Value added tax rate variation, import demand and sectoral output in Nigeria

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This study employs computable general equilibrium (CGE) model to estimate the effect of increase in value added tax (VAT), from 5 per cent to 7.5 per cent, on import demand and sectoral output in Nigeria. The study uses 2020 as the base year for the data analysis. The results show that increase in VAT affects import demand negatively, based on import penetration ratios, with mixed effect across six sectors. The implication of the result is that the VAT policy discourage consumption of foreign products, and constitute excess burden to consumers of such products in Nigeria. The results further reveal that the VAT policy enhances outputs from the agricultural, manufacturing and solid mineral sectors, however, outputs from services, construction as well as oil and gas decline. The result implies that increase in VAT is not detrimental to output in all economic sectors. The study, therefore, concludes that increase in VAT has adverse effect on import demand, and counter-productive in some sectors. It recommends that government should widen the VAT base and increase investment in critical sectors to boost revenue rather than increasing VAT since the policy has undesirable effect on aggregate sectoral output in Nigeria.

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1. Introduction

Trade theories have it that nations engage in international trade to benefit from specialized production, with each nation focusing on producing products that have the

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lowest opportunity costs. This idea recognizes international trade as a tool that triggers growth. In developing economies, the role of imports and exports in economic development is enormous, given that consumable goods, capital goods as well as technical know-how can be acquired through trade. Given that Nigeria is a small open economy and import-dependent, economic policies to achieve sustainable and economic growth cannot be isolated from trade components such as imports (Oyelade, 2018). It is evident that import demands in Nigeria has progressively heightened over the years. The Central Bank of Nigeria (CBN) reported that the non-oil imports trade steadily grew from N8,884,002 million to N16,152,184 million and N17,802,182 million in 2018, 2019 and 2020 respectively (CBN, 2020). The rising volume of Nigerian's imports may be due to continued rise in demand which is unmatched with domestic supply that is affected by government policies (such as tax policy) and reforms. This has prompted scholars to identify factors that would affect imports.

On the other hand, economic sectors contribute a greater share to gross domestic product (GDP) in Nigeria through its value addition. Statistical evidence showed that the share of agricultural sector to GDP has been on the increase, from 21.2% to 21.91% and 24.14% in 2018, 2019 and 2020 respectively (Statista, 2022). The performance of industrial sector also rose from 25.73% to 27.38% and 28.22% from 2018, 2019 and 2020, while the service sector has witnessed a declining performance from 52.02% to 49.73% and 46.39% in 2018, 2019 and 2020 respectively (Statista, 2022). Though, according to Osinowo (2015), government policies and reforms greatly determine how economic sectors performs within an economy. To this effect, the Manufacturing Association of Nigeria has augured that the upward review of VAT policy in Nigeria will be counter-productivity and hampered economic sectors particularly the manufacturing sectors (MAN, 2019).

Accordingly, the impressive performance of VAT in other countries (France, Germany and USA) as well as the intention of the Nigerian government to increase her domestic earning base principally accounted for the introduction of VAT in the country in 1993 which hitherto was charge at a flat rate of 5% for all VAT rated products (Oraka *et al.*, 2018). However, after the adoption of VAT in Nigeria as a replacement

for sales tax, it has become a controversial issue. While VAT can contribute to economic growth by providing stable government revenue, it may also affect consumer spending patterns and business operations due to increased prices (Aminu, 2019).

Moving toward domestic sustainability due to persistent fluctuations in oil price at the international market, Nigerian government has implemented a fiscal action of deficit cut through increase in VAT rate from 5% to 7.5% in 2020 (Tonuchi, 2020). Consequently, the economic effect of the VAT policy is contestable and has become a concern. Given that Nigeria is an import-dependent economy, government reforms such as the increase in VAT rate are likely to affect imports (Oyelade, 2018). Empirically, Aminu (2019) found that decline in imports and economic output is associated with increase VAT policy, in contrast to the positive impact of VAT on import and export trade reported by Benzarti and Tazhitdinova (2019). Furthermore, Ahmed (2019) held that the upward review of VAT in Nigeria will increase government revenue and reduce dependency on oil revenue. Thus, it has become an empirical issue of whether the new VAT policy is desirable for domestic consumption of foreign products for an import-dependent economy like Nigeria.

