Determinants of value added tax revenue in Kenya

By Nelson H.W. WAWIRE [†]

Abstract. Past studies that have been undertaken on the responsiveness of Value Added Tax revenues to changes in GDP in Kenya have found a positive relationship. However, the studies omit key determinants of tax revenues, such as the nature of the tax system, institutional, demographic and structural features of the economy. Due to this omission, the estimated income elasticities are unreliable for planning purposes, a situation that might be responsible for the recurring budget deficits. The specific objectives of the paper are to establish the determinants of Value Added Tax revenue and assess yields response to changes in bases and reforms. The paper uses Paul Samuelson's (1955) the paper are fundamental general equilibrium analysis of the public sector to derive its main results. The estimation results show that GDP elasticity is less than the elasticities with respect to monetary GDP, suggesting the existence of an underground economy. It is also found that tax yields respond with substantial lags to changes in its determinants and revenues are sensitive to reforms and unusual circumstances. The study concludes that Kenya's Value Added Tax revenue is very responsive to changes in its determinants especially international trade. There is the challenge of creating a stable Value Added Tax system.

Keywords. Tax revenue, Elasticity, Tax system, Underground economy, Unusual circumstances.

JEL. H25, H24, H27.

1. Introduction

The major aim of most governments in developing countries is to stimulate and guide their economic and social development. These governments continue to reach out for the goal of government promoted and directed development. Kaldor (1964) pointed out the importance of government revenue in accelerating economic development. Whatever the prevailing ideology or political situation of a particular country, it must steadily expand a host of non-revenue yielding services such as education, health, infrastructure, and social security. Toye (1978) asserted that the link between taxation and economic development is a link between a universal desire and a form of government action that is believed to be a means to that end. Wildford & Wilford (1978a) asserted that one of the most important policy upon which most economists agree is that emerging nations must increasingly mobilize their own internal resources to provide economic growth. The most important instrument by which resources are marshaled is through the implementation of an effective tax policy.

Tax revenues play a vital role in Kenya's economic development. This is evidenced by the attention problems of taxation have received over the years (Republic of Kenya, 1965, Republic of Kenya, 1986, Republic of Kenya, 1994, Republic of Kenya, 2000, Republic of Kenya, 2007. Tax Management Administration Guidelines (1986) and the Vision 2030 contain reforms in all areas of tax policy. They emphasize the need to raise more revenue without increasing the burden of taxation on those who are already contributing to the exchequer. The

[†] Department of Applied Economics, School of Economics, Kenyatta University, P.O. Box 43844 - 00100, Nairobi, Kenya.

☎. +254722347139

✉. wawire2012@gmail.com

tax measures contained in these documents consist of broadening the tax base to include additional sector activities and strengthen tax administration.

These measures were adopted after the government realized that the present tax structure does not raise adequate revenues thereby encouraging domestic borrowing and seeking external finance, which are only temporary measures of deficit financing. Moreover, external funds can no longer be relied on due to donor conditions and the increasing interest to channel funds to Eastern Europe after the cold war (Gelb, 1993). Furthermore, potential sources for domestic borrowing are few and external grants reduce autonomy and increase political and economic dependence. The alternatives are therefore to raise money through taxation, curtail desired government expenditures, or continuously revise the tax structure.

The main shortcoming of Kenya's tax structure since independence has been its over-dependence on a small number of sources of tax revenue, namely trade taxes, sales tax/ value added tax (VAT) and income tax (Ole, 1975, Wawire, 1991, Wawire, 2000, Muriithi & Moyi, 2003, Wawire, 2003 and Wawire, 2006). The trade taxes, sales tax/VAT on various imported products are vulnerable to external events because their prices are determined in the world market and tend to be volatile. This has resulted in inadequate tax revenues and continuous existence of budget deficits.

The sources of inadequacy of revenue from taxation include tax structure that is not buoyant or income-elastic, a long time lag between government revenue collection and spending, lack of fiscal discipline, reluctance of the government to control its expenditures, and lack of information about the behaviour of Kenya's tax revenue functions. The later forms the thrust of this paper and therefore the behaviour of Kenya's VAT revenue functions receives special attention.

1.2. The Statement of the Problem

Several studies have been undertaken on the response of tax revenues to changes in GDP (Ghai, 1965, Ole, 1975, Wilford & Wilford, 1978a; 1978b, Wawire, 1991, Osoro, 1993; 1995, Ariyo, 1997, Wawire, 2000, Muriithi & Moyi, 2003, Wawire, 2003). In Kenya, such studies have found a positive relationship between tax revenues and GDP. However, these studies omitted some key determinants of tax revenues, such as the nature of the tax system, and institutional, demographic and structural features of the economy.

Specific determinants that are usually omitted include: unusual circumstances that have been experienced in the economy such as coffee and tea booms, oil shocks, drought, labour unrest, 1982 coup *d'état* attempt, political uncertainty in the wake of multi-party elections, tribal clashes of 1991, 1992, 1997, and 2008; power rationing in 2000. The examples of new taxes attempt that have been introduced include sales tax in 1973, and VAT in 1990.

Due to the omission of some of the determinants of tax revenues and per capita tax revenues, the estimated income elasticities of VAT revenues are often inaccurate and unreliable for planning purposes, a situation that might be the cause of recurring budget deficits. This is because these factors that are often omitted, if their effects are significant, may change the slope and/or the intercept of the VAT revenue function making it difficult to predict accurately the revenues.

Furthermore, studies that have been done on this topic use annual total GDP data while VAT revenue data are collected and reported as per fiscal year, which starts on 1st July each calendar year and ends on 30th June the following calendar year. It is therefore vital that any study to identify the determinants of VAT revenues should use average GDP. Moreover, it is also important to assess the response of VAT revenues to changes in monetary GDP. This would indicate the extent to which monetization of the economy and subsequent reduction in black market activities would affect these revenues.

1.3. The objectives and significance of the study

The specific objectives of the paper are to establish the determinants of Value Added Tax revenue and assess the response of VAT structure to changes in tax bases and tax reforms. The study is important because its results can be used to design pro-growth tax policies and implement tax changes that are equity enhancing.

The study contributes to the existing literature on the VAT structure in Kenya. The results could be used to design growth-oriented programmes and carry out tax changes that are growth enhancing. The study provides an empirical groundwork on Kenya's VAT revenue structures upon which prudent tax measures could be based. It identifies the determinants of VAT revenues which when properly understood, documented, and captured in relevant tax revenue models, would make it possible to estimate accurately VAT revenues within a specified period of time. The study also stimulates further research in the area of taxation. It provides an informed basis for taking action on tax policy in addition to filling the gap about what is currently known about VAT revenue function in Kenya. The study is timely given the current effort to implement the constitution, change government structures, privatize state enterprises, rationalize the budget, eradicate poverty, reform tax structure and continue with the structural adjustment process.

1.4. Scope of the Study

The study is limited to the period 1963/64 to 2008/09 for a number of reasons. This period is long enough to capture the responsiveness of VAT revenues to changes in its determinants. Furthermore, the government had the opportunity to devise its own tax policies within this period.

It was within this period that the economy grew rapidly up to early 1970's. After the magical growth rate, it started experiencing fiscal strains, with expenditure rising more rapidly than domestic revenues due to large-scale infrastructure investment and other social expenditures. The economy also experienced persistent shocks such as the oil price crises of 1973 and 1979 that had far reaching repercussion on growth and fiscal deficits. It is possible in this period, to capture the effects on VAT revenues of such events like trade liberalization, privatization, tax modernization programme and the establishment of KRA.

During the study period, sales tax was introduced in 1973, in the fiscal year 1984/85, sales tax on domestic manufactures was separated from the one on imports, and VAT Act Cap 476 started operating on 1st January 1990. In a nutshell, this period is significant because it coincides with import substitution industrialization strategy, the onset of debt crisis in 1970's, the SAPs in 1980's, the liberalization policies of 1990's, and multiparty era of 1990's, 2000's and the Kenya's Vision 2030.

2. Literature Review

2.1. Estimating Techniques for Buoyancy of VAT

Several studies have used GDP as a determinant of tax revenue. Such studies include Ole (1975), Wilford & Wilford (1978a and 1978b), Rao (1979), Omoruyi (1983), Asher (1989), Osoro (1993 and 1995), Ariyo (1997), Wawire, (2000), Muriithi & Moyi, (2003) and Wawire, 2003). In these studies, the following model was used to estimate tax buoyancy.

$$T = e^{\alpha} Y^{\beta} e^{\varepsilon} \qquad (1)$$

Where T   =   tax revenue
       Y   =   income (GDP)
      α =   constant term
      β =   buoyancy coefficient
      e   =   natural number

The double-log version of equation (1) is estimated using OLS.

2.2. Estimating Techniques

2.2.1. Proportional adjustment method

The first is the proportional adjustment method. This was suggested by Sahota (1961) and Prest (1962) and later described by Mansfield (1972) and used by Omoruyi (1983), Osoro (1993), and Ariyo (1997). The method involves isolating the data on discretionary revenue changes based on data provided by the government. The resulting data reflect only what the collections would have been if the base year structure had been in force throughout the sample period (Osoro, 1993). The adjusted data is then used to estimate equation (2) that follows.

$$InT_p = \alpha_p + \beta_p \, InY + \varepsilon_p \qquad (2)$$

Where β_p provides an estimate of the income elasticity of the pth tax.

