DISSERTATION

THE VALUE ADDED TAX: ANNUAL vs LIFETIME PERSPECTIVE

EVIDENCE FROM TANZANIA HOUSEHOLD DATA

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY DELPHINA PROSPER MUSHI ENTITLED "THE VALUE ADDED TAX: ANNUAL vs LIFETIME PERSPECTIVE, EVIDENCE FROM TANZANIA HOUSEHOLD DATA" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

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The study compares the annual vs the lifetime perspective of the Value Added Tax (VAT) using the Tanzania Household Budget Survey of 2000/2001. The impact of exemptions on both government revenue and distribution of the tax burden is examined. The "distributional characteristics approach" is used to find whether exemptions are justifiable on distributional grounds. Finally the study examines changes in vertical equity of moving from the previous sales tax to the VAT.

Results show that when annual income is used to measure well being, the VAT looks very regressive, while using "lifetime income" makes the VAT proportional. With lifetime income as a measure of ability to pay, incorporating exemptions into the analysis makes the VAT slightly progressive while several alternatives to exemptions could make the VAT more progressive and improve revenue performance. The distributional characteristics of exempted items show that unprocessed food, public transport and petroleum products are mostly consumed by the relatively poor. On the other hand, the rich consumes postal supplies, books, newspapers, and others. Comparing VAT and the previous sales tax shows VAT to be less progressive, even though it is not regressive.

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And again, "I will put my trust in Him." And again, "behold I and the children God has given me." (Hebrews 2:13)

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DEDICATION

This dissertation is dedicated to my sons JULIUS and WISDOM for their patience.

TABLE OF CONTENTS

List of Figures

List of Tables

CHAPTER ONE

INTRODUCTION

1.1 Background to the Problem

The Value Added Tax (VAT) is a general sales tax on consumption that is imposed on all commercial activities involved in the process of producing goods or rendering services (a general tax) and a tax to be borne by consumers (a consumption tax). The tax is exactly proportional to the price of the good and services, whatever the number of transactions which take place in the production and distribution process before the stage at which the tax is charged. On each transaction, an applicable VAT rate is charged after deduction of the amount of VAT borne directly by the various cost components. For this reason, a VAT is neutral with respect to the number of passages there are between the producer and the final consumer. VAT is charged at each stage of the production and distribution process and is imposed on the added value of goods and services since the tax payable on a transaction is calculated after deducting the tax paid on the previous transaction. The tax base for a VAT can be broadly classified into four categories: all goods and services, goods and selected services, goods only, and consumer goods and capital goods. Most countries apply the broad base, all goods and services, while others use the goods and selected services.

VAT has been generally opposed by those who are concerned about its potential adverse effects on the distribution of tax burden among income classes. Simply stated, as a tax on

consumption, VAT is regressive since consumption falls as a percentage as income rises. VAT takes relatively more of the income of low-income than of higher income households.Empirical evidence in the literature does not seem to provide a conclusive answer to the question of regressivity or progressivity of a consumption tax such as the VAT. Typical measures of consumption tax incidence rank families by income over a single year. Evidence of some regressivity of consumption taxes come primarily from surveys of the population in a given year, which show that low income families spend a large proportion of their annual income on the taxed commodity than high income families. The challenge to these results is based on the argument that a single year of income data is too short a period to be able to measure the ability to pay taxes and hence to determine tax incidence.

Empirical studies have found VAT to be less regressive or even progressive than thought, when lifetime income rather than annual income is considered. This dissertation uses data from Tanzania, the Household Budget Survey (HBS) of 2000/2001 to evaluate the distribution of the value added tax burden among income groups, based on two measures of income; annual income and a proxy for lifetime income.

1.2 VAT as a Regressive Tax

For any consumption tax the chief objection is the difficulty of avoiding regressivity of the tax, heavy absolute burden on the lowest income groups, and discrimination among consumers on the basis of their relative preferences for various goods. Critics of consumption-based taxation usually do so on the theory that, these taxes are regressive in

nature, i.e., consumption-based taxes are felt to be more burdensome on the poor than on any other economic group. The reasoning is that the poor spend almost all of their income. In many instances, through borrowing or drawing down past savings, they may even spend more than their current income. A consumption-based tax would unfairly penalize the poor because their entire income, and perhaps even more, would be subject to the tax. On the other hand, higher income groups would not have all of their income taxed under a consumption-based tax. This tax would not reach the income of these latter groups that is saved or invested. For similar reasons, VAT has been generally opposed by those who are concerned about its potential adverse effects on the distribution of tax burden among income classes.

Conceptually and practically, the VAT is no less equitable than any of the alternative consumption taxes although in reality countries with a VAT commonly attempt to incorporate in it various progressivity features with multiple exemptions, zero rates, and reduced rates for the good or services consumed mostly by the poor. Measures like exemptions in general favor not only activities provided primarily to households and characterized by a high ratio of value added to receipts, such as services, but any activity with a high ratio of value added to receipts conducted by a small business. The cost in revenue, inequities and economic distortions might be considerable. The strength of the equity case depends on the range of policy instruments available. Unlike developed countries many developing countries do not have well functioning income taxes and/or targeted expenditure programs to facilitate attainment of equity objectives. The redistribution that can be achieved through indirect taxes alone however is intrinsically

limited. Even if the poor spend a large proportion of their income on some particular items, the rich will typically spend a large absolute amount on those items so reducing the tax rate would actually transfer more money to the rich than it does to the poor.

A common feature of the tax base in most VAT countries is to not tax a number of important goods or services because of political socio-economic considerations, technical difficulties, or administrative complexity. These goods and services generally fall into two major categories, zero-rated and tax exempt. Zero rating refers to a situation where the rate of tax applied to sales is zero, though credit is still given for taxes paid on inputs. In this case firms will get a full refund of taxes paid on inputs. Unlike zero-rated goods and services, vendors of exempt products are not eligible to receive any credit for the taxes paid on the inputs used to produce that good or service. Exemptions generally cover several items of consumption like necessary food items, services of financial institutions provided without explicit charge to customers and the services of the insurance companies. In some countries exemptions are allowed for medical services and activities of religious and welfare organization, educational and research activities. VAT generally exempts the domestic sales of financial intermediation and insurance services. For administrative and compliance simplicity, most VAT countries also exempt small businesses from tax. When these goods and services are exempted, the VAT is not applied to these sales and therefore exemptions favor not only poorer households but also small businesses. Apart from distributional considerations, exemptions are also for specific reasons such as conditions imposed by donors, especially in developing countries.

Exemptions can be justified if they are practically convenient substitute for a reduced rate, or the output is hard to tax, (such as exemption of financial services). The bad thing about exemptions is that they violate the basic logic of the VAT, being part way between levying a positive VAT rate in the usual manner (by taxing output and crediting input tax) and zero rating (remove all VAT embodied in the price of a product by crediting input tax, while not taxing output). VAT exemptions may reintroduce cascading effect which is associated with production distortions that occurs when an exempted good is an input into another good, the VAT embodied in the exempted good from earlier stages in the production chain cannot be claimed as a credit. Exemptions can compromise the destination principle for internationally traded items in the case where the exporter uses exempted goods as inputs. An alternative view is that the governments should emphasize the efficiency criteria while trying to address equity concerns through other means such as income transfers. Standard advice is for a short list of exemptions, limited to basic health, education and financial services.

Some countries apply a single VAT rate while others apply multiple rates. With respect to equity, a single rate VAT system is at best distributionally neutral, thus reflecting governments distributional as well as fiscal objectives. Differential rates of VAT can be supported on efficiency grounds, with the inverse elasticity rule implying that inelastically demanded goods should be subject to higher tax rates. However, such a case for different rates of VAT is greatly weakened by the need to take account of administrative considerations and by the fact that separate excise taxes can be levied on some of the more inelastically demanded commodities. The extent of redistribution that

can be achieved by VAT rate differentiation is typically very limited. For this reasons, most experts favor a single rate. The general argument remains to be that multiple rate structure, excessive exemptions and numerous zero rating are detrimental to the efficiency of the whole VAT system, an unintended distortions, and impose greater burden on the tax administration while at the same time they may not target those intended.

1.3 Research Question

Is the Value Added Tax Regressive or Progressive? How does the incidence of the tax differ from annual perspective as compared to lifetime perspective? Who benefits from the numerous exemptions in the VAT system? What is the impact of exemptions on the distribution of the burden of VAT? Are there practicable alternatives to exemptions that would make the VAT more progressive without a negative impact on revenue? Is VAT more or less progressive than the previous sales tax?

14 Objectives of the Study

This dissertation has three broad objectives. The first main objective is to compare the lifetime vs the annual perspective of the Value Added Tax. The second main objective is to examine the extent to which exemptions that are associated with most VAT systems help redistribute the burden of the tax in favor of the poor. The third main objective is to demonstrate possible applications of alternatives to exemptions that could be used to redistribute the tax burden.

Since for distributional purposes (among other reasons) the VAT in Tanzania like other countries allows exemptions for some goods and services, the study will attempt to examine the extent to which these exemptions fulfill the intended target. This is done by the use of the so-called "distributional characteristic of a good". This dissertation will demonstrate the use of possible alternatives to exemptions such as credit refund and limiting exemptions to a few items in order to redistribute the burden of the VAT while maintaining or even improving revenue collection. The possible impact of a reduced VAT rate shall be examined under alternative assumptions and finally the study will do a brief assessment of changes in vertical equity of moving from the previous sales tax to the VAT.

1.5 Significance of The Study

This dissertation contributes toward understanding the impact of the widely adopted VAT on the economic well being of its people defined in the broader sense and the redistributive impact of exemptions associated with most VAT systems. Other than studying the distributional impact of VAT, few studies have been concerned about how effective exemptions are in reducing the tax burden to the poor. Tanzania for example allows for many exemptions at the expense of the much-needed revenue (Levin, 2004). To the best of our understanding, this will be the first empirical study examining the impact of exemptions on the distribution of the burden of the value added tax in Tanzania. Policy implications derived from this study will aid Tanzania and other developing and transitional countries in understanding: first the impact of the widely adopted VAT on the economic well being of its people defined in the broader sense;

second the redistributive impact of exemptions associated with most VAT systems; third since exemptions are associated with a serious loss of the much needed revenue for developing nations, recommendations from this study will provide policy makers with other alternatives that can be used to reduce the burden of the tax to the low income class, while improving revenue performance.

1.6 Data Sources

Data on household consumption and income were obtained from the Tanzania Household Budget Survey of 2000/2001 prepared by the Tanzania National Bureau of Statistics (NBS). A list of VAT exempt items was obtained from the Tanzania Value Added Tax Act (2006). Data on sales tax was obtained from the Tanzania Sales Tax Act of 1976.

1.7 Adoption of The Value Added Tax in Tanzania

Value Added Tax (VAT) was introduced in Mainland Tanzania on July 1st, 1998 . In Tanzania Zanzibar, the system became operational beginning 1st January 1999. The VAT in Tanzania is a multi-stage sales tax applied to the sales of goods and services at all stages of the production and distribution chain. The tax is imposed on the destination principle therefore imports are taxed in the same way as domestically produced goods while exports are zero-rated. The main objective was to broaden the tax base and easing its administration. Tanzania also adopted VAT because of its extreme dissatisfaction with other taxes. Many of those taxes were highly distortionary with many multiple rates, often taxing capital and export. VAT was mainly introduced to replace the sales tax, which had numerous administrative problems and its inability to generate sufficient

revenue for the government due to its narrow base. At a more general level the adoption of VAT is also seen as the central element in a program of modernizing tax administration, developing the use of methods of self assessment whose generalization is expected ultimately to ease administration and compliance in relation to other taxes too. The introduction of VAT has relatively broadened the base as it is charged on all goods and services except those that are specifically exempt.

Two VAT rates are currently imposed in Tanzania: a zero rate (for exports), and a standard rate of 20 percent to all other goods not exempted. VAT in Tanzania like in other developing countries has proved to be a great revenue producer with better administrative and efficiency advantage over a general sales tax. In practice however, revenues from VAT are frequently lower than expected because of both administrative difficulties and the specific form of VAT structure that is adopted. The general performance of VAT has indicated some sort of mixed results. Excellent performance was recorded in 1998/1999 and 2000/2001, the periods immediately after introducing the system. During 2000/2001 the actual VAT collection exceeded targets by significant amounts. It has been proposed that the VAT rate in Tanzania should be adjusted downwards to 18.5% so as to enhance compliance. While it is believed that such a measure would stimulate aggregate demand and ensure a sustainable high level of growth rate in the economy, it has been argued that the proposed rate should be put in place after the introduction of Fiscal Services Tax that has been proposed to mitigate the possibility of revenue loss from the reduced rate.

1.8 Organization of The Study

The rest of the study is organized as follows. Chapter two gives a review both on theoretical literature and empirical literature. Chapter three outlines the methodology to be used; Chapter four will present the results while Chapter five is the conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

The literature review is divided into two parts, the theoretical review and the empirical review. The theoretical review discusses various models of tax incidence and the incidence of a consumption tax. The empirical part presents studies by various researches on the incidence of consumption taxes. The last section in this chapter gives a brief discussion about the incidence assumptions.

2.1Theoretical Review

Models of tax incidence can be divided into three: Partial equilibrium models, analytical General Equilibrium Models and Computable General Equilibrium Models.

The partial equilibrium analysis of Tax incidence assumes that the product in question have a market that is small relative to the entire economy. In the absence of taxation equilibrium is attained where supply equals demand. The incidence of taxes tends to be borne by inelastic demanders or suppliers. Two important principles are worth noting in the partial equilibrium analysis: first, tax incidence does not depend on which side of a market the tax is assessed; second, the burden of the tax will be borne by agents and factors that are less elastic in demand or supply. While the partial equilibrium analysis accurately describes the effects of introducing a single tax in a small market where there

are no pre-existing distortions, it is difficult to extend to other cases. Partial equilibrium studies have been criticized mainly for making assumptions about the ultimate incidence of various types of taxes. However, some evidence (Devarajan, Fullerton, and Musgrave 1981) suggests that the results of judgmental studies are fairly close to those of full-scale general equilibrium analysis.

In considering taxes that affect a large part of the economy it requires a general equilibrium perspective rather than a partial equilibrium view. In the general equilibrium approach, the incidence of a tax cannot be considered in isolation, rather the effects of a tax change will depend on whether the tax is used to finance changes in government spending, rebates to consumers, or change in other taxes. The Modern General Equilibrium (GEM) incidence theory is based on the marginal productivity theory of distribution which assumes firms choose factor proportion so as to minimize costs, and set commodity prices at profit maximizing levels. The GEM is based on neoclassical assumptions: perfectly competitive commodity and factor markets, no foreign trade, perfect mobility of factors of production between different industries, total supply of all factors are perfectly inelastic for the economy as a whole. In contrast to the partial equilibrium models of tax incidence analysis where all agents have identical consumption preferences (i.e. owners of factors are also the consumers) the general equilibrium analysis shifts from the question of whether producers or consumers bear the burden of a tax to the question of the division of the tax burden among the owners of productive factors. As one should expect, the aggregate supply elasticities of and demand elasticities

for particular factors play key roles in the analysis of the incidence of uniform commodity and factor taxation.

To examine the incidence of large tax changes in an economy with multiple sectors and types of consumers, the appropriate model is the computerized GEM, or Computable General Equilibrium Model (CGE). This analysis requires specifying explicit functional forms for preferences and production technology. The parameters of these functions are then selected such that initial equilibrium values of the model are in rough accord with those actually observed in the economy. The CGE can also be used to study tax incidence in the case of factor mobility or open economy. In contrast to the analysis of a country-wide tax on capital in a closed economy, tax on capital imposed by one country on income earned by capital in that country is not fully borne by the capital initially in the country imposing the tax. Since capital is internationally mobile, reduction in capital rentals in one country imply reduction in the other. The incidence of the tax borne by capital is shared evenly across all capital, regardless of the country in which it is ultimately used. If a factor complementary to capital is assumed, say land, land owners in the two countries will be differentially affected by the tax (in contrast to capital owners). Land owners in the country imposing tax on capital lose rental income, while land lords in the country with no tax gain.

The methodological approaches to tax incidence discussed so far did not consider the different effects of current tax policies to different generations. Capitalization effects might be so important, that the owners of taxed assets at the time the tax is imposed may

bear up to the entire future burden of the tax. This brings us to the second major type of GEM; the dynamic models of tax incidence. Dynamic models of tax incidence are concerned with the longer run effects of a tax policy. In its simplest form the analysis can assume two periods (or two generations) such as the Diamond (1965,1970) life-cycle overlapping generations model that distinguishes members of different generations explicitly. In such models, fiscal policies can directly redistribute across generations without direct effects on relative prices. Alternatively, fiscal policy can affect relative prices but alter the intergenerational resource redistribution in an indirect manner. However, actual fiscal policies generally combine these two effects.

The life cycle models assume a single good that can either be consumed or used as capital, zero costs of transforming a unit of capital into a unit of consumption and vice versa, individuals live only for two periods, working only in the first period, labor force grows at an exogenous rate and there is no technical progress. Examples of such models include Feldstein's (1976) two period General Equilibrium model of land rent taxation and Partial Equilibrium Model of Summers (1981) for changes in corporate policy. Auebarch and Kotlikoff (1983a) describe the transition paths from balanced budget structural tax changes. In their model agents live for 55 periods and are concerned only about their own welfare. An important contribution of the model is that it solves the economy's perfect foresight equilibrium transition path from an initial to a final steady state equation. Chamley and Wright (1986) provide an extensive analysis of the dynamic incidence of the land tax in a general equilibrium model. They show that the initial generation of elderly land owners is always worse off because of the imposition of the

tax. In addition to that they show that the initial price of land can fall by more or less than the present value of future tax revenues. These models only illustrate potential intertemporal tax incidence, but they neither represent an exhaustive characterization of the government's intertemporal fiscal policies nor the possible time paths of dynamic tax incidence, (Kotlikoff and Summers 1986, March). It has been argued that for certain combination of preferences and production functions there may be an infinite transition path for the capital stock and price of land, all of which ultimately converge to the same steady state.

