An Analysis of Excise Taxation in Tanzania

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Abstract

This paper analyzes the performance and structure of excise taxation in Tanzania on the basis of the three main objectives of taxation: efficiency, equity and revenue generation. The main objective is to identify the revenue potential of excise taxation in Tanzania. In pursuit of this objective, the paper measures the buoyancy and elasticity of excise taxes, estimates demand functions for excisable goods, and computes revenue-maximizing tax rates. Consequently, the paper identifies goods that should bear excise tax.

Both the short and the long-run estimation results for buoyancy and elasticity show that excise tax revenue is inelastic with respect to the quarterly change in GDP. In addition, the buoyancy of excise tax has been higher than elasticity, implying that discretionary changes undertaken over the period of the study enhanced revenue collection.

The estimation results of the demand functions for cigarettes, motor fuel, beer, *Chibuku* and *Konyagi* gin, show inelastic own-price elasticity of demand. Furthermore, the estimates in this paper show that the government can collect more revenue by levying higher rates of excises tax on cigarettes, motor fuel, beer, *Chibuku* and *Konyagi* gin. The revenue-maximizing tax rates for cigarettes, motor fuel and beer are high both in the short and long run.

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1. INTRODUCTION

One of the problems facing developing countries is lack of rapid, equitable and sustainable economic growth. Many studies advocate that the problem of economic growth can be overcome by having a stable budget position (Bird, 1992). Most important is that revenue be adequate to finance government investment in human capital development and allocate a higher proportion of expenditures to social expenditures (education, health) and provision of basic infrastructure such as water, reliable electricity, working telephone systems, a good transport system, etc. All this requires an efficient and well-designed tax system.

Since 1988, Tanzania has implemented fairly comprehensive tax reforms as part of a wider economic reform program to bolster growth and achieve sustained macroeconomic stability (low inflation, prudent fiscal stance, stable exchange rate and favorable balance of payments position). Reforms on the fiscal front have focused on improving revenue administration, reducing of tax rates, simplifying the tax structure, introducing a VAT and broadening of the tax base. In spite of these reforms, Tanzania still has a relatively low tax to GDP ratio (11.2%), which lies considerably below the average for sub-Saharan Africa of 16.4%. Severe under-funding of basic social services remains a critical impediment to economic growth and progress in sustainable human development. In addition, a large proportion of the budget still depends on unpredictable donor finances. These challenges prompt a re-examination of Tanzania’s tax system.

This study reviews and analyzes the performance and structure of excise taxation in Tanzania on the basis of three major objectives of taxation namely efficiency, equity and revenue generation, with the ultimate aim of offering some suggestions for improvement. The focus on excise taxation is motivated by the fact that excise taxes can generate high revenues with little distortionary effects (McCarten and Stotsky, 1995). In Tanzania, excise tax ranks third (after income tax and VAT) in terms of revenue generation. Besides being an important source of revenue, excise tax is in principle cheap to administer, and is potentially efficient, especially when applied to goods that cause negative externalities or face price inelastic demand. Furthermore, excise tax is consistent with a fair tax system and complements a broad-based tax such as the VAT.

2. EXCISE TAX: EFFICIENCY, EQUITY AND REVENUE GENERATION

Excise taxes are by definition taxes levied on particular products and services, typically with discriminatory intent. Sometimes, they refer to the profits of fiscal monopolies. In most countries, a large share of excise revenue comes from tobacco products, alcoholic beverages, and petroleum products, which are the traditional excisable commodities. Excises are also levied on a variety of other items such as motor vehicles, soft drinks, sugar, cement, entertainment, insurance, consumer luxuries, and electricity.

One of the canons of a good tax system is efficiency. There are several dimensions to efficiency. An efficient tax has low administrative costs, rarely more than 2 percent of total revenue. Most excises, and particularly the traditional ones, are relatively cheap to apply. An efficient tax also has low compliance costs. However, little is known about compliance costs that are related to excises. Furthermore, efficient taxation does not unduly distort the choices that producers and consumers make about what to produce and consume, how to produce it, and in what quantities. In the absence of externalities, tax rates should be chosen so that the deadweight loss imposed, per additional dollar of revenue collected, is the same for all taxes. In this situation, it is not possible to collect more revenue without imposing a greater cost on society. The high tax rates on excises could therefore be seen as reflecting price-inelastic demand, coupled with the importance of excisable goods in household demand. McLure and Thirsk (1978) report that in developed countries cigarettes and petroleum products are price-inelastic. Furthermore, excise taxation fits with the efficiency objective when it is applied on alcohol as well as motor fuels and vehicles. Taxes on alcohol are used to internalize the costs of its negative side effects whereas taxes on motor fuels and vehicles represent a form of charge on the road users. In addition, taxes on alcohol and tobacco are sometimes justified on the grounds that they discourage the consumption of goods, which morally ought to be discouraged.

As regards the objective of equity, the standard approach rests on the ability to pay criterion. To achieve vertical equity, the poor should bear a light tax burden. Excise taxation on luxury goods therefore adheres to this objective. Taking a wider view of the tax system as a whole, even regressive excises are acceptable in terms of fairness if revenues cannot be raised by other means, and if they are used to finance the badly needed public services for the poor (Cnossen, 1977).

From 1986, Tanzania embarked on major economic reforms, one of which was tax reform. The tax reforms, among other things included, re-introduced excise taxation in the fiscal year 1989/90[1]. It is noteworthy that the excise on local goods, which at its peak yielded about 12 percent of recurrent revenue, was phased out in 1978/79 and 1979/80. Its rates on beer, cigarettes, spirit, and textiles were consolidated into the sales tax (Bank of Tanzania, 1981). Two major reasons influenced its re-introduction in 1989. First, it was found that the sales tax had more than 20 rates ranging from 0 to over 300 percent rate. This system with many rates had an adverse effect on the administration of the tax. Second, many sales tax rates ranged between 20 and 60 percent. In contrast, a few goods that raised much revenue for the government attracted rates above 100 percent. As a result, both specific and *ad valorem* excise taxation started to be levied. The new excise duty was levied on both domestic goods and imports whereas the abolished one was confined exclusively to domestic goods.

Despite the reforms, the trend of the overall tax revenue shows that there have been very low collections compared to other countries such as Kenya. Whereas tax revenues in Kenya have averaged about 25 percent of GDP since 1993, in Tanzania they have averaged between 11 and 12 percent of GDP (Table 1). However, this has not impeded much the efforts to control inflation, due to the tight control of government expenditure particularly from 1996.

Since 1989, excises have ranked third in collection both as a percentage of GDP and total revenue. They have averaged about 2 percent of GDP and about 16 percent of the total tax revenue (Table 1 & Figure 1). The trend of excises has fluctuated widely. The trend shows that there was a sharp decline in excise revenue during fiscal years 1992/93 – 1994/95 when Tanzania reduced its excise tax rates. However, because of the high cost in terms of revenue cost, an IMF tax mission recommended reversing the policy (IMF, 1993). The highest annual percentage

[1] The fiscal year runs from July 1st to June 30th.

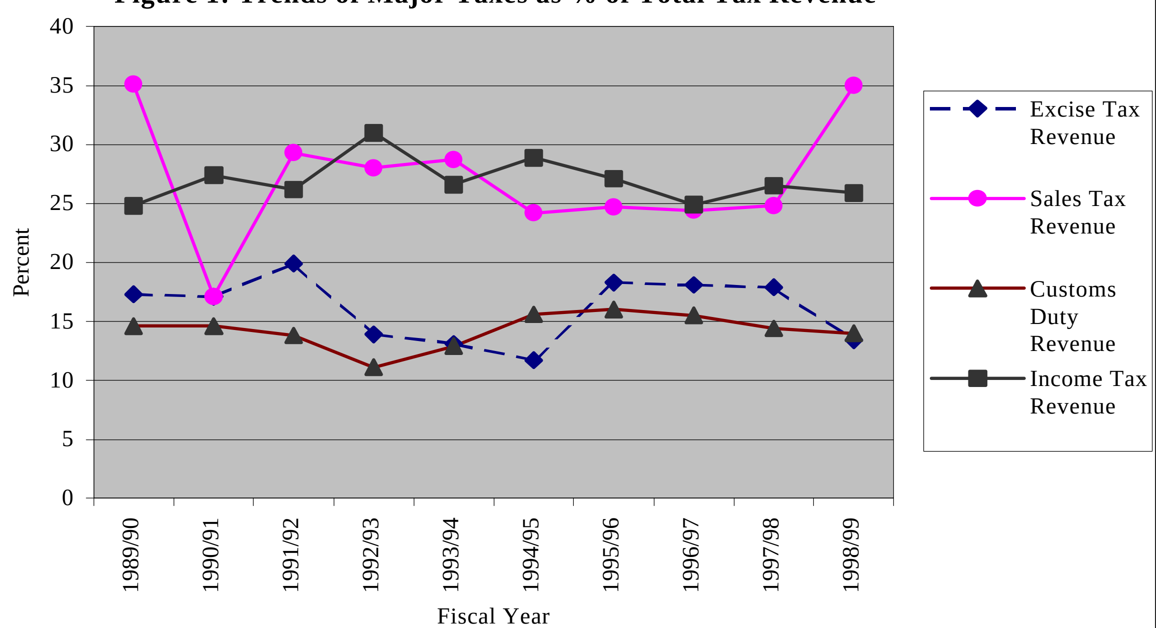
change of excise revenue collection was registered in fiscal year 1995/96, when excise revenue recorded an annual growth rate of about 56 percent. During the fiscal years 1997/98 and 1998/99 there was a drop in excise tax revenue as a percentage of total tax revenue from about 18 to 13 percent (Table 1 & Figure 1). During the same period, sales tax revenue rose from about 25 to 35 percent (Table 1 & Figure 1). This drop is explained by two phenomena: the introduction of Value Added Tax (VAT) in July, 1998 to replace the sales tax; and the reduction of excise rates on products that were formerly not attracting sales tax (e.g. beer and soft drinks).

Table 1: ***Various Tax Revenues as Percentage Total Tax Revenue and of GDP***

Year	**Total Tax Revenue**		**Excise Tax Revenue**		**Sales Tax Revenue**		**Customs Duty Revenue**		**Income Tax Revenue**		**Other Taxes**	
	% of Total Tax	**% of GDP**	% of Total Tax	**% of GDP**	% of Total Tax	**% of GDP**	% of Total Tax	**% of GDP**	% of Total Tax	**% of GDP**	% of Total Tax	**% of GDP**
1989/90	100.0	**11.1**	17.3	**1.9**	35.1	**3.9**	14.6	**1.6**	24.8	**2.8**	8.2	**0.9**
1990/91	100.0	**12.3**	17.1	**2.1**	17.1	**2.1**	14.6	**1.8**	27.4	**3.4**	23.8	**2.9**
1991/92	100.0	**12.5**	19.9	**2.5**	29.3	**3.7**	13.8	**1.7**	26.2	**3.3**	10.9	**1.4**
1992/93	100.0	**9.5**	13.9	**1.3**	28.0	**2.7**	11.1	**1.1**	31.0	**2.9**	15.9	**1.5**
1993/94	100.0	**11.0**	13.1	**1.4**	28.7	**3.1**	12.9	**1.4**	26.6	**2.9**	18.7	**2.0**
1994/95	100.0	**11.3**	11.7	**1.3**	24.2	**2.7**	15.6	**1.8**	28.9	**3.3**	19.6	**2.2**
1995/96	100.0	**11.3**	18.3	**2.1**	24.7	**2.8**	16.0	**1.8**	27.1	**3.1**	14.0	**1.6**
1996/97	100.0	**11.9**	18.1	**2.2**	24.4	**2.9**	15.5	**1.9**	24.9	**3.0**	17.0	**2.0**
1997/98	100.0	**11.2**	17.9	**2.0**	24.8	**2.8**	14.4	**1.6**	26.5	**3.0**	16.4	**1.8**
1998/99	100.0	**11.4**	13.4	**1.5**	35.0	**4.0**	14.0	**1.6**	25.9	**2.9**	11.7	**1.3**
Period Average	100.0	**11.4**	16.1	**1.8**	27.1	**3.1**	14.3	**1.6**	26.9	**3.0**	15.6	**1.8**

Source: Appendix Table A1.