There are several shortcomings of proportional adjustment method as cited by Ariyo (1997). To start with, data on revenue receipts directly and strictly attributable to discretionary changes in tax policy are not available. In fact, it relies on budget estimates for discretionary effects of tax revenue, which tends to differ substantially from the actual tax revenue collected. The approach assumes that the discretionary changes are as progressive as the underlying tax structure, hence it is contingent on the assumption that discretionary changes are more or less progressive than the tax structure they modify (Leuthold & N'Guessan, 1986 and Chipeta, 1998). Further, the approach is highly aggregative compared to other methods highlighted in this section.

2.2.2. Dummy variable technique

The second method for estimating income elasticity of a tax is to use the dummy variable technique developed by Singer (1968). The method introduces a dummy variable into equation (2) for each year in which there was an exogenous tax policy change. The resulting estimating model becomes:

$$InT_p = \alpha_p + \beta_p \, InY + \sum \sigma_i D_i + \varepsilon_p \qquad (3)$$

Where the dummy variable D_i (i = 1, 2, …) takes the value of zero (0) before the discretionary change and one (1) after the change. The coefficient β_p estimates the revenue elasticity. The summation accounts for the possibility of multiple changes in the period (Wilford & Wilford, 1978a; 1998, and Osoro, 1993). However, Ariyo (1997) suggested additional modifications to models (2) and (3). The first modification is the introduction of a one-year lag in GDP. The argument is that new policy guidelines contained in a budget speech may not be implemented until the relevant circulars are issued. The one-year lag in income (GDP) added to equations (2) and (3) captures the potential effects on tax revenues due to implementation time lag. If there are pronounced administrative lags or delayed remittances, the lagged value will be more significantly associated with the dependent variable in each equation.

The second modification involves the introduction of a slope dummy in equation (3). The argument is that over a long period of time or under unusual circumstances, not only do the intercepts change but also their slopes may change (Koutsoyiannis, 1988). Ariyo (1997) argued that policy proposals in the budget are based on the performance of each tax revenue source in the preceding period. Those that perform above expectation are given more ambitious targets in the new fiscal year and put under great surveillance. Ariyo's (1997) non-dummy and dummy models are given as:

$$InT_t = \beta_0 + \beta_1 InY_t + \beta_2 lnY_{t-1} + \varepsilon \qquad (4)$$
$$InT_t = \beta_0 + \beta_1 InY_t + \beta_2 lnY_{t-1} + \beta_3 D_1 + \beta_4 D_2 + \varepsilon \qquad (5)$$

Where Y_{t-1} = previous level of income (GDP)

T_t = total tax revenue
Y_t = income (GDP)
t = year
D_1 = intercept dummy
D_2 = slope dummy ($D_2 = D_1 * Y_t$)

Khan (1973) has applied this method in estimating the responsiveness of tax yields to increases in national income and tax revenue forecasting. The shortcomings of this technique are that the method becomes impossible to use where tax policy changes are too frequent and also creates a potential multicolinearity problem from the inclusion of more than one dummy variable into the tax function.

2.2.3. Constant Rate Structure

The third method of estimating tax elasticity, as used by Andersen (1973) for Denmark & Choudhry (1975) for west Malaysia, is the Constant Rate Structure. The method involves collecting statistics on actual tax receipts and data on monetary value of the legal tax bases and corresponding revenues. The tax bracket of the base year is then multiplied by the corresponding base values and the products summed up. The simulated tax revenue data is then regressed on GDP. However this method can only be applied if the number of items is small, the range of tax rates is narrow and the data can be compiled easily. Furthermore, this method requires highly dis-aggregated data and detailed tax base series for all individual taxes and this could be difficult to obtain, besides getting the same tax base over time.

2.2.4. Divisia Index

The fourth method of estimating elasticity of a tax is the Divisia Index, which introduces a proxy for discretionary tax measures. The index measures the technical change, which is taken as the effects of discretionary changes in tax yields. The index is derived from the estimated tax function analogous to the production function. The tax function must be well defined, continuously differentiable and homogeneous of degree one. The method is best suited where the revenue effects of discretionary measures are not available. It uses time trends as proxies for discretionary changes. This is its major weakness because it introduces bias, leading to either an overestimation or underestimation of the adjusted tax revenues (Choudhry, 1979).

Choudhry (1979) carried out a detailed comparison of these methods. The study concluded that the Proportional Adjustment method was more superior compared to the Dummy Variable Approach, Divisia Index method, and Constant Rate Structure method. The study found that the Constant Rate Structure method had the smallest elasticity estimates. This was probably due the generation of a simulated tax revenue series on the basis of the effective tax rate for a given reference year.

2.3. Empirical Literature

The studies that have measured the impact of GDP on tax revenues include Wilford & Wilford (1978a) who estimated income-elasticity and buoyancy of the tax revenue in Central America for the period 1955 to 1974, using an exponential tax revenue function. The study found that income elasticity of the tax revenue was less than unity. This suggested that the tax structure was stable and therefore tax revenue grew less than proportionately in response to growth in income.

Osoro (1993) examined the revenue productivity implications of tax reforms in Tanzania. In the study, the tax buoyancy was estimated using double log form equation (2) and tax revenue elasticity using the proportional adjustment method (equation 4). The argument for the use of proportional method was that a series of discretionary changes had taken place during the sample period, 1979 to 1989, making the use of dummy variable technique impossible to apply (Osoro, 1993). For the study period, the overall elasticity was 0.76 with buoyancy of 1.06. The study concluded that the tax reforms in Tanzania had failed to raise tax revenues. These results were attributed to the government granting numerous tax exemptions and poor tax administration.

Ariyo (1997) evaluated the productivity of the Nigerian tax system for the period 1970-1990. The aim was to devise a reasonable accurate estimation of Nigeria's

sustainable revenue profile. In the study, tax buoyancy and tax revenue elasticity were estimated using equation (4) and (5) respectively. The slope dummy equations were used for the oil boom and SAPs. It was found that on the overall, productivity level was satisfactory. However, the results indicated wide variations in the level of tax revenue by tax source. The variations were attributed to the laxity in administration of non-oil tax sources during the oil boom periods. Significant reduction in public expenditure and prudent management of financial resources were suggested as solutions to the fiscal deficit. The study further asserted that there was need to improve the tax information system to enhance the evaluation of its performance and facilitate adequate macro-economic planning and implementation (Ariyo, 1997).

Chipeta (1998) evaluated effects of tax reforms on tax yields in Malawi for the period 1970 to 1994. The results indicated buoyancy of 0.95 and an elasticity of 0.6. The study concluded that the tax bases had grown less rapidly than GDP. Kusi (1998) studied tax reform and revenue productivity of Ghana for the period 1970 to 1993. Results showed a pre-reform buoyancy of 0.72 and elasticity of 0.71 for the period 1970 to 1982. The period after reform, 1983 to 1993, showed increased buoyancy of 1.29 and elasticity of 1.22. The study concluded that the reforms had contributed significantly to tax revenue productivity from 1983 to 1993.

Milambo (2001) used the Divisia Index method to study the revenue productivity of the Zambian tax structure for the period 1981 to 1999. The results showed elasticity of 1.15 and buoyancy of 2.0, which confirmed that tax reforms had improved the revenue productivity of the overall tax system. However, these results were not reliable because time trends were used as proxies for discretionary changes and this was the study's major weakness.

In relation to Kenya, Ole (1975) estimated income elasticity of tax structure for the period 1962/63 to 1972/73. Tax revenue was regressed on income without adjusting for unusual observations. The results showed that the tax structure was income inelastic (0.81) for the period studied. The study recommended that the system required urgent reforms to improve its productivity. The results also implied that Kenya's tax structure was not buoyant and therefore the country would require foreign assistance to close the budget deficit.

Njoroge (1993) studied the revenue productivity of tax reforms in Kenya for the period 1972/73 to 1990/91. Tax revenue was regressed on income after adjusting tax revenues for discretionary changes. The period of study was divided into two to make it easier to analyze the effects of tax reforms on revenues from various taxes. Income elasticity of total tax structure was found to be 0.67 for the period 1972 to 1981. This meant that the government received a decreasing share of rising GDP as tax revenues. The elasticity estimates for individual taxes were as follows: sales tax 0.6, import duties 0.45 and income tax 0.93. The buoyancy for the overall tax system for the same period was 1.19, implying that the tax system was quite buoyant. For the period 1982 to 1991, Njoroge (1993) found that the overall elasticity was 0.86 while buoyancy was 1.00. The study concluded that from a revenue point of view, the system did not meet its target, hence it required constant review as the structure of the economy changes. However, the results could not be relied upon because the study never took into account time series properties of the data.

Adari (1997) study focused on the introduction of value added tax (VAT) in Kenya that replaced sales tax in 1990. The study analyzed the structure, administration and performance of VAT. The estimated buoyancy and elasticity coefficients were less than unity implying a low response of revenue from VAT to changes in GDP. This suggested the presence of laxity and deficiencies in VAT administration. However, the estimation of buoyancy and elasticity coefficients were done in total disregard of the time series properties and without taking care of unusual observations in the data. Therefore, the results were not reliable for planning purposes.

Wawire (2000) used GDP to estimate the tax buoyancy and income-elasticity of Kenya's tax system. Tax revenues from various sources were regressed on their tax bases. Based on empirical evidence, the study concluded that the tax system had failed to raise necessary revenues. However, the shortcomings of the study were, first, it

never considered other important determinants of tax revenues, for example, unusual circumstances that could have affected tax revenue productivity. Second, it never disaggregated tax revenue data by source hence it was difficult to say which taxes and bases contributed more to the exchequer. Third, it never took into account the time series properties of the data.