Following the implementation of new VAT rate in Nigeria, it is imperative to empirically investigate the consequences of the new tax policy in the country. This paper, therefore, simulates the effect of increase in VAT on import demand and sectoral output (agricultural, manufacturing, solid mineral, services, construction and oil and gas sectors) in Nigeria. This paper is important as it could help policy makers to understand the implications of the new VAT rate on importation and sectoral outputs, and supports the adoption of appropriate tax policies that will reduce tax burden, control inflation, as well as ensure favourable international trade balance. The novelty of this study is its consideration of a single simulation scenario based on government VAT implemented policy in 2020, which capture the real effect of VAT in the economy hence, making use of the new policy take-off data in Nigeria.

The rest of the paper is structured as follows: Literature review is in Section 2, while Section 3 contains data and methodology. The simulated results and discussions are reported in Section 4 and Section 5 presents conclusion and recommendations.

2. Literature Review

2.1 Theoretical Literature

Neoclassical economist Leon Walras laid the groundwork on the general equilibrium theory. The theory holds that all prices and quantities in all markets are determined by market forces of demand and supply (Ekanem & Iyoha, 1999). The Walrasian theory has been greatly complemented by the works of Wilfredo Pareto and Francis Edgeworth in 1881 due to its optimality property. As contained in the input-output table of Wassily Leontief, the doctrine supports the argument that real-world markets are interdependent where changes in demand and supply conditions usually have repercussions. A general equilibrium exists if each market is cleared at a positive price which is tax inclusive where economic agents maximize satisfaction and profit with least cost. It imposes income/expenditure and resources constraints thus ensuring that household are on their budget lines and the total amount of factors employed in production does not exceed a country's factor endowments. The theory supports the economy-wide perspective of market interactions and decision-making in perfect product and factor markets. Its solution and optimality properties are used as a norm to judge the significance and implications of deviations caused by fiscal policy. The equilibrium position is sensitive to government intervention such as its fiscal policy (tax) that can influence prices of output. Given that VAT burden is shifted to consumers of both domestic produced and imported commodities, analysing such policy has to take into account the decision of foreign demand for items.

On the other hand, the Laffer curve theory developed by the supply-side economist Arthur Laffer in 1974 describes the relationship between tax rates and total tax revenue. The Laffer curve supports an optimal tax rate that maximizes total tax revenue and at the same time drives economic activity. Laffer's theory provides the obvious reason that zero tax rates produce no tax revenue to the government and tax rate above a certain level reduces government tax revenue. According to Laffer (2004), the economic consequence of lowering tax rates is that it impacts positively on work, output and employment thereby creating incentive for increasing state activities. The prime concern of this doctrine is to ensure that reducing or increasing tax rates beyond a certain point is not counter-productive for raising further tax revenue. Since the emergence of Laffer doctrine, there has been debate over the role of tax on the

performance of an economy theoretically.

General equilibrium theory examines how supply and demand interact across different markets to determine prices and quantities of goods and services. An increase in VAT in Nigeria is expected to affects prices, altering supply and demand dynamics across various sectors. According to general equilibrium theory, consumers may adjust their consumption patterns to maximize utility given the new price levels, potentially reducing overall consumption. While producers might respond to an increase in VAT by adjusting their production levels, prices, or product offerings. The Laffer Curve also considers how individuals and businesses respond to changes in tax rates. With the increase in VAT in Nigeria, businesses may increase prices, and consumers may also look for ways to avoid or reduce tax burden by reducing consumption.

2.2 Empirical Literature

There is a plethora of empirical studies that explored the effect of VAT on economic variables. The reviewed empirical works in this study cut across developing and developed nations. For instance, Gourdon, *et al.*, (2020) used export data from 2003-2012 and assessed how changes in the export VAT affected China's export performance using heteroskedasticity robust standard errors model for the analysis. The results showed that a rise in the export VAT led to a relative decrease in export volume in China.

In another dimension, Sanjaya and Gretton (2019) considered 2011 as the reference year, and looked at the impact of VAT on exports services in Indonesia employing a computable general equilibrium model. Result revealed that there was a long-run national economic benefit of the wide impacts of zero-rated VAT on exports of business services in Indonesia. This finding was similar to the work of Benzarti and Tazhitdinova (2019) that explored the effect of VAT changes on trade flows across all EU member states from 1988 to 2016. With a panel regression, it found that VAT did not distort import and export trade. In another strand of argument and employing a recursive dynamic computable general equilibrium for Nigeria, with 2017 base year, Aminu (2019) found that the highest decline in imports and exports were associated with increase in VAT policy.