Figure 1: Trends of Major Taxes as % of Total Tax Revenue



Source: Table 1

The trend of local excise tax revenue shows that beer and cigarettes have been the major sources of excise revenue, contributing an average of over 30 percent each (Appendix Table A1). Since the fiscal year 1992/93 beer has led in generating high excise tax revenue, followed closely by cigarettes. Other sources included carbonated drinks and spirits, taking the third and fourth positions. As regards excise duty on imports, although the data cover a short period, the trend shows that petroleum products have taken a larger share in revenue generation (Table 2). Over 50 percent of revenue from excise duty on imports has come from petroleum products. The analysis of the potential of these items in terms of revenue generation is thus important and this is especially so for beer, cigarettes and petroleum products.

Table 2: ***The Trend of Excise Duty-Imports***

Year-Month	**PetExc**	**ImpExc**	**PetExc(%)**	**ImpExc(%)**
97-7	974.80	1882.50	51.78	100.00
97-8	1017.10	2158.60	47.12	100.00
97-9	1072.30	2042.40	52.50	100.00
97-10	1007.60	2338.70	43.08	100.00
97-11	1020.40	1972.30	51.74	100.00
97-12	957.90	2122.70	45.13	100.00
98-1	820.80	1752.60	46.83	100.00
98-2	761.90	1326.00	57.46	100.00
98-3	782.70	1642.50	47.65	100.00
98-4	762.50	1726.00	44.18	100.00
98-5	716.40	1487.40	48.16	100.00
98-6	961.30	2014.30	47.72	100.00
98-7	1010.50	2116.50	47.74	100.00
98-8	1248.10	1900.40	65.68	100.00
98-9	1764.00	2502.30	70.50	100.00
98-10	1654.60	2342.00	70.65	100.00
98-11	1764.80	2412.80	73.14	100.00
98-12	1991.20	2680.80	74.28	100.00
99-1	1670.40	2159.10	77.37	100.00
99-2	1174.20	1621.30	72.42	100.00
99-3	1260.40	1676.20	75.19	100.00
99-4	1778.00	2158.10	82.39	100.00

Key: PetExc = Excise revenue from imported petroleum products,
ImpExc = Total excise revenue from imports

Source: Ministry of Finance, Revenue Flash Reports and Own Computations.

3. HISTORICAL BACKGROUND

Excise duty is one of the oldest taxes in Tanzania. It was introduced before independence (1961) but was merged with the sales tax in 1979/80. Excise duties were re-introduced in fiscal year 1989/90 under the Excise Tariff Ordinance (Chapter 332). Excise tax started being levied during that fiscal year on domestic goods and imports that were deemed luxuries. These included, among others, beer, spirits, soft drinks, alcohol, cigarettes and tobacco, perfumes, consumer durables (refrigerators, cookers, passenger cars, televisions and videocassette recorders, music systems), luxury cloth and petroleum products. Both *ad valorem* and specific rates were imposed and with more or less the same rates as a decade before, the time when it was abolished.

Many changes in the excisable items as well as their rates have occurred since 1989/90. During the fiscal year 1989/90, the tax rates were adjusted. Beer was taxed at an *ad valorem* rate of 25 percent plus a specific rate of Tsh 94.40 per liter. *Konyagi* gin was taxed at 25 percent plus Tsh 450 per liter whereas other spirits (that is, brandy, gin, whisky, rum etc.) were taxed at 25 percent plus Tsh 1,000 per liter. Soft drinks had an *ad valorem* rate of 25 percent plus Tsh 16.50 per liter. Cigarettes were taxed at an *ad valorem* rate of 50 percent plus specific rates depending on the types of the product. The rates for locally produced cigarettes varied across cigarette brands. “Rex” and “Embassy” were taxed at Tsh 1.20 per one cigarette while for *Sigara Kali* or *Nyota* cigarettes the rate was 40 cents per one cigarette. For imported cigarettes, the specific rate was Tsh 1.20 per one cigarette. It was expected that those rate changes would raise Tsh 1,509 million for locally produced goods and Tsh 140 million for imported goods. In this case, total revenue from these tobacco products was estimated at Tsh 1,649 million.

During the fiscal year 1990/91 the government intended to rationalize excise duty rates. Targeted goods were beer, soft drinks, spirits, textiles, oil, soap, cigarettes and sugar. However, this excise was not applied to all goods. Only the specific rates for beer and cigarettes and *ad valorem* rates for spirits were raised.

In the fiscal year 1991/92, the government intended to simplify procedures and efficiency in collection of taxes, to stimulate economic development in the priority sectors of the economy including the social services; to give relief to the taxpayer and consumers in general; and to enhance government revenue resulting from the various measures proposed above. Thus, 1991/92 saw the lowering of the rates of excise duty from 85 percent and 35 percent to 80 percent and 30 percent respectively. The details of this are shown in the Finance Bill 1991. In addition, excise duty on several items was removed. This discretionary change led to a loss of revenue that was, however, financed through other revenue measures.

During the fiscal year 1992/93 there was a rationalization of excise duty rates. The *ad valorem* rate was set at 20 percent while specific rates remained unchanged for a few traditional excisable goods such as cigarettes, beer and spirits.

During the fiscal year 1993/94, only one amendment was made to the Excise Tariff Ordinance. Excise duty on petroleum products was set at Tsh 5.00 per liter. This change was not expected to raise the price of petroleum but increase government revenue by Tsh 4,505 million. The change was intended partly to compensate for the portion of the price of petrol that was used to finance costs of distribution of goods through roads (The Transport Equalization Fund, which was later abolished).

The major revenue policies that guided revenue collection for the fiscal year 1994/95 were to broaden the sales tax base, to adjust customs tariffs, to increase road toll rates, to introduce new administrative and legal measures intended to enhance efficiency in revenue collection, to review tax exemptions with a view to abolishing and reducing some of them, and to increase various fees charged on government services. No changes were made to the excise duty rates.

In order to curb evasion arising from under-declaration of imports, especially in respect of beer and textiles, it was proposed during the fiscal year 1995/96 to change the taxation of imports of these items by charging customs duties at *ad valorem* rates and excise duty at specific rates, combining the existing *ad valorem* rates on excise duty and sales tax. The excise duty rate for new textiles was set at Tsh 2,255 per kilogram or Tsh 226 per square meter. For used textiles, the excise duty rate was Tsh 25 per kilogram. Excise duty was also charged at the rate of Tsh 255 per liter for locally produced beer while imported beer from PTA countries was charged at the rate of Tsh 340 per liter and Tsh 370 per liter for beer from non-PTA countries. The apparent reduction of duties and taxes was not expected to have a negative impact on revenues because the control of evasion of tax through under-valuation was expected to raise additional government revenue of Tsh 1,684 million from textiles and Tsh 6,129 million from beer.

One of the major changes during the fiscal year 1996/97 was to adjust specific rates as indicated in different Acts so that they keep up with inflation. In addition, changes had to be made since excise duty was used for protection, which is an anomaly since import duties should be used for that purpose. Therefore, the rate imposed on locally produced beer remained at Tsh 280 per liter; beer from COMESA/PTA countries were changed to Tsh 300 per liter whereas beer from non-COMESA/PTA countries had an excise duty rate raised from Tsh 550 to Tsh 620 per liter. This measure was expected to generate Tsh 337 million for the government. The government imposed an excise duty rate of Tsh 34 per liter instead of 32.80 per liter on soft drinks. This measure was estimated to generate Tsh 300 million for the government. Excise duties on imported textiles had both *ad valorem* and specific rates. Their rates were 30 percent plus Tsh 271 per square meter. Rate categories for garments were Tsh 400, 600, 1,500 and 2,000 per garment or 30 percent depending on the size. This measure was estimated to generate about Tsh 600 million in government revenue. Finally, excise duty rates on cigarettes were raised by 20 percent in order to keep up with the trend of inflation. This measure together with that of custom duties was expected to yield Tsh 2,807 million.

Many changes were made during the fiscal year 1997/98 to partly fill the revenue gap of Tsh 64,042 million. First, the excise duty rate categories were reduced from six rate categories (0, 5, 10, 15, 20, 30 percent) to four (5, 10, 20, 25). In addition, the following changes in the rates of individual excisable goods were made. Excise duty of 30 percent was imposed on all Four Wheel drive vehicles. As regards beer from COMESA countries excise duty was increased from Tsh 300 to Tsh 350 per liter. Another measure was to combine sales tax and excise duty on locally produced cigarettes with the exception of *Sigara Kali* and Premium brand which were charged only the excise duty. The government also combined sales tax and excise duty on spirits. This fiscal year also saw the abolition of excise duty on textiles. The rates on petroleum products were generally increased. Excise duty on liquefied petroleum gas (LPG) was increased by Tsh 12 per kilogram, Fuel Oil by Tsh 4 per liter, JET-AI oil from Tsh 10.65 to Tsh 15.78 per liter, motor spirit premium (MSP) by Tsh 13.95 per liter, motor spirit regular (MSR) by Tsh 125.6 per liter and industrial diesel oil (IDO) from Tsh 9.1068 to Tsh 14.1068 per liter. From these excise duty rate adjustments the government envisaged to collect roughly an additional revenue of Tsh 24,694.7 million.

One of the revenue measures during the fiscal year 1998/99 was adjustment of tax and duty on beer, cigarettes, spirits, wine, *Chibuku* and soft drinks. During this fiscal year excise duty on beer and cigarettes was increased by 5 percent per liter and 5 percent per mil, respectively. Other increases in the excise duty were on petroleum products. Excise duty was increased on (LPG) from Tsh 32.1372 to Tsh 44.1372 per kilogram, on premium motor spirit (MSP) from Tsh 25.6891 to Tsh 64.2978 per liter, on regular motor spirit (MSR) from Tsh 24.3850 to Tsh 58.4214 per liter, on aviation kerosene (JET-AI) from Tsh 15.78 to Tsh 24.0848 per liter, on illuminating kerosene (IK) from Tsh 11.6403 to Tsh 19.9451 per liter and on gas oil (GO) from Tsh 8.3154 to Tsh 16.8736 per liter. Excise duty on imported spirits was reduced from Tsh 1815 to Tsh 1040 per liter, on locally produced wines from Tsh 792 to Tsh 508 per liter, on imported wines from Tsh 978 to Tsh 776 per liter and on passenger cars with engine capacity above 2000 cc from 30 percent to 10 percent. This fiscal year also saw the abolition of excise duty on relief granted to specified persons and returning citizens; on passenger cars above 3,000 cc; on passenger cars with engine capacity less than 2,000 cc; and on 'Chibuku'. Finally excise duty was imposed at a specific rate of Tsh 140 per liter on imported soft drinks and Tsh 43 per liter on locally produced soft drinks.