2.1.1 Annual Income vs The Life-Cycle Model

Despite the number of ways that VAT can be administered, the tax is generally considered to be a tax on consumption. The fiscal incidence of a tax will depend on whether it is passed forward leading to economic incidence on consumers, or passed backward leading to economic incidence on factors of production, or some combination of the two. Early studies (Musgrave Case, and Leonard (1974) and Pechman (1985) take the results from a wide number of empirical studies to make judgment about the appropriate shifting of individual taxes and conclude that consumption taxes are passed forward to and borne by consumers in proportion to their expenditures. In these studies families are ranked according to their annual income and average tax shares by decile or quintile are computed. These studies find that average tax rates for existing consumption taxes in the United States (federal excise taxes, state and local sales and excise taxes) fall with income, implying that consumption taxes are regressive.

Fluctuations in annual income tend to make a consumption tax look more regressive than it would be if income were measured on a permanent basis. Someone with a positive shock to income will appear rich and have a low consumption to income ratio whereas someone with a negative shock will appear poor and have a high consumption to income ratio. Lifetime consumption as a function of lifetime income is much more stable across income classes. Therefore a value added tax, even without substantial exemptions for necessities, is less regressive than calculations based on the annual incidence concept.

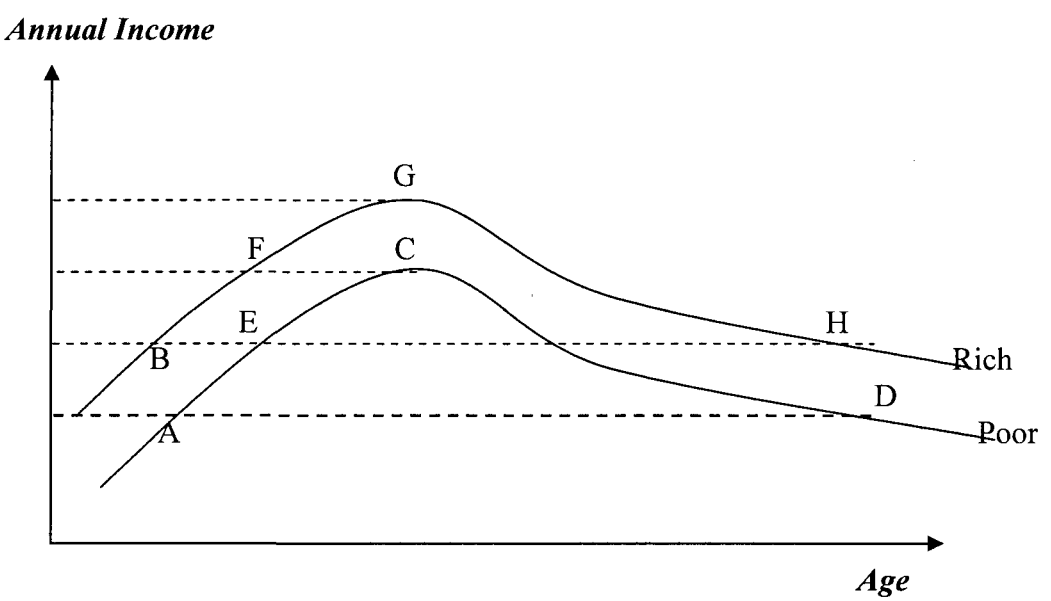
Interest in measuring the lifetime incidence of a consumption tax has been caused by two reasons. The first is the notion of Permanent Income hypothesis (PIH) formalized by Friedman (1957), which argues that people make consumption decisions based on an unobservable measure of permanent income. If the purpose of a distributional analysis is to group and rank people by a measure of their economic welfare, permanent income is probably a better measure than annual income. Secondly, life-cycle considerations suggest that we should view individual by their lifetime income (viz, Modigliani and Blumberg, 1954).

Recognizing the difficulties with using annual income as a measure of ability to pay, economists have conducted distributional analysis using life-cycle models in which a measure of lifetime income is used to rank households. Over a lifetime, the present discounted value of labor earnings must equal the present discounted value of consumption plus net bequest given or received. However it is not clear how a broad based consumption tax would affect the value of bequests even if they were not directly

taxed. But this can be taken care of by assuming that bequests given are not subject to or not affected by a VAT. Accounting for bequests in this way will not affect the central finding of proportionality in any significant ways.

The lifetime income theory makes the difficulties with the annual incidence approach readily apparent. People tend to earn the highest income in their lives around middle age and the lowest incomes in their youth and old age. Consequently in a cross sectional analysis, lower income groups are likely to include some young and elderly people (and some people with volatile incomes) who are not poor in the lifetime sense. Similarly, higher income groups are likely to contain some people at the peak of their age-earning profile for whom peak earnings are a poor measure of annual ability to consume. To illustrate the distinction between the annual income and the lifetime income approach, let's assume that the economy include only two types of individual: one has relatively poor lifetime prospects, advancing with age through points A, B, C and D (Fig 2.1) while the other type has relatively rich prospects and advances with age through points E, F, G and H. The typical annual incidence study would take individuals at point G as the highest income group, lump together individuals at F and C as the second, lump together those at point E, B and H for a third group while assigning those at A and D to the poorest group. Finding how taxes redistribute among these groups the results would convey nothing of importance about either of the two individuals, Fullerton and Rogers (1993). In contrast, the typical life cycle study would lump together individuals at A and E as the young group, B and F as another age group, C and G as the third group and D and H as the oldest group.

Fig.2.1 Two lifetime Income Profiles



Source: Fullerton and Rogers (1993) Page No. 3

While the life-cycle model is able to calculate redistribution of a tax among the old, the young and the middle generations, it is not able to calculate the distribution of the burden between the rich and the poor. Therefore, neither approach captures the fundamental distinction between the two types of individuals in this economy.

Friedman's Permanent Income Hypothesis (PIH) complements Modigliani's life-cycle model, by using the Irving Fishers theory of the consumer. Friedman argues that consumption should depend primarily on permanent income because consumers use savings and borrowing to smooth consumption. The challenge with this approach is to measure the unobservable variable, permanent income.

To solve this problem Poterba J. (1989,1991) has proposed using consumption as a proxy for lifetime income arguing that since household consumption tends to fluctuate less from

year to year than income, total annual consumption is likely to give a better measure of household well being than annual income. This approach of lifetime income is advantageous because of its simplicity: distributional tables can be constructed using data readily available in a single year. The disadvantage is that consumption may not in fact be a very good proxy for lifetime income. Caspersen and Metcalf (1993) show that distributional tables for consumption taxes using current consumption as a proxy for lifetime income underestimates the regressivity of a consumption tax. They argue that this is because the current consumption approach assumes that consumption is roughly constant over the lifetime, while infact it exhibits the same kinds of humps that income does over the lifetime although not as pronounced.

It has been argued that one approach to resolving the problem of relying on annual consumption as a proxy for lifetime income is to use an explicit Computable General Equilibrium life-cycle model to investigate the incidence of tax reforms. Fullerton and Rogers (1993) provides one of the best researches using this method. In their model they calculate tax incidence estimates based on age-income profiles and lifetime income measurements. They find that both corporate and individual income taxes appear to be less regressive in a life-cycle framework than under a snapshot analysis, while sales and excise taxes appear to be less regressive. However, their result on the overall incidence of the U.S. tax system seems to be about the same as estimated under an annual income framework. Fullerton and Rogers (1996) consider the impact of a proportional Value Added Tax (VAT) with and without various progressive features. They find that a proportional VAT reform is more regressive than the current system with after tax losses

of 4.3 percent for the lowest lifetime income group and after tax gains of 10 percent for the highest lifetime income groups. They also find that a $10,000 household consumption exemption generates progressivity at the lower end of the income distribution but that the tax continues to be regressive in the higher deciles.

2.1.1.1 The Burden of a Consumption Tax

Derived mathematically the incidence of a consumption tax for each perspective of economic well-being is outlined below. Two equations are considered for the uses of income in a simple framework in which there are no bequests.

$$Y = C+S \quad \text{.....(2.1)}$$

$$W = \sum_t C_t/(1+\rho)^t \quad \text{.....(2.2)}$$

Where W represents household wealth, $(1+\rho)$ is the discount factor.

Equation 2.1 states that annual income is allocated between consumption and saving. Average consumption is given as:

$$C/Y = 1 - S/Y \quad \text{.....(2.3)}$$

Average consumption tax applied at rate τ is given by:

$$\tau C/Y = \tau(1 - S/Y) \quad \text{.....(2.4)}$$

Based on the assumption that the tax is passed forward to consumers, the tax is regressive in an annual context to the extent that the savings ratio rises with income. In a lifetime framework equation *2.2* states that lifetime income is the present discounted value of consumption over the individual's life. Assuming the tax was applied to all consumption the tax liability would equal τC in any year, and the present discounted value of the lifetime tax payments would equal:

$$\sum \tau C_t/(1+\rho)^t = \tau W \quad \text{.....(2.5)}$$

The average tax rate over the lifetime would equal τ which is the statutory rate, indicating that the tax is proportional. Since bequests are not subject to consumption tax, the expression above overstates the progressivity of the tax. Menchik and David (1982) find that the ratio of expected bequests to lifetime earnings is U-shaped with the trough at the 80th percentile, suggesting that ignoring bequests will only overstate the progressivity of a consumption tax for the top of the income distribution while underestimating the progressivity of the tax over the rest of the distribution. In addition to excluding bequests, a consumption tax like a VAT tends to be less regressive by the provision of zero rating or exempting some items for distributional purposes, among other reasons.

Studies of annual incidence indicate that a proportional consumption tax places higher tax burdens on low-income households than high-income households because the proportion of annual consumption to annual income falls as income increases. However, it has been noted that a proportional consumption tax could be close to a proportional tax on a

lifetime income because the present value of lifetime consumption should equal the present value of lifetime income, Poterba (1989). Some have found that the incidence of a proportional consumption tax might not be proportional to lifetime income if income includes the full value of untaxed leisure, inheritance and bequests, (Fullerton, and Rogers, 1993).

Trying to find the lifetime distribution of a tax burden, researchers have used tax return data that have extensive information on property income and longitudinal tax return databases with unchanging sample of taxpayers for some period of time (Lindsey, 1987, Feldstein 1995a, Feenbert and Poterba, 1993, Slemrod, J.,1992). However, since households with incomes below a filing threshold need not file a return, the distribution of taxpayers will omit a significant fraction of the lower tail of the distribution of household income in addition to omitting those who illegally fail to file a return. Moreover, the extent of omitted taxpayers changes over time because the real filing threshold is not constant. As an alternative to this other studies rely on population survey data. For example, most U.S analyses of inequality trend rely on data from the Current Population Survey (CPS) provided by the Census Bureau. The CPS has the advantage that it is designed to be a sample of the entire population and therefore not restricted to tax filers. It also collects a wide variety of demographic details including family structure and earnings disaggregated by family member. However the poor coverage of capital income by the CPS is the major weakness. Realized capital gains are not included at all or with some components of realized capital underreported. In addition, all components of income are top-coded, so that there is no information of the upper tail of the

distribution of income or its components. These problems are very important in the analysis of the high-income population.

Researchers have focused on lifetime income rather than annual distributional analysis, with the view that tax burdens should be related to the discounted lifetime income rather than annual income which is subject to much fluctuations. Studies based on lifetime income approach include Poterba, (1989), Fullerton and Rogers (1993), Lyon and Schwab (1995), Caspersen and Metcalf (1993), Metcalf (1993), among others. Kotlikoff (1992) and various coauthors go beyond lifetime income incidence and calculate the effect of various policies on tax burdens of different generations. Both the lifetime and annual income approaches provide useful information. Since lifetime data are not available, stylized models of lifetime consumptions and income are sometimes used. It has been argued that, these stylized models may not accurately reflect behavior. Some have argued that consumption may not be a good proxy for lifetime income for households unable to borrow or lend freely in credit markets: among other reasons. Others have argued that, analyses are most useful when they are understandable and considered relevant by those making policy. In that sense politicians reject the lifetime view because they do not understand it and it does not correspond to their view of political reality since tax systems change frequently and elections occur regularly, Barthold, (1993).

A true measure of the burden of a tax is the equivalent or the compensating variation. The equivalent variation (EV) is the amount of lump sum income that a person would give up

to avoid a particular tax change (such as the imposition of a tax or a complex to a system of taxes). So long as the taxpayer can take some action to influence the amount of taxes paid (short of tax evasion), the EV will exceed the tax revenue collection from the taxpayer – and the difference is defined as the deadweight loss of the tax. The true economic burden of a tax, therefore, exceeds the revenue loss to the taxpayer unless that tax is lump sum in nature. The challenge with this approach is that one needs to know the utility function (or equivalently the expenditure function) to measure EV.

Many recent studies of tax incidence have built large-scale CGE models that specify particular functional forms for production and for consumer behavior and then calculate the effects of a large tax change on each product price and on each factor return. Such models are necessary in order to capture much detail with many production sectors and many consumer groups that own different factors and buy different goods, and large taxes that have non-marginal effects on prices. On the other hand, many interesting conceptual questions of tax incidence can be addressed using small models that can be solved analytically.

2.2 Empirical Literature

The reviewed literature in this study is divided into four according to different approaches to estimating income or potential to consume. There are two main approaches: the annual income approach and the lifetime income approach. However, empirically, researchers differ especially in defining or estimating lifetime income. Some have constructed the lifetime income from tax returns data and/or panel data collected for

several years; we call this time exposure approach. Others have estimated lifetime income by using current consumption as a proxy. Some have taken the explicit Computable General Equilibrium Approach in estimating the tax burden through the Equivalent Variation.

2.2.1. The Annual Income Approach to Tax Incidence

Typical measures of tax incidence rank families by income over a single year. Evidence of some regressivity of consumption taxes come primarily from surveys of the population in a given year, which show that low income families spend a large proportion of their annual income on the taxed commodity than high income families.

Pechman, J., and Okner, B (1974) provides one of the most cited study using annual incomes. Using a sample of 72,000 households they capture information on demographic characteristics such as age and family size, tax return items such as income from dividends, interest, rent, capital gains and wages and salaries for each household. To classify households into income groups, they use a measure of "economic income" that includes transfers, the share of household's retained earnings, and the imputed net rental income from owner occupied homes. The shifting of each tax is dependent on alternative assumptions and these burdens are added up together for each income group. Pechman and Okner assume in all cases that the burden of the personal income tax is borne by the household, the employee part of the payroll tax is paid by the worker. The employer share of the payroll tax is paid by employees or sometimes split half to workers and half

to consumers. The burden of sales and excise taxes falls on consumption. They assume that the property tax affect either the return to landowners specifically or all capital owners generally. For the capital income tax they assume that the burden falls in different proportions to shareholders, capital owners, wage earners and consumers. For each combination of assumptions, Pechman and Okner calculate the effective tax rate (the total tax burden as a fraction of economic income) on each household. They find that the overall U.S tax system is roughly proportional over the middle eight deciles but a bit higher at the very tails of the income distribution. The perception behind this is that the progressive effects of the personal income tax and the corporate income tax are more or less completely offset by the regressivity impact of payroll taxes, sales taxes, and excise taxes (Fullerton. and Rogers, 1993). Studies with similar approach include among others, Musgrave, et al (1974), Browning, and Johnson (1979).

In contrast to Pechman and Okner, Browning and Johnson find that the U.S tax system as a whole is highly progressive. They assume that sales and excise taxes raise product prices, but government transfers are indexed to provide the same real benefits and therefore protect low-income transfer recipient. In a slightly similar approach, Massere and Norregard (1989) estimate VAT incidence using a partial equilibrium approach. They find that average tax burden fall as income rises. They conclude that VAT is somewhat regressive. Musgrave, Case and Leonard (1974) obtain similar results by using annual income as a measure of well-being.

These studies have three main problems. First they classify households by annual income alone and do not use longer time periods. The problem with this approach is that the group with the lowest annual income is a mixed bag including some the young who are just starting their careers and therefore likely to earn more later, retirees who had earned more earlier, some people with volatile income who had just a bad year, as well as the real perennially poor. But the welfare of these individuals differs because some are really poor, some are rich and some are just comfortable. Second they consider alternative assumptions about the distribution of the burden of a system of taxes rather than calculating changes in consumer welfare. Third they use incidence results from different kinds of models including those with general equilibrium effect of taxes on factor returns or on product prices but they do not calculate these effects in a single model. The main advantage of this approach is that it can employ detailed microdata on thousands of households.

The challenge to the annual income approach is based on the argument that a single year of income data is too short a period to be able to measure the ability to pay taxes and hence to determine tax incidence. Instead it is argued that the conceptually more appropriate measure of economic well-being or ability to pay taxes is the discounted value of the total income received by an individual over his or her lifetime.

2.2.2 The Lifetime Income Approach to Tax Incidence

Invoking Friedman's (1957) Permanent Income Hypothesis as well as Life Cycle considerations, economists have recognized that annual income may not be a very good

measure of individual's economic well-being or potential to consume. If capital markets were perfect, individuals should be grouped according to the present discounted value of earnings plus gifts received. This theory highlights the shortfalls with the annual incidence approach to measuring tax burden readily apparent. Researchers with this view utilize estimates of a lifetime income (eg household annual expenditure or age income profile) as a measure of the taxpaying unit economic well-being. In general their studies find that consumption taxes are less regressive from a life-cycle perspective than from an annual perspective. In the lifetime approach to tax incidence there are two main groups of studies, namely the time exposure income and the current consumption.

2.2.2.1 Time Exposure Income

Several economists have examined the incidence of various taxes using life-cycle models. Fullerton and Rogers (1991 and 1993) estimate lifetime income in a large-scale multigenerational CGE framework. They first estimate age-income profile and using data on individuals from the Panel Study of Income Dynamics (PSID). They regress the wage rate on time, the age of each individual and various demographic variables. The results of this regression indicate how a person's earning potential changes over time is related to age and other factors. After determining these profiles, each person in the data set can be assigned a measure of her respective lifetime income calculated by summing up the discounted values of the areas under the estimated age-income profile for each person. Fullerton and Rogers proceed to re-estimate profiles for each group and calculate tax incidence estimates based on the age-income profiles and the lifetime income measurements. They find that both individual and corporate income taxes appear to be

less progressive in a lifetime framework while sales and excise taxes appear to be less regressive. It is also noted that, despite these changes, the overall incidence of the U.S tax system seems to be about the same as estimated under an annual income framework. Slemrod (1992) notes that a snapshot of one year suffers from fluctuations, while a lifetime income perspective requires heroic data assumptions. He argues that a time exposure of about seven years may be a reasonable compromise. Following this argument Slemrod compares two periods, 1967-73 and 1979-85. While annual income inequality had risen substantially over those decades, Slemrod finds less increase in time exposure income inequality. However, the effect of taxes on inequality was the same in both cases. The general conclusion, based on comparison of annual measures of inequality to inequality measured over longer period of time has been that a longer accounting period reduces inequality very little.

