# EFFECTS OF VALUE ADDED TAX REFORMS ON HOUSEHOLD WELFARE AND COLLECTION EFFICIENCY AND THE DETERMINANTS OF ITS COMPLIANCE GAP IN KENYA

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## DECLARATION

This thesis is my original work and has never been presented for the award of a degree in any other university, or for any other award.

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## DEDICATION

I dedicate this thesis to my wife Winnie Apondi and my late mother Doryne Aoko.

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| **ADB** | Africa Development Bank |
| **ATAF** | African Tax Administration Forum |
| **AUC** | African Union Commission |
| **BRP** | Budget Rationalization Programme |
| **DTD** | Domestic Tax Department |
| **ERS** | Economic Recovery Strategy |
| **ETR** | Electronic Tax Register |
| **GDP** | Gross Domestic Product |
| **IBFD** | International Bureau of Fiscal Documentation |
| **IFS** | Institute for Fiscal Studies |
| **IMF** | International Monetary Fund |
| **KIPPRA** | Kenya Institute for Public Policy Research and Analysis |
| **KRA** | Kenya Revenue Authority |
| **OECD** | Organization for Economic Co-operation and Development |
| **RA – GAP** | Revenue Administration – Gap Analysis Programme |
| **RARMP** | Revenue Administration Reform and Modernization |
| **TMP** | Tax Modernization Programme |
| **VAT** | Value Added Tax |

## OPERATIONAL DEFINITION OF TERMS

**Consumption tax** This is tax levied on consumption of goods and services and include value added tax, import duty, and excise tax.

**Efficiency of a tax system** This is the ability of a tax system to give maximum revenue at minimal cost possible.

**Exempted goods and services** These are goods and services that are not subjected to value added tax and are also not eligible for refund of VAT paid on inputs.

**Productivity** Efficiency of a tax in terms of revenue collection.

**Tax gap** This is the difference between the potential revenue capacity of a tax and the actual revenue collected. It is actually the amount of revenue lost either due to tax evasion, inefficiency of tax or tax avoidance.

**Tax Reforms** These are changes made on the tax system of a country from time to time to meet changing needs of the government and economy.

**Value Added Tax** This is a consumption tax levied incrementally, based on value addition of a product or service at each production level or distribution.

**Value Added Tax Gap** This is the difference between the predicted VAT revenue and actual VAT revenue collected.

**VAT reforms** These are the changes made in the tax system to ensure maximum collection of value added tax.

**Welfare** The level of prosperity and improvement in the standard of living of the population of an economy.

**Zero rated commodities** These are commodities that are not subjected to value added tax. However, traders are entitled to claim value added tax refund on inputs used.

## ABSTRACT

The study evaluated the Value Added Tax reform process in Kenya, and established its effect on welfare of households and collection efficiency of Value Added Tax. In addition, the study estimated the Value Added Tax gap in Kenya and evaluated its determinants. The study made use of the Quadratic Almost Ideal Demand System model to assess the effects of Value Added Tax reforms on household welfare, Value Added Tax efficiency was measured using the Collection-Efficiency model and Value Added Tax gap was estimated using the International Monetary Fund Revenue Administration-GAP model. Secondary data was used from the year 2015/16 Kenya Integrated Household Budget Survey, whereas data on value added tax revenue, final consumption, Gross Domestic Product, was obtained from Statistical Abstracts, Economic Surveys, Kenya Revenue Authority and World Bank Data base. The study found the VAT reforms in Kenya to have led to decline in welfare of households, since the uncompensated price elasticities for all the selected ten food items were found to be negative; tea leaves, sugar, beans, salad, white-bread, rice, cooking fat, spices, soda, maize, which was an indication that consumers would respond to increase in prices of the commodities by cutting down their expenditure on them. Further, coefficients of eight out of the ten food items exhibited positive expenditure elasticities; sugar, beans, salad, white-bread, rice, cooking fat, soda, and maize. The results demonstrated that households were under consuming these commodities and required either a reduction in their prices or income compensation to consume more, this was another pointer of decline in welfare of households as a result of VAT reforms in Kenya whose net effect was general increase in price levels. The tax reforms were found to have significantly improved VAT collection efficiency but also contributed to widening of VAT compliance gap in Kenya. The ARDL model run to estimate the determinants of VAT compliance gap obtained the following results; standard VAT rate (0.097), VAT reforms (0.150), number of VAT rates (-0.022), manufacture value added growth (0.032), population growth (-4.91), import as a percentage of GDP (0.066), final consumption as a percentage of GDP (-0.122), and export as a percentage of GDP (-0.087), all significant at one, five and ten percent levels. These results revealed that tax evasion and avoidance were quite rampant in Kenya and also laxity on the part of Kenya Revenue Authority to effectively collect VAT revenue. This study will be useful for future policy formulation in Kenya and in designing more effective tax reforms with consideration to welfare of households by the National Treasury, Kenya Revenue Authority and Scholars.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

This section presents the global perspective of Value Added Tax reforms, Kenya's Value Added Tax reforms, the performance of Value Added Tax in Kenya and welfare effect of the Value Added Tax reforms in Kenya.

### 1.1.1 Global Perspective of Value Added Tax Reforms

Taxation is the main source of revenue for the day to day operations of the government and also plays a critical role in income redistribution within an economy. To perform these duties, there is need for a good tax policy weighed against the following criteria: economic efficiency; economic growth; revenue adequacy; revenue stability; simplicity; and low administrative and compliance costs (Glenn, Kuo & Shukla, 2000). The revenue generation role of the taxes has been given much attention across the globe since both developing and developed economies have been confronted with growing fiscal deficits which have been attributed to inadequate budgetary resources, wasteful budgetary process, loopholes in budgeting process, tax evasion, excessive government borrowing, weak revenue mobilization and increased public expenditure (Wawire, 2006; Kosimbei, 2009 and International Monetary Fund, 2013).

To arrest the growing fiscal deficit, a number of economies in the world have embarked on tax reforms as an instrument for raising tax productivity (Chipeta, 1998). Further, upsurge of tax reforms has also been attributed to the growing need to substitute

dwindling public enterprise profits with tax revenue as the main source of government revenue, adjustment of tax policy to conform with the dynamics of global development strategy and globalization which has led to the need to standardize economic activities to the international standards (Rao, 2005)

Consequently, tax reforms ought to lead to a growth-oriented tax system that endeavor not only to abate economic distortions but also promote drivers to economic growth such as investment, entrepreneurship and innovation (Organization for Economic Co-operation and Development, 2010a). According to OECD income taxes were more harmful to economic growth than consumption taxes hence a growth-oriented tax reform should shift burden from income taxes to consumption taxes. Tax reforms have tended to be biased towards consumption taxes and more so the Value Added Tax (VAT). Which is believed to have high revenue potential, to be less distortionary, efficient, cost effective and has a broader base (Moyi & Muriithi, 2003; Bird, 2005; Keen & Lockwood, 2010). The VAT has been adopted in more than 160 countries across the globe, in both developed and developing economies as part of the tax reform process (International Bureau of Fiscal Documentation, 2014).

In support of the increasing prevalence of VAT reforms across the globe, Institute for Fiscal Studies (2010) noted that despite being a fruitful fiscal modernization, no single VAT system was optimal and this was attributed to its inefficient administration, narrow base, rampant evasion and less than optimal rate structure leading to huge revenue shortfalls occasioned by widening VAT gap. Against this backdrop, the trilemma most

countries have been facing with their VAT is how to balance equity, efficiency principles of their VAT systems and at the same time ensure maximum compliance level hence minimal VAT gap. Many countries that adopted VAT therefore almost immediately embarked on further reforms of the same. For instant in Kenya barely a year after its inception in 1990, a number of reforms of VAT were initiated in the system primarily to simplify its compliance and to increase its revenue potential (Moyi & Muriithi, 2003). Some countries adopted single rate VAT whereas others adopted multiple rate VAT. Those who adopted the former have been grappling with the optimal rate to administer for VAT while those with the latter debate on whether to change to single rate. In advocating for differentiated rate VAT rates in developing countries OECD (2010b) highlighted redistributive role as a justification for this noting the limited options for target transfer in these countries while acknowledging their inability to effectively administer it and tackle frauds that may accompany it leading to a growing level of VAT gap as a result of either of the two factors or a combination of both. On the other hand, single rate VAT has been considered to be less distortionary and more efficient. Levin and Sayeed (2014) further argued that a single rate VAT may be less distortionary and more efficient however, from the welfare perspective, basic necessities such as food ought to be exempted from VAT.

This is because low income households spend a high proportion of their income on them. Conversely, while assessing VAT, Adhikari (2015) observed that one of the main limitations of VAT is that it is regressive since its burden is heavier on the low income households because they spend higher fraction of their income on consumption hence

resulting to welfare loss, this is in agreement with Maingi (2010) who argued that a higher tax burden is not desirable for both individuals and corporations since it leads to reduction of disposable income for the former hence low consumption, low savings and investment while for the latter, it leads to decrease in sales revenue therefore deterring growth.

On the contrary, Keen (2013) view exemptions as a source of inefficiency in VAT resulting to huge revenue loss which could otherwise be directed to increase public expenditure directed at supporting low income members of the society. Empirical evidence from Liberati (2000) demonstrated that the relative price variations occasioned by differentiated VAT rates resulted to welfare loss leading to higher inequality level in Italy. The debate of whether to adopt a single rate or multiple rate VAT has therefore played a key role in the ongoing wave of VAT reforms across the globe with most countries sending signals of their preference of single rate VAT.

Although VAT is thought to be an efficient source of revenue to government, Adhikari (2015) argued that its proponents overlook the diverse economic environments in which it is implemented such as the level of economic development of the country, size of informal sector in the economy, tax capacity, tax evasion and tax administrative capacity of the country, which can have significant influence on the efficiency of the VAT system. Therefore, the numerous factors determining VAT efficiency are country specific and can only be addressed case by case.

Introduction of VAT in African countries has been lauded as the most significant tax reform over the last three decades and by 2012, a number of African countries had adopted it. However, as already noted, most countries which adopted VAT followed immediately with major reforms in the tax administration. Following the various VAT reforms, the average VAT as a percentage of GDP for a sample of 16 African countries increased from 3.7 per cent in the year 2000 to 5.7 per cent in the year 2015. On the contrary, revenue from other taxes declined in these countries over the same period. The latter case is attributed to trade liberalization (Organization for Economic Co-operation and Development, African Tax Administration Forum & African Union Commission, 2017).

According to OECD, ATAF & AUC (2017), Morocco realized positive gains in her tax reforms that were conducted between the year 2003 and the year 2013 where VAT was the main target. These reforms entailed both tax policy and administrative reforms of the tax system and resulted to an overall increase in tax revenue from 23.1 percent of GDP to 28.1 percent of the countries GDP during the reform period. Morocco's VAT registered an impressive growth in comparison to most African countries during the same period with VAT as a percentage of GDP growing at a rate of 2.8 percent unlike most African countries whose VAT grew by less than 1.0 percent as a percentage of GDP.

East Africa region also joined the rest of the world in VAT adoption and reforms of the same thereafter. Kenya, Uganda, Tanzania and Rwanda introduced their VATs in the years 1990, 1996, 1998 and 2001 respectively with slight disparity in their standard VAT

rates Kenya's being 16% and Uganda, Tanzania and Rwanda's being 18% in the financial year 2017/18. All these countries have already made a few if not several attempts to reform their VATs since introduction. Rwanda introduced a raft of reforms in her VAT exactly one year after its inception which included a review of the standard rate from 15 percent to 18 percent and inclusion of a number of goods and services in the VAT exempt list such as educational services, agricultural foods and public transport (Heshmati, 2016). Heshmati conducted a study to evaluate the effect of these reforms on household welfare in Rwanda, the findings established that the increase in standard VAT rate from 15% to 18% had a negative effect on houshold welfare, moreso the household in the first three quintiles which consumed more of the taxable goods. The study concluded that mutliple rate VAT could result to welfare gain in Rwanda without widening the VAT gap leading to revenue gain.