4. ADMINISTRATIVE ASPECTS

Excise duty is imposed under the Excise Tariff Ordinance (Chapter 332). The Tanzania Revenue Authority (TRA) monitors the collection of Excise duty under its two departments: the Customs and Excise Department (CED) and the Value Added Tax Department (VATD). While excise duty on imports is under the control of the CED, the excise duty on the locally produced manufactured goods is under the control of the VATD.

The CED is headed by the Commissioner for Customs and Excise. The Commissioner, who is answerable to the Commissioner General, is assisted by four Deputy Commissioners: (1) Deputy Commissioner - Dar es Salaam; (2) Deputy Commissioner - Upcountry operations/Preventive Services; (3) Deputy Commissioner-Reforms; and (4) Deputy Commissioner - Zanzibar. The VATD is headed by the Commissioner for VAT who is also answerable to the Commissioner General. Working under the Commissioner for VAT are the Deputy Commissioner - Dar es Salaam and the Deputy Commissioner - Upcountry Regions.

The levying procedures involve a stamp *Twiga* on cigarettes while for motor vehicles such as saloon cars, one makes a declaration at the Custom’s *Long-room* after filing the Single Bill of Entry (SBE). The payment point for the excise duty is at the entry point for imported goods and at the production point for the locally produced goods. Assessment of tax is done at the Long-room in Dar and at the customs border posts when filling the Single Bill of Entry. Normally TRA excise duty officers are assigned to each industry/factory producing excisable goods. Their job is to monitor the trend of production, which they do by recording the volume of production; the volume/number of raw materials coming into the factory and other production related factors.

5. ANALYTICAL FRAMEWORK AND ESTIMATION TECHNIQUES

5.1 Introduction

As mentioned in the preceding section, excise taxation is one of the oldest in Tanzania. This tax was abolished in the fiscal year 1979/80 and re-introduced in the fiscal year 1989/90. Since its re-introduction, excise taxation has contributed a significant share of tax revenue. The fact that there was a period of ten years in which excises were not levied makes any long-term annual quantitative analysis of excises in Tanzania difficult. Accordingly, this study utilizes quarterly data for the period 1990 -1998.

5.2 Methodology

5.2.1 Data

Most of the data used in this study were collected from various sources: Ministry of Finance (MOF) Revenue Flash Reports, Tanzania Revenue Authority (TRA) disaggregated revenue collection reports, National Bureau of Statistics (NBS), Tanzania Breweries Co. Ltd. (TBL), Tanzania Distilleries Co. Ltd., Tanzania Cigarette Co. Ltd. (TCC), Tanzania Petroleum Development Corporation (TPDC), and Chibuku Company Ltd.

5.2.2 Analytical Framework and Estimation

(a) Analytical Framework

To attain its objectives, this study estimates the buoyancy and elasticity of excise tax, demand equations for various excisable commodities and revenue maximizing tax rates for various excisable goods.

(i) Buoyancy and Elasticity

The buoyancy of a tax system reflects the total response of tax revenue to changes in national income as well as discretionary changes in tax policies over time. Though closely related to buoyancy, the elasticity of the tax system measures the responsiveness of tax revenue to changes in national income abstracting from discretionary changes in the tax structure. Hence, in estimating the elasticity of the tax system, one must correct for effects of discretionary changes in tax policy on historical tax revenue series. It is important to obtain both the buoyancy and the elasticity of the tax system because the responsiveness of tax revenue to changes in GDP is of two types: the automatic response to GDP changes, and the response resulting from discretionary changes in tax rates, tax base and tax legislation. The combined effect of the two is known as the buoyancy of a tax.

Buoyancy is measured by generally estimating the responsiveness of tax revenue to changes in income or output without taking into account discretionary changes in the tax policy. According to Mansfield (1972) and Osoro (1992), the traditional method of measuring tax buoyancy starts with the following model:

(1) $T = aY^{b}e^{e}$

from which the double log function

(2) $\log T = \log a + b \log Y + e$

is derived, where *T* is historical tax revenue, *Y* is GDP and   is a stochastic disturbance term. Ordinary least square (OLS) is used to estimate the coefficients *a* and *b*. Since Equation (2) is in logarithmic form, it provides an estimate of tax buoyancy because it measures the percentage response in the left-hand variable for a one-percent change in the right-hand variable.

Tax elasticity is measured in the similar way as buoyancy with the exception that in elasticity estimation discretionary changes in the tax policy are taken into account. Discretionary changes in the tax policy include changes in the tax rate and/or base; changes in the efficiency of tax administration; the introduction of new taxes and the abolition of some others, etc. Therefore, historical tax revenue series have to be refined by adjusting them to exclude revenue changes attributable to discretionary measures.

Proportional adjustment is one of the techniques commonly used to refine historical tax revenue series to obtain adjusted series. This technique adjusts the tax revenue to discretionary effects for each of the years in the sample based on the budget estimates. It then applies to each year in the sample a sequence of multiplicative factors, which measure the revenue impact of discretionary changes on future years' tax revenues. Proportional adjustment is represented by:

(3) $T_{i,j} = T_{j-1,j} \cdot \frac{T_{j-2,j-1}}{T_{j-1}} \cdots \frac{T_{2,3}}{T_{3}} \cdot \frac{T_{1,2}}{T_{2}}$

where T_j is the actual tax revenue in the *j*th year; T_{ij} is the jth year's actual tax revenue adjusted to the tax structure existing in the year *i*; $T_{j-1,j} = T_j - D_j$ (where D_j is the revenue effect - positive or negative - in the jth year of the discretionary tax changes in that year).

The tax elasticity equation - Equation (4) - is similar in nature to the buoyancy equation. The only difference is that the elasticity equation has the tax revenue adjusted to discretionary changes. Following this adjustment, tax elasticity is estimated by the following single-equation model:

(4) $\log T^{*} = \log a + b \log Y + \varepsilon$

where T^* is the adjusted tax revenue to discretionary tax changes; *Y* is GDP; *e* is the disturbance term; and *a* and *b* are coefficients with *b* representing the tax elasticity.

(ii) Demand Equations

Microeconomic theory postulates that the quantity demanded of a product is a function of its own price, the prices of substitutes and the prices of complements, consumers' income, and tastes and preferences of the consumers. Thus, the demand function can be expressed as

$$(5) \qquad Q_{di} = f(P_i, P_s, Y, T)$$

where Q_{di} is quantity demanded of product i; P_i is price of product i; P_s is a vector of prices of substitutes or complements; Y is consumers' income; and T are tastes or preferences.

However, for the case of the demand for motor fuel this study applies the model used in Baltagi and Griffin (1983). The model assumes that the use of motor fuel is tied to the stock of motor vehicles. Thus, the econometric model starts with the following identity:

$$(6) \qquad \text{motor fuel demand} \equiv \left[\frac{\text{distance}}{\text{vehicles}}\right] \cdot (\text{number of vehicles}) \cdot \left[\frac{1}{\text{efficiency}}\right]$$

where efficiency *(E)* is the distance traveled per unit of motor fuel. Only the first term in the identity can be considered as a utilization variable, and as such, a route for short-run adjustment. Unfortunately, lack of data in Tanzania for utilization and efficiency prevents the direct use of this structure. So motor fuel is normalized on a per vehicle basis, and utilization is hypothesized to depend upon the following economic variables: the real price of motor fuel (P_{fuel}/P_{GDP}), real per capita income (Y/N_{pop}), and number of vehicles per capita $(N_{vehicles}/N_{pop})$[2].

The model then becomes:

$$(7) \quad \ln\left[\frac{\text{fuel}}{\text{vehicle}}\right] = a_0 + a_1 \ln\left[\frac{Y}{N_{pop}}\right] + a_2 \ln\left[\frac{P_{fuel}}{P_{GDP}}\right] + a_3\left[\frac{N_{vehicles}}{N_{pop}}\right] + a_4 \ln(E)$$

The efficiency variable *(E)*, for which there are no data, is hypothesized to be a long-run function of the real price of motor fuel (P_{fuel}/P_{GDP}) and real per capita income (Y/N_{pop}). Consequently, the efficiency variables in Equation (7) can be replaced by a lagged-structure of these variables. Although there are several alternative lag structures, the polynomial form, which is derived from the Almon transformation, is used. From this, equation (8) is generated.

$$(8) \quad \ln\left[\frac{\text{fuel}}{\text{vehicle}}\right] = d + \sum_{i=0}^{m} a_i \ln\left[\frac{Y}{N_{pop}}\right]_{-i} + \sum_{j=0}^{n} b_j \ln\left[\frac{P_{fuel}}{P_{GDP}}\right]_{-j} + g \ln\left[\frac{N_{vehicles}}{N_{pop}}\right],$$

where m and n denote the degrees of the polynomials. The short-run elasticities are the coefficients, such as a_0 and b_0, are associated with the current values of the variables. The long-run elasticity for each variable is calculated as the sum of the current and all lagged coefficients.

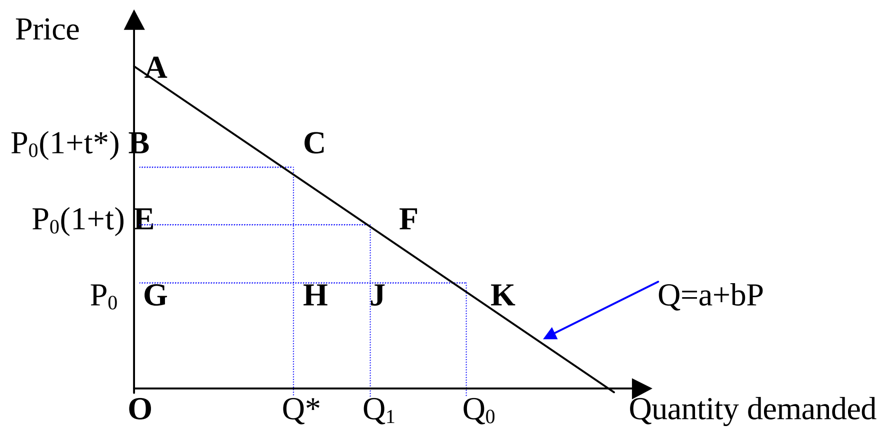
[2] More vehicles per capita are expected to reduce utilization. Thus, the expected sign for the variable is negative. However, for some developing countries, with a low stock of vehicles, the sign may be positive.

(iii) Revenue-Maximizing Tax Revenue

Assuming a single-good case with a linear demand and a horizontal supply curve the revenue maximizing tax rates can be reasonably estimated for the major excisable commodities.

Figure 2 illustrates this case. Given P_0 the pretax price and Q_0 its corresponding quantity sold, imposing a tax rate of t raises the retail price to $P_0(1+t)$ and lowers the quantity demanded to Q_1. The resulting tax revenue is given by the area *EFJG*. It is assumed in this illustration that tax revenue will be maximized by imposing the tax rate t^*. The calculation of the revenue-maximizing rate proceeds as below (following Haughton 1998)

Figure 2: ***Computation of Revenue Maximizing Tax Rate***



Given the linear demand curve,

(9) $Q = a + bP$,

where $b<0$ reflects a downward sloping demand curve, the tax revenue resulting from imposing the tax rate t is:

(10) $R = tP_0Q_1$

where $Q_1 = a + b(P_0(1+t))$.