Davies et al (1984) constructs lifetime histories of earnings, transfers, inheritances, savings, consumption and bequests. Using Canadian survey data, they measure lifetime income and use it to classify households, and then add up each household's lifetime burdens under each set of incidence assumptions. Thus they extend the approach of Pechman and Okner (1974) to a lifetime context. They find that personal income taxes are less progressive in a lifetime context, while sales and excise taxes are less regressive, so the Canadian tax system is as mildly progressive in the lifetime framework as it is in the annual framework. In contrast to the approach based on Pechman and Okner (1974) they assume the incidence of each tax without utility or production functions, but employ detailed micro data on many thousands of households. This detailed approach also allows

calculations of incidence across dimensions other than income such as region, race, gender, or other demographic characteristics. For these reasons, several recent efforts also build upon the original approach of Pechman and Okner. For example, Kasten et al. (1994) combine data from Labor Department's Consumer Expenditure Survey, the Commerce Department's Census Bureau, and the Treasury Department's tax returns. Instead of trying to construct a full measure of economic income, however, they classify households by a measure of realized cash income. They calculate federal income taxes and payroll taxes for each household, and they assign corporate taxes and federal excise tax burdens according to assumptions about their incidence (but they omit all state and local taxes on income, sales and property). Despite major changes in federal tax policy between 1980 and 1993, they find virtually no change in the overall level of taxation or in the distribution of burdens, except a slight decline in the effective tax rate for those in the top one percent of the income distribution.

Gale et al. (1996) uses data from the survey of income and program participation (SIPP) and classify households by expanded income that includes some imputed income (eg. employer provided health insurance) but not others (eg. imputed rental income from owner occupied homes). They consider federal and state income taxes, corporate taxes and payroll taxes, but not federal excise taxes, state sales taxes, or local property taxes. They do consider transfer income. They find that the current tax system is progressive.

2.2.2.2 Current Consumption as a Proxy for Lifetime Income

According to these models, lifetime income can be measured on the source side or on the use side. On the source side, lifetime income is the present discounted value of earned income E and bequests receive G. On the use side lifetime income is equal to the present discounted value of consumption C minus bequests made, B. From the use side, Poterba (1989,1991) has proposed using a measure of consumption as a proxy for lifetime income in studies of federal excise taxes. Under the assumption that consumption tends to be smoother than income, total annual consumption is likely to be a better measure of well-being than is annual income. Poterba, uses data from the Consumer Expenditure Survey to study the distribution of the burden of excise taxes on alcohol, tobacco and gasoline, and finds that the taxes are less regressive than they appear when viewed in an annual income framework.

Caspersen and Metcalf (1993) measure the lifetime incidence of the Value Added Tax using income data drom the Panel Study of Income Dynamics and Consumption from the Consumer Expenditure Survey. They find that when annual income is used as a measure of economic well being, a VAT looks quite regressive, while in the same analysis using lifetime income they find that VAT in the United States would be proportional or slightly progressive. Caspersen and Metcalf find that a VAT on total expenditures would be proportional over the lifetime while zero rating or lump-sum household rebates would increase the progressivity of the tax substantially at the cost of losing substantial tax revenue.

Feenberg, Mitrusi and Poterba (1996) also use the consumption proxy for lifetime income in a detailed analysis of a shift from the current income tax system to a national sales tax. They find that the regressivity of the shift measured using annual income is substantially reduced and the shift can be made progressive through straightforward measures.

From the source side, Fullerton and Rogers (1993) has conducted an extensive study of lifetime incidence of the US. Tax system, redoing Pechman and Okner (1974) study in a lifetime setting. They construct a measure of lifetime income by estimating age- income profile for different demographic groups and use it to impute a stream of wage rates from which their lifetime income can be constructed. They find that the system of federal, state and local sales and excise taxes in the US is roughly as regressive in a life cycle perspective as in an annual perspective. However, Poterba (1994) argues that this finding cannot be carried over to a VAT because the tax rates used in their study range widely from 0% for housing to 79% for tobacco and therefore much of the regressivity is due to the fact that necessities tend to be taxed at higher rates than luxury goods whereas VAT could be structured differently.

Muñoz S. and Stanley Sang-Wook Cho (2003 November) analyze the incidence of a VAT by using the 1999/2000 Household Income, Consumption and Expenditure Survey of Ethiopia. In their construction of consumption aggregates for the tax incidence analysis they exclude non-consumption expenditure, lumpy and infrequent expenditures such as those on marriage and dowries, births and funerals. They also inflate the expenditures proportionally using changes in nominal GDP between 1999/2000 (the

period covered by the Household Survey data used in their study) and 2002/20003 (their period of analysis right after the introduction of VAT in Ethiopia). They use household consumption as their welfare measure, dividing the sample into deciles of total expenditure. They first look into the effective tax rate for each decile and examine the generalized Lorenz Curve for expenditure and the concentration curve for the VAT.[1] Their analysis show that VAT is progressive at the national level, while it is regressive or at most neutral in urban areas. In comparison with the replaced sales tax, they find VAT to be less progressive as they argue that it has fewer exemptions and only one rate. However, they argue that exemptions cannot be justified on equity ground since most of the exempt goods and services are consumed relatively more by the better off. Their study points out the high ratio of in-kind transactions for poorer household to be the major reasons for the progressivity of the VAT in Ethiopia at that time. They conclude that the introduction of VAT in Ethiopia has not had a major adverse effect on the poor and if the additional revenue from the VAT was used to finance more primary education and health, the poorest 40 percent of Ethiopians would be net beneficiaries.

Salah A, Abdallah D and Mustafa D (2007) examines the regressivity of the VAT in Lebanon. Their estimates of the GINI coefficient using income and spending show that using spending instead of income would result in a more equitable distribution of national product. Their estimate of the VAT incidence using expenditure data shows that the incidence of the tax in Lebanon is not regressive, while exemptions on food, education, shelter and health care made the VAT more progressive than the direct income tax. They

[1] Lorenz curve plots cumulative expenditure against population share, with the population ordered by income or expenditure level. The concentration curve plots cumulative expenditure against cumulative population. If the concentration curve lies below the Lorenz Curve the tax is progressive.

also evaluate the proposal by the government of Lebanon to increase the VAT rate to 16% from 10% by means of GINI coefficient and find that if this were implemented the distribution of the burden of the tax would be better. They also find that tax revenue would increase considerably while the extra burden on the poor is negligible.

Rafaqat S. (2005) assesses the distributive impact of Goods and Services Tax (GST) reform on Pakistan households using two data sets (1990 and 2001) from Household Integrated Economic Survey. Unlike other studies on incidence analysis that use expenditure pattern (and/or income) and calculate average tax rates, the study by Rafaqat differs from many expenditure incidence analyses. It identifies each taxable item, aggregates them to get household taxable expenditure, then multiply by the tax rate to get household tax liabilities. From that the effective tax rate is calculated by dividing the tax liability by paid expenditures. In addition to the national level, Rafaqat estimates VAT incidence at provincial and regional levels and compare progressivity of VAT and GST. It was found that the tax reforms are slightly welfare reducing, however not clearly regressive. In addition it looks at each individual commodity for 20001-20002 data set and examine the distributional characteristics of commodities to see what goods households are spending on and how each good affects the burden of the tax. Rafaqat found the overall food expenditure to be consistent with Engel's law, with expenditure on food declining as households become better off.

2.2.3 General Equilibrium Models of Tax Incidence

Ballard *et all* (1985) examines expenditure in twelve income groups that receive income from labor, capital and indexed government transfers. Their model shows how consumer demand depend on product prices and factor supplies depend on net factor return. By establishing the benchmark equilibrium with current tax rules and initial prices and quantities, Ballard and others were able to simulate the effects of a change in any particular tax.

In analyzing the structure and distributional impact of revenue generation in Tanzania at a sectoral level Jörgen Levin (2004) uses concentration curves and a General Equilibrium analysis to evaluate the effect of broadening the VAT base. Based on the information from the 1990 Tanzania Household Budget Survey (HBS) the study starts by comparing concentration curves for a variety of goods and services. The study finds that the poor disproportionally purchases food products except for wheat, coffee and oil but does not purchase much non-food commodities. It is therefore concluded that if the VAT base were to be broadened then non-food products and private services would seem to be the preferred targets. In order to capture indirect effects that are not captured by the incidence analysis based on concentration curves, Jörgen used a Computable General Equilibrium of the Tanzania economy to evaluate the indirect effects of broadening the VAT base. The study analyzes short term impacts assuming fixed sectoral capital stocks. To evaluate the impact on household groups of broadening the VAT base, equivalent variation is used. In the CGE analysis a 50% refund is assumed and regardless of the section in which VAT is raised, welfare improves in almost all cases except that results

differ among different experiments. Jörgen finds that the rural poor experience welfare gain regardless of the sector in which VAT is raised whereas the urban poor experiences a welfare loss when VAT is increased in the food sector. The study concludes that, based on a 50% refund the best sector in which to raise the VAT from the perspective of the poor would be consumption goods, building and construction and public and private services where welfare gain would be the greatest.

A different type of general equilibrium model is built by Auerbach et al (1983) and fully described in Auerbach and Kotlikoff (1987). Auerbach and Kotlikoff sacrifice intragenerational heterogeneity to concentrate on intergenerational redistribution. Their model has only one sector but allows for 55 overlapping generations with life-cycle savings decisions. Instead of calculating the incidence of a tax across 12 income groups, they calculate the incidence across age groups. In particular they find that the switch from an income tax to a wage tax would reduce the burden of the elderly, while the switch to a consumption tax would substantially raise tax burdens on the elderly. Auerbach and Kotlikoff provide the first computational model of lifetime tax incidence for different age groups, but cannot calculate progressivity across different income groups. Later efforts proceed to calculate lifetime tax incidence for different income groups at each age (Fullerton and Rogers, 1993 and Altig et al, 2001). All of these computational general equilibrium models can calculate the incidence of each tax using explicit production function and utility-based measure of welfare (such as EV), but computational feasibilities require some aggregation across households, such as considering only 12 groups.

Ballard, Scholz and Shoven (1987) use Computable General Equilibrium Model (CGE) to estimate the incidence associated with the introduction of VAT in the U.S. economy. In their analysis, the VAT is assumed to be a partial substitute for the individual income tax. Their results indicate that, the implementation of a VAT, without zero rating or exemptions, produces welfare losses for the lower income cohorts while it would be welfare improving for the rich, so the tax is regressive.

Disadvantage with a general equilibrium model is that it takes much iteration until it finds a set of equilibrium prices in all markets. With such iterations the sample must be reduced or aggregated. The main advantage is that it uses a structural model that derives its demand and supply behavior from explicit production functions and utility functions. Other several advantages are that the analyst can see explicitly how results are tied to a particular elasticity parameter and consistent incidence results due to simultaneous tax burden interactions and the easiness of measuring the effect at each income level by equivalent variation and excess burden. However, like a partial equilibrium model, the structural model of GEM requires many assumptions on functional forms and elasticity parameter values, which if varies, will generate different amounts of burden shifting.

Thomas M. Selden and Michael J. Wasylenko (1992, November) points out that the results of a General Equilibrium Analysis do not give definitive answers on benefit incidence or on net fiscal incidence. They argue that the model is sensitive to parameter specifications and therefore while definitive answers to benefit or fiscal incidence depend on the accurate estimation of the parameter of the model, the empirical knowledge about

functional form and elasticity parameters is absent. They conclude that because of this CGE models may dramatize the weaknesses in benefit incidence studies while not yielding precise estimate of fiscal incidence. Dilnot, Kay and Keen (1990) explain well the weaknesses of the partial approach in analyzing incidence of taxation especially of the shifting assumptions.[2] They also argue that theoretical work on non-competitive product and labor markets has compounded the difficulty associated with full forward shifting and that under perfect competition one can at least be sure that the forward shifting of an indirect tax will lie between zero and 100 percent, but with imperfect competition there can be plausible over shifting. While the computable General Equilibrium models provide an alternative to ad hocery in the treatment of shifting or perhaps shift the ad hocery into the less visible work of calibration, they remain some way from being able to capture all the complexities of actual tax systems, and behavior. More than that CGE models fail to exploit the wealth of available disaggregated household data, (Dilnot, Kay and Keen, 1990).

2.3 A Note on Empirical Tests of Incidence Assumptions

The standard assumption about sales and excise taxes is that the burden is shifted 100% to consumers, and this assumption has been tested several times. Some of these studies cannot reject 100% shifting to consumers, while others find significantly less than 100 shifting, and still others find significantly more than 100% shifting. Fullerton (1996) and Metcalf (1999) employ a model with constant returns to scale and perfect competition, which allows the long run supply curve to be horizontal (flat), and any product tax

[2] There is a potential inconsistency in assuming both perfectly inelastic commodity demands (in order to attribute all indirect taxes to consumption) and perfectly inelastic factor supply (in order to attribute all income taxes to labor), Prest (1955).

logically must be passed on to purchasers. They then use input-output evidence on each industry purchases of taxed products to calculate the increase in the cost of production of each industry–and thus the increase in each equilibrium output price. Finally, data on consumer expenditure can be used to indicate which consumers pay those higher prices. This assumption, too, has been tested, but results are mixed. If the flat supply curve in the above analysis is replaced with an upward sloping supply curve, then the burden of an excise tax might be shared in any proportion between consumers and producers, such that product prices rise by less than the tax.

In contrast, several studies reviewed by Poterba (1996) find "overshifting" in that the product price rises by more than the tax. In his own analysis, however, Poterba uses city-specific clothing price indices for 14 cities during 1925-39 with finding of less than complete forward shifting and 8 cities during 1947-77 with finding of mild, if any, overshifting. On the other hand, Besley and Rosen (1999) point out that overshifting is perfectly consistent with several models of imperfect competition. They find substantial overshifting for more than half of the 12 goods they study in 155 cities. This result would make excise taxes even more regressive than conventionally thought. For the payroll tax, virtually all applied incidence studies assume that both the employee share and the employer share are borne by the employee (through a fall in the net wage by the full amount of the payroll tax). This assumption has been tested and confirmed repeatedly (Brittain (1971), Gruber (1997) among others. Finally for the personal income tax, applied studies have consistently assumed that economic incidence is the same as statutory incidence – on the taxpayer-even though this assumption has never been tested.

In summary, few of the standard assumptions about tax incidence have been tested and confirmed. The standard assumption about the corporate income tax that the burden falls 100% on capital remains the standard assumption even though it is commonly believed to be false (because of international capital mobility and endogenous savings). Most general equilibrium simulation studies "calculate" the incidence of each tax based on carefully articulated theories, and many data-intensive studies use these results to assume the incidence of each tax. But competing theories are rarely tested and so econometric estimation still remains fertile ground for future research.

CHAPTER THREE

METHODOLOGY

The first step in measuring lifetime income is to choose the unit of analysis. Many researchers in this area categorize consumers according to household income and other variables at the household level.

3.1 Estimation of Permanent/Lifetime Income

Lifetime income can be measured on the source side or on the use side. On the sources side, lifetime income, is the present discounted value of earned income and bequests receive. On the use side lifetime income is equal to the present discounted value of consumption and bequests made. From the use side, Poterba (1989,1991) has proposed using a measure of consumption as a proxy for lifetime income in studies of federal excise taxes. Under the assumption that consumption tends to be smoother than income, total annual consumption is likely to be a better measure of well-being than is annual income.

Metcalf (1993) follows the approach developed by Poterba to examine the system of state and local sales taxes in the United States. The lifetime income W according to Metcalf can be measured by:

$$W = \sum^{T}_{t=1}[(E_t+G_t)/(1+\rho)^t] = \sum^{T}_{t=1}[(C_t + B_t)/(1+\rho)^t] \quad \ldots\ldots(3.1)$$

Equation *3.1* says that, on the source side lifetime income is the present discounted value of earned income, E and bequests received, G, while on the use side, it equals the present discounted value of consumption C and bequests made, B; ρ is the individual's discount rate.

Metcalf (1993) defines current consumption as total expenditure less new vehicle purchases and housing costs for homeowners plus the imputed rental value for homeowners and automobiles. In addition he nets out contribution to pension and life insurance. Metcalf takes the imputed rental value of housing as a proxy for current house consumption, while for automobiles he uses a regression analysis to impute the value of new car purchases as a function of demographic characteristics for consumers who make a vehicle purchase. To account for bequests Metcalf takes an alternative measure of consumption that includes an annualized value of bequests and considers whether including bequests as part of the income measure affects the distributional effects of the tax. From the use side of lifetime income definition we have:

$$W = B + C \quad \ldots\ldots (3.2)$$

Where B is the present discounted value of bequests given i.e $B = \sum B_t/(1+\rho)^t$ and C the present discounted value of consumption i.e $\sum C_t/(1+\rho)^t$. Then because current consumption is a proxy for C as assumed in our model the tax base is specified by ignoring B (Metcalf, 1993). Menchink and David (1982) estimate the ratio of bequests to

lifetime income by using income tax return and probate records data. According to Menchink and David, this ratio is written as:

$$\phi = B/(B+C) \quad \ldots\ldots(3.3)$$

Metcalf refers this as the ratio of annualized bequests to the sum of annualized bequests and current consumption and rewrites it as:

$$B/C = \phi/(1-\phi) \quad \ldots\ldots(3.4)$$

Let $C^* = C + B$, and rewrites

$$C^* = C(1+B/C) = [1+ \phi/(1-\phi)]C = [1/(1-\phi)]C \quad \ldots\ldots(3.5)$$

Where C^* represents C adjusted by annualized bequests. However, Metcalf finds that adjusting consumption for bequests (but not subjecting bequests to a VAT) does not alter the results very much. Metcalf argues that excluding bequests in the construction of a proxy for permanent income does not appear to affect results significantly.