Muriithi & Moyi (2003) applied the concepts of tax buoyancy and elasticity to determine whether the tax reforms in Kenya achieved the objective of creating tax policies that made yield of individual taxes responsive to changes in national income. They used equation 2 to estimate the responsiveness of tax yields on income. The results showed that tax reforms had a positive impact on the overall tax structure and on individual tax handles. The study concluded that despite the positive impact, the reforms failed to make VAT responsive to changes in income. However, VAT had been around for about eleven years only and subjecting it alone in a regression model did not make statistical sense. The current study differs from this study because it separates the effect of average monetary GDP and average total GDP on tax revenue and uses average figures instead of the annual ones because the tax revenue figures are on fiscal year basis that starts on 1st July while the GDP figures are on calendar year that starts on 1st January.

In an attempt to highlight the trends in Kenya's tax ratios, tax effort indices and their implication for further tax reforms, Wawire (2003; 2006) performed a regression of tax revenue on income. The estimated tax equation was used to compute tax effort indices by dividing the predicted with the actual figures. After examining the tax effort indices, the study concluded that the slowdown in economic growth had resulted in high levels of taxation that did not match delivery of public goods and services. The study however, never took into account the time trend characteristics of variables that were used.

3. Methodology
3.1. Theoretical Framework
The analysis in this study closely followed Paul Samuelson's fundamental general equilibrium analysis of public sector activities (Samuelson, 1954, 1955, Musgrave, 1986, Chipman, 1982, Bolnick, 1978, Varian, 1992, Barnett, 1993). The model that the study uses is constructed taking into account the demand side for government financing of public goods provision. It emphasizes the optimal allocation of resources between the public and private goods. The model is relevant to the study because it considers both the government revenue and its expenditure to provide the public goods. Moreover, it is a model of resource allocation that can be modified to emphasize the interaction between desired levels of public goods provision and the economic cost of levying taxes (Barnett, 1993).

To model, assume that there is a pure private good (Q_p) and a pure public good (Q_g). Control of all resources initially lies with the private sector, and must be transferred to the public sector for producing Q_g. Increasing marginal opportunity cost characterizes this transference activity. This marginal cost includes resources used directly to levy taxes plus loss of Q_p through dampened incentives and reduced efficiency in the private sector resulting from the tax policies (Branson, 1989, Agénor & Montiel, 1996, Froyen, 2002, Dornbusch, Fischer & Startz, 2003).

Assume further that the government fully finances its activities through taxes. Also assume a set of individualistic preferences, $\bar{U}$ (Q_g, Q_p) embodying continuously diminishing marginal rates of substitution between the public and private goods (Bolnick, 1978, Stiglitz, 1988, Barnet, 1993). This preference function is assumed to be a characteristic of Scitovsky's social indifference curves (Samuelson, 1976, Scitovsky, 1941; Layard & Walters, 1978, Mishan, 1981) or Bergson-Samuelson social welfare function (Varian, 1997, Bergson, 1938, and Samuelson, 1977).

The demand function for the public good is derived by considering a model of utility-maximizing behaviour coupled with a description of underlying economic constraints. The basic assumption is that a rational individual will always choose a

most preferred bundle (**x**) that consists of both public and private goods from a set of affordable alternatives (X) that satisfy the individual's budget constraint. If Y is a fixed amount of income available to the individual and p = (p_g, p_p) is the vector of prices for a public good (p_g) and a private good (p_p), the set of affordable bundles and the budget of the individual could be given by:

B = {xin X: PX ≤ Y}

The problem of utility maximization is then expressed as:

Max U(x)
Such that PX ≤ Y and **x** is inX

However, under the local nonsatiation assumption, a utility-maximizing bundle **x*** must meet the budget constraint with equality (Varian, 1992). This allows the restating of the utility problem in indirect form as: V (P, Y) = Max U(**x**)

Such that PX = Y

The value of **x** that solves this problem is the individual's demand bundle which expresses how much of each good the individual would buy at given levels of prices and income. The function that relates **P** and Y to the demanded bundle, conditional on other covariates is the individual's demand function.

The individual's bundle that maximizes utility is at a point where the budget line is tangent to the indifference curve (Stiglitz, 1988). Therefore, a rational individual would choose to allocate the income between public and private goods in such a way that the marginal rate of substitution of the public good for private good ($MRS_{g,p}$)

equals the ratio of their prices, i.e, $MRS_{g,p} = -\dfrac{p_g}{p_p}$ (see also Mansfield, 1975, Silberberg, 1990, and Pindyck & Rubinfeld, 1996). However, according to Nath (1979), free foreign trade may prevent efficient allocation of income over time (see also Agénor & Montiel, 1996). This implies that for optimum allocation, the marginal benefit of any good must be equal to its marginal cost which should be equal to its

world price in a competitive foreign market. Therefore, $MRS_{g,p} = -\dfrac{P_g}{P_p} = -\dfrac{P_{gw}}{P_{pw}}$.

Figure 1 illustrates this condition at the tangency of the budget line with the indifference curve for a taxpayer.
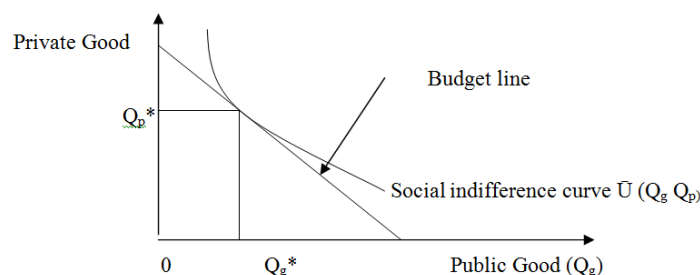

Figure 1. *Utility-maximizing conditions*

Q_g^* and Q_p^* are the optimal quantities that should be provided for the public and private good respectively. The position and slope of the budget line depends on income and the prices of the public good and the private good. For each level of income, there will be some optimal choice for each of the goods. For the public good (Q_g), the optimal choice at each set of prices and income will be the demand function.

The demand equation of the following general form is often estimated: $Q_g = f(p_g, y, z)$; where Q_g represents the demand for the public good for an individual, p_g is the price an individual pays for a unit of the publicly provided good, y is the income of the individual, and z is a vector of variables reflecting such things as the economic and political composition of the economy (Barnett, 1993). Y is exogenously determined, while p_g is dependent on the tax share which in turn depends on the form of the tax base. The demand curve is actually the marginal willingness to pay curve (Stiglitz, 1988). At each level of output of the public good, the demand curve shows how much the individual would be willing to pay for an extra unit of the public good. The tax price for the public good at the optimal level is equal to the marginal rate of substitution which is the amount of the private good that an individual must give up for one more unit of the public good.

When income changes, the vertical intercept of the budget line is altered but its slope does not change if prices are fixed. With an increase in income, the budget line shifts outwards parallel to the original one. The individual can now purchase more of both goods and attain a higher utility-maximizing consumption choice for both public and private goods. The resulting locus of utility-maximizing bundles is known as the income expansion path (Silberberg, 1990, Varian, 1992, Varian, 1997).

From the income expansion path, an Engel curve is derived which relates income to the quantity demanded of the public good. A straight income expansion path leads to a linear Engel curve through the origin. In this case the individual's demand curve has unit income elasticity. This implies that the individual will demand the same proportion of each commodity at each level of income (Varian, 1992). However, in the case of utility-maximizing consumption choice, the income expansion path is expected to bend towards the private good implying that as the consumer gets more income, more of both goods are demanded but proportionately more of the private good than the public one. Figure 2 that follows is the income expansion path for a utility-maximizing consumer.
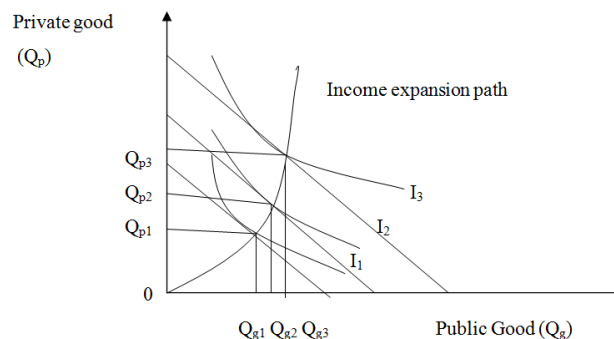

Figure 2. *The income expansion path*

I_1, I_2 and I_3 are indifferent curves. In the case of a bending income expansion path like the one above, the resulting Engel curve bends towards income implying that as the consumer's income increases, proportionately less of the public good is demanded. This is presented graphically in the following figure.
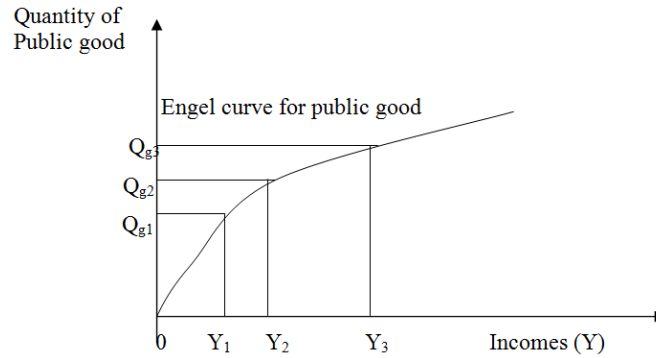
Figure 3. *The Engel curve*

Suppose the government wishes to tax a utility-maximizing individual in order to obtain a certain amount of revenue that is used to provide the public good the individual consumes, the revenue obtainable would be determined by the tax bases especially the individual's income. In this study therefore, total tax revenue is taken as a function of per capita income. This relationship paves the way for the estimation of Engel curves that relate the amount of tax revenues from various taxes to income (GDP).