### 1.1.2 Kenya's Value Added Tax Reforms

Tax reforms in Kenya has been informed by the understanding that tax base has been tremendously narrow resulting to widening tax gap and low tax revenue collection. Among the raft of measures recommended by IMF to address the issue of dwindling tax revenue collections in Kenya, was replacement of sales tax with VAT (Cheeseman & Griffi ths, 2005). In the fiscal year 1989/90, Kenya substituted the sales tax with VAT which became effective from 1st January 1990. The change was based on the thought that VAT had a higher revenue productivity due to its broader base. Unlike the sales tax it covered both manufactured goods as well as other goods and services.

At the inception, credit-invoice system VAT was adopted with a standard rate of 17 per cent together with 14 other rates with the lowest rate being zero per cent and the highest being 210 per cent. Within the first year of VAT implementation, the Ministry of Finance that was charged with administration of taxes was faced with a number of challenges in administration of the new tax. These included low level of compliance, misclassification, too many applications for VAT exemptions and high rate of smuggling. To address these challenges, the country embarked on the first phase of VAT reforms. The reforms undertaken included the rationalization of the VAT rates. Table 1.1 gives an account of the VAT rationalization process and variations in standard rates from the fiscal year 1989/90 to the fiscal year 2016/17.

**Table 1.1 Value Added Tax Rationalization Progression in Kenya**

| Fiscal year/ | Number of VAT rates | Standard VAT rate | Other VAT rates |
|---|---|---|---|
| 1989/90 | 15 | 17 | 0, 3, 5, 17, 18, 25, 30, 35, 45, 50, 75, 80, 100, 150, 210 |
| 1990/91 | 9 | 18 | 0, 5, 30, 45, 50, 80, 100, 150 |
| 1991/92 | 8 | 18 | 0, 5, 25, 35, 50, 75, 100 |
| 1992/93 | 6 | 18 | 0, 3, 5, 30, 50 |
| 1993/94 | 4 | 18 | 0, 5, 40 |
| 1994/95 | 4 | 18 | 0, 5, 30 |
| 1995/96 | 4 | 15 | 0, 6, 25 |
| 1996/97 | 3 | 15 | 0, 8 |
| 1997/98 | 3 | 17 | 0, 10 |
| 1998/99 | 4 | 16 | 0, 10, 12 |
| 1999/00 | 4 | 15 | 0, 10, 13 |
| 2000/01 to 2002/03 | 4 | 18 | 0, 10, 16 |
| 2003/04 to 2006/07 | 3 | 16 | 0, 10 |
| 2007/08 to 2009/10 | 3 | 16 | 0, 12 |
| 2010/11 to 2011/12 | 4 | 16 | 0, 12, 14 |
| 2012/13 | 3 | 16 | 0, 12 |
| 2013/14 to 2016/17 | 2 | 16 | 0 |

**Source:** Karingi and Wanjala, (2005); KRA; Economic Surveys, various issues

The process of VAT rates rationalization was believed to help in reducing tax evasion and promote competitiveness of domestic products (Karingi & Wanjala, 2005). Kenya's VAT was subjected to radical reforms as can be seen in Table 1.1, barely three years after its adoption, the VAT rates had already been reduced from fifteen to four, in 1996/97 the rates were further reduced to three then back to four again in 1998/99, in 2003/04 the rates were reduced to three and back to four again in 2010/11 and to three in 2012/13 and in 2013/14 to 2016/17 the rates remained two. Whereas the highest rate had been reduced from 210 per cent to 150 per cent, 100 per cent, 50 per cent, 40 per cent, 30 per cent, and 25 per cent in the years 1990/91, 1991/92, 1992/93, 1993/94, 1994/95 and 1995/96 respectively. From 1996/1997 to the year 2016/17, the highest rate has been the

prevailing VAT standard rate. The standard rate has also been reviewd from the year 1989/90 to the year 2016/17 as follows: In 1989/90 the standard rate was 17 per cent which was reviewed upwards to 18 percent in 1990/91, it was later reduced to 15 per cent in 1995/96, in 1997/98 the rate was reviewed upwards to 17 per cent, then dowdwards to 16 per cent in 1998/99 then to 15 per cent and 18 per cent in the years 1999/00 and 2000/01 respectively. From the year 2003/04 to the year 2016/17 the standard rate remained at 16 per cent.

To optimize VAT revenue productivity in Kenya, additional measures were undertaken. From the fiscal year 1990/91 to the fiscal year 1995/96 the base of VAT was widened to bring in as many goods and services as possible to the VAT bracket. The outstanding ones include, the service sector whose coverage was extended to comprise transport services, personal services, maintenance and repair of equipment inclusive of motor vehicles, hotel/restaurant services, businesses, conferences, construction, advertising and telecommunication. Goods designated not to include supply of immovable property, rental and intangible property were also included. There was also a gradual transfer of tax point from manufacture level to retail point in so many sectors like furniture, jewellery, entertainment equipment and household appliances and the retail point sales tax was charged to manufacture point VAT together with business services (Moyi & Muriithi, 2003).

Kenya joined the rest of the world in undertaking comprehensive tax reforms on the tax administration by establishing Semi Autonomous Revenue Authorities (SARAs). The Kenya Revenue Authority (KRA) was established by an Act of Parliament (Chapter 469 of laws of Kenya) in July 1995. The revenue authority was tasked with the responsibility of management of revenue collection on behalf of the government, and was to benefit the government in improved revenue collection, efficiency in tax administration, reduced cost of tax compliance, improved service delivery among others (Nada, 2009). Between the financial years 1995/96 and 2008/09 Kenya's tax revenue growth averaged 11 per cent. However, ten years after its inception, KRA through its Second Corporate Plan noted that it had not attained the desired level of integration and that most processes were still manual. To address these challenges, KRA embarked on the Revenue Administration Reform and Modernization Program (RARMP) in 2004/05 with an aim of fully assimilating its operations, bringing in the informal sector into the tax net to broaden the tax base, introduction of Electronic Tax Register (ETR) to improve compliance, and improving on customer focus by the year 2008/09 (KRA, 2006).

In 2004, KRA merged the Income Tax Department and the VAT Department to form the Domestic Tax Department (DTD). In 2005, domestic excise tax was also included in the DTD. The changes were in line with the global practice where most countries with VAT had merged their direct and indirect taxes in order to reduce tax evasion and improve revenue performance to enable automatic verification of data, improve tax administration and reduce compliance burden on tax payers since they would deal with only one department (KRA, 2010).

Despite the numerous reforms, the VAT system in Kenya was still faced with a number of challenges which included the rise in value added tax evasion, the rise on taxable suppliers from the informal sector not registered for VAT and non declaration of taxable sales due to lack of appropriate records, leading to a growing value added tax gap (KRA, 2010). To solve these problems, KRA introduced "Withholding VAT Agency System" in the year 2003. The system required KRA to appoint withholding agents who were tasked with the resposibility of withholding VAT on taxable goods and services and remit to the KRA commisioner on a weekly basis. The Electronic Tax Register System was also introduced in 2005 to improve VAT compliance.

Additional raft of wide-ranging reforms in Kenya's VAT system were introduced in the fiscal year 2012/13 through the Value Added Tax Act of 2013. The act eradicated VAT reduction leading to elimination of reduced VAT rate of 12 per cent on some products and services (fuel oil, diesel, electicity and hotel services) which were moved to 16 per cent bracket. There was also immense reduction in the number of VAT excempt goods and services as well as zero rated goods and services and the enforcement of 16 per cent standard VAT rate on all VATable goods and services. Some of the goods and services that were moved from excempt and zero rated category to taxable category included computers, softwares, text books, cell phones, medical equipment, processed milk and newspapers (Matosek, 2015).

### 1.1.3 The Performance of Value Added Tax in Kenya.

Kenya's value added tax revenue trend is as shown in figure 1.1.

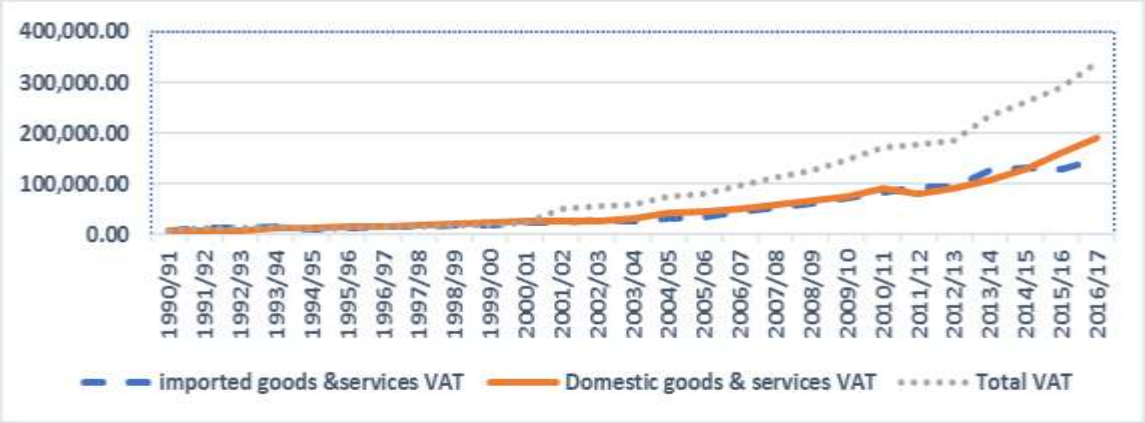


**Figure 1.1 Kenya's VAT trend from the fiscal year 1990/91 to the fiscal year 2016/17**
**Source of data:** Republic of Kenya, various issues of Economic Survey

The reforms have been successful to some extent as the VAT revenue has been on an upward trend over the years though the rate of increase has been almost static throughout this period. Figure 1.1 is showing that domestic goods and services VAT revenue has been growing at almost the same rate as the imported goods and services VAT whereas the reforms that have been undertaken so far on the Kenya's VAT system have to a large extent targeted domestic goods and services therefore one way of gauging its success would be looking at the performance of the domestic goods and services VAT revenue growth over time which ought to be far much better than the import goods and services VAT revenue, but that has not been the case in Kenya.

As a result of the VAT reforms in Kenya, the number of enlisted tax payers rose by 90 per cent from 4,421 in the financial year 2002/03 to 8,785 in the financial year 2003/04. Further, there was a 14 per cent increase in VAT revenue within the same period to Ksh. 31,411 billion in 2003/04 from Ksh. 27,586 billion in 2002/03 and Ksh. 40,183 billion in

2004/05 (KRA, 2010). In the financial year 2004/05 to 2005/06 there was a rise in VAT revenue from Ksh. 42 billion to 52 billion translating to 24 per cent growth. However, Kenya has continued to record underperformance of VAT. Cheeseman & Griffiths (2005) attributed the underperformance of Kenya's VAT and KRA to high rate of unemployment in the country, increasing size of the informal sector, tax evasion, corruption, high rate of poverty in the country and laxity in implementation of tax policies.

The key performance indicator for VAT by the KRA is the percentage of VAT revenue to the total tax revenue. In the period 2015 to 2018 the revenue authority had set a target of attaining a VAT revenue to total tax revenue percentage of 27 per cent, 31 per cent and 35 per cent respectively for the years years 2015/16, 2016/17 and 2017/2018 (KRA, 2015). The targets for the first two financial years were not met. This is a clear signal that Kenya's VAT is grossly underperforming despite the numerous comprehensive reforms that it has been subjected to and there is still a huge VAT gap in Kenya. This shows that the reforms have not been effective, or there are issues in the implementation of the reforms.

A key objective of VAT reforms in Kenya has been to improve its efficiency in order to guarantee the government optimal tax revenue collection. The reforms were aimed at making the VAT simpler and easy to administer by reducing the number of VAT rates from about fifteen at the time of its inception to current rates which are only two, zero per cent and 16 per cent with a few items exempted from VAT. It was expected that after the

reforms, the Kenya's value added tax would be more efficient and that KRA would be able to meet its revenue targets from this particular tax and the VAT revenue as a percentage of total tax revenue as well as a percentage of GDP should grow steadily. The trend of VAT as a percent of total tax revenues in the period 2000/01 to 2016/17 is given in figure 1.2.