This implies that

(11) $R = tP_0(a + bP_0(1+t)) = aP_0t + bP_0^{\,2}t + bP_0^{\,2}t^2$

The first order condition the revenue maximizing rate gives

(12) $$\frac{dR}{dt} = aP_0 + bP_0^2 + 2bP_0^2 t = 0$$

which yields

(13) $$t^* = \frac{-(a + bP_0)}{2bP_0} = \frac{-Q_0}{2bP_0}.$$

Given the difficulties of obtaining the pretax prices it is useful to express the equation in elasticity form (although this adds some further error of approximation especially when the elasticity is absolutely small). The own price elasticity is defined as:

(14) $$h \equiv \frac{dQ}{dP}\frac{P}{Q} \equiv b\frac{P_0}{Q_0},$$

and therefore

(15) $$t^* \approx \frac{-1}{2h}.$$

(b) Estimation Techniques for Buoyancy, Elasticity and Demand Equations

Ordinary Least Squares (OLS) estimation was used in estimating buoyancy, elasticity and demand equations. However, the data that were used in the analysis were time series in nature. As such, some of the variables may be spuriously related. To overcome this problem stationarity tests for each of the variables corresponding to equations (2), (4), (5) and (8) were undertaken using the Augmented Dickey-Fuller (ADF) test. The ADF equations were generally expressed for each of the variables as

(16) $$\Delta x_t = a_{1j} + a_{2j} x_{t-1} + a_{3j} t + \sum_{i=1}^{k} a_{4j} \Delta x_{t-1} + e_t ,$$

where, x_t is the variable that is tested for stationarity, t is the trend, and a_{ij} are coefficients with a_{2j} representing the coefficient used in the unit root test. The null hypothesis is that $a_{2j} = 0$ (there is a unit root) against the hypothesis that $a_{2j} < 0$ (the variable is stationary). If it reveals that the variables are not stationary in their levels, then they are differenced until stationarity is achieved. It should be noted that the estimation of the equations with variables that are not differenced provides a measure of the long run relationship.

Cointegration models augmented by an Error Correction Mechanism (ECM) have been found to be useful tools to analyze both economic theory relating to the long run relationship between variables and short run disequilibrium. Since a differenced model normally loses its long run properties, an attempt is made to restore these long run properties by including an Error Correction Mechanism (ECM) in the model. Assuming all the variables in a specified equation are integrated of order one I(1), then the error correction model would generally be expressed as

$$(17) \quad \Delta y_t = a_0 + \sum_{j=1}^{k-1} a_{1j} \Delta x_{1t-j} + \sum_{j=1}^{k-1} a_{2j} \Delta x_{2t-j} + \ldots + \sum_{j=1}^{k-1} a_{7j} \Delta x_{7j=1} + ECM_{t-1} + e_t$$

where Dy_t is the first difference of the dependent variable in equations (2), (4), (5) or (8); *Dx's* are the first differences of the independent variables of the equations; ECM_t is the Error Correction Mechanism derived from residuals of the regressions as specified by equations (2), (4), (5) or (8); and e_t is the error term.

6. EMPIRICAL RESULTS AND POLICY IMPLICATIONS

6.1 Buoyancy and Elasticity

In estimating the long-run responsiveness of excise tax revenue to GDP, the variables used were first tested for normality and then for stationarity.

6.1.1 Normality test

The normality test of the variables used to compute buoyancy and elasticity of the excise tax system showed that two variables (excise tax revenue and GDP at market prices) were not normally distributed before they were converted to the logarithmic form (see Table 3). After the conversion these variables became normal. In this case the logarithmic form is seen as powerful in inducing normality in the variables.

Table 3: ***Descriptive Data Analysis***

Variable	Mean	Standard Deviation	Skewness	Excess Kurtosis	Minimum	Maximum	Normality Chi(2)
T	12046.04	8112.86	0.61	-1.26	1826.30	28371.30	20.9**
T*	4025.81	1774.44	-0.37	0.22	530.55	8170.60	1.69
GDP	672464	386898	0.47	-1.17	207673	1351468	9.7**
LT	9.15	0.71	-0.02	-0.97	7.51	10.25	1.32
LT*	8.12	0.73	-1.65	1.50	6.27	9.00	49.1**
LGDP	13.24	0.62	-0.11	-1.32	12.24	14.00	5.17

Notes:
T = Excise Tax Revenue
T* = Adjusted Excise Tax Revenue
GDP = Gross Domestic Product at market price
LX = The logarithm of any variable X
All the data are in millions of Tanzanian Shillings, quarterly running from 1990 to 1998.
** = statistically significant at the 1% level.

6.1.2. Unit Root Test

This test is normally conducted in order to do away with spurious regressions. As shown in Table

4, the test reveals that all the variables are stationary in the first difference when tested using various versions of the Augmented Dickey Fuller equation.

Table 4: ***Unit Root Test for the Variables***

Variable	ADF	No. of Lags	Inference
DLT	2.782*	5	Integrated of Order One I(1)
DLT*	-2.987*	4	Integrated of Order One I(1)
DLGDP	-3.025*	2	Integrated of Order One I(1)
ECM-1	-2.550*	5	Integrated of Order One I(0)

Notes:
Critical value: 5% = -2.70; * imply the respective variable is stationary at five percent level.

6.1.3 Regression Results for Buoyancy and Elasticity

(a) Buoyancy

(i) Results of the Long-run Relationship

Identification of the long-run relationship between excise tax revenue and GDP requires the estimation of the cointegrating equation. This equation was estimated and the results are as shown in Equation (18).

$$(18) \qquad LT = \underset{(1.487)}{-3.261} + \underset{(0.112)}{0.938}\, LGDP \qquad (SE)$$

Adjusted $R^2 = 0.66$, $F(1, 34) = 69.82$ [0.00], and DW = 1.80.

The results show the excise tax responsiveness to GDP as having almost unitary elasticity. The coefficient of the GDP has the expected positive sign implying that excise tax revenue is directly related to changes in GDP. The coefficient of determination is 0.66 implying that more than half of the total variations in the excise tax revenue are explained by the variations in GDP. Finally, the Durbin-Watson statistic indicates approximately that there is no serial correlation.

(ii) Error Correction Model Regression Results

The estimation results of the Error Correction model are shown in Table 5.

Table 5: ***Modeling DLT by OLS***

Variable	Coefficient	Std. Error	t-Value	t-Prob	PartR^2
Constant	0.02	0.08	0.29	0.77	0.00
DLGDP	0.59	0.72	0.81	0.42	0.02
ECM-1	-0.91	0.18	-5.19	0.00	0.46

Adjusted $R^2 = 0.44$, $F(2, 32) = 14.21$ [0.00], DW = 2.04, AR1-3F(3,29) = 0.48 [0.69], ARCH 3 F(3,26) = 0.03 [0.99], and RESET F(1,31) = 3.64 [0.065].

Results in Table 5 show that the short-run responsiveness of excise tax revenue to GDP is low as compared to that of the long-run shown in Equation (11). However, this responsiveness does not significantly explain the changes in the excise tax revenue at the conventional level of 5 percent.

The model reveals that the excise tax revenues are significantly explained by their long-run trend. The error correction term indicates that about 91 percent of the total deviations between the short-run and the long trend are corrected every three months. With the diagnostic test, the model (based on the F-statistics) passes the auto-correlation test of order one to three, and the auto-regressive conditional heteroscedasticity and regression specification tests.

(b) Elasticity

(i) Cointegration Results

The long-run responsiveness of the excise tax revenue *adjusted for discretionary effects* relative to GDP are as shown in Equation (19).

$$(19)\quad LT^* = \underset{(2.34)}{17.04} - \underset{(0.18)}{0.67}\,LGDP \qquad (SE)$$

Adjusted $R^2 = 0.31$, $F(1, 33) = 14.49$ [0.001], and DW = 0.94.

Equation (19) shows that in the long-run the excise tax system is adversely affected by the changes in GDP. Although the variables in the model are jointly significant, the model is characterized by a low coefficient of determination and experiences positive autocorrelation. It is noteworthy that when the disturbances of a linear regression model are correlated, the coefficient estimates of ordinary least squares are inefficient, and the standard error estimates are biased. Thus, the Cochrane-Orcutt iterative method was attempted in order to obtain efficient estimates of an equation. The results of this method are presented in Equation (20).

$$(20)\quad LT^* = \underset{(4.21)}{17.72} - \underset{(0.32)}{0.73}LGDP \qquad (SE)$$

Adjusted $R^2 = 0.11$ $F(2, 33) = 5.29$*[0.02] DW = 2.24

The results still show that excise tax revenue is adversely affected by changes in the GDP. Moreover, the adjusted coefficient of determination has become lower.

(ii) The Estimation Results of the Error Correction Model

As hypothesized, the income elasticity of excise tax revenues as adjusted for discretionary changes is positive in the short-run, but low. The change in GDP only has a coefficient of about 0.72 and it is not significant at the conventional level of 5 percent (see Table 6). In the long-run relationship the error correction term has the expected negative sign and shows that about 60 percent of the short and long run deviations of the adjusted excise tax revenue are corrected every three months. The diagnostic tests as shown by the F-statistic are good in terms of the AR 1-3 and ARCH 3.

Table 6: ***Modeling DLT* by OLS***

Variable	Coefficient	Std. Error	t-Value	t-Prob	PartR^2
Constant	-0.08	0.11	-0.72	0.48	0.02
DLGDP	0.72	0.92	0.78	0.44	0.02
ECM-1	-0.61	0.16	-2.90	0.01	0.21

Adjusted R^2 = 0.32, F(2, 31) = 8.92 [0.0009], DW = 1.96, AR1-3F(3,28) = 0.05[0.9856], and ARCH 3 F(3, 25) = 0.60 [0.6195].

6.2 Estimation Results for the Demand Functions

(a) Demand For Local Brew *Chibuku*

(i) Normality Test

Before giving the estimation results of the demand for *Chibuku*, it is important to test for normality since non-normality of variables can impair the normality of the disturbance term in the estimated equation. The normality results are provided in Table 7.

Table 7: ***Descriptive Data Analysis for Variables***

Variable	Mean	Std.Devn.	Skewness	Excess Kurtosis	Minimum	Maximum	Normality $Chi^2(2)$
LQc	6.499	0.069	-0.308	-0.601	6.343	6.619	1.135
LPc	0.083	0.120	-0.268	-1.201	-0.151	0.266	5.257
LPb	0.562	0.145	0.062	-1.545	0.343	0.768	9.743**
LPk	2.385	0.064	-0.008	-0.556	2.255	2.515	0.029
LYp	4.701	0.012	0.906	-0.360	4.687	4.729	15.237**

** imply one percent level of significance.

Notes:

LQc = the logarithm of quantity demanded for *Chibuku* in thousands litres

LPc = the logarithm of the real price per a litre of *Chibuku* in Tanzanian Shillings

LPb = the logarithm of the real price per half a litre of beer in Tanzanian Shillings.

LPk = the logarithm of the real price per crate of *Konyagi* in Tanzanian Shillings.

LYp = the logarithm of real per capita income.

The data are run from the first quarter of 1990 to the last quarter of 1998.

The results of the normality test show that the logarithm of the price for beer and per capita income are normally distributed.

(ii) Unit Root Results for the Variables

The unit root results for the variables used in estimating the demand for *Chibuku* are shown in Table 8. All variables in the demand for *Chibuku* are integrated of order one at different lags. The error term is stationary allowing us to use error correction model.

Table 8: ***Unit Root Test for the Variables***

Variable	ADF	No. of Lags	Inference
DLQc	-3.431**	4	Integrated of Order One I(1)
DLPc	-2.739*	3	Integrated of Order One I(1)
DLPb	-3.273*	4	Integrated of Order One I(1)
DLPk	-2.876*	3	Integrated of Order One I(1)
DLYp	-2.972*	2	Integrated of Order One I(1)
ECM_{-1}	-4.575**	1	Integrated of Order One I(0)

Critical values: 5% = -2.70 and 1% = -3.40; * and ** imply the respective variable is stationary at five and one percent respectively.

