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ABSTRACT

The introduction of Value Added Tax in January 1994 has remained the most important development in the country's effort to reform taxation. One of the most important issues in VAT however is the size of the potential tax base, which is essential for a revenue forecast. The aim of this paper is to provide an analytical framework for estimating the potential VAT base and revenue collection using micro simulation techniques. The model is based on the input-output approach, which is static in nature. Empirical result using the model revealed that a lot more could be realized from VAT if compliance is improved. The model was used to estimate VAT revenue at different compliance level under current VAT legislation. Clearly a well-administered broad based VAT can result in higher coverage and increase in revenue.

INTRODUCTION

In Nigeria like most other countries of the world, a shift has been made away from raising revenue from sales tax to a broad-based consumption-type value added tax (VAT). Since its introduction in January 1994, VAT has enjoyed unprecedented growth and has therefore, become an important part of the fiscal system. In 1995, VAT accounted for approximately 15.3 per cent of the total non-oil tax revenue of the government. In 1996 the proportion increased to 20.5 per cent. The tax has grown from 1.0 per cent of GDP in 1995 to 1.5 per cent in 1999. Vat has undoubtedly remained the most important development in the country's effort to reform taxation in recent years.

Several articles have been written on a wide range of issues relating

to value added tax in Nigeria {Naiyeju (1996), Ogundele (1996) and Popoola (1997)}. The range of issues addressed in the publications, incude VAT administration, VAT effect on efficiency, inflation and revenue. However, there has been very little attempt at calculating the theoretical base of the VAT, even though broad estimates of revenue expected from the tax have been published in the budget from year to year. One of the most important issues in VAT however, is the size of the potential tax base, which is essential for a revenue forecast. Since VAT revenue depends on consumption of goods and services, the focus of any forecasting model is the nature of the domestic transaction of such goods and services. Analytical framework for simulating consumption tax behaviour and forecasting tax revenue therefore, begins with the construction of tax bases. It is important to calculate the VAT base in order to know how much of the base is actually being taxed, so as to realize the proper potential of the tax.

The main purpose of this paper is to provide an analytical framework for estimating the potential VAT base and revenue collections from 1995 - 2005 using micro simulation techniques. Micro simulation models have become very attractive because of their potential to respond to important needs for information on the effect of broad policy changes on revenue, on the relevant population groups and on programme costs. In addition to forecasting the revenue estimates, the model will provide the necessary tool to assess the consequences of government policy decisions regarding changes in tax rate and increased compliance with the tax law.

In section 2 the characteristics of VAT in Nigeria that are essential for the calculation of the base are described. Section 3 outlines approaches for calculating the VAT base and the methodology used for estimating the VAT base in this paper. Empirical result is discussed in Section 4, while Section 5 contains the summary, conclusion and policy recommendations.

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2.0 CHARACTERISTICS OF VAT IN NIGERIA

Value added tax was introduced in 1994 to replace retail sales tax, which had a narrower base. Although the VAT Decree No. 102 of 1993 was signed into law in August 1993 it became operational on 1st January 1994. The value-added tax in Nigeria is the consumption type, which takes only consumer goods and not capital goods. It is based on the destination principle which means that all sales meant for the domestic market is taxed whether they are manufactured in the country or abroad. Although, it is called a value-added tax the total value added in the country is not the base on which the tax is levied. Imports that are consumed in the country come from other countries where the value added is produced. Similarly, for exports, value added is in the country but consumption is in a foreign country. Therefore, in Nigeria as in other countries, the practice is to tax imports and exempt exports. This makes the VAT base equal to domestic retail sales but not the same as value added in the country.

VAT has a single general rate of 5% on the invoice value of goods and services supplied by a taxable person. A taxable person is defined as a manufacturer, a wholesaler, an importer or a supplier of taxable goods. The tax is computed using the tax credit or invoice method and it is applied at all stages of the production process where it is calculated by the difference between the tax paid on inputs and that charged on output. One significant characteristic of the invoice method is that the invoice becomes an important evidence of the transaction as the tax liability is attached to it. An unbroken chain of credit is therefore, accumulated as the item moves from one stage of production to another, to distribution and to the final consumer. Moreover, the method creates a good audit trail (Tait, 1990).