At the empirical level, tax revenue functions are proxies for Engel curves. Since taxes are used to finance public goods, a relationship of tax revenue to income is but a proxy for the relationship between consumption of a public good and income, which is a public good's Engel curve. The factors that shift the Engel curves were identified to include monetary GDP, the degree of openness of the economy as measured for example, by the volume of international trade, population, unusual circumstances, introduction of new taxes, establishment of KRA, introduction of SAPs, trade and financial liberalization, tax evasion, tax avoidance, tax exemptions, free riding strategy by some individuals, and discretionary changes in the tax bases, tax rates, tax legislation, tax administration, and collection techniques.

3.2. Empirical Model

The multiplicative functional form of tax revenue model is specified as:

$$T = e^{\alpha} Y^{\beta} e^{\varepsilon} \tag{6}$$

Where: T = tax revenue

β = estimated parameter

Y = income

α = constant term

e = natural number

ε = error term

As noted in the literature review, this specification follows standard practice in this area (See example, Ole, 1975, Wilford & Wilford, 1978a and 1978b, Rao, 1979, Omuroyi 1983, Asher, 1989, Osoro, 1993 and 1995, Ariyo, 1997, Wawire, 2000, Muriithi & Moyi, 2003, and Wawire, 2003).

To estimate the parameters using OLS method, the multiplicative equation is linearized by taking the logarithms of the variables in the empirical model 6 and introducing an error term ε and the subscript i, for a particular source of tax revenue. Therefore, the general estimating equation is:

$$InT_i = \alpha_i + \beta_i InY + \varepsilon_i \tag{7}$$

Where, Ti = revenue from the ith source

β_i = elasticity coefficient

The foregoing approach does not pay attention to the special characteristics of the nature of the tax system and institutional and demographic factors that shape the trends in the economy. Considering the fact that tax revenues might change over time due to changes in the exogenous variables, the equations presented above are re-specified and some re-parameterized and dummies defined for discretionary changes, unusual circumstances and events. Dummies were introduced in those years where reforms and unusual observations were detected through various diagnostic tests following Johnston & Dinardo (1997), Thomas (1997), Kennedy (1989), Maddala (1977), Wilford & Wilford (1978a). The estimating equation is re-specified as:

$$T = e^{\sum \alpha Di} Y^{\sigma} e^{\in} \tag{8}$$

Where D = 0 for no unusual observation(s), and D = 1 for unusual observation(s), while σ measures the tax revenue-income elasticity. Taking logarithm of equation (8), the estimating equation where unusual observations are detected is:

$$\ln T_t = \sum_{i=1}^{k} \alpha_i D_t + \sigma \ln Y + \in_i \tag{9}$$

Where T = revenue from the ith source.

σ = income elasticity of the tax revenue.

K = dummies representing unusual circumstances

A slope dummy maybe introduced in equation (9) by interacting Y with a dummy variable. This is because over a long period of time and under unusual circumstance, not only do intercepts change but also slopes may change (Koutsoyanniss, 1988, Ariyo 1997). Furthermore, lags in GDP are introduced in the model because new policy guidelines contained in the budget speech are not usually implemented until the relevant circulars are issued to the implementing departments. The lags capture the potential effects of the implementation time lag.

The following tax revenue equations are estimated.

$$InT_t = \alpha_i + \beta_1 InY_t + \beta_2 InY_{t-1} + \in_t \tag{10}$$

$$InT_t = \sum_{t=1}^{k} \alpha_{it} D_t + \sigma_1 InY_t + \sigma_2 InY_{t-1} + \lambda_i D_t * Y_t + \gamma_i D_t * Y_{t-1} + \in_t. \tag{11}$$

Where,

Y_t	=	current income
Y_{t-1}	=	previous year income
D_t	=	intercept dummy variables
D_t*Y_t and D_t*Y_{t-1}	=	interaction terms
αi	=	coefficient of intercept dummies, 1…i
γ_i	=	estimated parameters for slope dummies, 1…i
t	=	year.
T	=	total tax revenue
σ_1, σ_2, β_1, and β_2	=	elasticity estimates

Dummies are included in the model only if they enhance the predictive power of the model by improving adjusted R-squared, Durbin-Watson (D.W) statistic and reduce the standard error of regression. From the equations that were estimated and found to be well specified on statistical grounds, some have more than two lags. For these equations, acceptable first formulations were reached at, and a search for acceptable simplification is performed following Johnston & Dinardo (1997) procedures.

The appropriate number of lags for each estimated equation was determined on the basis of Akaike information criterion (AIC), and the Schwarz criterion (SC). The specification that minimized the Akaike information criteria was selected. However, in choosing the number of lags, caution was taken because although longer lag lengths are appropriate since they fully capture the dynamics of the system being estimated and increases the parameters that are estimated, they reduce the degrees of freedom and increase data requirement.

The average values for the independent variables are the average of that year and the previous year's. The average values were used because the figures for independent variables are usually given per calendar year while those of dependent variables are given as per fiscal year that starts on July 1st of each calendar year.

3.3. Stationarity of variables

Time series analysis is central to the understanding and empirical modeling of dynamic response of tax revenues to changes in their determinants. The non-random behaviour of time series data would have therefore, undermined the usefulness of the standard econometric methods had they been applied in the study without considering time series properties (Russell & Mackinon, 1993, Gujarati, 1995, Adam 1998, Johnston & Dinardo, 1997, Hill, Griffith & Judge, 2001). Regression on such data would have been spurious and inconsistent because a common time trend is shared (Yule, 1926, Granger & Newbold, 1974, Russell & Mackinnon, 1993, Hill, Griffith & Judge, 2001).

One way that is used to detect the presence of spurious correlation is by the use of the D.W statistic. The standard rule that is applied is that if the adjusted R-squared is greater than the D.W statistic, there is an increasingly high probability of spurious correlation that cannot be solved by increasing the sample size. The second method is to use the Breusch-Godfrey asymptotic (LM) test for serial autocorrelation.

The formal statistical test for the presence of a unit root was used to detect non-stationary variables in this study. The test procedures followed that were are those of Augmented Dickey Fuller (ADF) as explained by Dickey & Fuller (1979), Mackinnon, (1991), and Thomas (1997).

3.4. Cointegration analysis

The use of cointegration technique allowed the study to capture the equilibrium relationship between non-stationary series within a stationary model, following Adam (1998:26), Johnston & Dinardo (1997:266). Furthermore, cointegration avoids both the spurious and inconsistent regression problems, which would have otherwise occurred with the regression of non-stationary data series. It also permitted the combination of the long-run and short-run information in the same model and overcame the problems of losing information that might occur from attempts to address non-stationary series through differencing (Adam, 1998). Cointegration technique makes it possible to capture the information of non-stationary series without sacrificing the statistical validity of the estimated tax equations.

Testing for cointegration is done through estimation of the Engle-Granger cointegrating relationships (Granger, 1986 and Engle *et al*, 1987). The test involves detecting whether the regression residuals are stationary or non-stationary. The ADF and the Philip-Perron (PP) unit root tests were performed on the regression residuals for this purpose. The PP unit root test for regression residuals was

performed because Pierre (1989) argued that the presence of unusual circumstances might invalidate conventional ADF unit root test (Johnston & Dinardo, 1997). Other diagnostic tests performed included normality test using Jarque-Bera statistic, the Breusch-Godfrey asymptotic test for serial autocorrelation (LM), ARCH residuals test, homoscedasticity, white heteroskedasticity test, and the Ramsey RESET test for specification error, Chow forecast test and CUSUM test for parameter constancy.

The years that had experienced unusual observations were determined after the graphical inspection of the regression residuals from the initial formulation of the cointegrating relation showed dramatic spikes either downward or upwards. The dummy variables were used depending on whether or not their inclusion improve the adjusted R-squared and Durbin-Watson statistic, and at the same time, reduced the standard error of regression.

The elasticity estimates are derived from the meaningful long run relationships that passed a battery of diagnostic tests. For Autoregressive Distributed Lag (ARDL) models, the elasticity estimates were calculated using the procedure outlined by Johnston & Dinardo (1997), Hill, Griffiths, & Judge (2001).

The ARDL relation is given as;

$$A(L) Y_t = m + B_1(L) X_t + B_2(L) X_{2t} + \varepsilon_t \tag{12}$$

and the implied long run relationship is:

$$\tilde{y} = \frac{m}{A(1)} + \frac{B_1(1)}{A(1)} \bar{X}_t + \frac{B_2(1)}{A(1)} \bar{X}_2 \tag{13}$$

Where;

$A(1) = 1$- sum of the coefficients of lagged dependent variable (y) values

$B_1(1) = $ Sum of the coefficients of explanatory variable X_1.

$B_2(1) = $ Sum of the coefficients of explanatory variable X_2.