Polbin (2018) conducted a macroeconomic analysis of the effects of VAT increase

in Russia. By employing a computable general equilibrium model with 2017 data, it was discovered that increased VAT rate would decrease exports and imports compared to the theoretical economic scenario which envisages no changes in fiscal policy. Similarly, Freund and Gagnon (2017) looked at value added tax, real exchange rates and trade balances in 34 advanced economies with data spanning from 1970 to 2015. Employing a panel regression, result showed that an upward VAT review tends to benefit real exchange rate with minimum impact on the current account balance. In another study on U.S trade by Nicholson (2010) using panel regressions covering 1997-2008, it was discovered that implementation of VAT declined both export and import demand in U.S. VAT reduced the trade volumes of both imports and exports. Using a cross sectional time-series panel data and panel regression in Asian countries from 1985 - 2014, Yoke and Chan (2018) studied the effect of value added tax on manufacturing performance. Results showed that export intensity performed better in countries without VAT, and the manufacturing sector's output was adversely impacted by VAT. Similarly, in another study of the effect of VAT change on the tourism sector in Turkey using structural vector autoregression, Griselda (2018) finds that tourism activities were positively affected by VAT reduction.

Utilizing a forward-looking model, Pereira and Pereira (2017) conducted a simulation analysis to determine the consequence of increase in VAT on electricity (power sector) in Portugal using a dynamic general equilibrium model. The model was calibrated with data starting from 2005 - 2015. The study unveiled that increase in VAT was non-distortionary to electricity services but rather increase revenue. The simulation results also revealed a positive budgetary effect due to increase in VAT on electricity. Nipers, *et al.* (2019) also employed a computable general equilibrium model to investigate the influence of reducing value added tax on food items in Latvia taking 2013 as the base year for estimation. The estimated result illustrated that VAT reduction on food items in first quarter of the year was favourable to customers and producers even though the consumers' gain outweighs producers' gain. VAT reform had a positive influence on food industries due to increase in food sales. The study concluded that reduction in VAT for food resulted in a decrease in food prices.

None of the reviewed studies considered the 2020 increased VAT policy in Nigeria.

Thus, the effect of 50% increase in VAT on import-demand and sectoral output in Nigeria that the study considered has not be sufficiently studied in extant literature using data from the take-off of the VAT policy by applying Computable General Equilibrium model. Also, how the increase in VAT affect consumption of imported products based on each economic sector in Nigeria is underexplored. This study therefore, fill this research gap, and contribute to knowledge on the effect of VAT adjustment on economic variables.

3. Data and Methodology

3.1 Data

The data used in this study was obtained from different sources. Data of value added tax was sourced from Federal Inland Revenue Services (FIRS) site. Sectoral output data was obtained from Central Bank of Nigeria (CBN) annual statistical bulletin. Import demand data, labour, capital and household consumption data were sourced from National Bureau of Statistics site. The study constructed Social Accounting Matrix (SAM) using 2020 data from the Federal Office of National Bureau of Statistics (NBS) and the Nigeria Institute of Social and Economic Research (NISER). The constructed SAM was based on the 2006 input-output table, which replaced sales tax with VAT, and it was calibrated using the General Algebraic Modelling System (GAMS). The choice of 2020 data was due to the implementation of the new rate which took effect from 2020 following the government's proposal of the policy in 2019. The SAM provides a snapshot representation of an economy, typically over a one-year period, capturing the feedback relationships between production and income. Also, the use of 50% increase in VAT (5% -7.5%) is policy based (in line with the new VAT region), as implemented by the Nigerian government in 2020.

3.2 Method of Data Analysis

The study utilized the CGE model to simulate the effect of the policy due to the model's economy-wide framework that incorporates demand and supply interaction and feedback within which economic variables adjust until production and consumption decisions are consistent. The model is efficient in tracing components of the economy, hence, relevant for policy. The impact of VAT is expected to be reflected in changes in commodity prices, revenue and volume of output from economic sec-

tors. The choice of CGE model over dynamic general equilibrium model is due to its effectiveness in simulating the effects of policy or reform changes within a single scenario, such as the implemented 7.5% VAT which is applicable to all VAT-rated products in Nigeria. Thus, given that a single VAT rate is implanted in Nigeria, CGE was preferred over the dynamic general equilibrium model that considered multiple scenarios which does not aligned with the current tax practice in Nigeria. The analysis used GAMS software.