The VAT legislation in Nigeria taxes every good and service except those exempted or zero-rated. For social and economic reasons seven items of goods and three items of services are exempted from VAT. Exemption

becomes necessary when it is not desirable to tax an aspect of the production or distribution of a good or service but some tax on the final consumption of the good is desirable. Under an exemption VAT is paid on all stages of production or distribution up to the exempt stage. The exempt stage cannot claim any refund of the tax paid on its purchases.

Goods exempted for VAT are:

- Medical and Pharmaceutical Products,
- Books and Educational Materials,
- Newspapers and Magazines,
- Baby Products,
- Commercial Vehicles and Commercial Vehicle Spare Parts,
- Fertilizers, Agricultural and Veterinary Medicine
- Machinery and Transportation Equipment,

Services Exempted are:

- Medical Services
- Services rendered by Community Banks, People's Banks,
- Mortgage Institutions and
- Plays and Performances conducted by Educational Institutions as part of learning.

All exports are zero-rated.

Equity and social policy considerations along with administrative convenience are the most common arguments used to exempt or zero rate commodities. Exemptions are usually granted when it is believed that VAT on goods and services consumed by the poorer segments of the society will increase their burden. Sometimes the administrative difficulties

encountered in taxing some goods e.g. farm products, makes it necessary to exempt them from the tax base. Exemption has however, been criticized on two grounds. First, it can result in cascading of tax on tax because input tax is not refunded for the exempt firms. Secondly, firms producing exempt and taxable goods are required to allocate resources between the exempt and non-exempt categories, which may be difficult.

The objective of zero rating commodities, on the other hand is to remove the entire VAT including those collected at earlier stages, from a particular good. Hence, full credit is allowed for tax shown on invoices for the purchase of inputs or the commodity that is zero-rated. The only difficulty with zero rating is that it gives rise to numerous refund of tax, which may be difficult to monitor.

The legislation in Nigeria does not specify any threshold for registration so as to discourage firms from splitting in other to get below the threshold and avoid taxation. Coverage of the tax however, incudes all professionals such as lawyers and accountants but exclude retailers and petty traders who are permitted to register voluntarily. As a result, the tax has been confined to the import and manufacturing sectors. One reason why retailers are not brought into the tax net is the size of their businesses. Retailing in Nigeria, like in most other developing countries is usually a very small business whose owners are illiterates with little or no record keeping ability. Excluding retailers however, removes a substantial part of the potential VAT revenue base because as a group their total contribution to sales is high. Other problems resulting from the exclusion of retailers, is that the practice discriminates against firms integrated forward into the distribution sector and encourages manufacturers to shift function and thus costs beyond the point of impact of the tax.

3.0 APPROACHES TO MODELLING VAT REVENUE FORECAST

There are three approaches to the estimation of the VAT base; the aggregate approach, the sector approach and the input-output method.

3.1 THE AGGREGATE APPROACH

This approach computes the tax base by subtracting exports and adding imports to GDP to show the consumption base following the destination principle. Taxes based on the destination principle remove exports from the tax net but, taxes all imports into the country where they are consumed. The base is further adjusted by subtracting gross capital formation since, consumption type VAT allows companies to have input tax credit for capital investment. Zero-rated consumption expenditure and exempted commodities final consumption expenditure are all subtracted from the base, while expenditure on business inputs purchased by exempted sectors are added. Finally, the base is adjusted for small business exemptions.

The approach can be represented as follows:

$$GDP = C + I + G + E - M$$

$$\beta = GDP - (E - M) - P - Z - X - D - (S - B) - N$$

Where:

C = Private consumption expenditure
I = Gross Private domestic investment
G = Government expenditures
E = Exports.
M = Imports.
P = Private expenditures abroad.
Z = Zero rated consumption expenditure.
X = Exempt final consumption expenditure.
D = Imputed rent for owner-occupied dwellings.
B = Business inputs purchased by exempted sectors.
N = New residential construction.
S = Small business exemptions.
B = Aggregate tax base

The potential VAT base is βt

where: t = VAT rate.