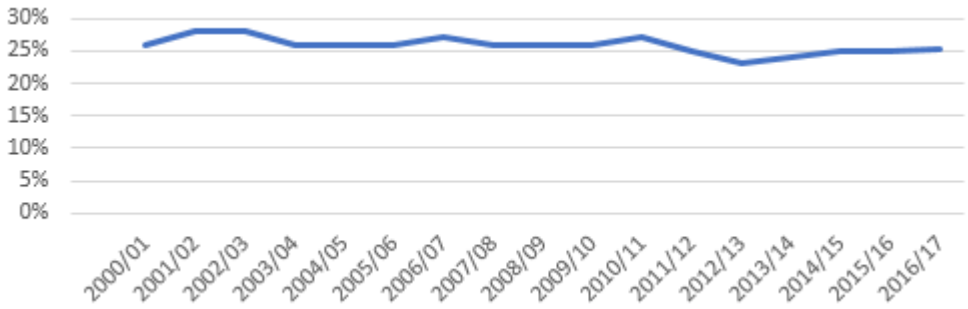


**Figure 1.2: Kenya's total VAT revenue as a percentage of total tax revenue for the fiscal years 2000/01 to the fiscal year 2016/17**

**Source:** KRA

In figure 1.2, VAT as a proportion of total tax revenue declined from about 28 per cent in the fiscal year 2001/02, 2002/03 and stabalised at about 25 per cent from the year 2015/16 to 2016/17. This is a clear indication that Kenya's VAT may not be efficient. Although Kenya has not been conducting tax gap analysis, there are indications that the VAT gap for the country has been widening. On the basis of the VAT revenue targets that KRA sought to achieve from the year 2013/14 to the year 2016/17 and the actual revenue collected during the same period, VAT gap have been increasing as shown in table Table 1.2.

**Table 1.2: Kenya Revenue Authority's VAT Performance Indicator**

| Year | 2013/14 | 2014/15 | 2015/16 | 2016/17 |
|---|---|---|---|---|
| Target VAT revenue % of total tax revenue | 25% | 27% | 31% | 35% |
| Actual VAT revenue % of total tax revenue | 24% | 25% | 25.2% | 25.3% |
| VAT Gap: VAT revenue % of total tax revenue | 1% | 2% | 5.8% | 9.7% |

**Source**: KRA (2015) and Republic of Kenya 2017.

Table 1.2 shows the revenue authority's VAT revenue targets for the years 2013/14, 2014/15, 2015/2016 and 2016/2017 as a percentage of total tax revenue which were 25 per cent, 27 per cent, 31 per cent and 35 per cent respectively. From the table, the actual VAT revenue as a percentage of total tax revenue attained for the respective periods were 24 per cent, 25 per cent, 25.2 per cent and 25.3 per cent. This shows that the gap to attain the expected target for the periods shown in table 1.2 grew steadily from one per cent to two per cent, 5.8 per cent and 9.7 per cent for the respective periods. KRA (2015) estimated Kenya's VAT gap to be between 21.5 per cent to 44.3 per cent which translates to revenue loss of between Ksh. 39.1 billion to Ksh. 81.2 billion.

### 1.1.4 Welfare Impact of VAT Reforms in Kenya

The outcomes of VAT reforms in Kenya indicate that it had both negative and positive effects in the economy as captured in various issues of Kenya's Economic Survey a fact which is in agreement with Heckman and Vytlacil (2005) who argued that attaining a successful tax reforms is a complex process and in most cases the proposed solutions do not consider all the possible outcomes as they may result to benefits which end up being offset by costs that are often overlooked. According to the Republic of Kenya (1992),

Kenya's economy experienced a sudden rise in inflation rate to 19.6 per cent in the year 1991 from 15.8 per cent in the year 1990. This rise in inflation rate was mainly attributed to the introduction of VAT in Kenya together with other factors which included the consequences of the gulf crisis and the depreciation of the local currency.

The rise in inflation rate resulted to decline in the real average earnings in the same year a situation which may have had adverse effects on the welfare of households as well as in the production sector of the economy. In the year 1995, there was a sharp drop in inflation rate to 1.6 per cent from 28.8 per cent in the previous year, a situation majorly attributed to the reduction of the standard VAT rate to 15 per cent from 18 per cent in the fiscal year 1995/96 and tight monetary policy pursued by the Central Bank of Kenya then (Republic of Kenya, 1996). The inclusion of the manufactured essential food in the VAT exempt bracket cushioned the food processing segment from declining further. The decline in inflation rate in 1995 was short-lived as it rose sharply from 1.6 per cent to 9.0 per cent in the year 1996. VAT reforms was partly blamed for the increase and more specifically the extension of VAT coverage on more goods and services within the economy together with other factors such as the rise in prices of petroleum products (Republic of Kenya , 1997). In can therefore be noted that every year when there was a review of VAT rates, there was a corresponding variation in inflation rate.

As a consequence of VAT reforms, the country experienced a decline of 11.6 per cent of import duty realized from importation of tobacco, food and drinks in the period 2000 to 2004. The decline was attributed to the removal of VAT exemption on food products.

This suggests that inclusion of food in the VAT bracket led to rise in its costs and hence less importation. Following the VAT reforms there was a decline of 19.6 per cent in the growth of domestic clothing sub sector in the year 2009 due to imposition of VAT at the rate of 16 per cent on locally produced cotton. In the year 2010 when the sector was exempted fromVAT but imported textile subjected to VAT, the sector experienced growth of 6.6 per cent and grew further in 2011.

From the few cases reviewed under this section on the effects of VAT reforms on household welfare, it is clear that various changes on VAT have varying effects on the economy. The distributional consequences of the broadening of VAT base by removing some goods and services from the zero rated and exempt bracket are of utmost importance in evaluating the welfare effect of the VAT reforms in Kenya.

### 1.2 Statement of the Problem

Kenya's VAT has been subjected to a number of reforms to improve its revenue collection, enhance compliance, curb evasion and improve its efficiency. Some of the notable reforms on VAT include reduction of the rate bands from fifteen to three just two years after its adoption, review of the standard rate, reduction of the number of exempt and zero- rated goods and services, introduction of VAT registration threshold and review of the same, among others. Most of the basic commodities consumed by the low income households that were initially exempted, zero rated or taxed at reduced rates are now taxed at the standard rate of 16 per cent. This has resulted to the rise of prices of the commodities. The welfare of households in Kenya may have been affected by these

reforms, especially low income households who spend a larger proportion of their income on consumption. Further, an increase in tax rate may result to change in behaviour by consumers as some may reduce their consumption of the affected commodities, or shift to consumption of close subtitutes whose prices have not been affected, whereas other consumers may evade the taxes (IMF, 2013). An analysis of the impact of the VAT reforms on the welfare of the low income households in Kenya is therefore necessary to provide empirical evidence for policy reviews.

Despite the comprehensive reforms on the Kenya's VAT system, KRA has raised concerns regarding its performance (KRA, 2015). It was expected that the reforms would improve the efficiency of the tax and raise revenue to account for a minimum of 35 per cent of the overall tax revenue in Kenya. However, in the year 2015, VAT accounted for about 25 per cent of the total tax revenue, far below the 31.5 per cent, average for a sample of 16 African countries in the same year. The VAT to GDP ratio for the same sample was found to have increased from 3.7 per cent in the year 2000 to 5.9 per cent in 2015 (OECD, ATAF & AUC 2017), but for Kenya, the VAT as a percentage of GDP was only 4.6 per cent between 2014 and 2015 (KRA, 2015) way below the Africa's estimated average. The difference between the targeted VAT revenue and the actual VAT revenue attained amounts to loss of revenue. For the year 2013/14 to 2015/16, Kenya's VAT gap was estimated to be between 21.5 per cent to 44.3 per cent translating to revenue loss of between Ksh. 39.1 billion to Ksh. 81.2 billion (KRA, 2015). The low performance of VAT as well as the large VAT gap necessitates an analysis of the extent to which the tax reforms implemented to improve VAT revenue have been effective as well as the

determinants of the VAT revenue gap. This would provide an empirical basis for further VAT reforms.

A number of studies have been done on Kenya's VAT and tax system in general, Muriithi and Moyi (2003), Karingi et al (2004), Nada and William (2009) focused on the general tax reforms and revenue mobilization in Kenya. Moyi and Ronge (2006) concentrated on taxation and tax modernization in Kenya. Whereas, Wawire (2017) focused on determinants of value added tax revenue in Kenya. However, these studies have not assessed the welfare impact of VAT reforms on households in Kenya, as well as the collection efficiency of the VAT post the reforms. There is also no evidence of studies that have decomposed the VAT gap into compliance and policy gap to ascertain the level and the sources of non-compliance. This study is therefore intended to provide an empirical evidence on the identified gaps.

### 1.3 Research Questions

The study intends to answer the following research questions:

i) What is the effect of Value Added Tax reforms on the welfare of households in Kenya?

ii) What is the effect of tax reforms on Value Added Tax revenue collection efficiency in Kenya?

iii) What are the determinants of Value Added Tax compliance gap in Kenya?

## 1.4 Objectives of the Study

The general objective of this study is to establish the effects of value added tax reforms on the economy of Kenya. The specific objectives are:

i) To evaluate the effect of Value Added Tax reforms on the welfare of households in Kenya.

ii) To investigate the effect of tax reforms on VAT revenue collection efficiency in Kenya.

iii) To examine the determinants of Value Added Tax compliance gap in Kenya.

## 1.5 Significance of the Study

This study contributes to the existing literature on the VAT reforms in Kenya and stimulate additional research in the area of taxation. The study creates consciousness of the Value Added Tax reforms process in the country, its effect on welfare of households and establish the determinants of current Value Added Tax compliance gap. Therefore, provide the revenue authority and policy makers with additional information that could be useful in policy formulation and implementation particularly in the area of tax reforms in Kenya so as to improve the tax contribution to revenue without adversely affecting the welfare of tax payers. Households will also be able to understand the welfare impact of VAT reforms in the country.

## 1.6 Scope of the Study

This study focused on the effects of VAT reforms in Kenya from the fiscal year 1989/90 to 2016/2017 owing to a number of reasons. First, this period is long enough to assess the VAT reform process in Kenya and its welfare impact. Secondly, it was within this period that Kenya has been having VAT and a number of reforms were introduced to boost its revenue productivity.

## 1.7 Organization of the Study

The study is organized as follows: Chapter one presents the background to the study, research questions, the objectives and the significance of the study. Chapter two reviews theoretical and empirical literature on Tax reforms, household welfare and efficiency Value Added Tax, chapter three presents the research design, theoretical framework, the empirical models that were estimated, and data collection and estimation procedures. Chapter four presents the study findings while chapter five concludes the study with the summary, conclusions, policy implications and areas for further research.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This chapter reviews both theoretical and empirical literature regarding rationale for tax reforms; its effects on efficiency of value added tax and welfare of the household. Literature on determinants of tax gap is also reviewed. An overview of the reviewed literature is also offered. Section 2.2 presents the theories on tax reforms, efficiency of taxes and welfare effects of taxes on consumption. Section 2.3 grants a discussion of the application of the theories in various studies while 2.4 concludes with overview of the literature.