This dissertation estimates the distribution of the value added tax burden using a single cross section of household data for Tanzania obtained from the 2000/01 Household Budget Survey (HBS). Using the SPSS package, current consumption, a proxy for lifetime income will be estimated. Our definition of current consumption will be a variant

of that of Metcalf. The challenge with the approach as seen above is to measure lifetime income. While Metcalf's approach starts from total consumption, and makes necessary adjustments to arrive at current consumption, estimations of current consumption in our study starts from disaggregated detailed household data on expenditure for goods and services, taking only the relevant components of current consumption and ignore irrelevant ones such as all forms of saving (life insurance and deposit to banks), social security and insurance premiums. Included however, are money transfers such as remittance to relatives, and gifts to others. Therefore the consumption component will have two parts, expenditure on goods and services for the household, denoted by C_H and expenditure on gifts and transfers denoted by C_T. The Tanzania HBS does not have specific bequests details. Included instead are net gifts, defined as gifts received minus gifts given. This gives total consumption for the household:

$$C = C_H + C_T \quad (3.6)$$

To account for housing consumption, rent and water for renters are considered. Due to limited information costs of building a house, new vehicle purchases and large durable goods are not included in the analysis. Transport costs are included for all ground transportations such as bus, lorry and train fares for public transport while for car owners gas is also included.

3.1.1 VAT Liability and VAT Rate

The approach in this dissertation for calculating the tax burden is two fold. First, we adopt the approach taken by Metcalf in calculating the tax burden as the statutory rate (20 percent) multiplied by the TZS amount of total consumption, then divided by the relevant income measure to get the tax rate. Secondly, in addition to the Metcalf approach, tax rates for each item in the 15 groups of items are calculated for each household. (Table 4.8 in chapter 4 provides the groups of item). This will help find out how relative preference for items may affects the distribution of the tax burden. However, the most important part in that subsection is to find the impact of distributional weights (if taken into consideration) on the distribution of the tax burden.

3.1.2 Altering the VAT Burden

It has been argued that VAT could be made substantially more progressive by allowing limited cash exemption in spending per person and this has been found to have reduced the tax liability substantially. Metcalf, (1993) considers several approaches to alter the VAT burden, two of which are discussed here. One of these approaches is zero rating food, shelter and medical care. He finds that while this kind of zero rating substantially diminishes revenue potential, the tax becomes substantially more progressive when applied on the lifetime income, but nearly constant when annual income is used. Metcalf considers an alternative way of altering the VAT burden by allowing a $1,000 refundable credit per household along with a VAT, which amounts to reducing the VAT base for each household by the same amount. Then he adjusts the tax rate to raise the same amount of revenue as a 5 percent VAT without the credit. Metcalf computes the tax rates

as the ratio of the net VAT liability (5 percent of the new base) to current consumption. His results show that VAT applied to total expenditure with a $1,000 refundable credit leads to a negative median average tax rate in the lowest decile (i.e they pay less than $1000 in VAT) while the rate rises sharply in the highest decile. Excluding food, shelter and medical care from the VAT in addition to the refundable $1000 credit led to a subsidy for the median taxpayer in the bottom three deciles, and lowers the top rate.

In this dissertation similar approaches are considered, starting with the assumption of limited exemption to food, fuel and light, items that in total comprise the largest percent of the poorest income group consumption. Tax rates will be calculated excluding these items from household total expenditures. The second one is to assume a credit refund to taxpayers, an amount that that will be deducted from taxable amount and then calculate tax rates as usual.

3.2 Changes in Vertical Equity of Moving from Sales Tax to the VAT

Despite the many challenges associated with VAT, the real issue is whether at lower levels of development the VAT fares worse than other taxes for similar amounts of revenue. Obviously this will depend on, among other things, the cost involved in its operation. However the issue of administrative costs is beyond the scope of this dissertation. It is of interest to compare how more or less regressive the VAT is as compared to the tax that it has replaced, sales tax in the case of Tanzania. Based on the HBS 2000/2001 household data and sales tax rates from the Tanzania Sales Tax Act

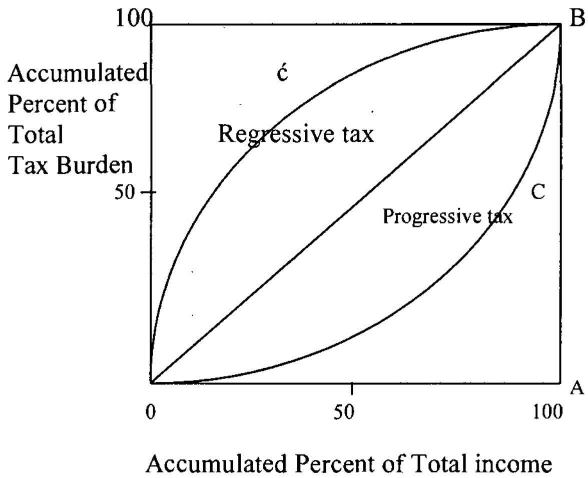
(1976) this study will examine the changes in vertical equity of moving from sales tax to the VAT. This analysis will be done by using the so called the Suites Index.

3.2.1 The Suits Index

The Suits Index is often used in tax policy analysis to measure the degree of overall progressivity of a tax or to analyze changes in progressivity under alternative tax regimes. The idea is to examine changes in vertical equity caused by a move from the sales tax to the Value Added Tax. The Suits Index follows the same logic as that of the Lorenz Curve and the Gini coefficient.

To measure the general regressivity or progressivity of a tax, the accumulated percent of tax burden is plotted against the accumulated percent of income on the horizontal axis. If the consumption tax were strictly proportional to income, the poorest 10 percent (or any other percentile group) of all families who earn say 2 percent of all family income, would bear 2 percent of the consumption tax burden. The (Lorenz) curve plotted for such a proportional tax would follow the diagonal line *OB* (fig. 3.1). If the tax is progressive, the percentage of tax burden borne by the lowest income group is smaller than their share of total income and the (Lorenz) curve sags below the diagonal. If the tax is regressive, the percent of total tax burden imposed on low-income families exceeds their percentage share of total income, so the (Lorenz) curve $0\acute{C}B$ arches above the diagonal.

Fig.3.1. A Hypothetical Lorenz Curve: Progressive vs Regressive Tax



In order to compare the overall regressivity of a VAT versus a sales tax, the Suits index S will be defined in terms of K, the area of the triangle OAB. Let L be the area of $OACB$, contained between the Lorenz curve and the horizontal axis OA and let L' be K-L, the area between the Lorenz curve and the diagonal line $0B$. The Suits index is defined as the ratio of area L' to area K, that is:

$$S = L'/K \qquad (3.7)$$

For a proportional tax $L = K$, therefore $L' = 0$ and $S = 0$. For a progressive tax area L is smaller than area K , area L' is positive and the Lorenz curve sags below the diagonal line. For a regressive tax area L is greater than area K, area L' *is* negative and the Lorenz curve arches above the diagonal line. As a result, the index S is positive (negative) for progressive (regressive) taxes. In the limiting case where the highest income bracket bears the entire tax burden, the Lorenz curve lies along the sides OA and AB, so $L = 0$,

L'= K and $S = +1$. In the extreme case of regressivity, $L=2K$, $L' = K - L = -K$ and $S = -1$. That is to say, the index of progressivity S, varies between $+1$ in the limiting case of progressive tax, through zero for proportional taxes, to -1 in the limiting case of regressivity. The Suits index for a tax x can be written as the equation for the area under the curve:

$$L_x = \int_0^{100} T_x(y)dy \quad \text{(3.8)}$$

Where y, is the accumulated percent income as a variable that ranges from 0 to 100 and $T_x(y)$ the corresponding accumulated percent of total tax burden for a given tax x (the ordinance of the Lorenz curve). Since the area of the triangle OAB has been designated K, then the Suits index can be given by:

$$S_x = L'/K = 1 - L_x/K = 1 - (1/K) \int_0^{100} T_x(y)dy \quad \text{(3.9)}$$

Also written as

$$Sx = 1-(1/5000)\int_0^{100} T(Y)dy \quad \text{(3.10)}$$

The $1/5000$ term comes from the area of the triangle (*area K*) below the line of proportionality whose legs are both 100 percent. In reality the cumulative distribution $T(Y)$ is only available for a few discrete values of Y. In this case the discrete approximation of the Suits index is given as:

$$S = 1-(1/5000)\int_0^{100} T(Y)dy \approx 1-(1/5000)\sum^{i=n}_{i=0}[T(Y_i) + T(Y_{i-1})][Y_i - Y_{i-1}] \ldots\ldots\ldots\ldots\ldots\ldots (3.11)$$

Where n is the total number of taxpayers in the sample. If the change from sales tax to VAT transferred tax burden to the higher income group, then S will increase, while if the change shifts the burden to the low-income group S will fall. A change in the law that transfers tax burden to the higher income group increases S. while any transfer of tax burden to the low-income group lowers S.

It has been argued that the Suits Index is a point estimator and therefore does not provide researchers with assistance in assessing whether changes are statistically significant. Small changes may lead to false conclusions, particularly where small sample sizes are involved. On the other hand large samples are less sensitive to broad fluctuations of one or several data point observations than are small samples. Small changes in progressivity as measured over two time periods or between tax regimes may be caused by unobserved confounding variables. Unless a test of significance for the suits index is used, speculations on significance might lead to wrong conclusions. This dissertation uses a method called the Bootstrap methodology developed by Anderson, Roy and Shoemaker (2003), for estimating confidence intervals for differences in Suits indices. The Bootstrap methodology is outlined in the appendix.

CHAPTER FOUR

RESULTS

4.1 Introduction

In this chapter Tanzania's Household Budget Survey of 2000/2001 (HBS 2000/2001) is used to show the distributional impact of a single VAT rate. Our main focus is to show how the definition of income affects the distribution of the tax burden. Two definitions of income are considered, annual income and lifetime income. Annual income is defined as income from all sources for a single year, while lifetime income is defined in this study as current consumption. The impact of exemptions on revenue and the distribution of the tax burden is examined. The most important part in that subsection is to demonstrate alternative means like limiting exemptions or credit refund that could be used to alter the VAT burden while maintaining revenue neutrality. VAT is applied to total expenditure to find the total tax liability for each household, and the liability is divided by income and computed as percent to get the tax rates.

VAT rates are also calculated separately for each item, and then distributional weights are applied to find the impact on the overall tax burden. The distributional characteristic approach is used to find if exemptions are justifiable under distributional grounds. Finally VAT is compared to the previous sales to find changes in vertical equity.

4.2 Data Cleaning

The collected data (the Tanzania Household Budget Survey (HBS) of 2000/2001) consists of 22,178 households. The survey carried by the Tanzania National Bureau of Statistics from 2000 to 2001 gives monthly details on expenditure and income from representative households throughout the 20 regions of the country. It is implicitly assumed that household characteristics (in terms of income and expenditure) remain to be the same for twelve months, thus the terms annual income and current consumption (proxy for lifetime income). This will not affect the relative estimations of annual income and lifetime income.

As a primary data, it needed a lot of cleaning out missing and unusual cases. After removing households with missing and negative total aggregates 20,913 cases (households) remained. However, even after this cleaning, we found unconvincing cases for income and other variables. While the highest consumption appeared to be too high for typical consumption at the household level, the minimum appeared to be too low (close to zero) for typical household consumption. To correct this, households with per month consumption above 1,500,000 TZS, and those below 10,000 TZS are excluded from the analysis. We do a similar cleaning for income and finally 18, 552 households remained for the analysis.

All incomes and expenditures in this study are given in Tanzanian shillings (TZS).[1] Household annual income is obtained by aggregating all incomes from all sources, ranging from employment, self-employment, agricultural income and others. Current

[1] One U.S dollar is equivalent to around 1300 Tanzanian shillings.

consumption is used as our proxy for lifetime income. Household current consumption is obtained by aggregating consumptive expenditures on all items except for durable goods. Our measure of lifetime income (current consumption) is divided into two; consumption itself and net consumption. Net consumption adds to consumption gifts received less gifts given. However, our initial summary statistics show that there are no significant differences between the two and therefore later the former is dropped and the latter, consumption plus net gift is used as our proxy for lifetime income. For convenience it will be termed "consumption" throughout the study.

4.3 Basic Assumptions of the Analysis

The current study assumes a purely and absolute incidence analysis, i.e. there is no removal or alterations of any other tax. Secondly we assume that the VAT is passed forward to final consumers and therefore the amount of tax burden falling on a consumer unit is the statutory rate multiplied by the TZS amount of consumption. This assumption can be justified by assuming that the supply of consumption goods is perfectly elastic as would be the case with perfectly competitive markets with constant returns to scale in production. This approach makes it easier to compare results from the current study with previous researchers in similar topics. Third, the unit of analysis is the household, assuming that major household decisions are typically made at the household level.

Table 4.1 provides summary statistics on annual income and consumption from the Tanzania Household Budget Survey (2000/2001).

Table 4. 1 Summary Statistics on Income and Consumption

	Annual Income	*Consumption*	*Consumption+Net Gift*
Valid N	18552	18552	18552
Missing N	0	0	0
Mean	140,401.1805	83,712.1188	85,308.6696
Median	75,000.0000	58,680.0000	60,097.5000
Std Deviation*	198,293.48926	86,512.12939	87,157.67431
25 Percentile	45,300.0000	38,825.2500	39,966.2500
75 Percentile	144,415.0000	94,097.5000	96,258.7500
Coefficient of Variation	1.41	1.03	1.02

Mean Income is about 87% greater than the median while mean consumption is about 43% greater that median consumption. Both annual income and current consumption have high skews, but the former seems to be much more skewed than the latter. Variation in income is 1.41, higher than variation in consumption, which is 1.03. Adding net gifts to consumption has no significant impact but slightly increases the mean, the median, and the standard deviation. However, the coefficient of variation slightly decreases.

Table 4. 2. Boundary Values for Income Groups

Deciles	Annual Income (TZS)	Consumption (TZS)	Consumption+ Net Gift (TZS)
1	22,450.00	28,795.00	29,475.00
2	31,235.00	35,415.00	36,430.00
3	40,120.00	42,130.00	43,345.00
4	61,290.00	49,760.00	50,940.00
5	75,000.00	58,680.00	60,095.00
6	93,725.00	69,705.00	71,055.00
7	122,202.00	84,280.00	86,010.00
8	173,560.00	108,375.00	110,380.00
9	295,765.00	159,465.00	161,970.00
10	1,984,990.00	1,408,825.00	1,408,825.00

Table 4.2 reports the upper limit values for the deciles for three different income measures from the 2000/2001 Tanzania Household Budget Survey. For example, 28,795.00 is the maximum value for the first consumption decile.[2] The values reported for the tenth decile are the maximum values in the sample. Income exceeds consumption for the higher income groups. However, for most of the lowest deciles consumption exceeds income, indicating that their annual income has been reduced by temporary income shocks. Adding net gift to current consumption does not bring any significant impact. Since there are two measures of income, the annual income and lifetime income, it is of interest to know how the two income measures are related for each income group. This can be shown by cross-tabulating income against current consumption from our sample. Table 4.3 is intended to show the dispersion of consumption within income deciles. Cell entries in percentages are the probabilities of being in a consumption decile conditional on being in a given income decile. The diagonal probabilities show chances of being in the same consumption decile as a household's income decile.

Table 4.3 Consumption vs Income in the 2000/2001 Household Budget Survey

	Consumption deciles									
Income deciles	1	2	3	4	5	6	7	8	9	10
1	**28.6%**	20.0%	14.0%	10.6%	9.2%	7.0%	4.7%	2.9%	1.8%	1.2%
2	22.0%	**18.2%**	17.3%	13.0%	10.6%	7.0%	4.9%	3.7%	2.6%	.7%
3	14.0%	15.3%	**17.9%**	15.0%	12.4%	9.8%	6.6%	4.3%	2.7%	2.0%
4	10.0%	13.7%	14.1%	**14.8%**	12.3%	10.1%	11.2%	7.3%	4.4%	2.3%
5	9.0%	10.0%	12.0%	13.6%	**13.0%**	13.7%	12.2%	8.9%	5.8%	1.9%
6	5.5%	8.0%	8.5%	9.4%	13.0%	**14.6%**	15.1%	11.5%	10.1%	4.2%
7	4.1%	6.6%	7.0%	8.1%	10.2%	13.7%	**13.2%**	17.8%	12.7%	6.6%
8	3.5%	3.9%	3.8%	7.5%	9.2%	10.6%	13.5%	**17.4%**	19.4%	11.1%
9	2.1%	2.1%	2.9%	5.0%	5.4%	8.3%	10.9%	15.3%	**23.4%**	24.6%
10	1.2%	2.1%	2.7%	3.0%	4.7%	5.1%	7.8%	11.0%	17.0%	**45.5%**

[2] The terms income group and decile will be used interchangeably in this study unless otherwise noted

About 18 percent of the households in the lowest income decile have current consumption above median consumption in the overall sample of the study. About 32 percent of the households have consumption greater than income while about 68 percent have consumption less than income. About 54 percent of those with consumption greater than income are found in lowest three income deciles, 52 percent of those with consumption less than income, on the other hand, are those in the three highest income deciles. These results indicate that there is a high dispersion of consumption within income deciles, making us cautious about using income as a measure of well-being.

4.4 Distribution of a Broad Based VAT

Tax rates are computed as the ratio of tax liability to income. VAT liability per household is computed as 20 percent of total expenditures. Household tax liability is then divided by the appropriate income measure and computed as percentage to get tax rate for that particular household then median values are taken for each decile. Table 4.4 below gives median tax rates for households sorted by income from the lowest to the highest decile.

Table 4.4 Median VAT Rates on Annual Income and Consumption

Deciles	*Annual Income*	*Current Consumption*	*Current Consumption plus Net Gift*
1	26.3	20.0	20.0
2	22.0	20.0	20.0
3	20.3	20.0	20.0
4	18.6	20.0	20.0
5	16.9	20.0	20.0
6	16.3	20.1	20.0
7	14.7	20.2	20.0
8	12.9	20.3	20.1
9	11.9	20.5	20.4
10	8.3	21.0	21.0

Table 4.4 show that when annual income is used to rank household the VAT looks highly regressive. Median tax rates fall from 26.3 percent in the lowest decile to 8.3 percent in the highest decile. When current consumption is used to rank households the VAT seems to be proportional up to the fifth decile; with all income groups paying the statutory rate while for higher deciles the VAT looks mildly progressive.

The results in table 4.4 suggest that a broad based VAT would be proportional if lifetime income is used to measure the ability to pay, rather than the annual income. Using consumption plus net gift as a measure of income does not have a significant difference, however it makes the VAT more proportional but the last three deciles where it remains to be progressive. Since excluding net gift from the construction of permanent income does not affect the results significantly, from this point one measure of permanent income, current consumption plus net gift is used and we name it consumption or current consumption for more convenience.