The tax base calculated above, using the aggregate approach allows adjustments to be made on the economy as a whole but not on the individual sectors that make up the economy, since detailed information by sector is normally not available. The tax base is not detailed enough to identify its major components which is a major disadvantage. Although, the quantitative information provided using this approach could be used for revenue forecast, the approach does not provide the necessary analytical tool to assess the consequences of the treatment of major sectors and commodities.
Therefore, policy makers cannot use this approach to address "what if" questions in order to evaluate any given policy proposal. In other words, the approach does not allow for the analysis of price effect, tax incidence or any other issue of interest to policy makers.

3.2 THE SECTOR APPROACH

The approach computes the base by summing the value added generated by each sector in the economy. Using this approach the value of sales (gross product plus imports minus exports) by sector is calculated following the destination principle. The sales figure is adjusted by excluding sales of exempted and zero rated commodities. In addition, the figure will be modified by the change in stock in each sector and adjustment made for the use of intermediate goods. The VAT base in each sector is calculated after deducting the exempted portions.

The measurement of the VAT base can be summarized as follows:

Tax Base by Sector = Y-X-I-K+T

where:

Y	=	Sales (gross product by sector adjusted for imports, exports and inventories)
X	=	Sales of zero-rated or exempted goods.
I	=	Purchases of intermediate goods
K	=	Purchases of Capital goods.
T	=	Purchases of inputs to produce exempted goods.

The major obstacle in developing a VAT base using this approach is the lack of adequate data for the different sectors of the economy. For example, the value of exports and imports by industry in order to allow for adjustments regarding changes in inventories and commodities that are tax free or exempted are not available. Like the aggregate approach, the VAT base calculated by this method would provide only aggregate quantitative information derived from the sectors of the economy. Consequently, the methodology does not permit the appraisal of policy impact on sections of the economy e.g. the exemption of certain goods.

3.3 THE INPUT-OUTPUT APPROACH

The value of goods and services purchased by consumers automatically captures the destination principle of the VAT since, it excludes exports while imports are included. Therefore, the VAT base is calculated using the value of sales to final consumers. The approach allows the analysis of incidence and price impact of VAT on consumers.

The estimation of the VAT base by this method depends mainly on information on domestic consumption contained in the final demand matrix of the Input-Output tables. The VAT base using this approach is:

$$\beta = \Sigma - X - Z - B - O$$

where:

β = VAT base

Σ = Gross expenditures by final consumers

Z = Zero-rated goods and services

X = Exempt goods and services

B = Adjustment for exempt business activities

O = Other adjustments.

The next section describes the input-output methodology in detail.

3.4 THE INPUT-OUTPUT APPROACH FOR ESTIMATING THE VAT BASE

This section presents the input-output (I - O) approach as outlined above for the estimation of the VAT base. It is important to note that 1 - 0 models are static in nature and as such do not allow for behavioural changes.

The analytical framework discussed in this paper does not take into account behavioural responses due for example, to increase in VAT rate. Data required for the simulation model is obtained from 1 - 0 tables and national accounts. National account statistics provides the model with specific macroeconomic information such as GDP growth rate, growth rate of the various sectors of the economy etc. The main data source used for the estimation of this model is the input-output model of the Nigerian economy for 1995 updated in 1999 and the National accounts published by the Federal Office of Statistics.

The I - O tables divide the entire economy into thirty productive sectors using the industry as the statistical unit. Gross expenditure estimates are therefore, on industrial basis. In the input-output framework the VAT base can be derived from the value of sales to final consumers which can be calculated using data for domestic consumption contained in the final demand matrix of the I - O tables. However, the gross expenditures contained in the final demand matric of the I - O tables must be modified for several factors in order to arrive at the VAT base.