The three sums are to be significantly different from zero for a cointegrating relationship to exist. Thus the existence of a cointegrating relationship is confirmed by testing whether $A(1)$, $B_2(1)$ and $B_2(1)$ are zero. Testing that $A(1)$ is zero, is equivalent to testing that the sum of the coefficients on the lagged dependent (y) terms is equal to one. The short run elasticity estimates are the coefficients of the non-lagged explanatory variables, while the long run elasticity estimates are computed using the formula:

$$\frac{B_1(1)}{A(1)}, \quad and \quad \frac{B_2(1)}{A(1)}, \text{ for } X_1 \text{ and } X_2 \text{ respectively.}$$

3.5. Correlation analysis

Correlation analysis was vital because violation of one of the assumptions of the Ordinary Least Squares method that the explanatory variables should not be strongly collinear would have impaired the efficiency of the estimated parameters or made their estimation impossible.

The procedure that is explained by Koutsoyiannis (1988) is used to detect the presence of multicollinearity. The procedure involve gradually inserting additional variable in the estimating equation and examining its effects on the individual coefficient, on the student t-values, and on the overall adjusted R-squared. If the variable improved adjusted R-squared without rendering the individual coefficients unacceptable on a priori consideration, the variable was considered useful and retained as an explanatory variable. If the new variable did not improve adjusted R-squared and did not affect, to any considerable extent, the values of the individual coefficients, it was considered superfluous and was excluded from the regression.

If the new variable adversely affected the sign or the value of the coefficient, it was considered detrimental to estimation results and was rejected as an explanatory variable.

3.6. Data

Data collection guidelines were used to collect the data for the study. Time series data were obtained from Quarterly Budgetary Reviews, International Monetary Fund Financial Statistics Year Books, International Monetary Fund Government Finance Statistics Yearbooks, Economic Surveys, Budget Speeches, Statistical Abstracts and National Development Plans. Other sources included library desk studies and visits to the Ministry of Finance (MF), KRA, Kenya Institute of Public Policy and Research (KIPPRA), African Economic Research Consortium (AERC), The World Bank local office, and Ministry of Planning and National Development (MPND), where a substantial amount of materials and records were obtained.

Both dependent and independent nominal variables were converted to real variables, measured in constant (1995) Kenya shillings. Time series data for average GDP and its related variables were converted from their nominal values to their real values by dividing nominal values with the GDP deflator using 1995 as the base year. The deflator was chosen because it is the most comprehensive price index for GDP (Branson, 1989). Furthermore, it correctly measures inflation since it amounts to a weighted average of the changes in all prices of newly produced goods in the economy (Dernburg, 1985). Hence it had the advantage of incorporating all the newly produced goods in the economy and allowed for changes in composition of output (Dernburg, 1985).

The reason for the conversion of nominal average value of GDP to real average value of GDP is that the nominal average figures do not reflect changes in production and income caused by inflation that leads to prices rising when the quantities are falling. Furthermore, the real values are measures of aggregate production that eliminates the effects of inflation and shows what is happening to economic activities, apart from movement in prices.

Tax revenues were converted to their real values by dividing their nominal values with the consumer price index (CPI). This avoided biased results caused by inflation. The CPI was used because it falls on the expenditure side of the GDP equation. Furthermore, CPI is more of a cost-of-living index (Dernburg, 1985), and hence it is the right one to employ for tax revenues which have the effect of reducing disposable personal income. The other reason for its application is that it includes the cost of imports and some items that are not actually goods and services that affect the cost-of-living.

Population is used in this study as a control factor. This is in recognition of the fact that population growth rate has serious implications on demand for public goods and services and thus on tax revenues that fund these goods and services. High population growth rate is also associated with high illiteracy rate and low education level that make it difficult to implement tax policies. Population enters the tax revenue equations as an independent variable so as to determine its influence on tax yields from various sources. Second, all the nominal variables were divided by population to convert them into their per capita values. These sets of results are also reported.

The year 1995 is chosen as the base year because most macroeconomic variables showed normal performance during this year. Furthermore, apart from being a more recent year, it is a year during which few changes were experienced in the economy.

4. Empirical Findings

4.1. Findings of stationarity and cointegration analysis

The unit root test was performed in order to detect whether there existed stationary or non-stationary series closely following Dickey & Fuller (1979), Mackinnon (1991) and Thomas (1997). The tests showed that the time series for all the variables were non-stationary at levels using 1 percent critical value. The first difference for all the variables did not exhibit unit roots, which means that the data were stationary at first difference. Furthermore, the conventional test, assuming an intercept and four lags did not reject the unit root hypothesis at the first difference.

The results of the unit root tests for cointegration of variables confirmed that the regression residuals for different specification of the VAT model that were estimated were stationary, which implied the existence of cointegrating relationships.

4.2. Distribution and other properties of variables

Before accepting the results of the dynamic specification, it was important to ensure that the equations estimated tracked the data well. Therefore distribution and other properties of variableswere performed. This ensured that the VAT models captured the salient features of the data and was consistent with economic theory.

The histogram-normality test (Jarque-Bera test) is a test of the distribution of the error term and it uses the first four moments of the distribution namely mean, standard deviation, skewness and kurtosis. The results of the Jarque-Bera test had probability values greater than 0.05, hence the normality assumptions of the regression residuals for all the estimated equations were not rejected. The regression residuals therefore followed a normal distribution, which meant that the OLS estimates obtained were efficient and consistent.

Two types of autocorrelation tests were performed. These were the DW statistic test for first order autocorrelation and the Lagrange Multiplier (LM) test for higher order autocorrelation. This was in recognition of the fact that OLS models assume serial independence in the residuals (Maddala, 1977, Greene, 1990). The DW statistics were close to two (2) and in some cases greater than two, implying no evidence of autocorrelation. However, the standard DW statistic was not a sufficient test for autocorrelation since all regressors were not strictly exogenous and the error process was not considered to be of the first order. The DW statistic was therefore a test of only the first order auto correlation and had relatively low power (see Adam, 1998, Thomas, 1997). Furthermore, the presence of lagged dependent variable in the tax models might have tended to bias the DW test statistic towards two (2).

To offset the shortcomings of the use of DW test statistic, the LM test was performed. The LM test is a general test for high order autocorrelation and is relatively more powerful than the DW test, especially for this study, where higher order lagged dependent variables were included as regressors and the error process was AR (M). The LM test was performed by regressing regression residuals on their own lagged values up to the sixth lag. The appropriate lag lengths were determined by the AIC and the Schwarz criterion. From the results, the hypotheses of zero autocorrelation in the residuals were not rejected. This was because the probabilities were greater than 0.05. The LM test did not therefore reveal serial correlation problems for the VAT models.

In recognition of the fact that there might be autocorrelation disturbances in the series leading to homoscedasticity (Johnson & Dinardo, 1997 and Engle, 1982a), the ARCH test was performed with one up to six lags. Furthermore, although the problem of heteroscedasticity is mostly encountered in cross-section data (see for example Johnson & Dinardo, 1997 and Engle, 1982b), in this study, the white heteroscedasticity test was performed on the residuals as a precaution.

The results of the ARCH test showed probabilities of individual coefficients lying between 0.13 and 0.99, with probability of F-statistics lying between 0.11 and 0.96. These high probabilities meant that the assumption of homoscedastic residuals for the estimated tax equations could not be rejected in favour of the ARCH residuals. Furthermore, the results of white test showed very high probabilities that were greater than 0.05, which rejected the presence of heteroscedasticity.

Considering Ramsey (1969) and Ramsey & Schmidt (1976) argument that various specification errors such as omitted variables, incorrect functional form, correlation between independent variables and the error term, give rise to non zero error term vector (Johnson & Dinardo, 1997) the performance of the Ramsey RESET test was inevitable. The test was performed to determine whether there were specification errors. The results showed high probability values that were greater than 0.05, meaning that there was no significant evidence of miss-specification.

According to Johnson & Dinardo (1997), an estimated equation should have relevance for data outside the sample used in the estimation. In recognition of this fact, the Chow Forecast test was performed to determine the parameter constancy following Chow (1960). Observations from 1964/65 to 1994/95 were used for estimation and those from 199596 to 2002/03 for testing. To avoid the F-statistic overstating the true significance level, disturbances were checked for the absence of heteroscedasticity first before the Chow test was performed. The results showed probability values that were greater than 0.05, implying that the estimated parameters were constant.

Considering the fact that the study used time series data where time gives a unique ordering of the data (Johnson & Dinardo, 1997), recursive estimations were performed for each tax equation in order to detect specification errors through estimated parameter inconstancy. The CUSUM test, CUSUM residual squares test, one-step-forecast test, N-step forecast test and recursive coefficient tests were performed. In all cases, there were no residuals lying outside the two standard error bands, suggesting that the parameters were constant.

The t-statistic was used to test the hypothesis that a coefficient was equal to zero. Two methods were used in this study to interpret the t-statistic. The first method was to observe its estimated value. If the computed t-statistic for a coefficient was greater than 1.96 or smaller than -1.96, the null hypothesis was rejected. If, on the other hand, the computed t-statistic was smaller than 1.96 or greater than -1.96 the null hypothesis was accepted (Koutsoyiannis, 1988). The second method was the probability (p-value) of observing the t-statistic given that the coefficient was equal to zero. At 5 percent significance level, a p-value lower than 0.05 was taken as evidence to reject the null hypothesis, while at the 1 percent significance level, a p-value lower than 0.01 led to the rejection of the null hypothesis. The standard errors of regression (which are the standard deviations of the regression residuals) were also small, meaning that the estimated VAT equations tracked the data well.