4.5 Distribution of the VAT Burden with Exemptions

So far it has been assumed that the VAT is broad based ignoring the fact that VAT in Tanzania, like many other countries, is subject to other modifications including zero-rating and exemptions. The following section considers VAT applied to items that are subject to VAT by law. In this study there is no complete information for items that are legally subject to the VAT in Tanzania, however, there is specific information on exempted items. While excluding these items from the calculations does not give accurate information on VAT and exemptions in Tanzania, this modification enables us

to see how exemptions affect both revenue and distribution of the VAT. [3] Using the available information we have created a summary of items subject to the VAT in Tanzania. Note that the food category in both cases involve cereals, starches, vegetables and fruits, milk, meat (other than fish) and others. The only distinguishing factor in the two groups is the term processed or unprocessed.

Table 4.5 Grouping of Items Subject to VAT in Tanzania[4]

Items subject to VAT	*Exempted Items (VAT Act Tanzania, 2006)*
Processed foods	Unprocessed food
Sugar and sweets	Locally grown tea/coffee
Building materials	Pesticides, fertilizers, insecticides and all products
Purchase of seeds and fodder for animal and poultry feeds	necessary for use in agricultural production
Shell fish/Canned fish	Health supplies
Oils and fats	Educational supplies
Non alcoholic drinks	Veterinary supplies
Alcohol, meals and drinks consumed outside	Books and newspapers
Housing	Public Transport services
Fuel and Light- other than petroleum products	Financial and Insurance services
Furniture and equipment	Water except bottled water
Cloth, footwear and personal effects	Petroleum products
Personal care	Agricultural Implements
Entertainment and recreation	Postal supplies
Private transport	
Cigarette and tobacco	
Other Consumptives subject to VAT	

VAT rates are then calculated after removing the exempted items from total expenditures. VAT liability is calculated as 20 percent times total expenditures on items that are subject to the VAT, and then the VAT rate as the liability divided by the income measure. Table 4.6 shows the distribution of the VAT after taking exemptions into consideration. Results

[3] See the appendix for more clarification on items exempted from VAT.

[4] The collected information on items subject to the VAT is very general and therefore what we provide above is just designed to reflect the exempted items. Our analysis therefore ignores the role of zero-rated items as we consider all non-exempted items to be subjected to the VAT.

show that when annual income is used to measure income the VAT looks highly regressive as before. Unlike in the case of a broad based VAT, when current consumption is used to rank households in this case, the VAT looks a bit progressive ranging from 8.6 in the lowest decile to 10.1 in the highest decile.

Table 4.6 Median VAT Rates With Exemptions

Deciles	*Annual Income*	*Current Consumption*
1	15.4	8.6
2	13.4	9.2
3	11.3	9.4
4	9.8	9.6
5	8.9	9.7
6	7.9	9.7
7	7.1	9.7
8	6.2	9.9
9	5.1	9.9
10	2.7	10.1

Results in table 4.6 provide a hint that exemptions might help redistribute the tax burden in favor of the relatively poor. However, while exemptions might have a positive impact on redistribution of the tax burden, they pose a negative impact on revenue unless other measures are taken. Table 4.7 shows the impact of exemptions on revenue. The implicit assumption here is that without exemptions, all expenditures are subject to the VAT and all tax is collectable.

Table 4.7 Impact of Exemptions on Government Revenue

		All Items	*Non exempted items*
N	Valid	18552	18552
	Missing	0	0
Sum		340,569,536.20	137,352,135.20

The 20 percent statutory VAT rate is applied on total household expenditures followed by aggregation over all households to get revenue under the broad based VAT. Applying the statutory rate on expenditures net of exemptions gives revenue net of exemptions. If all items were subjected to the VAT, total revenue would be more than doubled. But the question should be what is the alternative to raise the same amount of revenue as would be raised under the current arrangement. Could the same amount of revenue be raised at a lower rate if all items were subjected to the VAT? The question is answered by finding another rate, *r* that would be applied to total expenditure on all items to generate the same revenue as the one generated by the 20 percent on items subjected to the VAT. These calculations give a revenue neutral rate of 8.1 percent for a broad based VAT. However, it is neither realistic to assume a 100 percent revenue collection, nor to assume taxation on all goods and services. The revenue neutral rate argument offers hope that there are alternatives to exemptions. In the following section other alternatives are explored that could both alter the VAT burden and raise the same revenue, while allowing exemptions on a fewer items.

4.5.1 Altering the VAT Burden

In chapter three alternative ways of altering the VAT burden have been discussed. Two main approaches, limiting exemptions and credit refund will be explored here. Examples from the literature shows that VAT could be made substantially more progressive by allowing a limited cash rebate in spending per person (Lester Thurow in Metcalf 1993), credit refund per household or limiting exemptions to a few items, Metcalf (1993). We have also seen a combination of both refund and limited exemptions with similar results.

This study considers the two same approaches, starting with limiting exemptions followed by credit refund per household.

4.5.1.1 Limiting Exemptions

The approach is to limit exemptions to fewer items presumably mostly consumed by the poor. Exemptions are limited to unprocessed food including locally grown tea and coffee, and health supplies. For the purpose of analysis in this study, items are grouped into 15 groups and expenditure on each item is computed as a percentage of total household expenditures. The grouping of items if found in table 4.8 while table 4.9 shows expenditure on each item as a percent of total expenditure for each income group. For example, 69.28 represents food as a percentage of total expenditure for the lowest income group. Rows represent items in the order of table 4.8, while columns represent income groups (current consumption used as proxy) starting from the lowest to the highest decile.

Table 4.8 Grouping of Items for VAT Analysis

1	Food Items
2	Non alcoholic drinks including coffee and tea
3	Alcohol, meals and drinks consumed outside
4	Housing (rent and utilities)
5	Fuel and light
6	Furniture and equipment
7	Cloth, footwear and personal effects
8	Medical and personal care
9	Educational supplies
10	Entertainment, recreation and related
11	Transport and communications
12	Cigarette and tobacco
13	Financial services
14	Building material and related purchase
15	Agricultural and farm implements

Table 4.9 Expenditure Pattern (percent) by Income Group

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	69.28	.88	3.09	.94	8.26	.77	2.61	1.70	.18	4.75	.89	.79	.47	1.06	4.32	100.00
2	67.26	1.06	3.65	.89	8.06	.98	3.22	1.65	.25	4.32	1.17	.89	.23	1.02	5.34	100.00
3	63.88	1.14	3.50	.93	7.62	1.20	3.90	1.73	.29	4.69	1.39	.91	.26	.66	7.89	100.00
4	62.68	1.33	3.62	.84	7.33	1.41	4.74	2.00	.38	4.81	1.32	.87	.36	1.22	7.09	100.00
5	61.02	1.36	3.40	1.06	7.04	1.42	5.04	1.84	.40	4.31	1.59	.80	.97	1.38	8.37	100.00
6	59.95	1.59	3.74	1.18	6.37	1.67	5.36	2.02	.46	4.90	2.07	.74	.61	1.38	7.97	100.00
7	57.09	1.65	3.47	1.08	6.26	1.92	5.90	2.12	.59	5.19	2.40	.74	.56	2.59	8.43	100.00
8	48.35	1.67	3.26	1.10	5.26	2.15	5.83	2.11	.74	5.09	2.67	.57	.70	2.12	18.38	100.00
9	48.47	2.06	4.08	1.23	5.12	2.66	7.31	2.44	1.42	6.02	4.17	.55	1.12	2.37	10.98	100.00
10	32.21	1.86	3.44	.90	3.43	3.54	7.37	1.99	3.20	7.60	12.91	.43	2.02	4.06	15.06	100.00

Table 4.9 shows that, food takes 69.28 percent of the lowest income group expenditure and also the largest portion of each income group's expenditure. It is then assumed that exemptions are limited to unprocessed food including locally grown tea and coffee, and health supplies. A 20 percent VAT rate is applied on the remaining expenditures to examine the impact on revenue and total distribution of the VAT among different income groups.

Table 4.10 Hypothetical VAT Revenue with Limited Exemptions

	With numerous exemptions	*With Limited exemption*	*Percentage increase*
Taxable amount TZS	686,760,676.00	840,036,307.00	22.32
Revenue TZS	137,352,135.20	168,007,261.40	22.32

Results in table 4.10 show that, by limiting exemptions without any other adjustments, taxable amount and revenue generated increase by more than 22 percent. This kind of adjustment in taxable items would also change dramatically the distribution of the VAT burden in favor of the relatively poor without much penalizing the higher income groups if current consumption is the measure of ability to pay. However, if annual income is used to measure ability to pay, the VAT still looks very regressive.

Table 4: 11 Median VAT Rates with Limited Exemptions

Decile	Consumption	Income
1	9.54	17.07
2	10.08	14.74
3	10.44	12.61
4	10.61	10.83
5	10.90	10.03
6	10.87	8.87
7	11.02	8.19
8	11.25	7.08
9	11.58	6.11
10	12.66	3.51

In order to maintain revenue neutrality, we need to find a hypothetical rate *t,* which would be applied to the new taxable amount with limited exemptions to generate revenue equal to TZS 137,352,135.20. Mathematically, this is expressed as,

$$Revenue = 137352135.20 = t(840036307.00) \quad \ldots\ldots(4.1)$$

This gives a revenue neutral rate of 6.12 percent. In itself, lowering the statutory rate do not have additional impact on VAT burden distribution, however, tax rates fall dramatically at all income levels (table 4.12).

Table 4.12 Revenue Neutral VAT Rates with Limited Exemptions

Deciles	Income	Consumption
1	8.3	2.9
2	4.5	3.1
3	3.9	3.2
4	3.3	3.2
5	3.1	3.3
6	2.7	3.3
7	2.5	3.4
8	2.2	3.4
9	1.9	3.5
10	1.1	3.9

4.5.1.2 Refundable Credit

The approach is to refund taxpayers some credit, automatically reducing their taxable amount. The choice of refundable credit is this study is average expenditure on unprocessed food and health supplies. This gives TZS 23,720.75 credit refund to each household. Table 4.13 gives the resulting distribution of the tax burden.

Table 4.13 Median VAT Rates on Total Expenditures With Credit Refund

Decile	*Consumption*	*Income*
1	-7.9	6.64
2	.3	3.59
3	4.5	6.74
4	7.4	8.01
5	9.6	9.34
6	11.4	9.48
7	13.1	10.22
8	14.6	9.76
9	16.3	9.83
10	18.9	7.74

Applying the 20 percent rate on expenditure less the refundable credit, the tax looks quite progressive when consumption is used as a measure of well being with the lowest decile

getting a subsidy. With annual income as a measure of well being the VAT has no clear pattern but looks less regressive.

4.5 Distributional Impact of the Proposed 18.5 Percent

Distributionally, lowering the rate by itself should not have impact. However, lowering the statutory rate without any other adjustments will reduce the overall burden and the revenue. VAT rates are calculated using 18.5 percent statutory rate to compare the results with the ones under the 20 percent rate for items subjected to the VAT. With a lower (18.5%) rate, government revenue would fall by 7.5%

Table 4.14 Hypothetical Change in Revenue Caused by a Lower Rate

20 %	*18.5 %*	*Change in revenue*	*% change*
137,352,135.20	127,050,725.06	-10,301,410.14	-7.50

Table 4.15 Impact of 18.5 Percent VAT on Household Tax Rates

Consumption				*Annual Income*		
Decile	20 %VAT	18.5 % VAT	%change	20 %VAT	18.5 %VAT	% change
1	8.6	7.9	-7.5	15.4	14.24	-7.5
2	9.2	8.5	-7.5	13.4	12.4	-7.5
3	9.4	8.7	-7.5	11.3	10.5	-7.5
4	9.6	8.8	-7.5	9.8	9.1	-7.5
5	9.7	9.0	-7.5	8.9	8.2	-7.5
6	9.7	9.0	-7.5	7.9	7.3	-7.5
7	9.7	9.0	-7.5	7.1	6.6	-7.5
8	9.9	9.1	-7.5	6.2	5.7	-7.5
9	9.9	9.2	-7.5	5.1	4.7	-7.5
10	10.1	9.3	-7.5	2.7	2.5	-7.5

Assuming no other adjustments, the overall impact of the proposed 18.5 percent VAT is to lower revenue as well as the burden by 7.5 percent. The most important thing in this section however is to explore alternative ways in which the lost revenue could be recovered or increased without increasing the burden to the lower income groups. Demonstrated below is an example of limited exemptions to a few items, namely, unprocessed food, locally grown tea and coffee and medical supplies. Expenditure on these items is deducted from taxable amount and tax rates calculated as before.

Table 4.16 Impact of 18.5 Percent VAT with Limited Exemptions

Deciles	*Income*	*Consumption*
1	18.1	8.8
2	13.6	9.3
3	11.7	9.7
4	10.0	9.8
5	9.3	10.1
6	8.2	10.1
7	7.6	10.2
8	6.5	10.4
9	5.7	10.7
10	3.3	11.7

With this kind of adjustment in taxable items, the VAT looks slightly more progressive when consumption is used to measure income, and looks highly regressive otherwise. The revenue impact of this change would be 13.1 percent increase.

Table 4.17 Revenue Impact of 18.5 Percent Rate

20% VAT	*18.5% VAT with limited exemptions*	*Percent change*
137,352,135.20	155,406,716.80	13.14

4.7 Distribution of the VAT Burden by Item

So far in the chapter, the analysis of the VAT burden has focused on total expenditures. However, the way in which different items are shared in the society determines the distribution of the tax burden as well. Table 4.8 and 4.9 are reproduced below for this purpose. The most left column of table 4.9 numbered from 1 to 10 represent income groups from the lowest to the highest, where the first row numbered from 1 to 15 represent item groups as defined in table 4.8. Cells entries in bold will now represent the weights, expenditure on each item as a percent of household total expenditures. Expenditures on food, fuel and light decrease with income. Expenditures on furniture, equipment, educational supplies, cloth, footwear and personal effects increase with income. Most of the remaining items have no consistent pattern.

Table 4.8 Grouping of Items for VAT Analysis

1	Food Items
2	Non alcoholic drinks including coffee and tea
3	Alcohol, meals and drinks consumed outside
4	Housing (rent and utilities)
5	**Fuel and light**
6	Furniture and equipment
7	Cloth, footwear and personal effects
8	Medical and personal care
9	Educational supplies
10	Entertainment, recreation and related
11	Transport and communications
12	Cigarette and tobacco
13	Financial services
14	Building material and related purchase
15	Agricultural and farm implements

Table 4.9 Expenditure Pattern by Income Groups

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	69.28	.88	3.09	.94	8.26	.77	2.61	1.70	.18	4.75	.89	.79	.47	1.06	4.32	100
2	67.26	1.06	3.65	.89	8.06	.98	3.22	1.65	.25	4.32	1.17	.89	.23	1.02	5.34	100
3	63.88	1.14	3.50	.93	7.62	1.20	3.90	1.73	.29	4.69	1.39	.91	.26	.66	7.89	100
4	62.68	1.33	3.62	.84	7.33	1.41	4.74	2.00	.38	4.81	1.32	.87	.36	1.22	7.09	100
5	61.02	1.36	3.40	1.06	7.04	1.42	5.04	1.84	.40	4.31	1.59	.80	.97	1.38	8.37	100
6	59.95	1.59	3.74	1.18	6.37	1.67	5.36	2.02	.46	4.90	2.07	.74	.61	1.38	7.97	100
7	57.09	1.65	3.47	1.08	6.26	1.92	5.90	2.12	.59	5.19	2.40	.74	.56	2.59	8.43	100
8	48.35	1.67	3.26	1.10	5.26	2.15	5.83	2.11	.74	5.09	2.67	.57	.70	2.12	18.38	100
9	48.47	2.06	4.08	1.23	5.12	2.66	7.31	2.44	1.42	6.02	4.17	.55	1.12	2.37	10.98	100
10	32.21	1.86	3.44	.90	3.43	3.54	7.37	1.99	3.20	7.60	12.91	.43	2.02	4.06	15.06	100

The key issue here is the extent to which a particular item is relatively important to households of different income groups. This is shown in fig. 4.1 by a graphical representation of the accumulated percent of expenditures against the accumulated percent of total income. Figure 4.1 shows that expenditures on food, tobacco, fuel and light is regressive. Tax on these items would hurt mostly the poor. For rent and utilities, expenditures are slightly proportional at higher levels of income, however slightly progressive at lower levels of income. This makes sense because the higher the income, the higher the quality of dwellings and therefore cost and utilities. Expenditure on transport, education, financial services and building materials as well as entertainment are very progressive. A large percent of higher income groups spend on these items.

Tax rates by item are calculated for each household and the median is taken as the nominal tax rate for the decile. Table 4.18 gives the distribution of the tax burden among households by item group. The first left column represents households sorted by income groups while the first row represents 15 items as defined in table 4.8.