3.4.1 CONSTRUCTION OF THE VAT BASE

Definition of Final Consumption

The final demand matrix in the I - O table contains consumption, investment, government expenditures, imports and exports. The VAT base however, will not include all of these items since exports are excluded and imports included in the base. Therefore, final consumption as it relates to

VAT will refer to purchases made by individuals, governments and non-profit making organizations. In the I - O tables the VAT base can be derived from personal expenditures, government expenditure, appropriate capital investment and imports

- **Distributive Margin**

The output as well as input in the I - O tables are valued at producers' price. Hence, the value of sales to the final consumers, which is the expenditure associated with the categories contained in the final demand matrix, is also valued at producers price. The producers price for a domestically produced good is the sum of payments to primary factors, intermediate inputs and government services less any government subsidy provided to the producer. Producers prices are defined to exclude distribution margins which are considered to be payments rendered by the distribution sectors to the buying industries or final sectors. In essence, it means the price does not include distributive margin. For the purpose of calculating the VAT base therefore, it becomes necessary to adjust for:

(i) the exclusion of trade and transport margins from the price and,

(ii) the exclusion of taxes at wholesale and retail levels.

Since transportation is exempted from VAT in this country and tax is not imposed at the retail level, adjustment is made for wholesale margin only.

Although trade margins vary from commodity to commodity and there are no statistical data that will allow one to quantify trade margins on commodities, discussions with people in the trade sector and staff of Federal Office of Statistics reveals that retail margin constitutes roughly two thirds of the distributive margin. In constructing this model, the wholesale margin factor is therefore, assumed to be one third of the distributive trade margin. This factor is applied to all sectors of the economy to bring gross expenditure to wholesale price.

- **Exemptions**

Policy considerations along with elaborate administrative requirements

makes it necessary that seven items of commodities and three items of services be exempted from VAT as discussed above. Under an exemption, VAT is not levied on the selling price of the affected commodity. However, inputs used in the production of such commodities may be subject to VAT, which the vendor cannot claim, credit for. In essence, the value added for the seller whose product is exempted from tax is excluded from the tax base. In calculating the VAT base therefore, appropriate deduction for exemption involves identifying the affected commodities and assessing the amount of tax, which would still be collected from them. The input-output table provides both a use and a make matrix. The make matrix details the commodities produced while the use matrix provides the commodities purchased by each industry to make the products. The general approach is to identify the industry, which produces the exempted good, and determine what percentage of the inputs purchased by the industry would be subject to VAT.

Zero-rated Commodity

The VAT legislation in Nigeria zero-rates exports only. A zero-rated commodity does not attract VAT on its selling price and the vendor receives full credit for VAT paid on inputs used to provide the commodity. Therefore, the full value of these commodities purchased by consumers must be removed from gross expenditure.

3.4.2 Calculating the potential Vat Base

The expenditure figures from the demand of I - O tables exclude wholesale and retail margins and since VAT is levied at wholesale level there is need to augment the result by the wholesale margin for each sector. Wholesale margin factor, assumed to be one third of the distributive trade margin was applied to all sectors of the economy. This brought expenditure to wholesale price in 1995.

The potential VAT base for each commodity was then calculated as follows:

$$B^{v}_{i} = \frac{Xi}{(1 + t_i)}$$

Where:

B^{v}_{i} = VAT Base

$_{1}$ = Taxable proportion

t_i = VAT Rate

$_{xi}$ = Expenditure on commodity i

- **Taxable Proportion**

Taxable proportions are determined by tax policies and the base must be adjusted to take full account of exempted goods and zero rated commodities. The use of industry as the statistical unit instead of commodities for the I - O table makes the calculation of taxable proportion difficult, since taxes are levied on goods and services and not on industries. The final expenditure figures in I - O table are aggregated along industry lines. The exercise requires the use of discretion to find out the proportion of goods produced in any industry that is subject to tax, taking into consideration goods exempted and zero-rated. In order to calculate the taxable proportion for each sector and commodity listed in the VAT legislation, each exempted item was given zero as taxable proportion since tax is not levied on the selling price. However, adjustment is made to reflect the proportion of inputs into the commodity on which VAT is paid. Therefore, while taxable proportion is zero for the final commodity, its inputs are 100 per cent taxable, if all its inputs attract VAT. In contrast to exempted goods, zero-rated commodities do not attract VAT and sellers of the commodities also get credit refund for VAT paid on inputs. This way the commodity is excluded from the tax base as tax is eliminated by applying zero to taxable proportion and zero as the rate of tax. On the other hand when a commodity is exempted no tax is imposed on the commodity but since the seller does not claim credit on inputs, the proportion of inputs on which tax is paid is 100%.