## 2.2 Theoretical Literature Review

### 2.2.1 Consumer Demand Theory

Consumer demand theory was founded during the time of Adams Smith, but much progress in its development was made in the late 1700s by Jeremy Bentham who devised the idea of utility, in the consumption of goods and services and individuals desire to maximise it. The theory was further advanced by William Stanley Jevons who introduced the concepts of marginal utility and consumer equilibrium into the theory (Samuelson & Nordhaus, 2009). The theory explains consumer behaviour in relation to purchase of goods and services from the market. It makes an assumption that all consumers are rational and their decision on what to purchase from the market is based on their desire to maximise their utility subject to income constraint faced by the consumer. Given a

decision to spend a given income, *m*, on a set of *n* goods, Deaton and Muellbauer (1980) specified a linear budget constraint as in equation 2.1 (Oordt, 2016 ).

$$m = \sum_{x=1}^{n} p_x q_x \tag{2.1}$$

A consumer therefore decides on the quantity of each commodity to purchase based on income and the price per unit of the goods. This gives rise to a Marshallian demand function for an individual i as in equation 2.2 (Oordt, 2016 ).

$$q_i = g_i(m, p) \tag{2.2}$$

Further, the theory argues that individual's choice for a commodity and the quantity to purchase is dependent on the expected satisfaction (utility) that will be derived from the particular commodity and the individual's income. The theory therefore attempts to explain how the concepts of demand and utility maximization determine consumer's choice for commodities. A rational consumer sought to maximize utility subject to budget constraint as shown in equation 2.3.

$$\text{Max } u = v(q) \quad \text{Subject to: } \sum_{x=1}^{n} p_x q_x = m \tag{2.3}$$

The consumer demand theory identifies price per unit of a given good, price of a related good and income of an individual as the key variables that determine the demand of a given commodity in the market. Variations in prices of commodities in the market may result to substitution or income effects (Wade, 2017). If price of a commodity rises, less of that commodity will be consumed as consumers will resort to the alternative whose price is not affected, which is the substitution effect. In case there is no compensation for

price rise, there will be a general decline in quantity of goods consumed, which is the income effect. Consequently, there would be an overall decline in welfare of households.

The consumer demand theory helps to identify prices of goods and income as the key determinants of choice and can help in explaining the welfare effect of tax reforms within Kenyan economy. The theory therefore forms the basis of demand models to be used in assessment of effects of tax reforms on welfare through consideration of both income and price effects of tax reforms on the income constraint.

### 2.2.2 Theory of Excess Burden of Tax

The theory of excess burden of tax can be attributed to the seminal work of Jules Dupuit 1844 and Fleeming Jenkin 1872 later advanced by Arnold Harberger in 1964 (Hines, 2007). The theory is of the view that taxation leads to reduction of the standard of living or decline in welfare of the tax payers through deadweight loss or excess burden. According to the theory the excess burden is the gap between the untaxed production and taxed production. Taxes can distort production leading to a fall in quantity produced due to increased cost of production or increased consumer prices leading to decline in demand (Hines, 2007). If tax reduces output, deadweight loss that results can be illustrated as in figure 2.1.

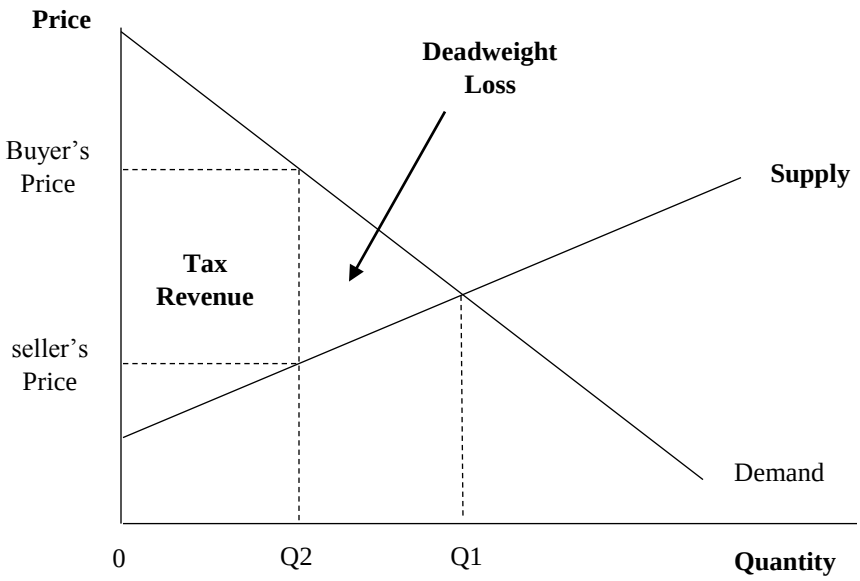


**Figure 2.1: The Deadweight Loss/ Excess burden of tax**
Adapted from Lester, 2012 page 17

Since imposition of tax on commodities increases the price of the commodity and reduces the profit margin of sellers, the market equilibrium is destabilized resulting to a fall in quantity supplied after tax and a decline in quantity demanded as well. The welfare loss in this case is the loss in trade for buyers and sellers who would have traded in the absence of tax (Lester, 2012).

The theory of excess burden of tax points to an important way to determine the level of deadweight loss within an economy as being the opportunity cost occasioned by taxes when they redirect resources from their optimal uses. According to the theory, there is a positive relationship between tax rates and deadweight loss. This suggests that the

broadening of a tax base which results to lower tax rate would lower deadweight loss (Lester, 2012). The theory of excess burden of tax is important to this study in extending the hypothesis that reforms associated with reduction in rates on consumer goods would reduce welfare loss and vise versa. This study will seek to test this by considering the welfare effect of taxation of goods and services that were previously exempted from VAT and zero rated.

### 2.2.3 Optimal Tax Theory

The tenets of optimal taxation were introduced in the 19$^{th}$ century by the then moral philosophers who introduced utilitarianism and greatest sum of happiness as criteria for judging a good tax. John Stuart Mill was of the view that the pressure felt by tax payers for paying tax ought to be equal among all tax payers and hence taxes should be considerate of the tax payer's ability to pay (Tenhunen, 2004). According to optimal taxation theory, commodities should be taxed at nonuniform rates differentiated based on their elasticity of demand where commodities with inelastic demand are taxed at a higher rates. Further, indirect taxation ought to be targeted at final consumption as opposed to intermediate goods in order to confine distortions to consumption as opposed to production and guarantee production efficiency in the economy and redistribution of resources (Diamond & Mirrlees, 1971). The nonuniform commodity tax rate is considered to be welfare improving because of its ability to redistribute resources from the rich to the poor occasioned by marginal utility of income. Therefore, a good tax system ought to be selected to maximixise social welfare given a number of constraints (Mankiw, Weinzierl, & Yagan, 2009), and revenue collection can be enhanced by

imposing a higher tax rate on goods and services that have inelastic demand, so as to minimize the excess burden on the tax payers. The theory of optimal taxation therefore provides the basis for the differentiated VAT tax rates. This study sought to evaluate the impact on household welfare within the economy.

## 2.3 Empirical Literature Review

As per the study objectives, the empirical literature is split into three sections; empirical literature on effects of tax reforms on efficiency, effect of tax reforms on welfare and determinants of VAT compliance gap.

### 2.3.1 Effect of Tax Reforms on Welfare

Go, Kearney, Robinson, & Thierfelder (2005) adopted the computable general equilibrium model (CGE) to examine the welfare and distributional outcome of likely reforms of the South African VAT system. They were interested in ascertaining the effect of increase of VAT rates on the household welfare. The study used South Africa's Social Accounting Matrix (SAM) for the year 2001 in which households were categorized into 10 income deciles. They proved that the availability of other tax structures that are beneficial to the poor housholds and at the same time only impose mild additional cost on the rich. Futher, they considered a scenario where VAT is elimanated from the price system whereas income tax is reviewed upwards proportionally. The study found the South African value added tax to be slightly regressive whereas the whole tax system was found to be progressive. Further, the study noted that the VAT's marginal cost of funds was higher for the poor than the rich. The study found VAT to be an

effective source of revenue and noted that it was possible to review the tax structure in a way that guarantees improvement in revenue generation of taxes without negatively impacting on the welfare of the households. The study used an appropriate model and gave good recommendations on possibility of tax mix that may guarantee improved revenue collection without distorting distribution of resources. However, the study did not give adequate information on the specific tax mix and again the study did not factor in possibility of tax evasion and tax avoidance by the higher income group if they realize that they are the targets of tax reforms.

Leyaro, Morrissey, and Owens (2010) carried out a study on the effects of VAT reforms on the welfare of households in Tanzania for the period 1991 - 2007. The study followed Deaton's method grounded on prices and budget share of households using Tanzania's Household Budget Survey's for the fiscal years 1991/92, 2000/01 and the year 2007. The results of the study indicated that the increases in real prices of food items for the period under study led to a 20 per cent decline in the the welfare of the regular household which was consistent in the 1900s and 2000s. The loss in welfare was larger among the low income households based in the rural areas where the decline in welfare was estimated at 27 per cent, high income households in the urban areas experienced a decline in welfare of only five per cent. The simulation results indicated that a tax cut would offset the welfare losses for all households, however, the low income households in urban areas would benefit more than their counterparts in the rural areas. The effect on the high income households was found to be the same regardless of the location. The study was similar to the present study to the extent that its objective was to estimate the effects of

VAT reforms on welfare. However, the present study used an advanced model of Deaton's method that clearly showed the direct link between tax reforms and welfare. Therefore, the current study adopted quadratic almost ideal demand system (QUAIDS).

Leahy, Lyons, & Tol (2011) studied the distributional effects of VAT in Ireland for the period 2007 – 2010. The study was motivated by the announcement by the Irish government to review VAT standard rates upwards to 22 per cent and 23 per cent in the years 2013 and 2014 respectively. The study used the 2004/2005 Household Budget Survey to examine the share of weekly disposable income that households spend on VAT. In addition, the study evaluated the possible effects of VAT reforms on welfare and tax revenue in Ireland, a micro-simulation model was used to estimate the effect of varying VAT rates on selected commodities and related response of revenue. The study found that the Ireland VAT system was regressive and adversely worsened the welfare of the households in the first income decile, rural areas based households and single-parent households. The study recommended that food items ought to be zero rated to improve the welfare of the poor as this would result to lower income decile households saving seven per cent of their disposable income and second decile households saving nine per cent of the same. The study did not consider the effect that variations in VAT rates would have on demand and supply of goods and service, the present study will incorporate this key aspect.

Enríquez (2015) investigated the effects of the year 2012 value added tax reforms in Spain on the welfare of the households. The study concentrated on non-alcoholic

beverages and food which were identified as key expenditure collections. The Quadratic Almost Ideal Demand System (QUAIDS) introduced by Deaton and Muellbauer (1980) was adopted as the methodology of the study and used to model demands for households. Further, the study used the Spanish Household Survey data for the year 2011. The study found that there was a negative relationship between the magnitude of welfare loss accasioned by VAT rate increment and income level, the higher income households experienced minimal welfare loss unlike the lower income households that were worst hit. The study chose to concentrate on basic items that consumers spend on across board irrespective of income level, with this it was possible to model the actual behaviour of majority of consumers in response to price variation by limiting the consumers options for substitution items. The study adopted quadratic almost ideal demand system (QUAIDS) which has been hailed as the best model in studies of this nature as it gives provision for zero observations, which is common in consumption habit surveys. The present study will also adopt the same model and apply it in Kenya. There is no known study that has used this model to study the effects of tax reforms on welfare of households in Kenya despite the numerous tax reform that have taken place.

Ndemezo and Baye (2016) evaluated the redistributive and welfare effects of the year 2002 value added tax reforms in Rwanda. The study used a methodology of an adaptation of the methodological framework of the elasticity of the tax base with respect to tax rate. The National Institute of Statistics of Rwanda's data on the second Integrated Survey on the Living Standards of Rwandan Households for the years 2005 and 2006 was used in the study. The study established that the tax reforms conducted in the year 2002 that led

to increase of VAT rates resulted to slight decline in the welfare of households. More specifically, the study found out that the households in the first three quintiles were more affected by the reforms because they spent a bigger proportion of their income on the taxable basic commodities. The study recommended a differentiated VAT structure which they were of the view that would improve the welfare of the households in Rwanda without resulting to a decline in revenue collection. The methodology adopted for the study was justified since it required the use of data that was readily available but it did not give a very clear link between tax reforms and welfare changes. The current study chose a model based on the data usage as well as the robustness of the model with an ability to demonstrate the linkages between different sectors in the economy as well as model preferences.