3.3 Theoretical Model

This subsection presents the general equilibrium theory in line with the tenets of the CGE model to achieve the goal of the study. It converts general equilibrium theory presented by Walras in abstract depiction into practical models in the society (Hosoe, 2004). The model assists in policy and reforms evaluation using specified data and parameters of demand and supply that reflect real situations in the economies. In CGE model, the demand for inputs and supply of outputs by firms are chosen in order to maximize profits, which depends on their production technology. The assumption is that production of commodities requires intermediate inputs, and regarding output, firms can produce by-products or multiple products. The model incorporates five sectors which include agriculture, manufacturing, construction, trade and services whereas decision to produce and consume must be attained. Factors and products from the sectors are traded using both local and foreign currencies; however, this analysis made used of naira currency. When extended to an open economy, the CGE structure considers substitutability among domestic supplies, imports and exports of the same sector with imperfect substitutes termed Armington assumption (Ekanem & Iyoha, 1999).

3.4 Model Specification

The CGE model employed in this study is a modified version of Lofgren,
textitet al. (2002) and Abachi and Iorember (2017), tailored to suit the purpose of this study. In line with the tenets of the CGE model, the study grouped the model into four blocks namely: prices, production and trade, institutions, and system constraints as follows:

Price Block: The price system of the model assumed quality differences among

commodities of different origins and destinations. The price block consists of equations in which endogenous model prices are linked to other prices (endogenous or exogenous) and non-price model variables.

Demand price of Domestic None Traded Goods: The model comprises different prices for locally made products that is used within the country given that locally manufactured commodities are vatted based on the Nigerian tax system. This rate is reflected in the form of price that foster transaction between buyers and sellers as shown in Equation (1)

$$P_j \cdot \left(1 - vatq_j\right) \cdot QQ_j \;\; = DDp_j \cdot QD_j + Mp_j \cdot QM_j j \in JD \tag{1}$$

where P is the product price, $1 - vatq_j$ is the VAT adjusted rate impose on commodities. QQ is the quantity of commodity, DDp is the price of domestic demand, QD domestic quantity, Mp is price for imports, QM is imported quantity, $j \in JD$ denotes domestic sale of output j.

Import Price: The import price is computed in domestic currency units as the price paid by the domestic users for the imported goods. It is computed as world's price for imports, taking into account the real rate of exchange and VAT.

$$MP_j = pwmj \cdot (1 + vat) \cdot EXR + \sum PQj'ijm_{j'j} \tag{2}$$

is price of imported products that is not in the local currency, is the real exchange rate and is the trade input cost for j sector.

Price of Product on Sectors: Given that VAT is levied on the product, then the vector of VAT including sectorial prices can be define in Equation (3) as:

$$P_j \cdot (1 - vat_i) \cdot QA_i = VA_i \cdot QVA_i + PINTA_i \cdot QINTA_i a \in A \tag{3}$$

\left[\begin{matrix}activity\ price\\\left(net\ of\ VAT\right)\\times\ \\activity\ level\\\end{matrix}\right]=\left[\begin{matrix}value\ added\ price\\times\\quantity\\\end{matrix}\rig
input\ price\\times\\quantity\\\end{matrix}\right]

where P denotes price of product from sector j, is the quantity of commodity produced from a sector, is the product of value addition from economic sectors, is the

sum of price for inputs and quantity produced using the available inputs.

Absorption: This is the aggregate expenditure on a commodity at domestic demand price. Equation (4) defines absorption which includes value added tax. Absorption is considered as the aggregate domestic expenses incurred on locally made and imported product relative to demand prices. The equation is express as:

$$PQ_j \cdot (1 - vat) \cdot QQ_j = DDp_j \cdot QD_j + Mp_j \cdot QM_j \tag{4}$$

$$\begin{bmatrix} absorption \\ at\ demand \\ prices \\ net\ of\ VAT \\ for\ commodity \end{bmatrix} = \begin{bmatrix} price\ of \\ domestic\ demand \\ multiply\ by \\ domestic\ sales \\ quantity \end{bmatrix} + \begin{bmatrix} price\ of \\ import \\ multiply \\ by\ import \\ quantity \end{bmatrix}$$

PQ is the absorption at demand price, QQ is the quantity of commodity.

Activity Price

Equation (5) describes the level price for activity (PAa), which represented output per unit multiplied by output prices, plus all commodities given that an activity can manufacture varieties of products. Furthermore, activity price (gross revenue per activity unit) is affected by the increase in yield due to an upward review of the VAT rate. Thus, the equation is defined as:

$$PAa = \sum_{j \in J} PXAC_{aj}.\theta_{aj} a \in A \tag{5}$$

From Equation (5), $a \in A$ is activity set, PAa is price for an activity, = output price of a for a activity, and $\theta a\, j$ denotes output j in an activity per unit.