In constructing this model, the expenditure figures contained in the final demand of I - O table is adjusted by the taxable proportion figure to

show how much of each sector is really taxed. For instance, the sector Agriculture in the I - O table consists of annual major crops, minor crops and cash crops. Staple are exempted from VAT while most cash crops are zero rated for export purposes. However, VAT is paid on agricultural plantations and a few other products. From data available in FOS and CBN annual reports the proportion of agriculture taxable is estimated at 20%. Similarly, fishing trawlers are vatable while fish is exempted. The taxable proportion is estimated at 60%. In the livestock sector only livestock imported attract value-added tax. Taxable proportion for such items is therefore, zero. Transportation generally is not vatable but air travels and company car hire services are subject to VAT. A rough estimate of the portion subject to tax in this sector is 20 per cent.

Drugs and chemicals is another sector of the I - O table. Drugs are generally exempted from VAT under medical and pharmaceutical products. However, chemicals are not, except if they fall under agricultural products or veterinary medicine. It is believed that 50% of products in this sector is taxable. Except for these exemptions, all other products associated with other sectors are assumed to be 100% taxable.

The expenditure figures were reduced by the products of the taxable production and the tax rate to get the tax base exclusive of taxes in 1995. Since the tax was levied in 1994, VAT rate was applied to this base to get the potential VAT revenue at 100% compliance.

Compliance Rate

The potential revenue is forecast from the theoretical base of VAT, which is quite different from the actual revenue yield of the effective base. The gap between the two different tax bases depends on the rate of compliance with the VAT laws. The compliance variable determines to a large extent the revenue yield from the tax base.

In order to introduce the compliance component into the forecasting model, the theoretical tax base calculated is adjusted by the compliance

ratio expected from VAT collection. Since figures are available for actual VAT collections in 1995, the compliance ratio was calculated using

$$K = \frac{\text{actual VAT collection in 1995}}{\text{Expected VAT collection at 100\% compliance}}$$

Where

K = compliance rate

The compliance ratio turned out to be 35% in that year. The tax base is then adjusted to reflect the compliance variable. The expected VAT revenue is the summation of all adjusted tax base for all commodities purchased by personal and government sectors, multiplied by the VAT rate.

VAT revenue expected for commodity i is expressed as follows:

$$R^v_i = B^v_i * K_i * t_i$$

Where:

R^v_i = Vat revenue from commodity i

B^v = Vat base for commodity i

K_i = Vat compliance rate for commodity i

t_i = Vat rate for commodity i

4.0 Empirical Result

This section presents result of our empirical estimation. VAT revenue was projected for the period 1995 - 1999 using the 1995 I - O table so that model estimates of VAT revenue can be compared with actual collections while revenue for 2000 - 2005 was projected using the 1999 update of I - O table by NISER. GDP is assumed to grow at 3 per cent in year 2000 and 5 per cent in year 2001 as contained in the Federal Government Budgets. A five per cent growth rate is assumed for the remaining years. At sixty per cent compliance ratio and GDP growth rate of 3 per cent VAT revenue projection for year 2000 is ₦63,019.31 million. In year 2001, VAT revenue projection is ₦73,102.39 million.

Model Simulation

One of the objectives of developing this model was to estimate the revenue implications of alternative tax policy measures. In order to examine the sensitivity of the result to different compliance levels, revenue was projected using different compliance rates. The result suggests that if tax compliance increases from 60 to 70 per cent VAT at the current rate of 5% would yield ₦73,228.55 million in year 2000. If Government can enforce a higher compliance to 80%, the revenue in the year 2000 would be as high as ₦83,356.81 million. Table 2 shows the simulation result by varying compliance rates.

It is evident from the analysis performed that compliance with the VAT laws has been much lower than the theoretical tax base suggests. This implies that a lot more revenue could have accrued to the government if compliance had been higher.

Another implication derived from the analysis is that the impressive performance of VAT despite the parlous state of the economy resulted mainly from increasing compliance with VAT laws from year to year. The increase in revenue despite economic downturn showed basically that some sectors might have been omitted from the tax base initially or there is increase in compliance level as a result of improved administration. A well administered, broad-based VAT can result in higher coverage, which means more taxpaying units.