### 2.3.2 Effects of Tax Reforms on Collection Efficiency of Value Added Tax

Aizenman and Jinjarak (2008) assessed the structural factors that determine the collection efficiency of VAT. The study noted that according to theory, political stability is one of the key determinants of the efficiency of any tax system with political instability reducing tax collection efficiency. Further, the study observed that theory also identifies trade opennes, urbanization level, agriculture share of GDP, extent of tax evasion and the structure of tax system as other key determinants of tax efficiency in an economy. The study estimated a panel data of 44 states for the period 1970 to 1990 using VAT C-efficiency ratio. The results were found to be in line with theory indicating that 100 per cent probability of extension of a term of a political regime would improve VAT collection efficiency by 3.1 per cent, the same probability of flexibility in political

participation increases efficiency of VAT collection by 3.6 per cent. Further, a one standard deviation increase in GDP per capita, agriculture share of GDP, trade openness, and urbanization increases the VAT collection efficiency by 8.1 per cent, 4.8 per cent, 3.9 per cent and 12.7 per cent respectively. The study used the most recommended methodology to undertake the analysis of VAT collection efficiency. However, the study focused on so many countries which did not have similar features of the variables that were estimated. This study would have been much more important if it focused on only one country. As a result, the present study only focused on Kenya to come up with results that are specific for the country which can inform policy formulation.

Cnossen (2015) studied the Value added Tax structure for African countries, revenue performance and the shape of possible VAT reforms in Africa. The study used data for 40 African countries with VAT for the period 1991 – 2012. The study was motivated by the low C-efficiency of VAT in Africa attributed to too much exemptions and zero rating of certain basic commodities resulting to a narrower VAT base in the continent. The study adopted VAT C-efficiency that was developed by Ebrill et al. (2001) and advanced by Keen (2013) and recommended by many scholars because it could be linked to the structural features of VAT such as differentiated rates, exemptions and thresholds. Equation 2.1 illustrates the C-efficiency model.

$$\mathrm{C-efficiency} = \frac{Actual\ VAT\ revenue}{r\ X\ Final\ Consumption} \qquad 2.6$$

Where $r$ is the VAT standard rate. C- efficiency therefore estimates the performance of VAT in an economy as a proportion of actual revenue to potential revenue derived by

multiplying the final consumption by the standard VAT rate. The study found the average C-efficiency for African countries with VAT to be 0.39 and the results for specific countries as follows: Côte d'Ivoire 0.11, Niger and Ethiopia 0.67, Seychelles and South Africa 0.87. The study observed that in at least 67 per cent of African countries, the C-efficiency was less than 0.50 and less than 0.35 in 17 countries studied. The study therefore recommended that the African countries that were studied should embark on comprehensive VAT reforms to widen its base and reduce cost of collection. This study intended to establish why Kenya had undertaken the recommended reforms yet the collection efficiency of its VAT had not improved as expected.

Ndemo (2015) studied the factors that determine tax efficiency perceptions of Kenyan tax payers in Nairobi. The study was motivated by the findings of the previous studies that established that the efficiency of the Kenya's tax system was quite low. As such, the objective of the study was to determine the specific effects of digitalization of tax records, adoption of intergrated tax collection system and restructuring of KRA on the efficiency of the coutry's tax system. The study a adopted a linear regression model to estimate the data under study. The study found the coefficients for integrated systems, electronic methods, organisation restructuring and digitalization to be 0.30, 0.35, 0.20 and 0.30 correspondingly. Ndemo (2015) concluded that all the regressors were positively related to the dependent variable, therefore Kenya could improve its tax efficiency by targetting improvement in the identified variables. The study used microeconomic variables whose data is not readily available in the country and again which are also influenced by macroeconomic variable. The study also focused only in

Nairobi which is an urban set up and is characterised by low tax evasion. Further, the study generalised all taxes together, this did not appreciate that these taxes have different bases. The current study used macroeconomic variables and focused only on value added tax. The present study also made use of a robust model grounded on economic theory of taxation.

Ueda (2017) analyzed variations in C-efficiency ratio of VAT in developed economies in an attempt to appreciate its cyclic movements in these economies. The study used panel data for the Eurpean Union member countries and C- efficiency ratio was disintegrated into variations in policy and compliance gaps for the period 2000 – 2014. The study was motivated by the realization that there were cases where despite the VAT base remaining stable, the VAT revenue was found to be rather volatile than the base. The study measured the impact of business cycle on C-efficiency in the short run. The results of the study demostrated that variations is C-efficiency corresponded to the aggregate of independent variations of both policy and compliance gaps of value added tax. As a result, the study concluded that there is need for separate analysis of both compliance and policy gaps for better understanding of the variations in C-efficiency. The study then estimated the compliance and policy gaps using a dynamic panel model. The study found that a one per cent fall in output gap results to a 0.44 per cent fall in C-efficiency ratio, which was noted to be the sum of compliance gap, 0.24, and policy gap effects, 0.20. Further, the study estimated the eslasticity of C-efficiency to the output gap to be 0.79 given a C-efficiency of 55 per cent. The study noted that there is a possibility of variation of C-efficiency to output gap in different countries. The current study after analzing the

efficiency of the Kenya's VAT estimated determinants of its gap in order to establish the specific determinants in the country.

### 2.3.3 Determinants of VAT Compliance Gap

Barbone, Belkindas, Bettendorf, Bird, Bonch-Osmolovskiy and Smart (2013) in their study estimated the VAT gap for 26 European member states for the period 2000 to 2011. The study used econometrics analysis to determine the level of VAT compliance gap and its determinants. The results showed that the total VAT gap for the 26 countries was approximately 193 billion Euros or about 1.5 percent of the 26 countries' GDP. With respect to the determinants of the VAT compliance, they found a negative relationship between VAT compliance and VAT rates, a positive relationship between GDP and VAT compliance, a positive relationship between tax law enforcement and compliance and a negative relationship between shadow economy and VAT compliance.

Hutton, Thackray and Wingender (2014) used the Revenue Administration - Gap Analysis Programme (RA-GAP) methodology to estimate Uganda's value added tax gap for the fiscal years 2003/4 to 2012/13. The VAT base was estimated using top-down approach based on each sector's VAT revenue collections for the period under study. To obtain the compliance gap, the variance between estimated VAT revenue and actual VAT revenue was estimated. The study found that Uganda's compliance gap was about 60 per cent of the potential VAT revenue, which translates to about six per cent of GDP in the fiscal year 2012/13. This is an indication of a high tax inefficiency. On the other hand, the country's VAT policy gap was found to be relatively lower at one per cent of the

GDP. This was interpreted to mean that the numerous VAT exemptions and zero-rates had little impact on Uganda's VAT revenue. The study recommended the need to reduce Uganda's VAT gap as a measure to boost the country's revenue mobilization which would ease the country's budget deficit. There was need to conduct a similar study for Kenya to establish some of the causes of the shortfall in the revenue collections particularly tax revenue. Therefore, the present study sought to fill the gap.

Zídková (2014) assessed the determinants of the value added tax gap in 24 European Union member countries for the years 2002 and 2006 due to availability of data. The study used regression analysis as the methodology to achieve its objective. As a results, ordinary least square (OLS) regression analysis was undertaken on likely determinants of VAT gap in the 24 members of EU with VAT gap being the dependent variable. The study also sought to explain the meaning of VAT gap. Zídková (2014) noted that VAT gap is the variance between the expected VAT liability and the actual VAT collected in an economy in a given fiscal year. The study further argued that estimation of VAT gap was gaining relevance because of the growing level of tax evasion and tax fraud in the European Union. The results of the study indicated that there were some variables that had a negative impact on the VAT gap of the 24 countries studied, whereas there were other variables that had positive impact on the VAT gap. The specific results established that there was a positve relationship between VAT gap and final consumption in the year 2002, a one percent rise in final consumption resulted to a 1.07 per cent increase in VAT gap. A one per cent rise in the the ratio of VAT to GDP was found to reduce the VAT gap by 0.038 per cent. Whereas in the year 2006, a one percent rise in VAT to GDP ratio

led to a drop in tax gap by 3.095 per cent. The study made a good attempt to determine the determinants of the VAT gap in EU. However, the study was done in the year 2014 but relied on the data for the years 2002 and 2006 which is rather outdated and can not give a true reflection of the present state of the economy. The results of this study may not inform the policy of these countries much considering that in the year 2008, these economies were faced with a financial crisis and a lot actually changed in terms of policy. The present study focused on Kenya only and used recent data in order to come up with results that can be used to inform policy formulation in the the country.

Ueda and Thackray (2015 ) applied the IMF Revenue Administration Gap Analysis Program (RA-GAP) to estimate South africa's value added tax gap for the period 2007-2012. The study used macroeconomic approach to estimate the potential value added tax base, VAT statistical data obtained from each sector of the economy was used. The study established that South Africa's VAT compliance gap for the period 2007 to 2012 lied between five per cent and 10 per cent of theoretical value added tax revenue. The compliance gap was found to be highest at 10 per cent in the year 2009, and this was attributed to the effect of global financial crisis. Further the study found the policy gap for South Africa to range between 27 per cent and 33 per cent of potential VAT which was way below the average of EU country's which then was about 41 per cent. Based of the findings of this study, it can be concluded that South Africa's VAT was relatively efficient. The study made use of an appropriate model for this kind of study. The RA-GAP model has been recommended by a number of scholars because it decomposes the VAT gap into policy gap and compliance gap hence able to inform policy formulation

accordingly by pinpointing the area where tax revenue is lost. The present study adopted the same model in order to identify the source of VAT revenue shortfall in Kenya.

Wawire (2017) estimated the determinants of value added tax revenue in Kenya. The study adopted Paul Samuelson's (1955) fundamental general equlibrium model to achieve its objectives. Time series data was used by the study. The study was informed by the gap left by the previous studies that did not consider some important factors that determine tax revenue in an economy such as the structure of the economy, characteristics of the population and type of tax system. Therefore the study sought to ascertain the factors that determined VAT revenue and examine the elasticity of Kenya's VAT. The study found that the growth elasticities of VAT exceeded unity whereas the overall GDP elasticity of VAT revenues was less than the one for monetary GDP indicating the presence of a secretive economy in the country. The study noted that other main determinants of Kenya's VAT revenue included GDP, demographic, structural and institutional characteristics of the economy. The study concluded that improved economic activities in the country would guarantee improved VAT revenue collections. The study was very comprehensive in establishing the determinants of VAT revenue in Kenya. It adopted a good methodology and appropriate variables to achieve its objectives. The present study was different in that it first estimated the VAT compliance gap for Kenya then examined the factors that could have been responsible for the estimated VAT compliance gap. The study then gave recommendations of measures that should be taken to reduce the VAT compliance gap hence improve VAT revenue collection.

## 2.4 Overview of Literature

The literature reviewed revealed that value added tax reforms in a number of countries had impacted negatively or positively on the household welfare depending on the nature of the reforms. It was clear from the reviewed literature that reforms that led to rise in VAT rates, elimination of exemptions and zero rates, resulted to welfare loss whereas reforms that resulted to a cut in VAT rates, introduction of exemptions and reduced rates, were found to improve household welfare (Leahy et al., 2011; Giesecke & Nhi, 2010; Go, Kearney et al.,2005) some studies adopted Comptutable General Equilibrium (CGE) model to assess the impact of VAT reforms on welfare in various countries (Giesecke & Nhi, 2010; Go, Kearney et al.,2005) whereas other studies adopted Quadratic Almost Ideal Demand System (QUAIDS), and extension of Almost Ideal Demand System (AIDS) (Enríquez, 2015; Leyaro et al.,2010). However, based on the theories that were reviewed in the present study, consumer demand theory was adopted for more accurate estimation of the impact of the VAT reforms on household welfare, as such, Quadratic Almost Ideal Demand System (QUAIDS) was used in the study. The model was preferred because of the simplicity of its estimation, its functional form which is consistent with a wide range of household budgets, its consistency with the axiom of choice and it provides subjective first order estimation of any demand system. The 2015/16 Kenya Intergrated Household Budget Survey data was used.

