116	0.268
C(8)	1.442	0.917	1.573	0.121
C(9)	−1.689	0.937	−1.803	0.076*
C(10)	0.796	0.245	3.254	0.001***
C(11)	0.193	0.285	0.678	0.500
C(12)	−0.213	0.334	−0.638	0.525
C(13)	0.475	0.326	1.455	0.151
C(14)	1.885	4.455	0.423	0.673
C(15)	0.811	0.534	1.518	0.134
C(16)	−0.593	0.545	−1.088	0.281
C(17)	−0.006	0.142	−0.042	0.966
C(18)	−0.027	0.166	−0.164	0.870
C(19)	0.859	0.195	4.419	0.000***
C(20)	−0.104	0.189	−0.546	0.587
C(21)	−1.061	2.592	−0.409	0.684
Equation: LNPPP = C(1)*LNPPP(−1) + C(2)*LNPPP(−2) + C(3)*LNVAT(−1) + C(4)*LNVAT(−2) + C(5)*LNXGR(−1) + C(6)*LNXGR(−2) + C(7)				
Observations: 26				
R-squared	0.997	S.E. of regression	0.023	
Adjusted R-squared	0.996	Durbin-Watson stat	1.868	
Equation: LNVAT = C(8)*LNPPP(−1) + C(9)*LNPPP(−2) + C(10)*LNVAT(−1) + C(11)*LNVAT(−2) + C(12)*LNXGR(−1) + C(13)*LNXGR(−2) + C(14)				
Observations: 26				
R-squared	0.991	S.E. of regression	0.085	
Adjusted R-squared	0.988	Durbin-Watson stat	1.844	
Equation: LNXGR = C(15)*LNPPP(−1) + C(16)*LNPPP(−2) + C(17)*LNVAT(−1) + C(18)*LNVAT(−2) + C(19)*LNXGR(−1) + C(20)*LNXGR(−2) + C(21)				
Observations: 26				
R-squared	0.975	S.E. of regression	0.049	
Adjusted R-squared	0.967	Durbin-Watson stat	2.084	