Similarly, the model was used to simulate a variety of tax rates under the current VAT legislation using a compliance level of 52 per cent VAT rates of 6, 10 and 12 per cent were examined. The result showed an increase in estimated revenue from ₦73,102.4 million revenue to ₦87,302.35 million in 2001 if VAT rate is increased to 6 per cent. At 10%, projected revenue will

increase to ₦142,774.37 million. Details of the tax rate simulation are contained in Table 3.

The model was also used to simulate a combination of increases in VAT rate to 8 per cent and an increase in compliance rate from 60 to 80 per cent for example. Projected revenue would rise to ₦151,819.2 million in year 2001 and ₦176,110.38 million in year 2002.

5.0 SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

The paper has provided a framework for estimating the VAT base in Nigeria. The methodology was based on the input-output tables of 1995 and the 1999 update of 1995 I - O table by NISER. Revenue collections were estimated for an eleven year period from 1995 - 2005 and sensitivity analysis was performed to show revenue estimates under different levels of compliance and different VAT rates. While it may not be desirable to increase VAT yield by increasing the general tax rate, the authorities may want to consider the use of differentiated rates in order to increase revenue from products with high-income elasticity. Despite data limitations and the numerous assumptions contained in the analysis the model showed clearly that revenue enhancement could also be achieved by increasing the level of compliance with VAT laws. The level can be increased substantially by improving collection techniques based on modern information system to store data and organize taxpayer information into report. Accurate up to date information is the most powerful tool for effective VAT administration. The use of micro-computers combined with the self policing nature of VAT provide features for improving detection of non filers and those who are likely to defraud the tax authorities by over invoicing or under-invoicing. A good information system will reduce extensive auditing of taxpayers to enforce compliance. Strategies that often result in corruption because of

extensive contact between auditors and taxpayers if site audits are carried out.

Effective VAT administration would therefore, require extensive knowledge of the quantity and value of imports so that information can be captured about potential Vat payers.

Compliance rate can also be improved if the tax authorities have an idea of the magnitude of the input used by various producers. This will enable the tax authorities to make reasonable estimates of tax payable by each sector of the economy and also allow them to classify different types of taxpayers so that they can provide them with information that will make them comply with the law. The whole idea of using information about the nature of the taxpayer to provide better and more accurate service to them is already yielding a lot of benefits and increasing compliance in other countries. If VAT compliance measures are strengthened and the economy grows, VAT revenue may help reduce the dependence on oil and contribute immensely to macro economic stability.

TABLE 1

Model Projections, Budget Estimates, & Actual Receipts of Value Added Tax 1995 - 1999

Year	Model Projections	Budget Estimates	Actual Receipts
	(1)	(2)	(3)
1995	21,202.29	12,000.00	20,761.00
1996	35,099.60	22,000.00	31,000.00
1997	36,537.90	35,000.00	34,000.00
1998	35,813.05	40,000.00	36,867.70
1999	65,703.54	52,000.00	47,679.80

TABLE 2

Value Added Tax Revenue Estimates at Different Compliance Level

Year	Compliance Level %			
	60	70	80	90
2000	63,019.31	73,228.55	83,356.81	93,405.17
2001	73,102.39	84,945.12	96,693.90	108,350.00
2002	84,798.78	98,536.34	112,164.92	125,686.00
2003	98,366.58	114,302.15	130,111.31	145,795.76
2004	114,105.24	132,590.49	150,929.12	169,123.08
2005	132,362.07	153,804.97	175,077.78	196,182.77

TABLE 3

Value Added Tax Revenue Estimates at Different Tax Rates

Year	VAT Rate %			
	6	8	10	12
2000	75,260.65	99,396.27	123,081.35	146,329.94
2001	87,302.35	115,299.68	142,774.37	169,742.73
2002	101,270.73	133,747.63	165,618.26	196,901.57
2003	117,474.04	155,147.25	192,117.19	228,405.82
2004	136,269.89	179,970.81	222,855.94	264,950.75
2005	158,073.07	208,766.13	258,512.89	307,342.87

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