Factors such as political stability, trade openness, level of urbanization, agriculture share of GDP, tax structure and extent of tax evasion were found to determine tax efficiency (Aizenman & Jinjarak, 2008). Further, VAT C-efficiency was found to correspond to the

aggregate of independent variations of both policy and compliance gaps of value added tax (Ueda, 2017). C-efficiency model was recommended as the best model for estimation of VAT collection efficiency moreso because of its robustness and it uses data that is easily obtainable in any economy. The present study used the C-efficiency model to estimate the efficiency of Kenya's VAT.

The main determinants of VAT gap as per the studies reviewed include the level of final consumption, VAT to GDP ratio, VAT structure (standard rate, exemptions and reduced rates), size of informal economy, demographic factors and institutional factors within the economy (Aizenman & Jinjarak, 2008; Wawire, 2017). In estimating the value added tax gap, most recent studies used the top down methodology known as IMF RA- GAP (Revenue Administration Gap Analysis Programme) which has been hailed for its capability to decompose the VAT gap into policy and compliance gap. This has been viewed by a number of scholars as an advantage of the methodology because it makes it possible to identify the specific determinants of either policy or compliance gap hence gives more accurate results ( Hutton et. al, 2014; Ueda & Thackray, 2015). The present study used the IMF RA-GAP model to estimate Kenya's VAT gap.

Most of the empirical literature reviewed focused on developed countries. Those that focused on developing countries did not comprehensively look at the VAT reforms effect on welfare, revenue collection and determinants of the VAT gap. Similarly the studies done in Kenya looked at the tax system in general, the only recent study that narrowed down to VAT focused on determinants of value added tax revenue (Wawire, 2017),

factors that determine tax efficiency in Kenya, a case study of Nairobi (Ndemo, 2015). The present study filled this literature gap by focusing on Kenya's value added tax. The study specifically focused on the effects of Kenya's VAT reforms on the welfare of households and its collection efficiency. Further, the study estimated the value added tax gap in the country and assessed its determinants.

# CHAPTER THREE

# METHODOLOGY

## 3.1 Introduction

This chapter presents the methodology that the study adopted. The sections included are research design, theoretical framework, empirical model, model specification, estimation technique, definition and measurement of variables, data sources, collection and analysis.

## 3.2 Research Design

The non-experimental cross-sectional design was used to achieve objective one since data used was examined at one point in time. Whereas, non-experimental longitudinal design was used to achieve objectives two and three since the data used was examined over the years.

### 3.3.1 Theoretical Framework for Evaluation of the Effect of VAT Reforms on Household Welfare

The theory of consumer demand postulates that a consumer, representing a household, will purchase goods and services at an affordable price. According to the theory, an increase in price will decrease the demand of a particular commodity, thus, a reduction in consumption affecting consumer welfare. The effect on the welfare depends on price elasticity of demand, in theory, if a commodity is a basic necessity (inelastic), its demand will not change and therefore, the increase in price will reduce the consumption of other commodities by households due to substitution effect. On the other hand, for luxury commodities (elastic), demand will decrease more than the increase in prices.

There are several models of consumer demand in literature, this study used the Quadratic Almost Ideal Demand System (QUAIDS) developed by Banks, Blundell, and Lewbel (1996; 1997) to evaluate the impact of VAT reforms on household welfare. QUAIDS is an extension of the Almost Ideal Demand System (AIDS) model by Deaton & Muellbauer (1986). Households are directly affected by tax reforms since they are the consumers and some are producers of commodities whose prices vary as a result of tax reforms. Leyaro et al. (2010) argued that due to unavailability of production data, the effect of tax reforms on household can be analyzed through price transmision effect. QUAIDS model is preferred for this study since it focuses on price transmission. It is a model of static micro-approach to consumption and extends the AIDS of quadratic term of log income and allows for non-linear Engel curves. As noted by Bílý (2016), the model is also flexible and allows a good to be a luxury at one level of income and a necessity at another level of income therefore addressing a major limitation of the AIDS model. However, the QUAIDS model assumes that households split their income between saving and consumption which is further split between durables and non-durables, then assign expenditures that maximize utility. Following this assumption, current expenditure was included in the model instead of income (Deaton & Muellbauer, 1980).

The QUAIDS model is derived from an indirect utlity function as in equation (3.1).

$$\text{In} \quad v(x,p) = \left( \left( \frac{In\,x - In\,a(p)}{b(p)} \right)^{-1} + l(p) \right)^{-1} \tag{3.1}$$

Where x is expenditure, **p** is a vector of prices. The $a(.), b(.), l(.)$ denote price aggregators defined as in equations (3.2), (3.3) and (3.4).

$$In\, a(p) = \alpha_0 + \sum_i \left( \alpha_{i0} + \sum_k \alpha_{ik} \right) In\, p_i + \frac{1}{2} \sum_i \sum_j \gamma_{ij} In\, P_i\, In P_j \tag{3.2}$$

$$b(p) = \prod_i p_i^{\beta_{10} + \sum k \beta_{ik}} \tag{3.3}$$

$$In\, l(p) = \sum_i \left( \lambda_{i0} + \sum_k \lambda_{ik} \right) In\, p_i^1 \tag{3.4}$$

The index k in equations (3.2), (3.3) and (3.4) will converge to zero in order to relax the notation.

The budget share as in equation (3.5) is obtained by applying Roy's identity on the indirect utility function (3.1), which yields.

$$w_i = \sum_k \alpha_{ik} + \sum_j \gamma_{ij} In\, p_j + \sum_k \beta_{ik} In\, x + \frac{\sum_k \lambda_{ik}}{b(p)} In^2 x. \tag{3.5}$$

The parameters $\alpha_{ik}$, $\beta_{ik}$, $\gamma_{ik}$ and $\lambda_{ik}$ are the coefficients to be estimated. Summation of commodities of the budget shares must be equal to one giving the adding up condition illustrated in equation (3.6)

$$\sum_i \alpha_{ik} = \delta_{ok} \quad \forall k \qquad \sum_i \gamma_{ij} = 0 \qquad \forall_j \sum_i \beta_{ik} = 0 \quad \forall k \qquad \sum_i \lambda_{ik} = 0 \qquad \forall k \tag{3.6}$$

Equation (3.7) illustrates the homogeneity condition as per the theory of utility maximization which requires that the budget share function should be homogeneous of degree zero in p and x.

$$\sum_j \gamma_{ij} = 0 \qquad \forall_i \tag{3.7}$$

A symmetry assumption can be imposed yielding the symmetry condition as in equation (3.8)

$$\gamma_{ij} = \gamma_{ji} \qquad \forall_i, j. \tag{3.8}$$

The resultant Slutsky matrix is then tested for negative semi-definiteness. However, in case of Giffen goods the negativity criterion is not fulfilled.

Because of the difficulty often encountered in interpretation of the raw estimated parameters, it is important to report expenditure and price elasticities as well which can also be used to estimate the effects of the VAT reforms.

**Expenditure Elasticities**

Now for simplification purposes, from equation (3.5) let $A_i = \sum_k \alpha_{ik}$ likewise $\beta_i = \sum_k \beta_{ik} and\ L_i = \sum_k \lambda_{ik}$. therefore by substituting these in the budget share equation the resultant equation for budget share is (3.9).

$$w_i = A_i + \sum_i \gamma_{ij} In\ p_j + \beta_i In\ x + \frac{L_i}{b(p)} In^2\ x \tag{3.9}$$

The derivative of budget share $w_i$ with respect to In x denoted by $\mu_i$ is obtained as in equation (3.10).

$$\mu_i = \frac{\partial w_i}{\partial Inx} = \beta_i + 2\frac{L_i}{b(p)} In\ x \tag{3.10}$$

Further use

$$\mu_i = \frac{\partial w_i}{\partial In\, p_i} = \frac{\partial w_i}{\partial x} x \tag{3.11}$$

and

$$\frac{\partial w_i}{\partial x} = \frac{\partial \frac{p_1 q_1}{x}}{\partial x} = -\frac{p_i q_i}{x^2} + \frac{p_i \partial q_i}{x\, \partial x} + \frac{w_i}{x} + \frac{w_i}{q_i} \frac{\partial q_i}{\partial x} \tag{3.12}$$

To get equation (3.13)

$$\mu_i = \frac{\partial w_i}{\partial x} x = -w_i + w_2 \frac{x}{q_i} \frac{\partial q_i}{\partial x} = -w_i \left(1 - \in_i\right)^3$$

Lastly, by stating $\in_i$ and substituting (3.10) gives the expenditure elasticity equation (3.13)

$$\in_i = \frac{\mu_i}{w_i} + 1 = \frac{1}{w_i}\left(B_i + 2\frac{L_i}{b(p)} In\, x\right) + 1 \tag{3.13}$$

**Own and Cross Price Elasticities**

To obtain own and cross price elasticities we denote $\mu_{ij}$ the derivative of $w_i$ with respect to $In\, p_j$ as in equation (3.14)

$$\mu_{ij} = \frac{\partial w_i}{\partial In\, p_j} = \gamma_{ij} - \mu_i \left(A_j + \frac{1}{2}\sum_t \left(\gamma_{jl}\right) In\, p_j\right) - \frac{B_j L_i}{b(p)} In^2 x^4 \tag{3.14}$$

We then let

$$\mu_{ij} = \frac{\partial w_i}{\partial In p_j} = \frac{\partial w_i}{p_j} p_j \tag{3.15}$$

And

$$\frac{\partial w_i}{\partial p_j} = \frac{\partial \frac{p_1 q_1}{x}}{\partial p_j} = \frac{1}{x}\left(p_i \frac{\partial q_i}{\partial p_j} + \frac{\partial p_i}{\partial p_i} q_i\right) = \frac{p_i \partial q_i}{x \partial p_j} + \delta_{ij} \frac{q_i}{x} \tag{3.16}$$

Plugging (3.14)

$$\in_{ij}^{u}=\frac{1}{w_1}\left(\gamma_{ij}-\mu_i\left(A_j+\frac{1}{2}\sum_l\left(\gamma_{jl}+\gamma_{jl}\right)Inp_j\right)-\frac{\beta_j L_i}{b(p)}In^2x\right)-\delta_{ij} \quad (3.17)$$

The compensated Hicks price elasticities $\in_{ij}^{c}$ in equation (3.18) is obtained using the Slutsky equation.

$$\in_{ij}^{c}=\in_{ij}^{u}+\in_i w_j \quad (3.18)$$

The matrix with entries $\left\{\in_{ij}^{c} w_i\right\}+\in_i w_j$ can be used to check for the negativity condition. It should be negative semi-definitive.

Where $\in_i$ denotes the expenditure elasticity of demand for ith commodity and $\in_{ij}^{u}$ denote the uncompensated Marshall price elasticity of demand for ith good with respect to jth price.

### 3.3.2 Empirical Model for Evaluation of the Effect of VAT Reforms on the Welfare of Households in Kenya

To evaluate the effect of VAT reforms on household welfare in Kenya the study estimated the QUAIDS model from equation (3.5). The QUAIDS MODEL was considered as a system of equations in the form of equation (3.5) plus the error term $e_i$ for each household, resulting in system of equations as in equation (3.19).

$$w_i=\sum_k\alpha_{ik}+\sum_j\gamma_{ij}In\,p_j+\sum_k\beta_{ik}\,In\,x+\frac{\sum_k\lambda_{ik}}{b(p)}In^2x+e_i \quad (3.19)$$

The instrumental variable (IV) method was used to limit the likely endogeneity of log income together with its square term. The residuals, squares and cubic terms of the

remaining variables were used in regression of equation (3.19). Because of the adding up restriction previously discussed only n-1 equations was estimated, where n was the number of commodities, and the coefficients for the remaining commodity was calculated from the adding up condition.

The linearity of the model conditional on a(p) and b(p) was used. First, b(p) was replaced by 1 and a(p) by Stone price index (Stone 1954).

$$a(p) \approx \sum_i w_i In\, p_i$$

The expenditure elasticity, Hicks and Marshallian price elasticities were then calculated from the parameters according to (3.13), (3.17) and (3.18), respectively.