Fig.4.1 Lorenz Curve of Income Inequality

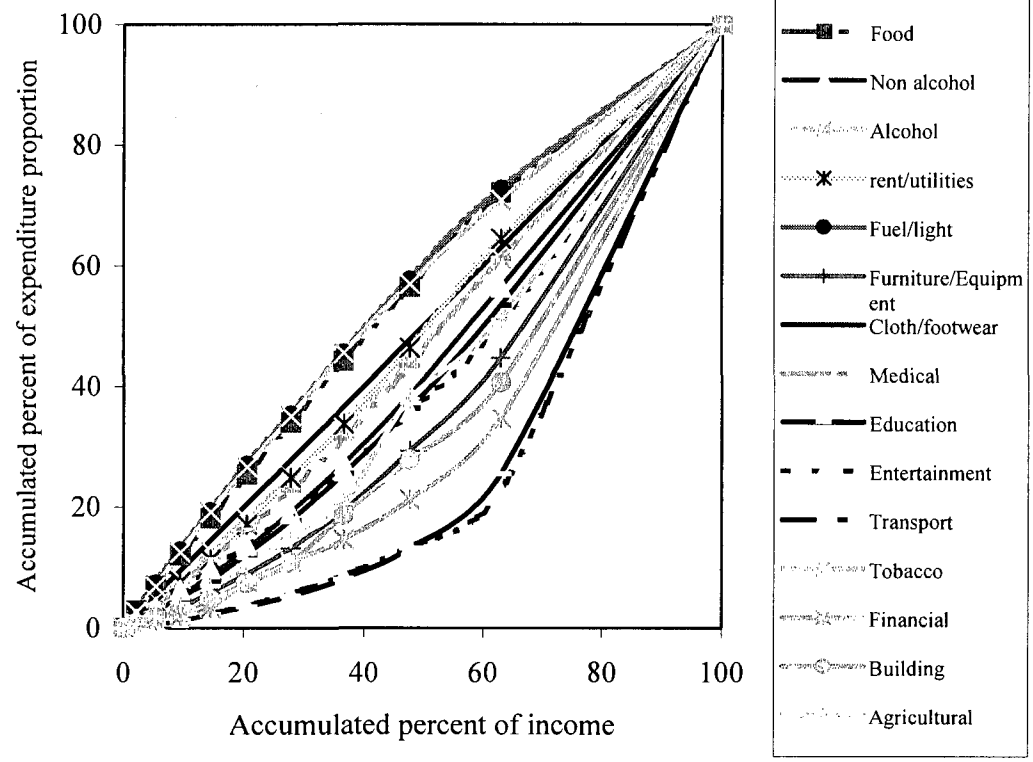


Table 4.18 Nominal VAT Rates by Item

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	***T***
1	15.16	.25	.75	.66	.00	.62	1.26	.38	.20	.57	1.04	.49	1.16	1.38	2.89	*1.79*
2	14.78	.23	.66	.53	1.56	.58	1.15	.34	.17	.51	.95	.45	.67	2.18	2.78	***1.84***
3	14.67	.23	.70	.54	1.57	.59	1.27	.33	.13	.50	.94	.50	.88	.91	2.54	*1.75*
4	14.30	.24	.65	.43	1.46	.54	1.45	.34	.15	.48	.79	.49	.57	1.46	2.24	*1.71*
5	14.13	.24	.53	.43	1.45	.49	1.40	.33	.12	.51	.82	.42	.62	1.48	1.64	*1.64*
6	13.86	.27	.57	.48	1.27	.51	1.33	.35	.12	.52	.74	.47	.80	1.81	2.12	***1.68***
7	13.44	.28	.54	.46	1.31	.51	1.39	.37	.12	.56	.82	.54	.65	1.50	1.50	*1.60*
8	12.83	.31	.52	.45	1.21	.56	1.43	.40	.13	.60	.77	.39	.51	1.72	2.01	*1.59*
9	11.55	.34	.64	.38	1.05	.55	1.61	.43	.16	.64	1.09	.34	.82	1.46	1.53	*1.51*
10	8.70	.34	.56	.29	.74	.61	1.76	.41	.20	.80	1.58	.23	.83	1.40	1.56	*1.33*

We see that if all items were taxable, VAT on food would be the highest for all income groups. It is interesting to see that only VAT on food is consistently regressive. The far right column, *T* gives the overall tax rate for each decile, calculated as average over all 15 items. The overall tax burden, *T* has no perfect clear pattern, however it is generally regressive except for the second and sixth decile. The overall tax, *T* in this case is just a rough estimate and in itself it might not give a very meaningful interpretation unless distributional weight are considered. This is done in the following section and the two results will be compared.

4.7.1 Introducing Distributional Weights

Distributional weights are estimates of relative welfare weights that are attached to households reflecting the extent to which distributional considerations are a concern. Distributional weights in this study are calculated as percentage consumption of each item, which implies that poorer households will have higher distributional weights. By this definition table 4.9 will serve this time for the distributional weights. These distributional weights are introduced in the calculation of tax rates by item and results are compared to the nominal rates in table 4.18 to see whether distributional weight, if considered, would make the tax look more or less regressive. Therefore, for household h that consumes n items, the overall tax rate with distributional weight considered, will be:

$$T^h = [d_1(t_1) + d_2(t_2) + \ldots\ldots + d_n(t_n)]/\mathrm{n} \qquad (4.2)$$

Where, d_n and t_n are the distributional weight and the nominal tax rate respectively, for household h. VAT with distributional weights is shown in table 4.19.

Table 4.19 VAT Rates with Distributional Weights

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	*T*
1	10.50	.00	.00	.01	.13	.00	.03	.01	.00	.03	.01	.00	.01	.01	.12	*.72*
2	9.94	.00	.00	.00	.13	.01	.04	.01	.00	.02	.01	.00	.00	.02	.15	*.69*
3	9.37	.00	.00	.01	.12	.01	.05	.01	.00	.02	.01	.00	.00	.01	.20	*.65*
4	8.96	.00	.00	.00	.11	.01	.07	.01	.00	.02	.01	.00	.00	.02	.16	*.63*
5	8.62	.00	.01	.00	.10	.01	.07	.01	.00	.02	.01	.00	.01	.02	.14	*.60*
6	8.31	.00	.00	.01	.08	.01	.07	.01	.00	.03	.02	.00	.00	.02	.17	*.58*
7	7.67	.00	.00	.00	.08	.01	.08	.01	.00	.03	.02	.00	.00	.04	.13	*.54*
8	6.20	.01	.00	.00	.06	.01	.08	.01	.00	.03	.02	.00	.00	.04	.37	*.46*
9	5.60	.01	.01	.00	.05	.01	.12	.01	.00	.04	.05	.00	.01	.03	.17	*.41*
10	2.80	.01	.01	.00	.03	.02	.13	.01	.01	.06	.20	.00	.02	.06	.23	*.24*

Comparing results in table 4.19 and those in table 4.18 three major findings can be noted. While in table 4.18 VAT on most items did not show a clear pattern (whether regressive or progressive) now the pattern is clear either regressive or progressive for many items. This turned out to shape the distribution of the overall tax burden T in one direction. Secondly, VAT on food that seemed to be slightly regressive, it now turns to be highly regressive with distributional weights. Thirdly, with distributional weights the overall tax burden, T has turned out to be clearly regressive ranging from 0.7 percent in the lowest decile to 0.2 percent in the highest decile. The overall tax rate, T in table 4.19, shows the importance of distributional considerations in tax policy analysis. For example VAT on alcoholic drinks and meals consumed outside (item 3) seemed to be regressive (although without a clear pattern in table 4.18) but when distributional weights are considered it turns out to be clearly progressive. The opposite is seen for items like fuel and light; with

no clear pattern under the nominal rates, now VAT turns out to be regressive when distributional weights are considered. Fourthly, VAT with distributional weights seems to place a smaller burden on households and therefore the average tax burden is much smaller.

4.7.2 The Distributional Characteristics of Exempted Items

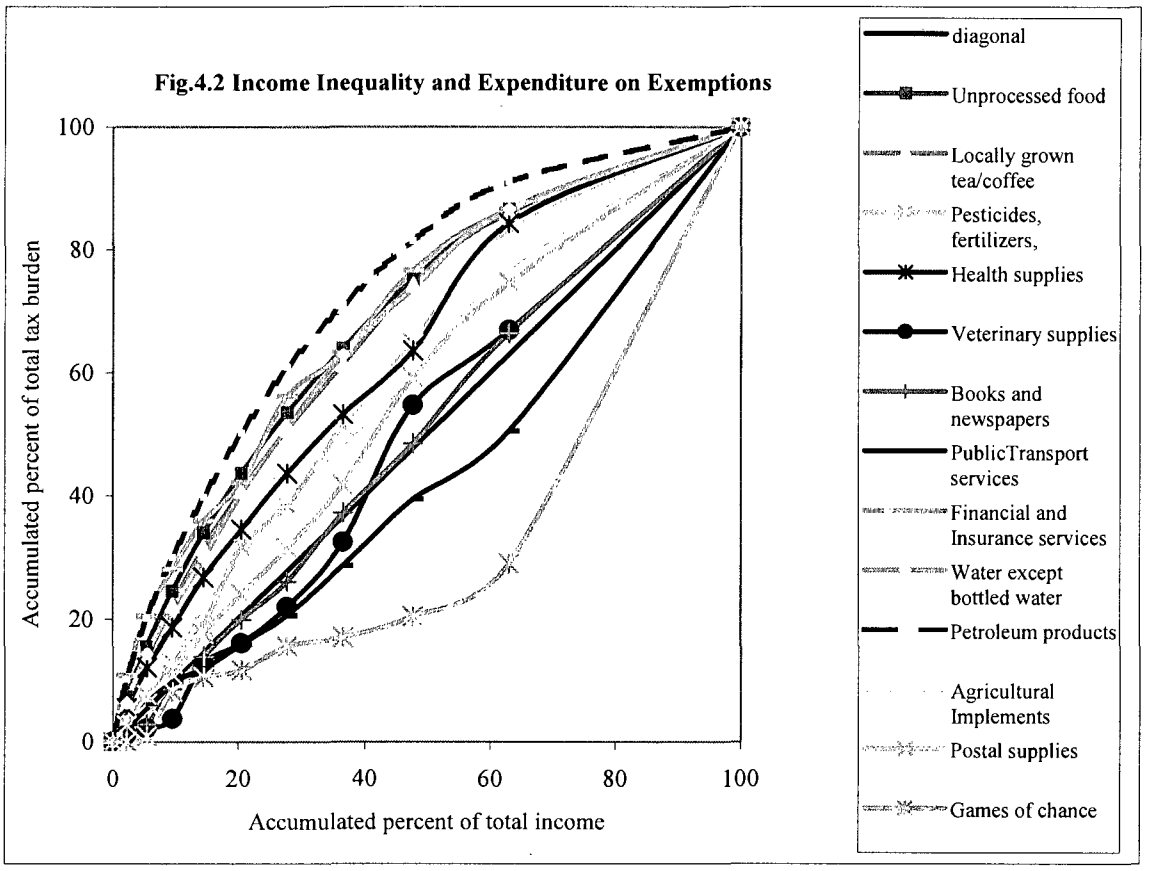
Having seen a significant negative impact of exemptions on revenue, it is worth finding out whether exemptions in Tanzania are justifiable on equity grounds. Some of the exempted items are listed in table 4.20

Table 4.20 Items Exempted from VAT (Tanzania Value Added Tax Act, 2006)

1	Unprocessed food
2	Locally grown tea/coffee
3	Pesticides, fertilizers, insecticides and all products necessary for use in agricultural production
4	Health supplies
5	Educational supplies
6	Veterinary supplies
7	Books and newspapers
8	Public Transport services
9	Financial and Insurance services
10	Water except bottled water
11	Petroleum products
12	Agricultural Implements
13	Postal supplies

Figure 4.2 shows the Lorenz curve for income inequality and exemptions. Expenditure on petroleum products, unprocessed food, locally grown tea and coffee, financial and insurance services are most regressive while expenditure on games of chance and public transport are very progressive. Expenditure on most items is regressive implying that in

the general sense these exempted items are mostly spent by the relatively poor. Expenditure on books and newspapers is almost proportional.



The graphical representation above gives a general picture about the inequality in income and expenditure on exempted items. The distributional characteristics approach help identify the proportion in which goods are consumed by the poor relative to the rich.

Martin Feldstein (1972) defines the distributional characteristics of a good *i* in terms of a ration *Ri* , a weighted average of the marginal social utilities, each household's marginal social utility weighted by that household's consumption of good *i.* Recalling the conventional welfare assumption of diminishing marginal utility, Feldstein argues that the higher the income elasticity of demand for a good, the lower the value of *Ri* and

therefore the value of *Ri* will be greater for a necessity than for a luxury. According to Feldstein each *Ri* can be calculated in terms of mean and variance of income, and the income elasticity of demand. The distributional characteristic of a good as presented by Feldstein is

$$Ri = \{\tilde{y}^{-\eta}(1+V)^{(1/2)\eta(1+\eta)}\}(1+V)^{-\eta\alpha i} \quad \ldots\ldots(4.3)$$

Where $\tilde{y}$ is the mean of income and V is the relative variance, $\sigma^2 y/\ \tilde{y}^2$. The term $\{\tilde{y}^{-\eta}(1+V)^{(1/2)\eta(1+\eta)}\}$ is a decreasing function of the average level of income and an increasing function of its relative inequality. It is equal to the utility value of a dollar distributed uniformly among all the households. The term $(1+V)^{-\eta\alpha i}$ shows that a good with a higher income elasticity of demand (α_i) has a relatively lower value of *Ri.* A greater income inequality *(V)* or a more egalitarian welfare function (higher income elasticity of demand) reduces *Ri* for any value of α_i and makes the *Ri* more sensitive to the distributional characteristics (Feldstein,1972).

Boadway and Bruce (1984) used the technique developed by Feldstein for measuring welfare changes in a many consumer economy:

$$dW = \sum_i \beta^i de_i \quad \ldots\ldots(4.4)$$

Where β^i is the marginal social utility of real income, and e_i is the expenditure function. $de_i = -\sum_j x^i_j(p,u^i)dp_j$ is the compensating variation of individual i from the change. Substituting above gives the change in welfare as:

$$dW = -\sum_i \sum_j \beta^i x^i_j dp_j = -\sum_j R_j x_j dp_j \quad \ldots\ldots(4.5)$$

where x_j is the aggregate demand for commodity j and R_j is the distributional characteristics of good j defined as:

$$R_j = (\sum_i \beta^i x^i_j) / xj. \quad \ldots\ldots(4.6)$$

The distributional characteristic is a weighted average of the β^i, weights reflecting the proportion of aggregate demand for x_j consumed by household of type i. Boadway and Bruce conclude that if β^i diminish with real income, R_j would be higher for necessities than for luxuries. They say that for luxuries a low β^i would be associated by a high x^i_j/x_j and vice versa.

This dissertation uses the result in equation 4.6 to calculate the distributional characteristic of the exempted items shown in table 4.20. Households are divided into *10* groups according to their proxy for lifetime income and the weights are calculated for each exempted item as the ratio of expenditure on that item to total household expenditures (table 4.21). The upper row represents items in the order of table 4.20, while the most left column represents households ranked in terms of income. Unprocessed food

constitutes the largest percent of expenditure on exempted items. For the lowest income group petroleum products follow at 2.74 percent, which is followed by water at 0.83 percent and then public transport at 0.77 percent etc.

Table 4.21 Expenditure on Exemptions as a Percent of Household Expenditures

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	38.24	.49	.12	.67	.00	.01	.00	.77	.42	.83	2.74	.09	.00
2	34.69	.55	.19	.66	.02	.00	.02	1.00	.27	.77	2.59	.29	.01
3	32.39	.52	.40	.72	.01	.01	.03	1.10	.29	.73	2.53	.15	.01
4	32.14	.59	.34	.81	.00	.04	.06	1.09	.34	.63	2.40	.19	.01
5	30.77	.57	.30	.71	.00	.02	.05	1.35	.99	.78	2.38	.25	.01
6	30.67	.60	.14	.81	.00	.04	.05	1.66	.59	.86	2.13	.13	.01
7	29.62	.60	.22	.85	.00	.04	.07	1.92	.51	.77	2.03	.29	.01
8	25.59	.51	.35	.91	.01	.17	.08	2.13	.66	.68	1.78	.22	.03
9	25.91	.53	.19	1.14	.01	.10	.09	3.14	.93	.85	1.67	.23	.05
10	18.85	.32	.28	.89	.01	.20	.14	7.55	1.95	.54	1.10	1.53	.04

For other lower-income groups the trend seems to be similar, however petroleum products is followed by public transport. For the higher income groups food is followed by public transport and from there the pattern differs.

Table 4.22 gives the distributional characteristics of exempted items. More details on these items are found in the appendix. The ranking of exempted items shows that unprocessed food ranks the highest followed by public transport and then petroleum products. A high price on these items would hurt the poor.

Table 4.22 Distributional Characteristic of Exempted Items

Exempted Items	Distributional Characteristic	Rank
Unprocessed food	**.262**	**1.00**
Locally grown tea/coffee	.005	8.00
Pesticides, fertilizers, insecticides and all products necessary for use in agricultural production	.003	9.00
Health supplies	.009	6.00
Games of chance	.000	13.00
Veterinary supplies	.002	10.00
Books and newspapers	.001	11.00
PublicTransport services	**.061**	**2.00**
Financial and Insurance services	.015	4.00
Water except bottled water	.007	7.00
Petroleum products	**.018**	**3.00**
Agricultural Implements	.013	5.00
Postal supplies	.000	12.00

These results however are not a surprise since food constitutes the largest percent of poor people's consumption. More than that, unprocessed food makes the largest percent of food consumption for the poorest households and for the population in general due to the general nature of the agricultural economy. Similar argument holds for households that cannot afford to buy or rent a car. Public transport is still the main transport for many office workers especially those at low-income levels. A VAT on public transport would hurt the relatively poor. The high ranking of petroleum products in general might seem a surprise at first. However, the reason for this result is that the main petroleum product included in this analysis is kerosene, the main source of energy for light and cooking for poorer households with no electricity or other sources of energy. Data on other petroleum products was very limited. Postal supplies, games of chance as well as books and newspapers rank among the lowest. Generally a VAT on these items would not hurt the poor. Surprising is the low rank of water. However, clean water is mostly available to the relatively better off. The poorer households get their water indirectly from households

with tap water, most of the time for free but they may also pay cash especially when there is water crisis. Other sources of water for the relatively poor are wells, rivers etc. However, this does not suggest a VAT on water since water is an input in every household activity whether that household has a connection to tap water or not.

The lower ranks in other items do not reduce the importance of some of these items like agricultural inputs or veterinary supplies. It is important to remember that while a broad category of goods might have a lower/higher distributional characteristic that may not be the case for all goods in that group. While a VAT on petroleum products might appear to be regressive, if the VAT included a significant amount of diesel and petrol, it might be progressive. Similarly a VAT on unprocessed food concentrated more on beef or lamb might turn out to be less regressive (Madden, 2009). Distributional characteristic of good might be more useful when calculated on item-by-item basis. Recommendation of VAT policy changes on the above items must take into account other factors and product specifics. The optimal tax theory recommends taking into account efficiency effects during tax reform and therefore recommending higher taxes on goods with low price elasticity (and low income elasticity) and hence high distributional characteristics (Madden, 2009). The issues of externality, complementarities as well as substitutability is important, for example, a VAT on pesticides and fertilizers might affect the demand for agricultural implements. It is important to note that items presented in this analysis do not give a complete list of exempted items in Tanzania. The chosen items are the ones with available data in the Household Budget Survey. This means that a complete analysis of exemptions would require a complete list of items that are exempted from the VAT.