(iii) Cointegration Results for *Chibuku*

The long-run relationship for *Chibuku* shows that the demand for *Chibuku* has inelastic own-price elasticity and elastic cross-price elasticities (see equation 21):

(21) $LQc = -10.671 - 0.527LQc_{-1} - 0.473LQc_{-2} - 0.495LQc_{-3} - 0.444LPc + 2.709LPb_{-1}$
(SE) (7.006) (0.193) (0.148) (0.127) (0.190) (0.418)
$+3.174LPk + 3.609LYp + 0.046Trend$
(SE) (0.654) (1.375) (0.008)
Adjusted $R^2 = 0.77$, $F(8, 24) = 15.44$ [0.000], and AR1-3F (3, 21) = 0.86 [0.480].

The logarithm of per capita income (LPC) suggests a positive and highly elastic responsiveness of the percentage changes of quantity demanded of *Chibuku* to the percentage changes in per capita income. Both the adjusted coefficient of determination and F-statistic are high at 0.77 and 15.44 respectively. AR 1-3F suggests absence of serial correlation of order one to three in error term.

(iv) The Estimation Results for the Error Correction Model

The results of the Error Correction Model are shown in Table 9. The results show that both beer and '*Konyagi*' act as substitutes for *Chibuku* in both the short-run and the long-run. The error correction term has the expected negative sign and shows that about 64 percent of the deviations between the short-run and the long-run demand for *Chibuku* are corrected every three months. In this case the behavior of the demand for *Chibuku* in the short-run is almost similar to that in the long-run. Regarding the diagnostic tests, the AR 1 – 3F suggests no serial correlation of lag 1 to 3 in the disturbance terms whereas the F-statistic for ARCH suggests no auto-regressive conditional heteroscedasticity; there is no error of specification of the model in terms of non-linearities as indicated by RESET.

Table 9: *Modeling DLQc by OLS*

Variable	Coefficient	Std. Error	t-Value	t-Prob	PartR^2
Constant	0.052	0.008	6.191	0.000	0.625
$DLQc_{-1}$	-0.428	0.116	-3.689	0.001	0.372
$DLQc_{-2}$	-0.438	0.091	-4.812	0.000	0.502
$DLQc_{-3}$	-0.358	0.093	-3.864	0.001	0.394
DLPc	-0.528	0.249	-2.120	0.045	0.164
$DLPb_{-1}$	3.522	0.481	7.328	0.000	0.700
DLPk	2.387	0.586	4.075	0.001	0.419
DLYp	2.609	3.358	0.777	0.445	0.026
ECM_{-1}	-0.640	0.206	-6.510	0.000	0.648

Adjusted R^2 = 0.79, F(8, 23) = 16.56 [0.000], AR 1 - 3F(3, 20) = 0.88 [0.465], ARCH 3 F(3, 17) = 0.90 [0.463], RESET F(1, 22) = 0.04 [0.835].

(b) Demand For Beer

(i) Normality Test

As done in the previous regressions, the test for normality is also done here before presenting the estimation results of the cointegrating equation as well as the estimation results for the error correction model. The normality results for the model in logarithmic form show that all variables included in the model, except the real price of beer, have normal distributions (Table 10).

Table 10: ***Descriptive Data Analysis for the Variables***

Variable	Mean	Std. Devn.	Skewness	Excess Kurtosis	Minimum	Maximum	Normality Chi^2(2)
LQb	4.866	0.207	0.568	-1.268	4.617	5.245	17.659**
LPp	0.562	0.145	0.062	-1.547	0.343	0.768	9.743
LPc	0.083	0.120	-0.268	-1.201	-0.151	0.266	5.257**
LYp	4.701	0.012	0.906	-0.360	4.687	4.729	15.237**

** imply one percent level of significance.

Notes:
LQb = the logarithm of quantity demanded for beer in thousands litres
LPb = the logarithm of the real price per half a litre of beer in Tanzanian Shillings.
LPc = the logarithm of the real price per a litre of Chibuku in Tanzanian Shillings
LYp = the logarithm of real per capita income.
The data run from the first quarter of 1990 to the last quarter of 1998.

(ii) The Unit Root Test

The results of the unit root test show that all the variables are integrated of order one. Moreover the error correction term is stationary (Table 11). This justifies the use of the error correction model.

Table 11: ***Unit Root Test for the Variables***

Variable	ADF	No. of Lags	Inference
DLQb	-3.116*	4	Integrated of Order One I(1)
DLPb	-3.273*	4	Integrated of Order One I(1)
DLPc	-2.739*	3	Integrated of Order One I(1)
DLYp	-2.972*	2	Integrated of Order One I(1)
ECM_{-1}	-2.733*	1	Integrated of Order One I(0)

Critical values: 5% = -2.70; * imply the respective variable is stationary at a five percent level of significance.

(iii) The Long-run Relationship Results for the Demand for Beer

The estimated cointegrating equation shows that in the long-run the price for beer has an inelastic own-price elasticity, and *Chibuku* acts as a substitute for beer (positive cross price elasticity). Per capita income has the expected positive sign as hypothesized, with an income elasticity of demand close to unity.

(23) $LQb = -4.074 + 0.872LQb_{-1} - 0.312LPb_{-2} + 0.078LPc_{-2} + 1.040LYp$
(SE) (1.367) (0.031) (0.049) (0.032) (0.304)

Adjusted R^2 = 0.99, F(4, 29) = 3727.4 [0.000], and AR1-3F (3, 21) = 2.255 [0.106].

The model has a high coefficient of determination and approximately no serial auto-correlation as indicated in equation 23.

(iv) Estimation Results for the Error Correction Model

The Error Correction term of the model (Table 12) shows that about 65 percent of the deviations between the short and the long-run trends in the demand for beer are corrected every three months. The model also shows the expected signs to the explanatory variables. In the short-run the demand for beer is influenced by own price, per capita income and tastes and preferences.

Table 12: ***Modeling DLQb by OLS***

Variable	Coefficient	Std. Error	t-value	t-prob	$PartR^2$
Constant	0.024	0.010	2.386	0.024	0.174
$DLQb_{-1}$	0.785	0.154	5.089	0.000	0.490
$DLPb_{-2}$	-0.215	0.048	-4.517	0.000	0.430
DLYp	7.294	2.462	2.963	0.006	0.245
Trend	-0.001	0.000	-2.655	0.013	0.207
ECM_{-1}	-0.645	0.197	-3.273	0.003	0.284

where *trend* is a time variable set equal to 1,2,3, etc. Adjusted R^2 =0.80, F(5,27) = 28.25 (0.000), AR 1-3F (3,24) = 0.0.700 [0.561], and ARCH 3F (3,21) = 0.65 [0.592].

Further, the diagnostic tests show a good coefficient of determination of about 80 percent and overall significance of the variables according to the F-statistic. The model also passes other diagnostic tests such as the auto-correlation test of order one to three - AR1-3, and the auto-regressive conditional heteroscedasticity of order three ARCH 3.

(c) Demand for Cigarettes

(i) Normality Test

The results of the normality test show the logarithms of all variables included in the model are normally distributed with the Chi square test significant at one percent. (Table 13).

Table 13: ***Descriptive Data Analysis***

Variable	Mean	Std.Devn.	Skewness	Excess Kurtosis	Minimum	Maximum	Normality $Chi^2(2)$
LQg	3.584	0.031	1.160	1.259	3.529	3.673	9.557**
LPg	0.583	0.090	1.521	1.581	0.479	0.850	27.667**
LPt	0.487	0.064	-0.930	-0.510	0.337	0.550	20.895**
LYp	4.701	0.012	0.906	-0.360	4.687	4.729	15.237**

** imply significance at one percent.

Notes:

LQg = logarithm of the quantity demanded of cigarettes in millions.
LPg = logarithm of real price per packet of cigarettes (i.e., 1 packet = 20 cigarettes) in Tanzanian Shillings.
LPt = logarithm of real price per kilogram of fire-cured tobacco in Tanzanian Shillings.
LYp = logarithm of real per capita income in Tanzanian Shillings.
The data run from the first quarter of 1990 to the last quarter of 1998.

(ii) The Unit Root Test for the Variables

The tests for stationarity of the variables used in analyzing the demand for cigarettes show all the variables to be integrated of order one (Table 14). Further, Table 14 shows that the error term is stationary.

Table 14: ***The Unit Root Test for the Variables***

Variable	ADF	No. of Lags	Inference
DLQg	-4.138**	4	Integrated of Order One I(1)
DLPg	-3.006*	4	Integrated of Order One I(1)
DLPt	-3.553**	2	Integrated of Order One I(1)
DLYp	-2.972*	2	Integrated of Order One I(1)
ECM_{-1}	-3.888**	1	Integrated of Order One I(0)

Critical values: 5% = -2.70 and 1% = -3.40; * and ** imply the respective variable is stationary at five and one percent respectively.

(iii) The Estimation Results of the Cointegrating Equation

The estimation results of the dynamic long-run relationship of the demand for cigarettes function show the own-price responsiveness of quantity demanded of cigarettes to be inelastic (Equation 24). The cross-price elasticity of demand for cigarettes with respect to tobacco is low and positive, implying that fire-cured tobacco acts as a substitute for cigarettes.

$$(24)\quad LQg = \underset{(3.708)}{-16.782} + \underset{(0.095)}{0.869LQg_{-1}} - \underset{(0.064)}{0.410LQg_{-3}} - \underset{(0.028)}{0.164LPg} + \underset{(0.113)}{0.527LPt_{-4}} + \underset{(0.827)}{3.937LYp}$$

(SE) (3.708) (0.095) (0.064) (0.028) (0.113) (0.827)

Adjusted $R^2 = 0.95$, $F(5, 26) = 124.51$ [0.000], andAR1-3F $(3, 21) = 0.37$ [0.773].

Equation (24) also shows a positive income elasticity, as expected. The adjusted coefficient of determination is high at 95 percent while the AR1-3F of about 0.37 indicates there is no serial correlation of the error term.

(iv) The Estimation Results of the Differenced Model

The results for differenced model are presented in Table 15. The error correction term is highly significant with and has the expected sign. The error correction term also shows that about 94 percent of the deviation of short run demand for cigarettes from long run demand for cigarettes is corrected every three months.

The differenced model also reveals that the own-price elasticity of demand is still low, as in the long-run case. As in the long-run, the cross-price elasticity of demand in the short-run is low (about 0.53). In either case the demand for cigarettes respond to the fourth lag of changes in own price and the price of the substitute. The diagnostic tests indicate the absence of auto-correlation of order one to three, and the absence of auto-regressive conditional heteroscedasticity of order three, but the specification of the model is rather weak.

Table 15: *Modeling DLQg by OLS*

Variable	Coefficient	Std. Error	t-Value	t-Prob	PartR^2
Constant	-0.001	0.001	-0.318	0.753	0.004
$DLQg_{-1}$	0.858	0.127	6.768	0.000	0.647
$DLQg_{-3}$	-0.428	0.108	-3.970	0.001	0.387
$DLPg_{-4}$	-0.112	0.047	-2.564	0.017	0.208
$DLPt_{-4}$	0.527	0.173	3.044	0.005	0.271
DLYp	4.406	1.344	3.278	0.003	0.301
ECM_{-1}	-0.936	0.210	-4.456	0.000	0.443

Adjusted R^2 = 0.76, F(6, 25) = 18.351 [0.000], AR 1-3F(3, 22)=0.273 [0.844],
ARCH 3 F(3, 19) = 0.372 [0.774], RESET F(1, 24)=4.565 [0.043].