Degrees of freedom, which are the number of variables that can vary freely, were used to perform tests of the reliability of estimates obtained. The number of degrees of freedom associated with sum of squares was given by the number of observations used to compute the sum of squares minus the number of parameters that had to be replaced by their sample estimates or restrictions placed on the variables used to form the sum of squares. The degrees of freedom associated with the sum of squares in all the estimated tax equations were large; hence the estimated results are reliable.

The F-statistic was used to test the hypothesis that all of the slope coefficients (excluding the constant) in the estimated tax equations were zero. The p-values for the F-statistics were zero, which led to the rejection of the null hypothesis that all slope coefficients were equal to zero. This meant that the corresponding adjusted R-squared statistics were different from zero. Therefore, the effect of all the

independent variables on the tax revenue for each tax equation was jointly different from zero.

4.3. Determinants of VAT revenues

In the light of the reported results of various diagnostic tests, the VAT revenue equations were deemed well specified on statistical grounds and were therefore used to analyze the determinants of VAT revenues. The OLS regression results for VAT equations are reported in the table that follows.

Table 1. *Determinants of sales tax /VAT revenues (t-statistics are in parenthesis)*

Independent variables	Dependent variables							
	log sales taxes/ VAT	log per capita sales tax /VAT	log sales taxes/ VAT	log per capita sales tax /VAT	log sales tax/ VAT	log per capita sales tax /VAT	log sales tax/ VAT	log per capita sales tax /VAT
Constant	-10.8 (-1.5)	-19.6** (-3.1)	-4.6* (-2)	-2.75 (-1.0)	-19** (-9)	-1.88 (-1.7)	-15** (-4.0)	-0.56 (-0.4)
Oil crisis, (D = 1 for years 1973 and 1979, = 0 otherwise)	-2.6** (-16.0)	-4** (-16.0)	-36** (-27.7)	-34** (-20.0)	-0.27** (-5.0)	-0.15* (-4)	-22** (-4.0)	-39** (-7.4)
Abolition of GPT, *El Nino* rains, ethnic strife, election fever, drought, (D= 1 for 1973, 1993, 1997, 2000, 2008 = 0 otherwise)	-0.22** (-2.9)	-0.17* (-3)	-0.2** (-6.0)	-0.25** (-6.4)				
Sales tax, favourable weather, elements of SAPs, VAT, KRA (D = 1 for 1973, 1980, 1986, 1987, 1988, 1990, 1995, = 0 otherwise)	0.30** (9.0)	0.29** (4.0)	0.21** (6.8)	0.21** (5.1)	0.26** (5.5)	0.14* (2.6)		
log total GDP	1.94** (2.7)	2.78** (3.1)						
log population	-1.2 (-1.8)		-0.5* (-1)		0.07 (0.63)		0.4** (2.8)	
log monetary GDP			1.96** (5.9)	1.03** (3.7)				
Log volume of imports					1.5** (6.7)	0.68** (8)		
Third lag of log imports					0.45* (2.6)	-0.17 (-1.3)		
First lag of log sales tax/VAT					0.59** (6.1)	0.6** (8)		
log volume of trade							1.5** (3.8)	0.38 (1.6)
Second lag of log volume of trade							1.00* (2.0)	0.60 (1.0)
Third lag of log volume of trade							-1.7** (-3.0)	-1.10 (-1.4)
Fourth lag of log volume of trade							1.1** (3.2)	0.90* (3)
Oil crisis*log volume of trade							1.7** (3.7)	3.9** (7.1)
Adjusted R-squared	0.96	0.94	0.99	0.98	0.86	0.85	0.92	0.90
Std. error of regression	0.13	0.14	0.06	0.08	0.07	0.09	0.18	0.17
Durbin-Watson	1.8	1.5	2.3	1.8	2	2.0	2	1.0
Degrees freedom	30	30	30	30	30	30	30	30
F-statistic	133	99	618	300	20	21	55	44
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: (i) The asterisk (*) and (**) denotes that the relevant parameter estimate is statistically significant at 5 percent level and 1 percent level respectively. (ii) Standard error is a ratio of the estimated coefficient to its t-statistic.

4.4. Interpretation and Discussion of Estimated Results

Sales taxes/VAT structure is elastic with respect to total GDP, unlike the long run total tax structure in Kenya which was found not to be very sensitive with respect to growth in GDP (Ole, 1975, Njoroge, 1993, Adari, 1997, Wawire, 1991, 2000, 2003, and Muriithi & Moyi, 2003). This means that a percentage change in

GDP leads to a more than percentage change in VAT revenue. Moreover, the VAT structure is elastic. The coefficients on log monetary GDP has positive sign and is statistically significant. This coefficient is greater than that on GDP meaning that monetary economic activities are easy to trace for the purpose of taxation than the non-monetary ones. This also point to the existence of an underground economy that may consist of parallel markets that comprise rent seeking activities, smuggled goods and currency, and the informal sector (see also, Osoro, 1995; Mwanza, 1997).

The log of volume of trade, its lagged values and the lagged value of log sales taxes/VAT revenue, have statistically significant effects on log sales taxes/VAT revenue. Therefore, the volume of trade, its previous volume and previous level of sales taxes/VAT revenue determine the amount of tax revenue that is collected from sales taxes/VAT. This means that changes in GDP and volume of international trade lead to a more than proportionate change in VAT revenue from this source.

The elasticities of sales taxes/VAT with respect to log volume of imports and log per capita volume of imports are positive and statistically significant, meaning that an increase in the volume of imports increases revenue collected from sales taxes/VAT levied on the imports. The study also finds that elasticities of sales taxes/VAT on volume of trade are greater than those with respect to the volume of imports implying an underground economy for imports.

A positive and significant coefficient was registered on log population. The positive coefficient indicates that an increase in population will increase VAT revenues. This can be attributed to high demand for taxable goods and services associated with population increases and also to the effort by KRA to target taxpayers in order to enhance tax compliance through introduction of electronic tax register.

The reforms and unusual circumstances that were experienced in the economy that positively influenced the VAT yields include introduction of sales tax (1973), coffee and tea booms (1976, 1977, and 1986), introduction of sales tax on imports (1984/85), budget rationalization programme (1985), and establishment of KRA in 1995. Others are favourable weather (1980, 1994, 2001), introduction of some elements of SAPs, Tax Management Guidelines (see also Republic of Kenya, 1975, 1986, 1996, 1997a, 2002a, 2002b, World Bank, 1983, and 2003).

The unusual circumstances that are found to have had adverse effects on VAT yields include oil price shocks (1973, and 1979), droughts and subsequent power rationing and the devastating effects of El Nino (1984, 1997, 1998, 2000). Others are ethnic violence in some of the high agricultural productive areas of the country (1991/92, 1997 and 2008), political uncertainty in the wake of multiparty elections (1992, 1997, 2002, 2007), declining tourism activities and travel adversaries by trade partners (1991, 1992, 1997), poor infrastructure linked to El Nino (1998) (see also Republic of Kenya, 1975, 1994a, 1999a, 2002a, 2002b and 2003, and World Bank, 1983, and 2003).

5. Conclusion

The determinants of VAT include GDP, institutional, demographic, and structural features of the economy. Among the notable ones that seem to have had positive influences on VAT revenues are introduction of sales tax in 1973, coffee and tea booms, introduction of sales tax on imports in the fiscal year 1984/85, budget rationalization programme, establishment of KRA in 1995, favourable weather, TMG, and the volume of international trade.

VAT revenues respond with lags to changes in their respective tax bases. This means that the previous levels of tax bases (such as GDP, volume of trade, and volume of imports) have significant influence on the present levels of VAT revenues. This further means that new policy guidelines contained in the budget speeches are not usually implemented immediately. Hence the long time lag in the

response of the taxes influences VAT revenue collected from various sources at a point in time.

A marked increase in VAT revenue can be achieved if taxable capacity is substantially expanded through increased economic activities. These increased activities should occur first and foremost in the sectors that attract VAT.

Expansion of volume of trade especially to non-COMESA countries would be a pre-requisite to increasing revenue from VAT on trade.

The government should rely on VAT because it is elastic and generate revenue with limited administrative costs, are less inconveniencing because they are hidden in the commodity prices being transacted, present less chances for tax evasion, are powerful tools for guiding resources allocation through changing supply and demand forces, are more flexible such that rates and coverage can be selective and can be modified to suit the objective of the government, apart from taking into account the externalities and allowing individuals the choice of whether or not to consume the taxed commodities.

Due to the potential negative effects of the implementation time lags on VAT revenues, new policy guidelines contained in the budget speeches and other tax policy documents should be implemented, as a matter of urgency, almost immediately.

VAT bases should be broadened and tax rates and special treatment reduced to ensure compliance by taxpayers, increase productivity and address the issue of the underground economy. In fact, reduction in VAT rate and special treatment may greatly increase the effectiveness of the tax reforms (see also Dethier, 1998, Sewell & Thirsk, 1997).

One way of drastically bringing about an improved VATstructure would be to provide information bases and taxpayer education through pamphlets dissemination, seminars, conferences and *barazas* (open air meeting with village headmen) which might encourage more people to pay taxes. Taxpayers should be encouraged to maintain proper audited accounts and observe honesty.

Population growth rate must be controlled since it impacts negatively on domestic VAT revenue. Hence reduction in the birth rate is very vital and tax relief for married couples should not encourage large families. However, population was found to have a positive effect on VAT revenue from international trade. This calls for a balance between the two.