4.8 A General Equity Comparison of the VAT System vs the Sales Tax System

This section attempts to compare the VAT with the previous sales tax in Tanzania. The Suit index is used to examine possible changes in vertical equity that might be caused by a move from a multiple sales tax to a single value added tax. The logic of the suits index is similar to that of the Lorenz curve by giving a graphical representation of the proportionality of a distribution. The Lorenz curve in this case will show the accumulated percent of tax burden against the accumulated percent of income on the horizontal axis. As explained in chapter 1, the sales tax in Tanzania was much more complicated with many rates and different structure for different items. To compare with the VAT, same items are selected from items that are subject to the VAT. Using a single set of data, the HBS (2000/01) for comparison implicitly assumes that consumption level remains the same, with only the tax system changing from sales tax to the current VAT. It is also assumed that the full burden of the tax falls on final consumers. Seventy-six items have been chosen from the 2000/2001 HBS for this part of the study. Items range from food, alcoholic and non-alcoholic items, furniture and equipment, fuel and light, cloth and footwear, transport and communication, cigarette and tobacco as well as entertainment and recreation. Food items in the sales tax are mainly processed food. The number of households included in the analysis is 17,649. The sales tax structure seemed to be more complicated than the VAT due to multiple rates, not only among different types of items but also for the same item different rates could apply depending on the specifics of that item. The list of items and their respective sales tax rates as it appears in the 1976 Sales Tax Act of Tanzania is provided in the appendix.[5]

[5] Note that any provisions and more specifications in the Sales Tax Act have been ignored in this analysis.

4.8.1 Data for the Analysis (sales tax rates)

Because of limited information and lack of enough details about the sales tax, some goods and services are not included in the analysis. On the other hand, due to multiple rates the provided rates in the appendix do not provide the full sales tax structure for the items. For example in food, wheat flour carried a 24 percent sales tax, while cereal products, sugar and sweets carried a lower rate of 12 percent like canned vegetables, fruits and some types of oils and fats. Also by using the 1976 Tanzania Sales Tax Act we ignore any subsequent changes in the following years. Table 4.23 gives the percentage expenditure on items used in this part of the study. For example, 46.29 is the percentage expenditure by all households, on food items included in the VAT/sales tax analysis.

Table 4.23 Items Included in the VAT/Sales Tax Analysis

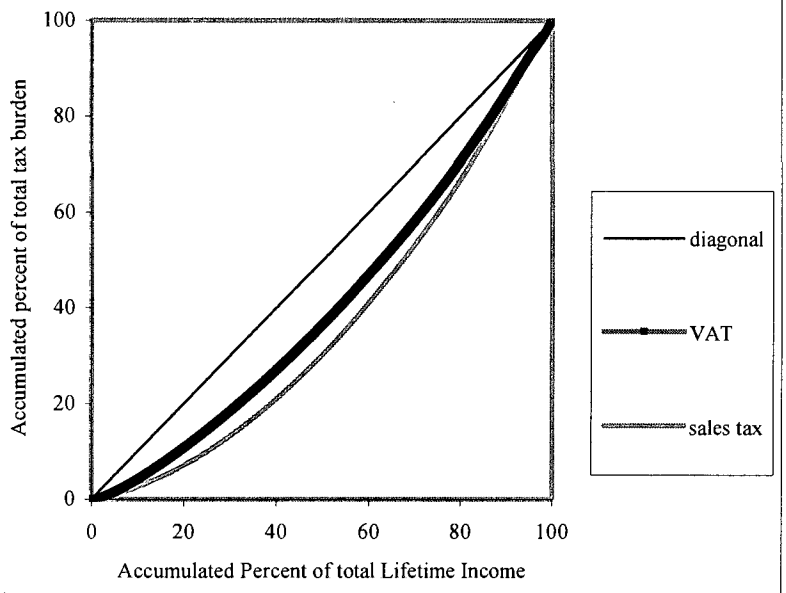
Item	*Percent of Expenditure in Analysis*
Food	46.29
Alcohol, meals and drinks consumed outside	.14
Fuel and light	.06
Furniture and equipment	17.66
Cloth, footwear and personal effects	30.63
Entertainment, recreation and other expenditures	3.24
Transport and communication	1.98

Expenditure on food is the highest for items included in the VAT/sales tax analysis, 46 percent. This is followed by cloth, footwear and personal effects at 30.63 percent. It seems that an unusually high percentage of total food expenditure has been included in the analysis compared to the other items.

4.8.2 The Lorenz Curves for VAT and Sales Tax

To compare the overall distribution of the VAT to that of the previous sales tax the Lorenz curve for the VAT and sales tax are plotted in a sing X-Y plane in figure .4.3 with the accumulated percent of tax burden on the vertical axis against the accumulated percent of income on the horizontal axis.

Fig.4.3 Lorenz Curve: VAT and Sales Tax



The graph shows that both taxes are progressive in the general sense but the VAT seems to be slightly less progressive than the sales tax. This suggests that a move from the sales tax system to the VAT system transfers the burden to the relatively poor.

4.8.3 Changes in Vertical Equity: The Suits Index

The Suits index is often used in tax policy analysis to measure the degree of overall progressivity of a tax or to analyze changes in vertical equity under alternative tax regimes. Given a Lorenz curve with *K* being the area below the diagonal line and *L* the area below the Lorenz curve, the Suits index is defined as.

$$S = 1 - L/K, \quad (4.7)$$

The value of the index lies between *-1* and *1*. A Suits index of value 0 identifies a tax system as proportional, implying that area *L* equals area *K*. On the other hand a positive value of the Suits index identifies a tax system as progressive while a negative value of the Suits index identifies a regressive tax system.

The area *K* is simply calculated by the formula for the area of a triangle, with equal base and height of 100, the accumulated percent of total income and the accumulated percent of total tax burden. Area *K* therefore equals *5000* and the Suits index becomes

$$S = 1-(1/5000) \int_0^{100} T(Y)dy \quad (4.8)$$

Where *Y* is the accumulated percent of total income and *T* the corresponding accumulated percent of total tax burden. The integral as a whole represents *L*, the area under the Lorenz curve. For a few discrete values the Suites index can be calculated by the formula:

$$S = (1-1/5000)\int_0^{100} T(Y)dy \approx 1 - (1/5000)\sum_{i=0}^{i=n} 1/2[T(Y_i)+T(Y_{i-1})][Y_i-Y_{i-1}] \ldots\ldots\ldots\ldots (4.9)$$

Where n is the total number of our representative taxpayers in the economy. The Suits index depends on the algebraic sum of the areas between the curve and the diagonal line. From these calculations the Suits index for VAT is *0.1365* while that of sales tax is *0.1828.* Change in the Suits index is therefore *-0.0463* indicating that a move from sales tax to the VAT made the tax less progressive, consistent with the graphical representation.

4.8.4 Significance Test for the Suits Index: The Bootstrap Methodology.

It has been argued that the Suits Index is a point estimator and therefore does not provide researchers with assistance in assessing whether changes are statistically significant. Small changes may lead to false conclusions, particularly where small sample sizes are involved. On the other hand larger samples are less sensitive to broad fluctuations of one or several data point observations than are small samples. Small changes in progressivity as measured over two time periods or between tax regimes may be caused by unobserved confounding variables. Unless a test of significance for the suits index is used, speculations on significance might lead to wrong conclusions.

The Bootstrap approach, initially developed by Anderson *et al* (2003), is a computer intensive resampling method that can provide standard error estimates and confidence intervals for parameters of interest without any parametric specification. According to

Anderson *et al* there is no standard statistical package for the estimation of bootstrap - t – intervals, rather one needs to program this task using common mathematical programs. A complete description of the Bootstrap methodology and its application in this study is outlined in the appendix. This study uses the approach to calculate the confidence intervals for the Suits indices of VAT and sales tax. The standard errors are computed using the bootstrap technique with a bootstrap sample size of $M=1,000$. All computations were performed using R statistical software (version 2.9.2).

Table 4.24 Bootstrap Results

VAT Suits Index	0.1365 (S.E 0.0024, 95% CI: 0.131-0.1412)
Sales tax Suits Index	0.1828 (SE 0.0023, 95% CI: 0.178-0.1873)
Change in Suits index	–0.0463 (95% CI: -0.0469-0.038)
p-value for comparison	p <0.0001

The bootstrap results show that VAT and sales tax are statistically significantly different and VAT is less progressive than the previous sales tax. However we suggest that, with a wider coverage of items and also depending on the skewness of the data results could be different. But since the effectiveness of the bootstrap method does not require the normality assumption the method still can give some estimate of result replicability.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This dissertation utilized data from Tanzania's Household Budget Survey of 2000/2001 to find the distribution of the VAT burden based on two alternative definitions of income, annual income and lifetime income. The sample used in the study was composed of 18,552 households from different areas of the country, rural and urban, and all levels of income. Annual income in the study is defined as earnings from all sources of income from formal and self-employment, agricultural income, and other sources. However, property income has been excluded to avoid unusual large values of income. Current consumption is considered as a proxy for lifetime income.

Individual households have been arranged according to their income, and tax burdens are calculated based on the two measures of income. Income exceeds consumption for the higher income groups. However, for most of the lowest deciles consumption exceeds income, indicating that their annual income has been reduced by temporary income shocks. Adding net gift to current consumption does not bring any significant impact. Lifetime income reduces inequality among households while the annual income was found to be more highly skewed than lifetime income and more dispersed. The methodology used in this dissertation is transparent and easy to apply at the household level. We are optimistic that results obtained provide a good approximation of the actual

distribution of the VAT burden in Tanzania. This makes sense especially for developing countries because ranking household by consumption gives a better approximation of income distribution.

Assuming all items are subjected to the VAT, the calculations of VAT rates based on annual income makes the VAT look very regressive while using consumption to measure well-being makes the VAT proportional. These results suggest that a broad based VAT would be proportional if lifetime income rather than annual income is used to measure the ability to pay. We conclude that VAT is not as regressive as it might be presumed to be. Using a proxy for lifetime income gives a better estimation of the true burden of a consumption tax like the VAT.

The VAT in Tanzania has numerous exemptions both for distributional and administrative purposes. Considering these exemptions in the analysis makes the VAT progressive when consumption is used to rank households. However, exemptions pose a serious negative impact on revenue. Two alternatives to numerous exemptions have been considered, namely, limiting exemption and cash rebate. The hypothetical example provided in the study offers alternatives that could be used to maintain revenue while improving the distribution of the tax burden. Limiting exemptions to unprocessed food including locally grown tea and coffee, and health supplies makes the VAT more progressive while improving taxable amount and revenue. On the other hand, using this approach together with maintaining revenue neutrality would lower the VAT rate dramatically from 20 percent to 6.1 percent.

The credit refund approach allows some limited deduction from taxable amount. The hypothetical example on this approach seems to make the VAT very progressive with the lowest income group actually receiving a subsidy. Even with annual income as a measure of wealth the VAT looks less regressive.

A lower rate of VAT, like the proposed 18.5 percent in Tanzania would only lower revenue and tax burdens uniformly among all households if there are no other adjustments. However, if this was accompanied with reduced exemptions the VAT looks more progressive with increased revenue. Therefore a new lower rate unless coupled with other measures to limit exemptions to basic items mostly consumed by the poor or other means like credit refund will lead to a serious revenue loss. A lower statutory rate with a broader base will increase revenue. Even if the poor spends a large proportion of their income on some particular items, the rich will typically spend a large absolute amount on those items so reducing the VAT rate would actually transfer more money to the rich than it does to the poor unless something else is done to redistribute from the rich to the poor.

The calculation of VAT item by item reveals that VAT on food is consistently regressive. While there is no common patter for the remaining items, the overall (average) tax rate seems to be slightly regressive. Introducing distributional weights (percent expenditure on each item) makes the VAT look very regressive due to extremely higher percent expenditures on food for the lower income groups.

The distributional characteristics approach shows that exemptions for kerosene, unprocessed food, and public transport are justifiable on distributional grounds, while exemptions on other items are not. However, the lower ranks in other items do not reduce the importance of these items. The analysis based on a broad category of items deserves careful interpretation. For example VAT on petroleum products might appear to be regressive or progressive depending on the percent of individual items (kerosene, diesel petrol etc) included in the analysis. The distributional characteristics might be different if calculated for each single item rather than for a category of items. However, availability of detailed information on each item for all income groups is crucial to conducting such an analysis.

Ranking households according to their share of expenditure on different items shows that higher income groups spend higher absolute amount on all items. The percentage share of expenditure on food, fuel and light exceeds the percentage share of income across all income levels. For some of the items like rent and utilities, the percentage share of expenditure is less than the percentage share of income for the poorest 50 percent of the sample while for higher income levels the percentage share is greater than their percentage share of income.

Comparison between the VAT and the previous sales tax in Tanzania has also been conducted. However the comparison was done on a small scale due to lack of enough details especially on the sale tax that had multiple rates. Results show that a move from sales tax to the VAT makes the tax system less progressive, however, not regressive.

Results could be different with a wider coverage of goods and services and a complete structure of the previous sales tax. Future research could do well by incorporating into the analysis the complete structure of the taxes. It has been assumed in this analysis that consumption pattern does not change, however, possible changes in consumption pattern might give different results. A similar argument holds with the assumption of constant prices that ignores possible price changes that might lead to change in consumption pattern or even substitution for different items. Estimating demand functions for individual goods and services would improve the results. This requires some sort of time exposure estimation with data on prices and quantities for several years.

5.2 Recommendations

The single VAT system in Tanzania could be improved by reducing exemption, broadening the VAT base to collect more of the much needed revenue without hurting the poor. Credit refund is a good alternative, however it requires a good record keeping and communication with tax payers. Given the limitation of these facilities in a developing country like Tanzania, limiting exemptions remains to be the most viable tool to raise more revenue and redistribute the burden of a consumption tax.

The proposition to reduce the VAT rate from the current 20 percent to 18.5 percent will only be a good idea if accompanied by other means to increase revenue such as reducing exemption like limiting them to a few necessary items like, food, fuel and light, water, transport. The VAT rate of 20 percent for Tanzania is extremely high with limited revenue advantage. By limiting exemptions to a few items, the rate could be lowered,

increase revenue and provide incentive for compliance and at the same time reduce administrative costs.

5.3 Study Limitations

In measuring the burden of the tax, a number of strong assumptions were made. With VAT being an indirect tax, it was assumed that those households that consume the taxed item actually pay the associated tax. The calculation involves use the statutory rate to estimate the tax paid by each income group. The importance of the informal sector, smuggling and corruption means taxes actually paid are far below what would be paid under perfect compliance. Future research would do well to relax this assumption by estimating demand function for individual goods and services.

Calculation of consumption aggregates might be affected by data limitation especially for durable goods such as housing and motovehicle. Many Tanzanians live in their own houses; the cost and quality of housing differ widely across areas and depending on individual wealth. As a consequence information on rent is available for only a small portion of the population, mostly in urban areas. While the HBS data does not provide information on rental value of owner occupied housings, the use of a regression approach in estimating rental values for homeowners is hindered by lack of a large enough sample on rents and housing characteristics for renters. A similar problem happens with estimating motovehicle consumptions

The reported comparison between the VAT and sales tax, implicitly assumes that demand and supply elasticities are zero i.e quantities consumed do not change when taxes change. However, this assumption greatly simplifies the analysis and it does provide first order approximation to the true incidence. Future research would do well to relax this assumption by estimating demand functions for individual goods and services and for system of goods and services.

For a perfect measure of incidence one needs to consider the so-called per Adult Consumption Equivalent unit (ACE). The current analysis does not treat differently consumption level of children and adults, so every member of the household is considered the same age group. However, the methodology used in this dissertation is transparent and easy to apply at the household level. We are optimistic that results obtained provide a good approximation of the actual distribution of the VAT burden in Tanzania. This makes sense especially for developing countries because ranking household by consumption gives a better approximation of income distribution.

5.4 Areas for Future Research

Future research may further improve the results by considering home production vs marketed items, rural vs urban, as well as taking into consideration consumption pattern for different income groups. A comprehensive comparison needs to be done to compare the VAT and the previous sales tax. The problem of tax evasion, especially in developing countries, cannot be over-emphasized. It might be of interest to study how effective a broad based VAT system is in reducing tax evasion. A comprehensive research on the

distribution of financial services is important before any move to taxing financial services. Meanwhile if Tanzania adopted the 18.5 percent VAT, limiting exemptions to a few items could be more appropriate.

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APPENDICES

A1. The Bootstrap Methodology

Anderson, Roy and Shoemaker (2003) developed a methodology (Bootstrap methodology) for estimating confidence intervals for differences in Suits Indices. The Bootstrapping is a computer intensive resampling method that can provide standard error estimates and confidence intervals for parameters of interest without a parametric specification. Any statistical package can be used to estimate the bootstrap - t -intervals. According to Anderson *et al*, one must program this task using programs like GAUSS or other common mathematical program. Programs that are written in FORTAIN, C,C++, Java, or VB can also be written in GAUSS.

Their method computes the bootstrap-t-statistics in order to build a student-t-table to be used to construct a confidence interval around the point estimate provided by the Suits index. They argue that the bootstrap-t-table constructed from the data using this procedure is only appropriate for the data at hand. The algorithm for computing the bootstrap-t-confidence interval for changes in the suits index was developed by Efron and Tibshirani (1993).

Step 1. $\hat{S}_1$ and $\hat{S}_2$ are estimates of Suits Indices, S_1 and S_2 computed from samples X_1 and X_2 consisting of n cross section observations on the income and tax liability. Each sample

has two variables income and tax liability. Hence X_1 and X_2 are both matrices of dimensions nx2.

Step 2 . *N* independent bootstrap random samples are drawn with replacement from the sample X_1 and are denoted by *nx2N* matrix,

$$x^*_1 = [x^*_{11},\ x^*_{12}\ldots\ x^*_{1N}]_{nx2N} \quad \ldots\ldots(1)$$

where, x^*_{1i} represents the i^{th} bootstrap random sample drawn with replacement from X_1. The resulting nx2 matrix is denoted as,

$$x^*_{1i} = [x_{1i,1},\ x_{1i,2}] \text{ for all } i = 1,\ldots,N. \quad \ldots\ldots(2)$$

In this matrix $x_{1i,1}$, is the first column vector *and* $x_{1i,2}$ is the second column vector each containing n observations on income (or current consumption in our case) and tax liability.