Trade and production block: This block describes the various activities that are carried out by producers in the country. In the production process, the activities are based on profit maximization with respect to technology. The activity production function can be expressed as follows:

$$QA_a = \left(\partial.Q + (1 - \delta_a^a).QINTA_a^{-p_a^a}\right)^{\frac{1}{p_a^a}} \quad a \in ACE(\subset A) \tag{6}$$

$$\begin{bmatrix} activity \\ level \end{bmatrix} = CES \begin{bmatrix} quantity\ of\ aggregate\ value\ added, \\ quantity\ of\ aggregate\ intermidiate\ input \end{bmatrix}$$

$a \in ACE(\subset A)$ is production in line with a CES function, δ is share parameter of CES production, $QINTA$ denotes sum of value added based on intermediate input and p_a^a is exponent of CES production function.

Sectoral Production and Output determination: Consider an economy with j sectors, each producing an output that are non- VAT exempted using labour and capital according to either a CES or Cobb-Douglas production function, the production function can be express as shown in Equations (7) and (8).

$$H_j(X_{vat}^j) = Z_j \tag{7}$$

$$\begin{bmatrix} vector \\ of\ inputs \\ of\ sector\ j \end{bmatrix} = \begin{bmatrix} sector\ j \\ capacity\ to \\ produce \end{bmatrix}$$

And

$$G_j(Y_{vat}^j) = Z_j \tag{8}$$

$$\begin{bmatrix} vector \\ of\ output \\ of\ sector\ j \end{bmatrix} = \begin{bmatrix} sector\ j \\ capacity\ to \\ produce \end{bmatrix}$$

where $j = 1 \ldots 6, H_(j)(X^j)$ is the vector of inputs of sector j, $G_j(Y^j)$ is the vector of outputs of sector j, Z_j is a variable reflecting sector $j's$ overall capacity to produce, vat is the VAT rate paid by sectors for their production. The inputs merely generate a general capacity to produce which are used for further production of a variety of commodities from different sectors are not zero VAT rated.

Institutional Block

The block considered equations that describe the movement of income from institutions to households ultimately. The inter-institutional entries in SAM of Nigeria are incorporated.

Institutional Factor Incomes

The institutional factor incomes from Equation (9) is fragmented among domestic institutions in fixed shares after payment of indirect factor taxes and transfers to the rest of the world.

$$YF_f = shif_{if}.\left[(1-vat\ )\ .\ YF_f\ - tsnf_{if}.\ EXR\right] \qquad \begin{matrix} i\epsilon\ INSD \\ f\ \epsilon\ F \end{matrix} \tag{9}$$

where $i\epsilon\ INSD$ is institutional set, YF_f is domestic income earnings for institution i from f factor, $shif_{if}$ is domestic institutional share in income for factor f, $1-vat$ is VAT adjusted rate for factor, and $tsnf_{if}$ shift from factor f towards institution .

Consumption Expenditure

The demand for commodities by the household in Equation (10), describes the remaining income after necessary deductions to institutions belonging to non-governmental organizations.

$$EH_h = (\ 1-vat\ ).\ (1-MPS_h).(1-TINS_h).YI_h \qquad _{h\epsilon\ H} \tag{10}$$

$$\begin{bmatrix} household\ income \\ disposable\ for \\ consumption \end{bmatrix} = \begin{bmatrix} household\ incomenet \\ of\ VAT, savings \\ andtransfer\ to\ other \\ non-governmental \\ institutions \end{bmatrix}$$

Where $i\epsilon\ INSN$ = a set of households.

Demand for government consumption: In this component, the primary element is the services provided by the government, calculated by multiplying the base-year value by an adjustment factor.

$$GDQ_j = \overline{AGDQJ}\ .\ \overline{qg_j} \tag{11}$$

Where GDQ_j denotes quantity of products consumed by the government sector, $\overline{AGDQJ}$ adjustment factor from the consumption component (exogenous variable), and $\overline{qg_j}$ is government demand from the base-year.

Import Demand

Given that Nigeria is an open economy and import is VAT inclusive, VAT reforms,

should consider the effect of consumption tax on import prices, given that import has a sizeable share in the country's GDP. Imposing VAT on foreign items is expected to increase the cost of products which is later shifted to consumers but lead to revenue increase to the government expressed in local currency.