**Table 3.1 Definition and Measurement of Variables for Evaluation of Effect of VAT Reforms on Welfare of Households in Kenya**

| **Variable** | **Definition** | **Measurement** |
|---|---|---|
| Budget share ( $w_i$ ) | Is the proportion of the household total budget spent on good i. | Value of good i purchased divided by household's total budget. |
| Price ( $p_j$ ) | This is the monetary value of category of good j | Measured in Kenya shillings. |
| Total expenditure of a household (x) | The monetary value of all goods and services consumed by household. | Measured by obtaining the quantity of all goods and services consumed by household then multiply by the price per unit in Kenya shillings. |

### 3.3.3 The Theoretical Framework for Analysis of the Effect of Tax Reforms on VAT Revenue Collection Efficiency and Determinants of its Compliance Gap.

The theory of excess burden of tax opines that excessive tax rates may distort production resulting to a decline in quantity produced following an increase in cost of production occasioned by high tax rates. Similarly, high tax rates on consumption goods and services

may result to decline in quantity demanded, tendency by consumers to evade taxes, and shift consumption to untaxed goods and services or to those taxed at lower rates. Such behavior change by consumers may result to a lower collection efficiency of a tax system or widen the tax gap.

To address these challenges, there is need for tax rates to be optimal. The pressure felt by tax payers ought to be equal and taxes should be considerate of tax payers ability to pay as postulated by the optimal tax theory.

Assessment of the efficiency of a tax system regularly is vital for identification of risk, non-compliance, tax frauds and tax revenue leakages therefore guiding formulation of an effective fiscal policy (Mohanty, Kumar, & Patra, 2017). Based on the excess burden of tax theory and the optimal tax theory, this study used C-efficiency ratio model developed by Keen (2013 ) to evaluate the efficiency of VAT. The c-efficiency model is derived by decomposing VAT revenue as follows :

$$\frac{V}{Y} = \tau_S E^C \left( \frac{C}{Y} \right) \tag{3.20}$$

Where $V$ denotes VAT revenue, $Y$ denotes Gross Domestic Product, $\tau_S$ denotes the standard rate of the VAT, C denotes consumption not subjected to VAT and,

$$E^C = \frac{V}{\tau_S C} \tag{3.21}$$

Following Keen (2013), decomposition in equation (3.20) identified three determinants of VAT revenues as the VAT standard rate, the C-efficiency and the proportion of consumption in GDP as shown in equation (3.22).

$$\left(\frac{V}{Y}\right) = \hat{\tau}_S + E^C + \left(\frac{C}{Y}\right) \tag{3.22}$$

To illustrate a distinct expression of C-efficiency factoring the determinants of VAT revenue in equation (3.19) is expressed as follows in equation (3.23).

$$V = \sum_{i=1}^{N} T_i^* C_i^* \tag{3.23}$$

Where $T_i^*$ is the VAT rate, and $C_i^*$ the consumption of taxable commodity $i = 1, \ldots, N$. Zero rated sales are included in C as items of government consumption. $C_{N+1}$ represents items not subjected to VAT i.e cost incurred in production of pure public goods. It followed that;

$$C = \sum_{i=1}^{N+1} C_i \tag{3.24}$$

Now substituting equations (3.23) and (3.24) in equation (3.21) gave C-efficiency model as shown in equation (3.25).

$$E^C = \frac{\sum_{i=1}^{N} T_i^* C_i^*}{\tau_S \left(\sum_{i=1}^{N+1} C_i\right)} \tag{3.25}$$

However, Keen (2013) observed that the C-efficiency model in equation (3.25) was not fully general and suggested that for instant purchases by non-residents enter the model through *V* and not C. Therefore equation (3.25) could be re-written as;

$$E^C = \left(\frac{\sum_{i=1}^{N} T_i^* C_i}{\tau_S \left(\sum_{i=1}^{N+1} C_i\right)}\right)\left(\frac{\sum_{i=1}^{N} T_i^* C_i^*}{\sum_{i=1}^{N} C_i}\right) \tag{3.26}$$

### 3.3.4 Empirical Model for Analysis of the Effect of Tax Reforms on VAT Revenue Collection Efficiency in Kenya.

The second objective of the study sought to establish the effect of tax reforms on VAT revenue efficiency in Kenya. The study achieved this by first estimating the VAT C-efficiency model following Keen (2013) and Cnossen (2015) using model specified as in equation (3.27).

$$E^{C}{}_{t} = \frac{V_t}{\tau_{St} \times C_t^f} \tag{3.27}$$

Where $E^{C}{}_{t}$ is the c-efficiency at time t, $V_t$ is actual VAT revenue at time t, $C_t^f$ is final consumption at time t and $\tau_{St}$ is the VAT standard rate at time t.

After estimating the efficiency of VAT revenue in Kenya, $E^{C}{}_{t}$ was incorporated in an ANCOVA model adopted from Tagkalakis (2014) to determine the effect of tax reforms on the VAT revenue collection efficiency in Kenya as specified in equation (3.28).

$$E_t^c = \alpha + B_1 VREF + B_2 NVRA + B_3 GDPG + B_4 SHDG + B_5 AGRG + B_6 TRD + \varepsilon_t \tag{3.28}$$

Where $E^C$ is VAT C-efficiency, *VREF* is VAT reforms, *NVRA* is the number of VAT rates, *GDPG* is the Gross Domestic Product growth rate, *SHDG* is the value of shadow economy as a percentage of GDP, *AGRG* is the value of agriculture output as a percentage of GDP, TRD is the value of trade volume as a percentage of the Gross Domestic Product growth rate and $\varepsilon_t$ is an error term. Note: *VREF* is a binary independent dummy variable taking a value 1 for year when there was a major VAT reform and 0 for a year with no major VAT reforms or no reform at all.

Equation 3.28 could not be estimated using OLS means of regression because the stationarity test results revealed that the variables that were used in the study were either integrated of order (0) or (1). Since none of the series was integrated of order (2) the Auto Regressive Distributed Lags (ARDL) modeling technique was ideal (Pesaran and Shin,1999; 2001). Therefore, equation 3.28 was modified into an ARDL equation as in equation (3.29).

$$E_t^c = \alpha + \sum_{i=1}^{K} B_1 \left(E_t^c\right)_{t-i} + \sum_{i=0}^{K} B_2 (VREF) + \sum_{i=0}^{K} B_3 (NVRA) + \sum_{i=0}^{K} B_4 (GDPG) + \sum_{i=0}^{K} B_5 (SHDG) + \sum_{i=0}^{K} B_6 (AGRG) + \sum_{i=0}^{K} B_7 (TRD) + \varepsilon_t \quad \text{.....(3.29)}$$

Equation (3.29) gave the short run ARDL model that was used to estimate the determinants of VAT c-efficiency in the study. ARDL model has been widely used by scholars because of a number of advantages that it is believed to have over other model such as; its ability to work well with variables which are integrated of different orders, its single equation set-up make it easy to implement and interpret and the possibility to assign different variables different lag lengths as they enter the model.

**Table 3.2: VAT Collection Efficiency Analysis Variables**

| Variable | Definition | Measurement |
|---|---|---|
| VAT collection efficiency ($E^C$) | This is the ratio of total actual VAT revenue in an economy as a proportion of potential VAT revenue within an economy. | It is measured by dividing the actual VAT revenue in each period by the estimated potential VAT revenue |
| Standard VAT rate ($\tau_S$) | This is the VAT rate charged on most goods and services. | The values were used as reported in various budget statements and publications by the Kenya Revenue Authority. |
| Actual VAT revenue ($V_t$) | This is the value of total revenue collected from VAT in a given year. | The values were used as obtained from various publications by the Kenya Revenue Authority. |
| Final Consumption ($C_t^f$) | This is the value of goods and services consumed in an economy. | The values were used as reported in the World Bank data base |
| GDP growth rate (*GDPG*) | This is the percentage change in value of goods and services produced in the country within a given year. | The values were used as reported in the World Bank data base. |
| Agriculture share in GDP *(AGRG*) | This is the percentage of the total value of annual agricultural output as a share of GDP. | Measured by the total value of annual agricultural output divided by the total value of the country's GDP then multiplied by a hundred. |
| Share of shadow economy in GDP (*SHDG)* | This is the estimated value of underground economy as a proportion of GDP. | The values were used as reported in a study by the International Monetary Fund (IMF) |
| Number of VAT rates ($NVR$) | This is the number of various rates used to charge VAT in an economy for different categories of goods and services including the standard rate. | Total number of rates for VAT in a given fiscal year. |
| VAT reforms (*VREF)* | These are changes made in the administration of the Value Added Tax to improve its revenue potential. | A value of 1 denotes a year when there was a major VAT reform whereas a value of 0 denotes a year with no major VAT reforms or no reform at all |

### 3.3.5 Framework for Analysis of Determinants of VAT Compliance Gap in Kenya

The VAT data obtained from the Kenya Revenue Authority was used to estimate VAT compliance gap by subtracting the actual VAT revenue collected from the targeted VAT

revenue for each fiscal year following IMF-RA GAP analysis model. The resulting VAT compliance gap value for each year was divided by GDP to obtain its percentage share. The resulting VAT compliance gap as a percentage of GDP data obtained was used in equation (3.30) as the dependent variable. A similar model was used by Zídková (2014) in estimating determinants of VAT compliance gap in the European Union.

$$VCGAP_t = \alpha + B_{1t}SVR_t + B_{2t}SEGDP_t + B_{3t}VREF_t + B_{4t}NVR_t + B_{5t}MNGDP_t +$$

$$B_{6t}POPG_t + B_{7t}IMGDP_t + B_{8t}FCGDP_t + B_{9t}XPGDP_t + B_{10t}AGRGDP_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (3.30)$$

Equation 3.30 could not be estimated using the OLS means of regression as the stationarity test results revealed that the variables that were used in the study were either integrated of order (0) and (1) but none was integrated of order (2) which was ideal for Auto Regressive Distributed Lags (ARDL) modeling technique (Pesaran & Shin,1999; 2001) Therefore equation (3.30) was modified into an ARDL equation as in equation (3.31).

$$VCGAP_t = \alpha + \sum_{i=1}^{K} B_{1t}(VCGAP)_{t-i} + \sum_{i=0}^{K} B_{2t}(SVR)_{t-i} + \sum_{i=0}^{K} B_{3t}(SEGDP_{t-i} + \sum_{i=0}^{K} B_{4t}(VREF)_{t-i}$$
$$+ \sum_{i=0}^{K} B_{5t}(NVR)_{t-i} + \sum_{i=0}^{K} B_{6t}(MNGDP)_{t-i} + \sum_{i=0}^{K} B_{7t}(POPG)_{t-i} + \sum_{i=0}^{K} B_{8t}(IMGDP)_{t-i}$$
$$+ \sum_{i=0}^{K} B_{9t}(FCGDP)_{t-i} + \sum_{i=0}^{K} B_{10t}(XPGDP)_{t-i} + \sum_{i=0}^{K} B_{11t}(AGRGDP)_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (3.31)$$

Econometric tests were done to establish distribution of the error term which ought to be identical and independent. Further, Chi-square goodness of fit test was performed to test the normality of residuals. Heteroskedasticity was tested using White test. Model

specification was tested using Ramsey test after the multicollinearity test to ascertain the correlation matrix of the regressors.