(d) Demand for Motor Fuel (Petroleum Products)

(i) Normality Test

The results of the normality test show that two variables are normal when they are expressed in a logarithmic form and the other two are not (Table 16).

Table 16: *Descriptive Data Analysis*

	Mean	Std. Deviation	Skewness	Excess Kurtosis	Minimum	Maximum	Normality Chi^2(2)
LQf	0.218	0.068	-0.708	-0.189	0.069	0.346	5.171
LPf	0.070	0.026	-0.626	-0.252	0.011	0.113	3.822
LVp	-2.100	0.017	1.482	1.405	-2.121	-2.052	27.345**
LYp	4.701	0.012	0.906	-0.360	4.687	4.729	15.237**

** imply significance at one percent.

Notes:
LQf = logarithm of the quantity demanded of motor fuel per vehicles in ltres.
LPf = logarithm of the price index for motor fuel at constant 1994 prices.
LVp = logarithm of vehicle to population ratio (per capita vehicle).
LYp = logarithm of real per capita income in Tanzanian Shillings.
The data run from the first quarter of 1990 to the last quarter of 1998.

(ii) The Unit Root Test for the Variables

Using the Augmented Dickey Fuller equation, all the variables were found to be integrated of order one (Table 17). The error correction term was found to be stationary. This justifies the use of the error correction model.

Table 17: ***The Unit Root Test for the Variables***

Variable	ADF	No. of Lags	Inference
DLQf	-3.145*	1	Integrated of Order One I(1)
DLPf	-2.996*	4	Integrated of Order One I(1)
DLVp	-2.924*	3	Integrated of Order One I(1)
DLYp	-2.972*	2	Integrated of Order One I(1)
ECM_{-1}	-4.364**	1	Integrated of Order One I(0)

Critical values: 5% = -2.70 and 1% = -3.40; * and ** imply the respective variable is stationary at five and one percent respectively.

(iii) The Estimation Results of the Cointegrating Equation

Empirical estimation of the long-run relationship shows that the logarithms of the price of motor fuel and per capita income are significant at 1 percent and have the expected signs (Equation 26). The logarithm of the vehicle to population ratio is also significant at 1 percent indicating that demand for fuel increases with an increase in vehicles per capita. The lagged per capita income included as the measure of efficiency is statistically significant at the 1 percent level implying that the demand for motor fuel decreases with an increase in the efficiency of a vehicle. The solved Static Long-Run equation is as shown below (Equation 26).

$$(26)\quad \underset{(SE)}{LQf} = +\underset{(3.816)}{24.830} + \underset{(0.133)}{0.262LQf_{-1}} - \underset{(0.084)}{0.267LPf_{-3}} + \underset{(0.503)}{2.183LVp} + \underset{(1.3105)}{7.729LYp} - \underset{(1.827)}{11.922LYp_{-4}} - \underset{(0.002)}{0.017Trend}$$

Adjusted R^2 = 0.98, F(6, 24) = 286.59 [0.0000], AR1-3F (3, 21) = 0.97 [0.541].

The adjusted coefficient of determination is very high at 98 percent and the AR1-3F statistic shows that there is no serious serial correlation. The F statistic is also very high at 286.6 showing that the model is jointly significant (Equation 26).

(iv) The Estimation Results of the Error Correction Model

Regarding the error correction model, the estimation results show that there is a very strong short-run relation between the fuel to vehicle ratio on the one hand, and the real price of fuel, the vehicle to population ratio and real per capita income on the other. This is because all the above-mentioned explanatory variables are significant at the conventional 1 or 5 percent levels. The model also shows that about 86 percent of the short-run deviations of the demand for motor fuel are corrected every three months (Table 18).

Table 18. ***Modeling DLQf by OLS***

Variable	Coefficient	Std. Error	t-value	t-prob	PartR^2
Constant	-0.005	0.002	-2.651	0.015	0.242
$DLQf_{-1}$	0.785	0.094	8.336	0.000	0.760
$DLQf_{-4}$	-0.277	0.060	-4.596	0.000	0.490
DLPf	-0.161	0.069	-2.321	0.030	0.197
DLYp	2.429	1.252	1.939	0.045	0.146
$DLYp_{-4}$	-3.285	1.4560	-2.257	0.034	0.188
ECM_{-1}	-0.860	0.152	-12.222	0.000	0.872

Adjusted R^2 = 0.90 F(6, 22) = 43.911 [0.000] AR 1- 2F (3, 19) = 0.823 [0.497] ARCH 3 F(3, 16) = 0.188 [0.903] RESET F(1,21) = 0.027 [0.872].

Furthermore, the diagnostic tests show a good coefficient of determination of about 90 percent and overall significance of the variables according to the F-statistic. The model also passes other diagnostic tests such as the auto-correlation test of order one to three –(AR1-3) and the auto-regressive conditional heteroscedasticity of order three (ARCH 3)

(e) Demand for *Konyagi* Gin

(i) Test for Normality

The test for normality of the variables is depicted in Table 19. According to the table, the logarithm of two of the variables are normally distributed while the other two are not.

Table 19: ***Descriptive Data Analysis***

Variable	Mean	Std. Deviation	Skewness	Excess Kurtosis	Minimum	Maximum	Normality Chi^2(2)
LQk	5.339	0.070	-1.237	-0.019	5.177	5.404	41.701**
LPk	2.385	0.063	-0.008	-0.556	2.255	2.515	0.029
LPc	0.083	0.128	-0.268	-1.201	-0.266	0.266	5.256
LYp	4.701	0.012	0.906	-0.360	4.729	4.729	15.237**

** imply 1 percent level of significance

Notes:

LQk = the logarithm of quantity demanded for *Konyagi*' in thousands crates

LPk = the logarithm of the real price per crate of *Konyagi*' in Tanzanian Shillings.

LPc = the logarithm of the real price per a litre of *Chibuku* in Tanzanian Shillings

LYp = the logarithm of real per capita income.

The data run from the first quarter of 1990 to the last quarter of 1998.

(ii) The Unit Root Test for the Variables

As usual, before applying Ordinary Least Squares it is imperative to check whether the variables are stationary. The results from the unit root test show that all the variables are stationary when differenced once (Table 20). The error term is also stationary.

Table 20: ***The Unit Root Test for the Variables***

Variable	ADF	No. of Lags	Inference
DLQk	-3.205*	1	Integrated of Order One I(1)
DLPk	-2.876*	3	Integrated of Order One I(1)
DLPc	-2.739*	3	Integrated of Order One I(1)
DLYp	-2.972*	2	Integrated of Order One I(1)
ECM_{-1}	-3.998**	1	Integrated of Order One I(0)

Critical values: 5% = -2.70 and 1% = -3.40; * and ** imply the respective variable is stationary at five and one percent respectively.

(iii) The Estimation Results of the Cointegrating Equation

In the long run the price of *Konyagi* has the expected negative sign and the own-price elasticity of demand is inelastic. The coefficient of about 0.1 on the logarithm of the price of *Chibuku* shows a relatively low cross elasticity of demand. The model fits well at 96 percent while the AR1-3F statistic of 1.26 predicts no autocorrelation of order one to three in the error term. (Equation 27). The solved Static Long-Run equation is:

$$\text{(27)} \quad LQk = -4.515 + 0.863LQk_{-4} - 0.643LPk + 0.123LPc + 1.457LYp_{-3} - 0.003Trend$$
$$\text{(SE)} \quad (3.168) \quad (0.101) \quad (0.119) \quad (0.045) \quad (0.582) \quad (0.001)$$

Adjusted R^2 = 0.94, F(5, 24) = 102.87 [0.000], and AR1-3F (3, 21) = 1.26 [0.313].

(iv) Estimation Results for the Error Correction Model

The estimation results of the error correction model show that all the variables are significant at 5 percent or less. The coefficient of the logarithm of the real price of *Chibuku* is highly significant at less than one percent (Table 21). This indicate that in the short run the demand for *Konyagi* is highly influenced by the real price of *Chibuku*. This can be explained by the fact that both *Chibuku* and *Konyagi* are consumed by low-income groups in Tanzania.

Table 21: ***Modeling DLQk by OLS***

Variable	Coefficient	Std. Error	t-value	t-prob	$PartR^2$
Constant	0.236	0.029	8.143	0.000	0.80
$DLQk_{-4}$	-1.391	0.228	-6.091	0.000	0.69
DLPk	-0.472	0.137	-3.651	0.048	0.25
DLPc	0.890	0.164	5.436	0.000	0.64
$DLYp_{-4}$	11.519	5.240	2.198	0.043	0.23
Trend	-0.011	0.001	-9.889	0.000	0.85
ECM_{-1}	-0.870	0.219	-4.273	0.005	0.46

Adjusted R^2 = 0.91, F(6, 16) = 40.93 [0.000], AR1-3 F(3, 21) = 1.56 [0.246], ARCH 3 F(3, 10) = 0.74 [0.553], Normality Chi2(2) = 1.41 [0.493], RESET F(1, 15) = 43.16 [0.00].

The model is good with the adjusted coefficient of determination of about 91 percent and the auto-correlation test of order one to three showing that there is no serial correlation. The overall significance of the model is good as indicated by an F-statistic that is significant at less than 1 percent (Table 21).

6.3 Computation of Revenue-Maximizing Tax Rates

Equation (15) was used to compute revenue-maximizing tax rates. Table 22 summarizes the short and long-run own-price elasticities obtained from regressions of the excisable commodities.

Table 22. ***Short and Long-Run Own-Price Elasticities of Demand***

	Short-run	**Long-run**
Chibuku	-0.528	-0.444
Beer	-0.215	-0.312
Cigarettes	-0.112	-0.164
Motor fuel	-0.161	-0.267
Konyagi	-0.472	-0.643

The corresponding revenue-maximizing rates using Equation (15) are presented in Table 23.

Table 23: ***Short and Long-Run Revenue-Maximizing Tax Rates (in percentages)***

	Short-run	**Long-run**
Chibuku	94.7	112.6
Beer	232.6	160.3
Cigarettes	446.4	304.9
Motor fuel	310.6	187.3
Konyagi	105.9	77.8

The results of the revenue-maximizing tax rates in Table 23 show that if rates of more than 100 percent were imposed on beer, cigarettes, and motor fuel then tax revenue would rise in both the short and long-run. The same is true for *Chibuku* in the long run and *Konyagi* in the short run. However, this is not true of tax revenue from *Chibuku* in the short run and *Konyagi* in the long run. In this case, less than 100 percent excise tax rates will maximize tax revenue from the two commodities.

7. CONCLUDING REMARKS

The objective of this study was to analyze the structure and performance of excise taxation in Tanzania in terms of achieving the objectives of efficiency, revenue generation and equity. Pursuit of this objective involved, first, assessing the revenue potential of excise taxation in Tanzania; second, measuring the revenue effects of discretionary changes in excise tax structure and changes in income; and third, identifying goods that should bear higher excise taxes and the magnitude of the (optimal) revenue-maximizing tax rates to be imposed. The first task involved computing measures of buoyancy and elasticity for excises in general, while the last two tasks were accomplished by estimating demand equations for the major excises and computing revenue-maximizing tax rates.