Equation (12) expresses the import demand for foreign product which are consumed locally that are vatable.

$$M^d_{vat} = f_i(P_{vat}, F_x) \tag{12}$$

$$\begin{bmatrix} quantity\ of\ import \\ that\ is\ VAT\ rated \end{bmatrix} = \begin{bmatrix} price\ of VATable \\ imported product, \\ and\ foreign\ exchange \\ reserve \end{bmatrix}$$

where M is imported product which are determined by price, f is function whose mathematical form is to be specified, p is $(1 + tvat)\frac{P^i}{P^d}$ is the ratio of price of import demand to domestic price level adjusted for VAT. Import is subject to other taxes such as tariffs as well as import duties but this analysis is limited to VAT effect relative to the adjusted rate.

System Constraint Block

The system constraint segment considered a situation where an economy must meet equilibrium point at a given market price. It is assumed that supply of the two factors are exogenous and given as parameters.

$$\sum_a QF_{fa} = \overline{QFS_f} \quad f \in F \tag{13}$$

$$\begin{bmatrix} demad\ for \\ factor\ f \end{bmatrix} = \begin{bmatrix} supply\ of \\ factor\ f[] \end{bmatrix}$$

Similarly, the equilibrium in the commodity market as expressed in equation 16 is the composite commodity market.

$$QQ_j = \sum_{a\ \epsilon\ A} QINT_{ja} + \sum_{h \epsilon H} QH_{vat} + qg_{jvat} + QINV_{j,} + qdst_j + QT_j \quad j \epsilon J \tag{14}$$

$$\begin{bmatrix} composite \\ supply \end{bmatrix} = \begin{bmatrix} intermidiate \\ use \\ fixed\ investment \end{bmatrix} + \begin{bmatrix} hpusehold \\ consumption \\ that\ VAT rated \end{bmatrix} + \begin{bmatrix} government \\ consumption \\ inclusive\ of\ VAT \end{bmatrix} + \begin{bmatrix} fixed \\ investment \end{bmatrix} + \begin{bmatrix} stock \\ change \end{bmatrix} + \begin{bmatrix} trade \\ input \\ use \end{bmatrix}$$

Equation (15) defines the indirect tax rates of non-government institutions which is VAT inclusive.

$$VATS_i = \overline{tvas_i}\ .\ \left(1 + \overline{TINSADJ}.tins01_i\right) + \overline{DTINS}\ .t \quad i \in INSDNG \tag{15}$$

$$\begin{bmatrix} indirect\ tax \\ VAT rate \\ for\ institution\ i \end{bmatrix} = \begin{bmatrix} base\ rate\ adjusted \\ for\ scaling\ for \\ selected\ institutions \end{bmatrix} + \begin{bmatrix} point\ changes \\ forselected \\ institutions \end{bmatrix}$$

Savings–Investment Balance

Savings-investment balance is another macro constraint, which is presented in equation 16. In the balance, savings and investment aggregate must be equated at a particular point. Saving aggregate is the sum of household savings as well as institutions. Savings are endogenous while investment is exogenously fixed because the model assumed that capital can move freely, meaning that investment levels may not be responsive to immediate economic shock compare to the responsive of savings. In addition, by allowing savings to adjust, the model can better capture changes in consumption behaviour which is more directly related than investment that may not receive instant economic policy change on consumption, hence, adjustment of savings is to meet consumption needs. The of sum of investment comprises the values of fixed investment and stock changes in the economy.

$$\sum_{i \epsilon INSDNG} MPS_i\ (1 - vats_i) + GSAV + EXR \cdot \overline{FSAV} = \sum_{j \in J} PQ_j \cdot QINV_j + \sum_{j \in J} PQ_j \cdot qdst_j \tag{16}$$

$$\begin{bmatrix} nongovernment \\ savings \end{bmatrix} + \begin{bmatrix} governemnt \\ savings \end{bmatrix} + \begin{bmatrix} foreign \\ savings \end{bmatrix} = \begin{bmatrix} fixed \\ investment \end{bmatrix} + \begin{bmatrix} stock \\ change \end{bmatrix}$$

where, MPS_i is non-government savings, $EXR \cdot \overline{FSAV}$ is foreign savings, $\sum_{j \in J} PQ_j \cdot QINV$ is the coefficient of fixed investment and $\sum_{j \in J} PQ_j \cdot qdst_j$ is the stock change for commodity i in institution j.

Import Penetration Ratio

Imports Penetration Ratio (IPR) is an indicator that measures the proportion of imported goods that are consumed domestically. It shows the performance of imports of a country if desirable or not under different economic conditions relating to government policies, environmental factors, among others. Import penetration ratio is given in Equation (17).

$$IPR_{(i)} = \frac{M_{(i)}}{D_{(i)}} \tag{17}$$

$$\begin{bmatrix} import \\ penetration \\ ratio \end{bmatrix} = \begin{bmatrix} import\ of\ commodity\ i \\ divide\ by \\ domestic\ demand \end{bmatrix}$$

where; $M_{(i)}$ is import of commodity i; $D_{(i)} = X_{(j)} + M_{(i)}$ is domestic demand; $X_{(j)}$ is output of the j sector, which is distributed between intermediate demand, private consumption demand, investment demand and government consumption demand.