KRA should put in place an electronic system that links the financial institutions (mostly banks) with its integrated system. This will make it easier for the KRA to monitor money flows into and out of the personal accounts. The money flow can then be compared with the tax returns filed. This exercise will go a long way to capture tax evaders/avoiders and reduce the underground economy.

Acknowledgements

References

Adam, C. (1998). *Macroeconomic management: New methods and policy issues, time series econometrics for developing countries,* Centre for the Study of African Economies. Oxford: University of Oxford.

Adam, C.S. (1992) *Recent development in econometric methods: An application to the demand for money in Kenya,* AERC Special Paper No.15 September, Nairobi African Economic Research Consortium. [Retrieved from].

Adari, M.M. (1997). *Value added tax in Kenya*. M.A. Research Paper, University of Nairobi.

Agénor, P.R., & Montiel, P.J. (1996). *Development Macroeconomics*. Princeton, New Jersey: Princeton University Pres.

Andersen, S.P. (1973). Built-in flexibility of sensitivity of the personal income tax in Denmark. *Swedish Journal of Economics*, 75(1), 1-18. doi. 10.2307/3439271

Ariyo, A. (1997). *Productivity of the Nigerian Tax System: 1970 - 1990,* Research Paper No.67. Nairobi: African Economic Research Consortium. [Retrieved from].

Asher, M.G. (1989). *Fiscal Systems and Practices in ASEAN: Trends, Impact and Evaluation,* Singapore: Institute of South-East Asian Studies.

Barnett, R.R. (1993). Preference revelation and public goods. *In* M.P. Jackson (Ed.), *Current Issues in Public Sector Economics,* (pp.94-161), London: Macmillan Press. doi. 10.1007/978-1-349-22409-8_5

Bergson, A. (1938). A reformulation of certain aspects of welfare economics. *Quarterly Journal of Economics,* 52(2), 310- 334. doi. 10.2307/1881737

Bolnick, B.R. (1978). Tax efforts in developing countries: What do regression measures really measure?. *In* J.F.J. Toye, (Ed.), *Taxation and Economic Development, England*: (pp.62-77), Frank Cass and Company Ltd.

Branson, H.W. (1989). *Macroeconomic Theory and Policy*. 3rd Edition. New York: Harper & Row Publishers.

Chipeta, C. (1998). *Tax reform and tax yield in Malawi,* AERC Research Paper No.81. Nairobi: AERC. [Retrieved from].

Choudhry, N.N. (1975). A study of the elasticity of the West Malaysian income tax system, 1961-1970. IMF *Staff Paper*, No.22. 494-501.

Choudhry, N.N. (1979). Measuring the elasticity of tax revenue: A divisia index approach. *IMF Staff Papers,* No.26, 87-96.

Chow, G.C. (1960). Tests of equality between Sets of coefficients in two linear regressions. *Econometrica,* 28(3), 211-222. doi. 10.2307/1910133

Dernburg, T. (1985). *Macroeconomics: The measurement, Analysis, and Control of Aggregate Economic Activity*. McGraw-Hill International Book Company.

Dethier, J. (1998). Overview. *In* L. Bokros, & J. Dethier, (Ed.) *Public Finance Reform during the Transition: The Experience of Hungary*, (pp.1-21), Washington D.C.

Dickey, D.A., & Fuller, W.A. (1979). Distribution of the estimators for autoregressive time series with a unit root, *Journal of the American Statistical Association*, 74(366), 427-431. doi. 10.2307/2286348

Dornbusch, R., Fischer, S., & Startz, R. (2003). *Macroeconomics,* Eighth edition, New Delhi: Tata McGraw-Hill Company Limited.

Engle, R., & Granger, C.W.J. (1987). Cointegration and error correction: Representation estimation and testing. *Econometrica*, 55(2), 251-276. doi. 10.2307/1913236

Engle, R.F. (1982a). A general approach to lagrange multiplier model diagnostics. *Journal of Econometrics*, 20(1), 83-104. doi. 10.1016/0304-4076(82)90104-X

Engle, R.F. (1982b). Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation. *Econometrica*, 50(4), 988-1007. doi. 10.2307/1912773

Froyen, T.R. (2003). *Macroeconomics Theories and Policies*. Seventh edition. New Delhi: Pearson Education Pte Ltd.

Fullerton, D. (1981). On the possibility of an inverse relationship between tax rates and government revenues. *Journal of Public Economics,* 19(1), 3-20. doi. 10.1016/0047-2727(82)90049-4

Gelb, A. (1993). Socialist transformations: Some lessons and implications for assistance. *In* SIDA *Redefining the Role of the State and the Market in the Developing Process*, (pp.15-52), Skara: Vastergot lands Tryckeri.

Ghai, D. (1965). Income elasticity of the Ugandan tax structure. A dissertation presented to the faculty of the Graduate School of Yale University for a Ph.D. Degree.

Granger, C.W.J., & Newbold, P. (1974). Spurious regressions in econometrics. *Journal of Econometrics,* 2(2), 111-120. doi. 10.1016/0304-4076(74)90034-7

Granger, C.W.J. (1986). Developments in the study of cointegrated economic variables. *Oxford Bulletin of Economics and Statistics,* 48(3), 213-228. doi. 10.1111/j.1468-0084.1986.mp48003002.x

Greene, W.H. (1990) *Econometric Analysis*. New York: Macmillan Publishing Company.

Gujarati, D.N. (1995). *Basic Econometrics*. Third edition. International Edition Economic Series. New York. McGrew-Hill Inc.

Hill, R.C., Griffiths, W.E., & Jugde, G.G. (2001) *Undergraduate Econometrics*. Second Edition. New York: John Wiley and Sons, Inc.

Hinrichs, H.H. (1966). The changing level of the government revenue share. *in* H.H. Hinrichs, *General Theory of Tax Structure during Economic Development*. (pp.1-31), Massachusetts: Cambridge.

Hira, N. (2000). Forms of corruption in the Kenyan tax system. *in* A. Mullei, (Ed.) *The Link Between Corruption and Poverty: Lessons from Kenya Case Studies*. (pp.89-99), Nairobi:African Centre for Economic Growth.

IMF. (2004). *International Financial Statistics CD-ROM*, Washington D.C: IMF.

Jackson, P.M. (1993). *Current Issues in Public Sector Economics*. London: Macmillan.

Johnston, J., & Dinardo, J. (1997). *Econometric Methods*, Fourth Edition., New York: The McGraw-Hill Companies.

Kaldor, N. (1964). Will underdeveloped countries learn how to tax?. *Essays on Economic Policy,* Vol.1, (pp.253-268), London: Gerald Duckworth & Company Limited.

Kennedy, P. (1989). *A Guide to Econometrics*. 2nd Edition. Massachusetts: MIT Press.

Khan, M.Z. (1973). Responsiveness of tax yields to increase in national income. *Pakistan Development Review*, 12(4), 416-432.

King, J.R. (1979). *Stabilization Policy in an African Setting: Kenya 1963-1973*, Nairobi: Heinemann Educational Books Ltd.

Kothari, C.R. (2004). *Research Methodology,* 2nd edition. New Delhi: New Age International Ltd.

Koutsoyiannis, A. (1988). *Theory of Econometrics,* 2nd edition, London and Basingstoke: Macmillan Publishers.

Kusi, N.K. (1998). *Tax Reform and Revenue Productivity in Ghana,* AERC Research Paper Number Seventy-four. Nairobi: AERC. [Retrieved from].

Layard, P.R.G., & Walters, A.A. (1978). *Microeconomic Theory.* New York: McGraw - Hill Book Company.

Leuthold, J., & Guessan, T.N. (1986). Tax buoyancy and elasticity in developing economy. *Bureau of Economic and Business Research, Faculty Working Paper,* No. 1272, Urban Champain: University of Illinois

Lortz, J.R., & Morss, E.R. (1967). Measuring tax effort in developing countries. *IMF Staff Papers,* No.14, 478-495.

Lortz, J.R., & Morss, E.R. (1970). A theory of tax level determinants for developing countries. *Economic Development and Cultural Change,* 18(3), 328-341. doi. 10.1086/450436

Mackinnon, J.G. (1991). Critical values for cointegration tests. *in* R.F. Engle, & C.W. Granger. (Eds.) *Long-Run Equilibrium Relationships,* (pp.267-276), Oxford: Oxford University Press.

Maddala, G.S. (1977). *Econometrics,* International Edition, Singapore: McGraw-Hill.

Manig, W. (1983). Government capacity to levy taxes in peripheral countries: The example of direct taxation. *Economica,* 27(1), 61-81.

Mansfield, C.Y. (1972). Elasticity and buoyancy of tax system; A method applied to Paraguay. IMF *Staff Papers,* No.29, 425 - 440.

Mansfield, E. (1986) *Principles of Macroeconomics.* 5th Edition. New York: W.W. Norton & Company.

Milambo, M. (2001). Elasticity and buoyancy of the Zambia tax system, Unpublished M.A. Paper, University of Nairobi.

Mishan, E.J. (1981). Economic efficiency and social welfare, *Selected Essays on Fundamental Aspects of the Economic Theory of Social Welfare.* (pp.33-44), London: George Allen & Unwin.

Muriithi, M.K., & Moyi, E.D. (2003). *Tax Reforms and Revenue Mobilization in Kenya,* AERC Research Paper No.131, Nairobi: AERC.

Musgrave, A.R. (1986). Samuelson on public goods 1983". *in* A.R. Musgrave (Ed.), *Public Finance in a Democratic Society.* Vol. II, (pp.319-334), Fiscal Doctrine, Growth and Institutions, Sussex: The Hamster Press Group.