The long-run estimation results for buoyancy and elasticity show excise tax revenue to be inelastic with respect to the quarterly change in GDP. However, buoyancy is higher than elasticity implying that discretionary changes undertaken over the period of the study did enhance revenue collection and that the existing excise tax system, if left alone, has limited potential for revenue generation. It is therefore a challenge to the government to proceed with tax reforms in the excise tax system if economic growth is to have any meaning in government revenue generation. The reforms should cover excise tax administration, revision of excise tax rates and broadening of the excise tax base.

The estimation results of the demand functions for the local brew cigarettes, motor fuel, beer, *Konyagi* and *Chibuku* indicate these commodities have inelastic own price elasticities of demand, with cigarettes, motor fuel and beer exhibiting the most price inelastic demand. The analysis shows that the government may charge higher rates on these items, and especially on cigarettes, motor fuel and beer, to generate additional excise tax revenue

The estimation of revenue-maximizing tax rates suggests that more than 100 percent rates should be imposed on cigarettes, motor fuel and beer in both the short and long-run, while a high tax rate could successfully be imposed on *Chibuku* in the long run and *Konyagi* in the short-run. But the high tax rate on cigarettes, motor fuel and beer should be reduced in the long-run, to avoid possible distortionary effects. However, excise tax rates that are suggested in this paper need to be interpreted with caution since recent tax reforms have reduced the existing excise rates following the introduction of VAT at 20% on these products. In the case of *Chibuku*, excise tax has been abolished.

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Appendix Table A1: Central Government Revenue by Source

Year	**Total Tax Revenue**	**Excise Tax Revenue**	**Sales Tax Revenue**	**Custom Duty Revenue**	**Income Tax Revenue**	**Other Taxes**	**GDP** (Converted To Match The Fiscal Year)
1989/0	81470.7	14057.0	28571.0	11930.0	20195.0	6718	732223
1990/1	118257.2	20172.0	20171.6	17321.0	32413.0	28180	958483
1991/2	153355.6	30536.0	44862.2	21103.0	40143.2	16711	1228073
1992/3	146420.0	20339.0	41047.7	16288.0	45455.0	23290	1547706
1993/4	220357.6	28959.0	63254.0	28404.0	58505.0	41236	2012202
1994/5	299899.0	35203.0	72643.0	46723.0	86645.0	58685	2659684
1995/6	383744.0	70125.0	94712.0	61271.0	103871.0	53765	3394072
1996/7	505354.7	91685.0	123502.6	78374.0	125726.2	86067	4235551
1997/8	566122.6	101251.0	140520.0	81751.0	149787.9	92813	5054666
1998/9	632897.3	84194.6	219647.3	88177.9	162355.1	73356	5532096

Source: Bank of Tanzania, Economic Bulletin, (1989-1998) and The Ministry of Finance.

Appendix Table A2: The Trend of Local Excise Tax Revenue by Source

PERIOD	BEEREX	CIGEX	SODREX	SPIRITEX	OTHEX	TOTEXL
92- 7	270.10	688.30	104.10	105.60	689.40	1857.50
92- 8	595.90	580.10	160.30	21.40	280.10	1637.80
92- 9	340.30	487.00	182.20	26.60	219.60	1255.70
92- 10	876.20	572.90	198.00	108.90	192.10	1948.10
92- 11	264.00	499.00	200.20	52.10	318.80	1334.10
92- 12	661.30	319.30	112.90	86.00	308.90	1488.40
93- 1	843.90	432.40	150.90	105.50	236.40	1769.10
93- 2	350.00	117.90	303.40	92.60	248.70	1112.60
93- 3	51.50	572.60	332.30	0.00	266.50	1222.90
93- 4	65.80	352.50	203.70	173.00	255.50	1050.50
93- 5	100.00	555.70	163.50	0.00	234.90	1054.10
93- 6	626.00	1251.60	184.90	106.00	98.50	2267.00
93- 7	803.10	741.50	186.60	77.90	392.10	2201.20
93- 8	602.80	681.40	212.60	89.00	620.00	2205.80
93- 9	372.00	652.40	118.70	89.10	958.80	2191.00
93- 10	676.70	784.70	133.20	123.10	731.30	2449.00
93- 11	613.50	721.30	267.70	112.10	1130.30	2844.90
93- 12	570.50	655.90	336.80	217.30	542.80	2323.30
94- 1	285.00	816.60	337.60	37.90	590.30	2067.40
94- 2	869.00	0.00	171.10	90.70	607.30	1738.10
94- 3	204.40	1438.20	212.40	86.30	889.40	2830.70
94- 4	319.20	578.20	254.70	75.60	536.30	1764.00
94- 5	467.90	0.00	293.30	61.10	488.70	1311.00
94- 6	1223.30	651.60	159.80	65.90	631.30	2731.90
94- 7	425.50	846.00	204.60	92.40	36.40	1604.90
94- 8	560.80	628.40	244.10	117.80	43.20	1594.30
94- 9	498.50	801.60	218.00	86.90	27.10	1632.10
94- 10	349.40	996.60	302.10	117.00	3.40	1768.50
94- 11	476.10	890.20	363.00	133.70	6.90	1869.90
94- 12	232.70	813.70	351.10	158.70	0.50	1556.70
95- 1	633.50	811.70	351.40	162.60	12.70	1971.90
95- 2	686.60	896.70	325.00	65.30	7.50	1981.10
95- 3	549.00	683.90	284.20	35.70	3.60	1556.40
95- 4	606.80	869.40	324.80	117.60	2.70	1921.30
95- 5	602.10	838.40	357.90	81.60	6.00	1886.00
95- 6	818.70	885.60	304.70	88.40	4.40	2101.80
95- 7	1319.90	881.00	352.90	119.90	4.10	2677.80
95- 8	1824.30	896.40	206.10	102.50	4.40	3033.70
95- 9	2134.70	1060.30	170.00	146.80	33.30	3545.10
95- 10	2129.40	1021.20	348.80	127.40	3.90	3630.70
95- 11	2190.90	955.80	284.90	127.70	7.60	3566.90
95- 12	2446.70	1004.30	395.90	152.60	27.10	4026.60
96- 1	2526.60	977.60	300.80	172.70	10.20	3987.90
96- 2	2448.30	1509.60	289.80	101.80	6.20	4355.70
96- 3	2166.40	1292.10	208.20	107.50	82.60	3856.80
96- 4	2156.40	1081.00	310.10	133.00	17.70	3698.20
96- 5	2483.50	961.10	165.80	136.00	17.90	3764.30
96- 6	2294.40	1192.70	144.10	129.40	6.70	3767.30
96- 7	2319.70	1383.60	321.70	75.80	5.00	4105.80

96- 8	3113.30	1480.50	207.90	166.10	4.20	4972.00
96- 9	3464.80	1537.50	325.20	156.20	4.40	5488.10
96- 10	1378.10	1554.80	329.80	113.00	5.90	3381.60
96- 11	5183.50	1287.50	364.40	140.10	1.40	6976.90
96- 12	3345.90	1619.50	364.70	121.20	4.40	5455.70
97- 1	3985.00	1417.00	439.20	157.60	3.40	6002.20
97- 2	3217.50	1649.00	337.10	128.00	8.00	5339.60
97- 3	2386.50	1058.90	304.30	81.90	3.50	3835.10
97- 4	2776.90	1362.10	309.60	116.40	3.60	4568.60
97- 5	3207.20	1364.80	277.50	131.20	61.50	5042.20
97- 6	3348.50	1439.60	277.70	131.10	3.80	5200.70
97-7	2885.60	2503.30	0.00	194.00	4.70	5587.60
97-8	3643.00	2849.50	0.00	178.60	4.60	6675.70
97-9	3529.00	2584.60	0.00	272.50	4.30	6390.40
97-10	3812.60	2940.00	0.00	257.90	6.20	7016.70
97-11	4133.90	3249.30	0.00	274.40	4.10	7661.70
97-12	4156.60	2869.80	0.00	221.80	11.00	7259.20
98-1	3907.10	2963.10	0.00	190.40	4.40	7065.00
98-2	3386.30	2515.80	0.00	263.60	2.80	6168.50
98-3	2941.20	2628.40	0.00	115.50	2.23	5687.33
98-4	3125.00	3124.40	0.00	183.40	3.90	6436.70
98-5	3043.93	3320.32	0.00	135.30	4.90	6504.45
98-6	3334.70	2806.60	0.00	183.40	5.32	6330.02
98-7	3531.90	3429.00	0.00	153.10	4.30	7118.30
98-8	2174.10	2125.30	318.10	148.60	2.60	4768.70
98-9	2407.00	2040.70	261.60	115.30	17.50	4842.10
98-10	2256.30	1753.60	424.00	104.90	3.70	4542.50
98-11	3749.80	1671.60	415.80	0.00	0.60	5837.80
98-12	3013.70	1837.40	434.60	85.80	0.80	5372.30
99-1	3180.70	1702.90	542.70	136.50	0.50	5563.30
99-2	1392.90	1545.40	385.80	50.50	0.00	3374.60
99-3	2541.50	1665.70	366.30	93.60	0.30	4667.40
99-4	2367.20	1613.90	399.20	84.30	4.60	4469.20

Key: BEEREX= excise revenue from beer, CIGEX = excise revenue from cigarettes, SODREX = excise revenue from soft drinks, SPIRITEX = excise revenue from spirits and *Konyag*', OTHEX = excise revenue from sources other than those mentioned in the table, and TOTEXL = total local excise revenue.
Source: Ministry of Finance, Revenue Flash Reports.

Appendix Table A3: The Trend of Local Excise Tax Revenue (as a Percentage of Total Excise Revenue)

PERIOD	BEEREX	CIGEX	SODREX	SPIRITEX	OTHEX	TOTEXL
92- 7	14.54	37.06	5.60	5.69	37.11	100.00
92- 8	36.38	35.42	9.79	1.31	17.10	100.00
92- 9	27.10	38.78	14.51	2.12	17.49	100.00
92- 10	44.98	29.41	10.16	5.59	9.86	100.00
92- 11	19.79	37.40	15.01	3.91	23.90	100.00
92- 12	44.43	21.45	7.59	5.78	20.75	100.00
93- 1	47.70	24.44	8.53	5.96	13.36	100.00
93- 2	31.46	10.60	27.27	8.32	22.35	100.00
93- 3	4.21	46.82	27.17	0.00	21.79	100.00
93- 4	6.26	33.56	19.39	16.47	24.32	100.00
93- 5	9.49	52.72	15.51	0.00	22.28	100.00
93- 6	27.61	55.21	8.16	4.68	4.34	100.00
93- 7	36.48	33.69	8.48	3.54	17.81	100.00
93- 8	27.33	30.89	9.64	4.03	28.11	100.00
93- 9	16.98	29.78	5.42	4.07	43.76	100.00
93- 10	27.63	32.04	5.44	5.03	29.86	100.00
93- 11	21.56	25.35	9.41	3.94	39.73	100.00
93- 12	24.56	28.23	14.50	9.35	23.36	100.00
94- 1	13.79	39.50	16.33	1.83	28.55	100.00
94- 2	50.00	0.00	9.84	5.22	34.94	100.00
94- 3	7.22	50.81	7.50	3.05	31.42	100.00
94- 4	18.10	32.78	14.44	4.29	30.40	100.00
94- 5	35.69	0.00	22.37	4.66	37.28	100.00
94- 6	44.78	23.85	5.85	2.41	23.11	100.00
94- 7	26.51	52.71	12.75	5.76	2.27	100.00
94- 8	35.18	39.42	15.31	7.39	2.71	100.00
94- 9	30.54	49.11	13.36	5.32	1.66	100.00
94- 10	19.76	56.35	17.08	6.62	0.19	100.00
94- 11	25.46	47.61	19.41	7.15	0.37	100.00
94- 12	14.95	52.27	22.55	10.19	0.03	100.00
95- 1	32.13	41.16	17.82	8.25	0.64	100.00
95- 2	34.66	45.26	16.41	3.30	0.38	100.00
95- 3	35.27	43.94	18.26	2.29	0.23	100.00
95- 4	31.58	45.25	16.91	6.12	0.14	100.00
95- 5	31.92	44.45	18.98	4.33	0.32	100.00
95- 6	38.95	42.14	14.50	4.21	0.21	100.00
95- 7	49.29	32.90	13.18	4.48	0.15	100.00
95- 8	60.13	29.55	6.79	3.38	0.15	100.00
95- 9	60.22	29.91	4.80	4.14	0.94	100.00
95- 10	58.65	28.13	9.61	3.51	0.11	100.00
95- 11	61.42	26.80	7.99	3.58	0.21	100.00
95- 12	60.76	24.94	9.83	3.79	0.67	100.00
96- 1	63.36	24.51	7.54	4.33	0.26	100.00
96- 2	56.21	34.66	6.65	2.34	0.14	100.00
96- 3	56.17	33.50	5.40	2.79	2.14	100.00
96- 4	58.31	29.23	8.39	3.60	0.48	100.00
96- 5	65.98	25.53	4.40	3.61	0.48	100.00
96- 6	60.90	31.66	3.83	3.43	0.18	100.00
96- 7	56.50	33.70	7.84	1.85	0.12	100.00