3.5 Simulation Design and Macroeconomic Closures

A single VAT policy scenario was created that is, from 5% to 7.5%. The baseline solution in the analysis assumes a situation of no change in VAT. The CGE model's closure rules for the scenario are that savings are endogenous and investment is exogenously fixed, thus, individual sectorial investments do not vary in the same direction as savings. Furthermore, the current account balance, budget deficit, and savings are all determined endogenously.

4. Results and Discussion

The effect of increased VAT on imported consumables under the scenario of 50% increase for all imported products is presented in Table 1.

Table 1: Effect of 50% increase in VAT on import demand

	Baseline value (N' Billion)	Simulated value (N' Billion)	% Δ	IPR	EV	Price
Imports of:						
Agricultural Goods	3556.950	2767.852	-22.19	-19.01	-216.20	13.27
Manufactured Goods	11196.190	9380.666	-16.22	-9.49		
Solid Minerals	280.360	232.033	-17.24	-16.69		
Services	2195.580	1638.251	-25.38	-19.41		
Construction	2.680	2.084	-22.25	-21.19		
Oil & Gas	2.750	2.086	-24.15	-22.07		
Total Imports	17234.51	14022.972	-18.63			
Exports	4111.59	5152.699	25.32			
Net Export	-13122.92	- 8870.273	-32.41			

Note: IPR and EV denote import penetration and Hicksian Equivalent Variation, respectively.

The import penetration ratio (*IPR*) in Table 1 showed the proportion of product that are supplied through imports from each sector (agricultural, manufacturing solid mineral, services, construction and oil and gas sectors). The result revealed that due to increase in VAT on imports, the imports of agricultural and manufacturing goods decline by 19.01% and 9.49%, respectively. This implies that the VAT policy does not favour importation of agricultural and manufacturing products which goes in line with the 2019 border closure by the Nigerian government. This finding is in line with the results of Aminu (2019) and Polbin (2018) who found that upward review of VAT reduced the volume of import.

Furthermore, imports of solid mineral goods, construction, services as well as oil and gas products fell by 16.69%, 19.41%, 21.19%, and 22.07%, respectively. The results imply that the VAT policy will adversely affect imported products in Nigeria. The implication of the finding is that an upward review of VAT from 5% to 7.5% has depressing effect on import demand in Nigeria. This is justified on the ground that the VAT policy increased import prices of consumables by about 13.27%. The result is theoretically plausible. This outcome corroborates Nicholson (2010) who finds that increased VAT rate would decrease exports and imports compared to the theoretical economic scenario which envisages no changes due to the policy. It suggest that the effect of VAT on consumption is through change in price of consumable goods and

services. The variation in exports and imports is due to the fact that exports are VAT exempted in Nigeria but imports are VAT inclusive. A trade deficit was revealed from the result with a negative net export value of 32.41% between the baseline and simulated value. The results signify that the negative effect of VAT increase on import would encourage domestic production and favour infant industries in line with the import substitution policy in Nigeria. Correspondingly, taxing imports will shift consumer demand to similar locally made products. Furthermore, the negative value of Equivalent Variation (EV) (-216.20) which is a measure of welfare due to price change or policy shift indicates that consumers of all imported products are worse off after upward review of VAT. This implies that the policy constitute excess burden to import consumers. The results for the effect of increase in VAT on sectoral output in Nigeria is presented in Table 2.

Table 2: Effect of VAT increase on sectoral outputs

	Baseline value (N' Billion)	Simulated value (N' Billion)	Percentage Change (%)
Total Consumption Expenditure	43824.56	40694.709	-7.14
Agricultural Output	33629.569	33721.711	0.27
Manufacturing Output	14934.033	15948.153	6.79
Solid Mineral Output	11034.006	11061.372	0.25
Services Output	33498.775	31870.368	-4.86
Construction Output	16806.730	16580.870	-1.34
Oil & Gas	38403.014	37378.919	-2.74
Total Output	148306.127	146561.393	-1.18
Price			13.27

The results presented in Table 2 showed that an upward review of VAT has mixed effect across the six sectors. The policy will bring about an output increase in agricultural, manufacturing, and solid mineral sectors. The increase in manufacturing output over other sectors is because as VAT increased, manufacturers shift the burden of tax to consumers in form of higher prices often higher than the increase in VAT. This result is theoretically plausible and in consonance with Nipers, *et al.* (2019) findings that producer benefits from VAT increase.