Musgrave, R.A. & Musgrave, P.B. (1984). *Public Finance in Theory and Practice,* 4th Edition. Singapore: McGraw-Hill Book Company.

Mwanza, J.M, (1997). The impact of tax reforms on buoyancy and elasticity of the Kenyan tax system, 1972/73 - 1995/96. M.A research paper, University of Nairobi, unpublished.

Mwega, F.M. (1986). The incidence of taxes and transfers in Kenya: A general equilibrium analysis. *East African Economic Review,* 2(1), 6-13.

Nath, S. K. (1979). *A Perspective of Welfare Economics,* London: The Macmillan Press.

Njoroge, J.W. (1993). Revenue productivity of tax reforms in Kenya: 1972/73-1991/92. Unpublished M.A. Research paper: University of Nairobi.

Nyamunga, J.B., & Ochieng, M. (2001) *Income Tax in Kenya: Assessment of Policy and Legislative Regimes*. Nairobi: Kenya Revenue Authority.

Ole, A.M. (1975) Income elasticity of tax structure in Kenya: 1962/63-1972/73 Unpublished. M.A Research Paper, University of Nairobi

Omoruyi, S.E. (1983). Growth and Flexibility of Federal Government Tax Revenue: 1960-1979. *Economic and Financial Review,* 21, 11-19.

Osoro, N.E. (1993). Revenue productivity implications of tax reform in Tanzania. *Research Paper* No.20, Nairobi; African Economic Research Consortium. [Retrieved from].

Osoro, N.E. (1995). Tax reforms in Tanzania: Motivations, directions and implications. *Research Paper* No.38. Nairobi: African Economic Research Consortium. [Retrieved from].

Philips, P.C.B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346. doi. 10.2307/2336182

Pierre, P. (1989). The great crash, the oil price shock, and the unit root hypothesis. *Econometrica*, 57(6), 1361-1401. doi. 10.2307/1913712

Pindyck, S.R., & Rubinfield, D.L. (1996). *Microeconomics*. Englewood Cliffs, Prentice.

Prest, A.R. (1962). The sensitivity of yield of personal income tax in United Kingdom. *Economic Journal,* 52, 576-596. doi. 10.2307/2229856

Pyle, D.J. (1993). The economics of taxpayer compliance. *in* P.M. Jackson, (Ed.), *Current Issues in Public Sector Economics.* (pp.58-93), London: Macmillan.

Ramsey, J.B. (1969). Tests for specification error in classical linear least squares analysis. *Journal of the Royal Statistical Society,* 31(2), 350-371.

Rao, V.G. (1979). *The Responsiveness of the Indian Tax System. 1969/1970-1973/1974.* Bangalore: Allied.

Republic of Kenya, (1965). *Sessional Paper No. 10 of 1965 on African Socialism and its Application to Planning in Kenya.* Nairobi: Government printer.

Republic of Kenya, (1975). *Sessional Paper No. 4 of 1975 on Economic Prospects and Policies.* Nairobi: Government printer.

Republic of Kenya, (1977). *Budget Speech.* Nairobi: Government Printer.

Republic of Kenya, (1982) *Report and Recommendations of the Working Party on Government Expenditure.* Nairobi: Government printer.

Republic of Kenya, (1986). *Sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth,* Nairobi: Government printer.

Republic of Kenya, (1994a). *National Development Plan 1994-1996.* Nairobi: Government printer.

Republic of Kenya, (1994b). *Sessional Paper No. 1 of 1994 on Recovery and Sustainable Development to the Year 2010.* Nairobi: Government printer.

Republic of Kenya, (1997a). *National Development Plan 1997 - 2001.* Nairobi: Government printer.

Republic of Kenya, (1997b). *Sessional Paper No. 2 of 1997 on Industrial Transformation to the Year 2020.* Nairobi: Government printer.

Republic of Kenya, (1999a). *Economic Survey.* Nairobi: Government printer.

Republic of Kenya, (1999b). *National Poverty Eradication Plan, 1999 - 2015.* Nairobi: Government printer.

Republic of Kenya, (2000). *Economic Recovery Strategy for Wealth and Employment Creation,* Nairobi: Government printer

Republic of Kenya, (2002a). *Medium -Term Expenditure Framework: Fiscal Strategy Paper 2002/03-2004 /2005.* Nairobi: Government Printer

Republic of Kenya, (2002b). *National Development Plan 2002- 2008.* Nairobi: Government printer.

Republic of Kenya, (2004). *Economic Survey,* Nairobi: Government printer.

Republic of Kenya, (2005). *Economic Survey,* Nairobi: Government printer.

Russell, D., & Mackinnon, J.G, (1993). *Estimation and Inference in Econometrics,* Oxford University Press.

Sahota, G.S. (1961). *Indian Tax Structure and Economic Development,* London: Asia Publishing House.

Samuelson, P.A. (1955). Diagrammatic exposition of the theory of public expenditure. *Review of Economics and Statistics,* 37(4), 350-356. doi. 10.2307/1925849

Samuelson, P.A. (1977). Reaffirming the existence of reasonable Bergson-Samuelson social welfare functions. *Economica,* 44(173), 81-88. doi. 10.2307/2553553

Samuelson, P.A. (1954). The pure theory of public expenditure. *Review of Economics and Statistics,* 36(6), 387-389. doi. 10.2307/1925895

Samuelson, P.A. (1976). *Foundation of Economic Analysis,* College Edition, New York: Anthem.

Scitovsky, T. (1941). A note on welfare propositions in Economics. *Review of Economic Studies,* 9(1), 77-88. doi. 10.2307/2967640

Scovill, M.E. (1975). Local taxation in Uganda, Kenya and Zambia. Unpublished Ph.D Degree Thesis, University of Illinois at urban - Champaign.

Sewell, D., & Thirsk, W. (1997). Tax reform in Morocco: Gradually getting it right. *in* W. Thirsk (Ed) *Tax Reform in Developing Countries,* (pp.329-360), Washington D.C: The World Bank. [Retrieved from].

Sharply, J. (1981). Resource transfer between the agricultural and non-agricultural sectors: 1964-1977, *in* T. Killick, (Ed.), *Papers on the Kenyan Economy, Performance and Policies,* (pp.311-319), Nairobi: Heinemann Educational Books.

Silberberg, E. (1991). *The Structure of Economics: A Mathematical Analysis,* New York: McGraw-Hill

Singer, N.M. (1968). The use of dummy variable in establishing the income elasticity of state income tax revenue. *National Tax Journal,* 21(2), 200-204.

Stiglitz, J.E. (1988). *Economics of the Public Sector,* Second Edition, New York: W.W. Norton & Company.

Thirsk, W. (1997a). Overview: The substance and process of tax reform in eight developing countries. *in* W. Thirsk (Ed.), *Tax Reform in Developing Countries,* Washington D. C: The World Bank. [Retrieved from].

Thirsk, W. (1997b). Bolivia's tax revolution. *in* W. Thirsk (Ed.) *Tax Reform in Developing Countries,* Washington D.C: The World Bank. [Retrieved from].

Thomas, R.L. (1997). *Modern Econometrics: An Introduction.* London: FT Prentice Hall

Toye, J.F.J. (1978). *Taxation and Economic Development,* London, England: Frank Cass & Co. Ltd.

Varian, H.R. (1992) . *Microeconomic Analysis.* Third Edition. New York: W.W. Norton & Company Inc.

Varian, H.R. (1997). *Intermediate Microeconomics: A Modern Approach,* 4th Edition, New Delhi: Affiliated East-West press.

Wawire, N.H.W. (2000). Revenue productivity implications of Kenya's tax system. *in* K. Kwaa Prah, & A.G.M. Ahmed (Ed.). *Africa in Transformation. Political and Economic Issues.* Vol. 1 Chapter 6. (pp.99-106), Addis Ababa: OSSREA.

Wawire, N.H.W. (1991). An empirical assessment of tax performance in Kenya: 1958-1989, M.A. Research Paper, Kenyatta University.

Wawire, N.H.W. (2003). Trends in Kenya's tax ratios and tax effort indices, and their implication for future tax reforms. *Egerton Journal,* 4, 256-279.

Wawire, N.H.W. (2006). Determinants of tax revenues in Kenya, Unpublished Ph.D. Thesis, Kenyatta University.

Wilford, S.D., & Wilford, W.T. (1978b). On revenue performance and revenue-income stability in the third world. *Economic Development and Cultural Change,* 26(3), 505-523. doi. 10.1086/451036

Wilford, S.D., & Wilford, W.T. (1978a). Estimates of revenue elasticity and buoyancy in Central America: 1955- 1974. *in* J.F.J. Toye, (Ed.), *Taxation and Economic Development.* (pp.83-100), London: Frank Cass & Co. Ltd.

World Bank, (2004). *Africa Database CD-ROM:* Washington D.C: World Bank, Online

World Bank, (1975). *Kenya: Into the Second Decade,* Baltimore: John Hopkins.

World Bank, (1983). *Kenya: Growth and Structural Change, A World Bank Country Study.* Vol.1, Washington D.C: World Bank.

World Bank, (2003). *Kenya: A Policy Agenda to Restore Growth,* Report No.25840 - KE. Washington D.C: The World Bank.

Yule, G.V. (1926). Why do we sometimes get nonsense correlations between time series? A study in sampling and the nature of time series. *Journal of theRoyal Statistical Society,* 89(1), 1-64. doi. 10.2307/2341482