The same procedures is followed to draw N independent bootstrap random samples from the sample X_2 , denoted as the *nx2N* matrix,

$$x^*_2 = [x^*_{21}, x^*_{22}, x^*23\ldots\ldots x^*_{2N}]_{nx2N}, \quad \ldots\ldots(3)$$

where x^*_{2i} represents the i^{th} bootstrap random sample drawn with replacement from sample X_2. The resulting *nx2* matrix is denoted as,

$$x^*_{2i} = [x_{2i,1},\ x_{21,2}] \text{ for all } i = 1,\ldots,N \quad \ldots\ldots(4)$$

where, $x_{2i,1}$ is the first column vector and $x_{21,2}$ is the second column vector containing n observations on income and tax liability, respectively.

Step 3 Each random samples in both matrices x^*_1 and x^*_2 is sorted by income. Sorted bootstrap samples are then used for the estimation of bootstrap replications of the Suits Indices. Corresponding to each bootstrap sample in matrix, x^*_1, a bootstrap replication of the Suits Index is calculated. An Nx1 vector represents N bootstrap replications of Suits Indices as

$$s^*_1 = [s^*_{11}, s^*_{12}, s^*_{13}, \ldots, s^*_{1N}]_{Nx1} \quad \ldots\ldots(5)$$

where, $s^*_{1i} = s^*_{1i}(x^*_{1i})$ for all $i=1\ldots,N$.

The same procedure is followed for each bootstrap sample in vector x^*_2 to create the N bootstrap replications of Suits Indices, defined by the $Nx1$ vector

$$s^*_2 = [s^*_{21}, s^*_{22}, s^*_{23}.., s^*_{2N}]Nx \quad \ldots\ldots(6)$$

where $s^*_{2i} = s^*_{2i}(x^*_{2i})$ for all $i=1, \ldots, N$.

Step 4. The difference between the two vectors s^*_1 and s^*_2 is computed as

$$s^*_d = [(s^*_{21} - s^*_{11}), (s^*_{22} - s^*_{12}), (s^*_{23} - s^*_{13}), \ldots, (s^*_{2N} - s^*_{1N})]_{Nx1} \quad \ldots\ldots(7a)$$

which is equal to,

$[s^*_{d1}, s^*_{d1}, s^*_{d1}, \ldots\ldots s^*_{dN}]_{Nx1}$ .....(7b)

where, $s^*_{di} = s^*_{di}(x^*_{1i}, x^*_{2i})$ for all $i = 1, \ldots N$.

In order to be able to compute the bootstrap- t- statistic, standard error of each bootstrap replication of Suits Indices is required. But since the distribution of the Suits Index is unknown there is no statistical formula for estimating standard errors of the difference between the Indices in vectors s^*_d.

The bootstrap algorithm for estimating standard errors is as follows:

Step 4a. m bootstrap random samples (with $m<N$) are generated with replacement, corresponding to each random sample in vector x^*_1 and denoted by the $nx2mN$ matrix as

$Y^*_1 = [y^*_{11}, y^*_{12}, y^*_{13}, \ldots\ldots\ldots, y^*_{1N}]_{nx2mN}$ .....(8)

Where, each y^*_{1i} is a matrix of dimension $n\,x2m$ and contains m random samples of size n and this can be written as

$y^*_{1i} = [y^*_{1i,1}, y^*_{1i,2}\ y^*_{1i,3}, \ldots\ldots\ldots y^*_{1i,N}\ ]_{nx2m}$ for all $i=1, \ldots\ldots N$.....(9)

Each $y^*_{1i,j}$ is the j^{th} random sample drawn with replacement from the i^{th} sample in matrix, x^*_1, and is denoted by the $nx2$ matrix as

$y^*_{i1,j}=[\,y^*_{i1,j1}, y^*_{i1,j2}]_{nx2}$ for all $j=1,...m.$ and $i=1,...n,$.....(10)

where $y^*_{i1,\,j1}$ is the first column vector and $y^*_{i1,\,j2}$ is the second column vector containing n observations on income and tax liability in that order.

In the same way m (where $m<N$) bootstrap random samples are also drawn with replacement corresponding to each random sample in vector x^*_2 and denoted by the $nx2mN$ vector as

$Y^*_2=[y^*_{21},y^*_{22},y_{23},....,y^*_{2N}]_{nx2mN}$... .....(11)

Where, each y^*_{2i} is a matrix of bootstrap random samples $nx2m$ drawn with replacement from sample and can be denoted as for all i = 1,...,N, where $y^*_{2i,j}$ is the j^{th} random sample of size n drawn from the i^{th} sample in matrix x^*_2 and denoted by the $nx2$ matrix as

$y^*_{2i,j}=[y_{2i,j1},y_{2i,j2}]_{nx2}$ for all $j=1,...,m$ and $i=1,...N$.....(12)

where $y_{2i,j1}$, is the first column vector and $y_{2i,j2}$ is the second column vector containing n observations on income and tax liability respectively.

Step 4b In order to compute the bootstrap replications of Suits Indices from mN random samples contained in matrices, Y^*_1 and Y^*_2, the samples are first sorted by income, then a

bootstrap replication of the Suits Index is calculated corresponding to each sample in the i^{th} matrix, y^*_{1i} and this is denoted by the *mx1* vector,

$$s^{**}_{1i} = [s^{**}_{1i,1},\ s^{**}_{1i,2},\ s^{**}_{1i,3}, \ldots\ldots\ s^{**}_{1i,m}]'_{mx1} \text{ for all } i = 1, \ldots N \quad \ldots\ldots(13)$$

In the same way a bootstrap replication of the Suits Index is calculated corresponding to each sample in the i^{th} matrix, y^*_{2i} and denoted by the *mx1* vector,

$$s^{**}_{2i} = [s^{**}_{2i,1}, s^{**}_{2i,2}, s^{**}2i,3\ \ldots\ldots s^{**}_{2i,m}]'_{mx1} \text{ for all } i = 1, \ldots N \quad \ldots\ldots(14)$$

Step 4c The difference between the vectors s^{**}_{1i} *and* s^{**}_{2i} is estimated for all $i = 1, \ldots N$ and denoted by the vector,

$$s^{**}_{di} = [(s^{**}_{2i,1} - s^{**}_{1i,1}), \ldots\ldots\ldots\ldots, (s^{**}_{2i,m} - s^{**}_{1i,m})]'_{mx1} \quad \ldots\ldots(15a)$$

This equals to

$$(s^{**}_{di,1}, s^{**}_{di,2}, s^{**}_{di,3}, \ldots s^{**}_{di,m})'_{mx1} \quad \ldots\ldots(15b)$$

where, $s^{**}_{di,j} = s^{**}_{di,j}(y^*_{1i,j} - y^*_{2i,j})$ for all $i = 1, \ldots N$

and $j = 1, \ldots m$. There are Ns^{**}_{di} vectors.

Step 4d. The formula for computing bootstrap standard errors of each $s^*_{di}(i = 1, \ldots N)$ *is*

$\hat{\sigma}^*_{di} = \sqrt{(\sum_1^M (s^{**}_{di} - \bar{s}^{**}_{di})^2/(m-1)}$ for all $i = 1, \ldots N$ .....(16)

where, $\bar{s}^{**}_{di} = \sum_1^m s^{**}_{di}/m$.

Step5. The bootstrap –t-statistic is computed for each s^*_{di} and is defined by,

$t_1^b = s^*_{di} - \hat{S}_d / \hat{\sigma}_{di}$ .....(17)

where $\hat{S}_d$ is a function of X_1 and X_2 , and is the estimate of the population value S_d, and s^{**}_{di} is the i^{th} bootstrap replication computed from the bootstrap samples x^*_{1i} and x^*_{2i} .

The bootstrap-*t*-table is constructed from the ordered values of t_i^h . Example for N = 1000 the estimates of the 5 percent and 95 percent points are the 50^{th} and 950^{th} largest values of t_1^h, respectively.

Step 6. Estimation of the confidence interval for S_d requires the standard error of its estimate, $\hat{S}_d$. The bootstrap standard error, $\hat{\sigma}_d$ of $\hat{S}_d$ is estimated utilizing the bootstrap method for calculating standard errors.

Step 7. The 100(1-2α) percent confidence interval for S_d is given by the expression [$\hat{S}_d - t^{(1-\alpha)}_d \hat{\sigma}_d$, $\hat{S}_d + t^{(1-\alpha)}_d \hat{\sigma}_d$].

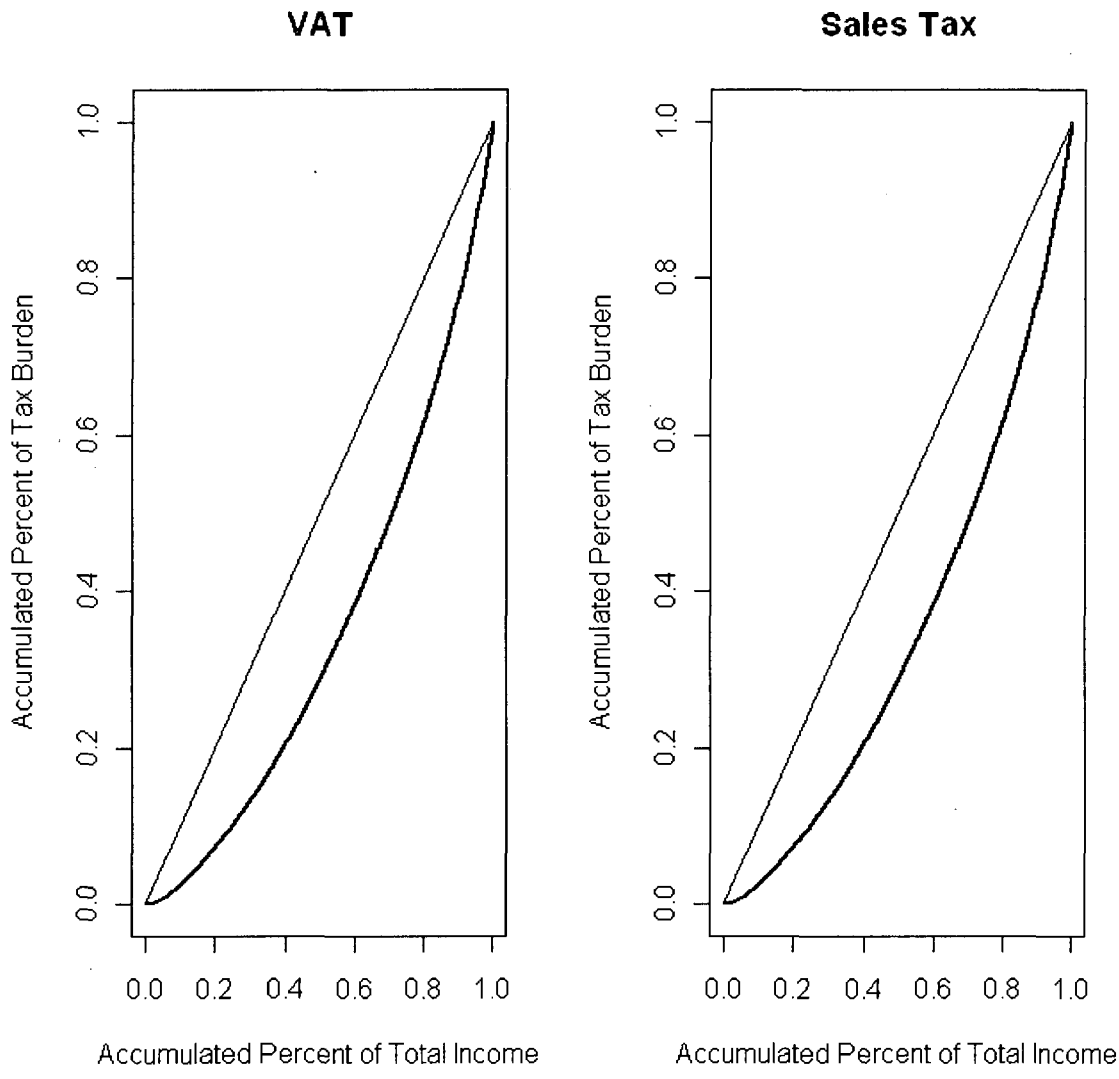
Anderson *et al* also provides an alternative for cases where $N\alpha$ is not an integer. They assume $\alpha \leq 0.5$ and let $k = [(N+1)\,\alpha]$, the largest integer $\leq (N+1)\,\alpha$. Then the α and $(1-\alpha)$ quintiles are defined by the k^{th} largest and $(N+1-k)^{th}$ largest values of (t^h)s .

Estimation of the bootstrap t interval requires N to be at least 1000, while the standard error estimation requires the number of bootstrap samples to be in the range of 25 to 100.

The student t statistic is called an approximate pivot *i.e* the distribution of the student t statistic is approximately the same for each population value of the parameter of interest. They say that this property allows the construction of bootstrap-t-intervals from the distribution of (t^h)s.

Bootstrap simulation results for the VAT and sales tax are shown below.

```
ORDINARY NONPARAMETRIC BOOTSTRAP


Call:
boot(data = cbind(data$lifetime.income, data$value.added.tax.burden),
   statistic = f, R = 1000)


Bootstrap Statistics :
    original       bias    std. error
t1* 0.1365547 -3.23094e-05 0.002495644
> boot(cbind(data$lifetime.income, data$sales.tax.burden),
+ f, R=1000)

ORDINARY NONPARAMETRIC BOOTSTRAP


Call:
boot(data = cbind(data$lifetime.income, data$sales.tax.burden),
   statistic = f, R = 1000)


Bootstrap Statistics :
    original       bias    std. error
t1* 0.1827684 -8.878035e-05 0.002500359
>
```


VAT
Accumulated Percent of Tax Burden
0.0
0.2
0.4
0.6
0.8
1.0
0.0 0.2 0.4 0.6 0.8 1.0
Accumulated Percent of Total Income
Sales Tax
Accumulated Percent of Tax Burden
0.0
0.2
0.4
0.6
0.8
1.0
0.0 0.2 0.4 0.6 0.8 1.0
Accumulated Percent of Total Income

A 2. Items Exempted from VAT

According to the Value Added Tax Act of Tanzania, 2006 revised edition the following items are exempted from the VAT.

1. Unprocessed food: This includes unprocessed animal products, unprocessed diary products, all unprocessed fish except shellfish and ornamental fish, unprocessed agricultural products such as vegetables and fruits, seeds and plants.[1] None of these items can be exempt when they are supplied in the form of catering by a restaurant, cafeteria, and canteen or like establishment.
2. Locally grown tea whether in the form of roasted, blended or packed, locally grown coffee whether in the form of roasted, grounded or instant coffee.
3. Pesticides, fertilizers, insecticides, fungicides, rodenticides, herbicides and all products necessary for use in agricultural production.
4. Health supplies: This includes medical services, human medicine and drugs, articles designed for use by the blind or disabled, mosquito coils, sanitary pads.
5. Educational supplies provided by an establishment registered by the government.
6. Veterinary supplies
7. Books and newspapers
8. Transport services: This includes transport of persons, by any means of conveyance including air charter but not including taxi, cabs, rental cars, boats or boat charters.

[1] Goods are regarded as unprocessed if they have undergone only simple process of preparation or preservation such as freezing, drying, chilling, salting, smoking, stripping or polishing. S

9. Housing and land: This includes the sale or lease of an interest in land, the sale of used or leased residential building.
10. Financial and Insurance services. This includes provision of any insurance services, transfer or receipts of money, provision of any loan, advances or credit, operation of current, deposit or savings account, transfer of ownership of equity, issue, payment, collection or transfer of ownership of any note or order of payment, cheque or letter of credit, the issue, drawing, acceptance or transfer of ownership of a debt or security including debentures, mortgages, loans and other debts in money. The supply or importation of currencies and travelers cheques to a registered bank, bureau de change and other financial institutions.
11. Water except bottled water or canned water or similarly presented drinking water.
12. Funeral services
13. Petroleum products such as jet fuel, LPG gas or LPG cylinders, petrol, diesel, kerosene and others.
14. Agricultural implements such as tractors, planters, harrows, combine harvesters, fertilizer distributors, sprayers, spades, hoes and all other tools used for agriculture, horticulture or forestry.
15. Tourist Services including tourist guiding, game driving, water safaris, animal or bird watching, ground transport and tourist charter services
16. Postal supplies such as the supply of postage stamps.
17. Aircraft engines and lease of aircraft.
18. Fishing nets and accessories, and outboat engines for fishing
19. Games of chance by means of private lotteries, casinos or slot gaming machines.

20. Computer, printers, parts and accessories connected thereto and specified cash registers

21. Locally processed yarn.

22. Packing materials

23. Winding generator and liquid elevators

24. Photovoltaic and Solar Thermal. This includes solar charge controllers, solar inventor, solar batteries, solar pumps, solar refrigerator, solar light, solar cooker, solar cooling system components and crop driers.

Table A3: Tax Rates for Selected Items (Tanzania Sales Tax Act, 1976)

Items	Sales Tax rate (1976)
Wheat, flour	24.00
Biscuits	12.00
Macaroni, spaghet	12.00
Cooking oil, oats	12.00
Sugar, Syrup, jams	12.00
Dried / canned vegetables	12.00
Dried/canned fruits	12.00
Sausages	12.00
Canned meat	12.00
Cheese	12.00
Curry powder	12.00
Instant coffee	12.00
Wine & spirits	40.00
Lamp/stove	26.00
Beds	12.00
Chairs, sofas, Tables and mirrors	12.00
Sheets, pillow	35.00
Blankets	57.00
Towels and bedspread	40.00
Table-cloth and curtains	40.00
Mattresses	40.00
Mosquito nets	30.00
Other linen	40.00
Dishes, plates, cups, glasses and mugs	12.00
Knives, fork, spoons	12.00
Thermos flask	24.00
Torches, batteries	10.00
Khanzus	12.00
Hats, caps, turban	12.00
Sarong, jackets, pullovers, sweaters	57.00
Coats, winter coats and rain coats	57.00
Shirts, cotton cloth	35.00
Other cloth	57.00
Leather shoes	12.00
Other men's	12.00
Khanga	55.00
Sarees	35.00
Trousers	57.00
Head gear	12.00
Scarves, shawls	57.00
Stocking, socks	35.00
Other footwear	12.00
Yarn & sewing	57.00
Umbrellas, gloves	12.00
Watches	18.00
Jewelers	24.00
Radio	24.00
Record/cassettes	24.00
Sports equipment	12.00
Telephone	12.00
Stamp & other	12.00
Pipe tobacco	24.00