However, outputs from services, construction, and oil and gas sectors declined from their baseline values. The decline in outputs is theoretically supported by the optimality property of the Walrasian general equilibrium theory ((Ekanem & Iyoha,

1999). Similarly, increase in VAT will raise input costs from sectors will likely impede productivity, since companies and firms treat VAT as a cost. In addition, the decline in production from other sectors may be because their outputs are used as intermediate inputs to manufacture, agriculture and solid mineral sectors. Nonetheless, the change in the aggregate output showed that 50% increase in VAT will negatively affect total sectoral outputs in Nigeria, meaning that the VAT reform is an undesirable policy to aggregate output due to its effect on prices.

5. Conclusion and Policy Recommendation

The study found that increase in VAT has adverse effect on import demand in Nigeria based on the negative values of import penetration ratio for all imported products. Result further showed mixed effect of the VAT upward review on output across the six sectors of the economy, but a negative effect on total output.

The study recommends that VAT increase should be exempted on imported products that have no domestic substitutes since it could hike prices which could lead to welfare loss to the household who consumes such items. Implementing the VAT reform does not encourage or sustain domestic production in some sectors but counterproductive due price hike at the expense of increase in revenue. The study advocates for investment in agriculture and manufacturing to diversify the economy and ensure self-sustenance rather than increasing VAT rate.

This paper contributes to the empirical literature by proposing a new model that incorporates the quantitative effects of VAT variation on import demand and sectoral output. The findings underscore the need for policymakers to implement a VAT rate that permits the consumption of un-substituted product in the domestic economy, and promotes sectoral performance.

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research consortium paper 92

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Appendix A

Table A1: Reformatted Social Accounting Matrix for Nigeria, 2020

	AGRIC	MAN	SLDMIN	SVR	Cons	OIGA	LAB	CAP	Hhds	CORP	GOV	DTAX	VAT	mVAT	SAI	ROW	TOTAL
AGRIC	695.3	2168	6942.71	45.0926	10609	4255.9	-	-	5165.9	-	537.93	-	-	-	5347	48.523	35816
MAN	1726.5	1020	12.8791	3428.88	114.74	832.4	-	-	10240	-	10.517	-	-	-	8827.4	145.08	26358
SLDMIN	385.47	313.1	6.79767	163.384	25.293	103.06	-	-	347.56		10.394	-	-	-	9446.2	41.936	10843
SVR	3046	1359	6.7216	7711.96	136.53	643.98	-	-	11770	-	1350.1	-	-	-	8274.5	122.11	34420
Cons	3279.4	1486	1199.33	34.7321	3.5025	828.73	-	-	3615.7	-	112.36	-	-	-	5463.7	2.7169	16026
OIGA	7273.8	480.5	2285.4	1937.8	3681.1	1887.1	-	-	12686	-	53.64	-	-	-	6117.4	3751.2	40154
LAB	12157	3560	7.02828	15858.1	27.01	62.867		-	-	-	-	-	-	-	-	-	31673
CAP	3510.5	3975	87.6537	2840	1411.6	31533	-	-	-	–	-	-	-	-	-	-	43358
Hhds	-	-	-	-	-	-	31672.691	18074		12511.799	2577.9	-	-	-	-	9705.6	74542
CORP	-	-	-	-	-	-	-	16818	-	-	-	-	-	-	-	-	16818
GOV	-	-	-	-	-	-	-	8465.9	-	-	-	8171.7	362.99	859.59	-	1713.9	19574
DTAX	-	-	-	-	-	-	-	-	3865.6	4306.117413	-	-	-	-	-	-	8171.7
VAT	7.1444	242.2	0.25687	95.3368	13.79	4.2302	-	-	-	-	-	-	-	-	-	-	362.99
mVAT	177.43	558.1	14.1015	109.497	0.2577	0.2367	-	-	-	-	-	-	-	-	-	-	859.59
SAI	-	-	-	-	-	-	-	-	26852		14921	-	-	-	-	1703.4	43476
ROW	3556.9	11196	280.36	2195.58	2.6838	2.7483	-	-	-	-	-	-	-	-	-	-	17235
TOTAL	35816	26358	10843.2	34420.3	16026	40154	31672.691	43358	74542	16817.91657	19574	8171.7	362.99	859.59	43476	17235	