96- 8	62.62	29.78	4.18	3.34	0.08	100.00
96- 9	63.13	28.02	5.93	2.85	0.08	100.00
96- 10	40.75	45.98	9.75	3.34	0.17	100.00
96- 11	74.30	18.45	5.22	2.01	0.02	100.00
96- 12	61.33	29.68	6.68	2.22	0.08	100.00
97- 1	66.39	23.61	7.32	2.63	0.06	100.00
97- 2	60.26	30.88	6.31	2.40	0.15	100.00
97- 3	62.23	27.61	7.93	2.14	0.09	100.00
97- 4	60.78	29.81	6.78	2.55	0.08	100.00
97- 5	63.61	27.07	5.50	2.60	1.22	100.00
97- 6	64.39	27.68	5.34	2.52	0.07	100.00
97-7	51.64	44.80	0.00	3.47	0.08	100.00
97-8	54.57	42.68	0.00	2.68	0.07	100.00
97-9	55.22	40.45	0.00	4.26	0.07	100.00
97-10	54.34	41.90	0.00	3.68	0.09	100.00
97-11	53.96	42.41	0.00	3.58	0.05	100.00
97-12	57.26	39.53	0.00	3.06	0.15	100.00
98-1	55.30	41.94	0.00	2.69	0.06	100.00
98-2	54.90	40.78	0.00	4.27	0.05	100.00
98-3	51.71	46.22	0.00	2.03	0.04	100.00
98-4	48.55	48.54	0.00	2.85	0.06	100.00
98-5	46.80	51.05	0.00	2.08	0.08	100.00
98-6	52.68	44.34	0.00	2.90	0.08	100.00
98-7	49.62	48.17	0.00	2.15	0.06	100.00
98-8	45.59	44.57	6.67	3.12	0.05	100.00
98-9	49.71	42.14	5.40	2.38	0.36	100.00
98-10	49.67	38.60	9.33	2.31	0.08	100.00
98-11	64.23	28.63	7.12	0.00	0.01	100.00
98-12	56.10	34.20	8.09	1.60	0.01	100.00
99-1	57.17	30.61	9.76	2.45	0.01	100.00
99-2	41.28	45.80	11.43	1.50	0.00	100.00
99-3	54.45	35.69	7.85	2.01	0.01	100.00
99-4	52.97	36.11	8.93	1.89	0.10	100.00

Source: As for previous table.

Appendix Table A4: Quarterly Data Used in Regression Analysis

Year	Pb	Pc	Pg	Pt	Pf	Pk	CPI
1990-1	189.11	36.00	199.00	69.56	29.80	8781.0	26.9
-2	188.50	39.00	190.00	76.49	31.10	9278.0	29.4
-3	188.50	45.00	190.00	80.12	39.70	9775.0	32.0
-4	188.50	45.00	190.00	83.75	40.30	10272.0	34.5
1991-1	188.50	45.00	120.00	87.37	44.30	10769.0	37.0
-2	188.50	55.00	120.00	91.00	45.80	11266.0	39.5
-3	260.50	64.00	120.00	107.66	49.40	11763.0	41.9
-4	260.50	82.00	150.00	124.33	49.60	12260.0	44.4
1992-1	260.50	86.00	150.00	140.99	49.70	12389.8	46.9
-2	260.50	93.00	150.00	157.65	51.10	12519.5	49.3
-3	260.50	93.00	160.00	173.56	52.30	12649.3	51.8
-4	260.50	93.00	170.00	189.47	55.70	12779.0	54.2
1993-1	274.79	93.00	170.00	205.37	67.50	14196.8	57.6
-2	274.79	93.00	200.00	221.28	69.60	15614.5	61.0
-3	274.79	93.00	200.00	229.21	72.40	17032.3	64.4
-4	274.79	93.00	300.00	237.14	87.00	18450.0	67.8
1994-1	320.83	98.00	300.00	245.07	88.00	19235.8	73.4
-2	320.83	107.00	300.00	253.00	99.10	20021.5	79.0
-3	270.83	130.00	300.00	278.08	97.90	20807.3	84.6
-4	270.83	130.00	300.00	303.15	100.00	21593.0	90.2
1995-1	312.50	145.00	346.85	328.23	122.70	22395.8	96.6
-2	325.00	145.00	346.85	353.30	123.20	23198.5	103.0
-3	337.50	145.00	449.66	378.73	128.10	24001.3	109.4
-4	354.17	145.00	449.66	404.15	135.70	24804.0	115.8
1996-1	366.67	152.00	475.99	429.58	149.20	26871.0	121.9
-2	366.67	155.00	475.99	455.00	155.30	28938.0	128.0
-3	375.00	155.00	495.63	479.00	172.40	31005.0	134.0
-4	383.33	100.00	495.63	503.00	172.80	33072.0	140.1
1997-1	383.33	120.00	495.63	527.00	192.20	33054.0	145.7
-2	383.33	127.00	495.63	551.00	196.30	33036.0	151.4
-3	391.67	143.00	495.63	532.50	200.20	33018.0	157.0
-4	391.67	150.00	495.63	514.00	206.10	33000.0	162.6
1998-1	408.33	153.00	495.63	495.50	211.80	33000.0	167.8
-2	408.33	160.00	495.63	477.00	214.80	33000.0	173.1
-3	408.33	167.32	681.00	466.25	218.70	33000.0	178.3
-4	408.33	174.98	681.00	455.50	222.50	33000.0	183.5

Key:

Pc = Nominal price per a litre of Chibuku in Tanzanian Shillings.

Pb = Nominal price per half litre of beer in Tanzanian Shillings.

Pg = Nominal price per packet of cigarettes (i.e., 1 packet = 20 cigarettes) in Tanzanian Shillings.

Pt = Nominal price per kilogram of fire-cured tobacco in Tanzanian Shillings.

Pf = Price index for motor fuel at constant 1994 prices from Consumer Price Index.

Pk = Nominal price per crate of *Konyagi* (i.e., 1 crate = 8 litres) in Tanzanian Shillings.

CPI = National Consumer Price Index (December 1994 = 100).

Appendix Table A5: Annual Data Used in Regression Analysis

Year	Qc	Qb	Qg	Qf	Qk	Yp	GDP	Mv	Pop
1990	13830.0	45044.0	3742.0	337.0	200500.0	52753.0	830693.0	182917	23.9
1991	15460.0	49890.0	3870.0	337.0	250833.0	51592.0	1086273.0	190438	24.6
1992	13260.0	49390.0	3789.0	357.0	313167.0	50431.0	1369873.0	197582	25.3
1993	14770.0	57050.0	3893.0	348.0	313667.0	49270.0	1725538.0	204370	26.0
1994	10695.0	56845.0	3383.0	340.0	327667.0	48650.0	2298866.0	210818	26.7
1995	11319.0	89301.0	3699.0	398.0	335167.0	48918.0	3020501.0	216944	27.5
1996	14031.0	125074.0	3733.0	336.0	305333.0	49530.0	3767642.0	222763	28.3
1997	13680.0	148340.0	4710.0	313.0	308167.0	49767.0	4703459.0	244958	29.1
1998	11993.0	170700.0	3933.0	312.0	332333.0	50194.0	5405873.0	266043	30.0

Key:

Qb = Quantity demanded for the Beer in thousands of liters.
Qc = Quantity demanded for the Chibuku in thousands of liters.
Qg = Quantity demanded of cigarettes in millions of packets (1 packet = 20 cigarettes).
Qf = Quantity demanded for the Petroleum fuels in thousands tons.
Qk = Quantity demanded of *Konyagi* in thousands of crates (1 crate = 8 litres).
Yp = Real per capita income in Tanzanian Shillings (1994 constant prices)
GDP = Gross Domestic Product at market price in Millions of Tanzanian Shillings
Mv = Total of Motor Vehicles in Tanzania.
Pop = Tanzania mainland population in millions.

Appendix Table A6: Computation of Adjusted Tax Revenue

YEAR	T	D	T-D	T*
1990-1	3162.7	0	3162.7	3162.7
-2	3754.5	0	3754.5	3342.25
-3	4182.4	0	4182.4	3723.166
-4	6063.1	0	6063.1	5397.362
1991-1	4538.5	0	4538.5	4040.166
-2	5387.6	0	5387.6	4796.033
-3	6331.4	0	6331.4	5636.202
-4	9178.4	0	9178.4	8170.597
1992-1	6870.4	0	6870.4	6116.019
-2	8155.8	0	8155.8	7260.28
-3	4655.192	0	4655.192	4144.044
-4	4909.279	0	4909.279	4370.233
1993-1	5227.933	0	5227.933	4653.898
-2	5546.586	0	5546.586	4937.562
-3	6541.363	1017.913	5523.45	4916.966
-4	6896.75	1073.216	5823.534	4377.394
1994-1	7469.629	1162.362	6307.267	4003.247
-2	8042.508	1251.509	6790.999	3639.544
-3	8100.2	0	8100.2	3665.652
-4	7624.1	0	7624.1	3450.198
1995-1	9139.7	0	9139.7	4136.066
-2	10338	0	10338	4678.342
-3	14988.3	2181.167	12807.13	5795.72
-4	1826.3	265.7717	1560.528	603.4297
1996-1	19120.9	2782.562	16338.34	5398.367
-2	17753	2583.499	15169.5	4282.776
-3	22195.5	1195.531	20999.97	5066.083
-4	23992.1	1292.302	22699.8	5181.188
1997-1	22257.7	1198.881	21058.82	4547.735
-2	21719.4	1169.886	20549.51	4198.715
-3	24737.2	10227.87	14509.33	2804.89
-4	28371.3	11730.43	16640.87	1886.867
1998-1	23643.5	9775.668	13867.83	922.2969
-2	24499.6	10129.63	14369.97	560.5505
-3	23248.3	0	23248.3	531.9208
-4	23188.2	0	23188.2	530.5457

Key:
T = Nominal Excise Tax Revenue in Millions of Tanzanian Shillings
T* = Nominal Adjusted Excise Tax Revenue in Millions of Tanzanian Shillings
D = Discretionary Changes in Millions of Tanzanian Shillings

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