**Table 3.3: VAT Compliance Gap Determinants Analysis Variables**

| Variable | Definition | Measurement |
|---|---|---|
| VAT compliance gap ($VATcompliancegap_t$) | This is the difference between potential VAT revenue under current policy framework and actual VAT revenue collected by KRA | It is measured by subtracting actual VAT revenue collected from the targeted VAT revenue for the specific fiscal year. |
| Share of shadow economy in GDP ( *SE* ) | This is the estimated value of underground economy as a proportion of GDP. | The values were used as reported in a study by the International Monetary Fund (IMF) |
| VAT reforms (*VREF)* | These are changes made in the administration of the Value Added Tax to improve its revenue potential. | A value of 1 denotes a year when there was a major VAT reform whereas a value of 0 denotes a year with no major VAT reforms or no reform at all |
| Agriculture share in GDP *(AGRG*) | This is the percentage of the total value of annual agricultural output as a share of GDP. | Measured by the total value of annual agricultural output divided by the total value of the country's GDP then multiplied by a hundred. |
| Manufacture value added as a percentage of GDP *(MNGDP)* | This is the net annual value addition by industrial sector in the economy as a proportion of the country's GDP | The values were used as reported in the World Bank data base |
| Final Consumption (*FCGDP)* | This is the value of goods and services consumed in an economy. | The values were used as reported in the World Bank data base |
| Import as a percentage of GDP *(IMPGDP)* | The value of total import as a proportion of GDP. | The values were used as reported in the World Bank data base |
| Standard VAT rate ( *SVR* ) | This is the VAT rate charged on most goods and services. | The values were used as reported in various budget statements and publications by the Kenya Revenue Authority. |
| Number of VAT rates ( *NVR* ) | This is the number of various rates used to charge VAT in an economy for different categories of goods and services including the standard rate. | Total number of rates for VAT in a given fiscal year. |
| Agriculture share in GDP ( *Agr* ) | This is the percentage of the total value of annual agricultural output as a share of GDP. | Measured by the total value of annual agricultural output divided by the total value of the country's GDP then multiplied by a hundred. |

### 3.4 Data Type and Sources

The study used both cross-sectional data and time series data. Cross-sectional data on the house hold budget was obtained from Kenya Integrated Household Budget Surveys (KIHBS) for the year 2015/16 from the Kenya National Bureau of Statistics (KNBS). Whereas time series data on public and private consumption, sectoral outputs and inputs in Kenya and VAT revenue was obtained from Economic Surveys and Statistical abstracts which are publications of Kenya National Bureau of Statistics (KNBS), World Bank data base and data on actual VAT revenue and potential (targeted) was obtained from the Kenya Revenue Authority (KRA) publications available at their resource centre.

### 3.5 Data Cleaning

In the Kenya Integrated Household Budget Survey (KIHBS) of 2015/16, a total of 21,773 households were surveyed. A total of 245 households were dropped for reporting total expenditure of zero on the ten food items considered in the study. In addition, 85 households were dropped for exhibiting total expenditure that were considered to be outliers and 233 households were dropped for having so many missing values and abnormal values which included negative expenditures and negative prices. Therefore, the estimated sample was reduced to 21,210 households.

### 3.6 Data Analysis

The first objective of the study sought to establish the effect of VAT reforms on household welfare in Kenya. The objective was achieved by estimation of equation 3.19 and the resultant coefficients were used to estimate price and demand elasticities of the

group of the selected household goods using equations 3.13 for expenditure elasticity, 3.17 for compensated elasticity and 3.18 for uncompensated elasticity. Stata has two commands for estimation of the model "quaids" that were introduced by Poi (2012) using non-linear seemingly unrelated regression (NLSUR) with household's specific elasticities estimated at the value of their own parameters.

The objective number two of the study estimated the collection efficiency of Kenya's VAT and evaluated its response to tax reforms. This was achieved by estimation of equation equations 3.27 and the result converted to percentages. VAT Collection efficiency of greater that 60 meant that VAT was efficient, a value below 50 percent meant an inefficient VAT system. The C-efficiency obtained for the various years was regressed in equation 3.29 as the dependent variable to evaluate the effects of tax reforms on it.

The third objective of the study sought to estimate Kenya's VAT compliance gap and establish its determinants. To achieve this objective, equations 3.30 was modified into 3.31 to fit ARDL regression because of the nature of the data set used where the variables were either integrated of order (0) or (1) and estimated using the ARDL technique.

The descriptive statistics analysis were conducted to ascertain the suitability of data, any abnormality detected such as non-stability and non-stationarity were tested and corrected accordingly. To guarantee the consistency and unbiasedness of the estimates derived from the models, diagnostic tests were undertaken. The tests for the ARDL model used in

objectives two and three included: the Breuch-Godfrey Lagrange Multiplier test for serial autocorrelation, the normality test using Jarque-Bera statistics, CUSUM test for stability of the models, Lagrange Multiplier test for autoregressive conditional heteroskedasticity (ARCH), multicollinearity test using correlation matrix and Ramsey RESET test for specification error.

# CHAPTER FOUR
# EMPIRICAL RESULTS AND DISCUSSION

## 4.1 Introduction

This chapter presents the findings of the study. First, an estimation of the effect of Value Added Tax reforms on the welfare of households in Kenya. Second, the VAT revenue collection efficiency is estimated, its responsiveness to tax reforms together with other determinants is evaluated. Third, VAT compliance gap is estimated. Finally, the determinants of VAT compliance gap are estimated.

## 4.2 The Effect of Value Added Tax Reforms on the Welfare of Households in Kenya

To evaluate the effect of VAT reforms on household welfare in Kenya, the study estimated the demand systems for 21,210 households in Kenya based on their expenditure on ten food items namely tea leaves, sugar, beans, salad, white-bread, rice, cooking fat, spices, soda, maize. All these products prior to 2013 VAT Act were zero rated but after the amendment of the VAT Act, tea leaves, salad, cooking fat, spices and soda were taxed at standard VAT rate. Whereas sugar, white-bread and rice were moved to the VAT exempt category. This action still had an implication of the rise in their prices. The study opted to estimate the demand system with only expenditure on food items for two main reasons. First, KNBS (2016) estimated the share of food expenditure in the total household expenditure in Kenya at national level, rural level, peri-urban level and core urban level and established that at national level, expenditure on food by households constituted the largest proportion of total household expenditure, at 54.3 percent. At the rural and peri-urban level, the expenditure share on food was highest at

64.7 per cent and 58 per cent of the total household expenditure respectively. In the core urban areas, the expenditure on food was slightly less than half of total household expenditure at 46.6 per cent of the total household expenditure. Secondly, there was lack of disaggregated data on households' expenditure on non-food items in Kenya that could be used to estimate households' demand systems. However, data was available on expenditure on food items. The ten food items used in the study were selected on the basis of their popularity with the surveyed households.

### 4.2.1 Descriptive Summary on Data

The descriptive summary on price and quantity data for the selected food items are presented in Table 4.1.

**Table 4.1 Descriptive Statistics on Quantity and Price of Selected Food Items**

| Variable | Mean | Std.Deviation | Min | Max |
|---|---|---|---|---|
| Price of tea (Ksh.) | 52.1514 | 20.2298 | 15 | 222.222 |
| Price of sugar (Ksh.) | 108.5147 | 11.26378 | 50 | 200 |
| Price of beans (Ksh.) | 75.82512 | 21.01872 | 23.07692 | 400 |
| Price of salad (Ksh.) | 151.6079 | 47.05991 | 25 | 845 |
| Price of whitebread (Ksh.) | 46.87801 | 39.10148 | 26 | 109.278 |
| Price of rice (Ksh.) | 34.28383 | 16.51185 | 22 | 250 |
| Price of cooking fat (Ksh.) | 78.20552 | 12.26459 | 51 | 750 |
| Price of food seasoning (Ksh.) | 32.8952 | 68.2989 | 16.667 | 450 |
| Price of soda (Ksh.) | 15.00561 | 18.05398 | 12 | 100 |
| Price of maize (Ksh.) | 18.56292 | 18.96923 | 10 | 140 |
| Quantity of tea (gms) | 53.34316 | 87.37212 | 0 | 900 |
| Quantity of sugar (kg) | 1.68192 | 2.5282 | 0 | 20 |
| Quantity of beans (kg) | 0.47901 | 5.208 | 0 | 150 |
| Quantity of salad (ml) | 94.84429 | 217.656 | 0 | 5000 |
| Quantity of Whitebread (gms) | 400.6324 | 328.7629 | 0 | 1200 |
| Quantity of whiterice (kg) | 2.38304 | 10.1541 | 0 | 50 |
| Quantity of cookingfat (gms) | 8.72109 | 146.6187 | 0 | 2000 |
| Quantity of seasoning (gms) | 8.618218 | 29.58811 | 0 | 600 |
| Quantity of soda (ml) | 300.45469 | 250.8183 | 0 | 9000 |
| Quantity of maize (kg) | 1.496256 | 22.20685 | 0 | 800 |

**Source of data:** KNBS, 2015/16 Kenya Integrated Household Budget Survey.

Table 4.1 shows that for the 21,210 households in the 2015/2016 KIHBS, the minimum price of tea reported by households was Ksh. 15 and the maximum was Ksh. 222.22 with a mean of Ksh. 52.15 and a standard deviation of Ksh. 20.23. The average price of sugar was reported to be Ksh. 108.51 with a minimum price of Ksh. 50 and a maximum of Ksh. 200. Of all the ten food items estimated, Table 4.1 clearly shows that their prices reported by households varied therefore they could be used in estimation of a demand system model.

Similarly, Table 4.1 clearly shows that the quantities of the selected ten food items as reported by the surveyed households also varied. This was confirmed as the standard deviation for the quantities of tea, sugar, beans, salad, white-bread, white-rice, cooking fat, seasoning, soda and maize were found to be 87.37, 2.53, 5.21, 217.66, 328.77, 10.15, 146.62, 29.59, 250.82 and 22.21 respectively. Therefore, the data exhibited sufficient variation to warrant estimation of the demand system.

Finally, for all the ten selected food items, a minimum value of zero quantity was reported by some households during the survey period. According to Maganga, Phiri, & Mapemba (2014) zero expenditure by households on some food items can be attributed to non-consumption of these food items during the survey period, non-affordability of these food items, the lack of preference for the food items and permanent non-consumption of the food items, by the households.

### 4.2.3 Coefficients of the Complete Demand System Estimated by QUAIDS

The estimation of the Quadratic Almost Ideal Demand System (QUAIDS) was done based on the iterated feasible generalized non-linear least square with the knowledge that the theoretical restrictions of homogeneity, symmetry and adding up were automatically executed to drop the last equation in order to manage the problem of singularity of the variance and covariance matrix. This was expected to address the problem of heteroskedasticity in the residuals. On the other hand, the problem of multicollinearity that was expected to exist between the prices of different food items was disregarded because it was expected to only inflluence the standard errors of the estimates leading to

few significant estimates. Table 4.2 shows the coeffients for the complete demand system estimated extracted from the complete QUAIDS model results in Appendix 1, Table A2.

**Table 4.2 Coefficients of the Complete Demand System Estimated**

| | Tea leaves | Sugar | Beans | Salad | White-bread | Rice | Cooking fat | Spices | Soda | Maize |
|---|---|---|---|---|---|---|---|---|---|---|
| Ln Price tea (γ) | 0.08*** | | | | | | | | | |
| Ln price sugar (γ) | 0.02*** | -0.04 | | | | | | | | |
| Ln price beans (γ) | 0.01*** | -0.06*** | 0.15*** | | | | | | | |
| Ln price salad (γ) | 0.01*** | -0.01** | -0.04*** | 0.30*** | | | | | | |
| Ln price bread (γ) | -0.09*** | -0.12*** | -0.03*** | -0.09*** | 0.50*** | | | | | |
| Ln price rice (γ) | 0.00 | -0.01*** | 0.00 | -0.01*** | -0.02*** | 0.06*** | | | | |
| Ln price cooking fat (γ) | -0.01*** | -0.02*** | -0.01*** | -0.08*** | -0.06*** | -0.00*** | 0.24*** | | | |
| Ln price spices (γ) | -0.01*** | -0.04*** | -0.01*** | -0.04*** | -0.04*** | -0.00*** | -0.02*** | 0.17*** | | |
| Ln price soda (γ) | -0.02*** | -0.05*** | -0.01*** | -0.04*** | -0.05*** | -0.01*** | -0.02*** | -0.01*** | 0.22*** | |
| Ln price maize (γ) | 0.00 | -0.01*** | 0.00 | -0.00*** | -0.01*** | -0.00*** | -0.00 | -0.00*** | -0.00*** | 0.03*** |
| Constant (α) | -0.13*** | 0.08*** | 0.06*** | 0.16*** | 0.41*** | 0.07*** | 0.20*** | -0.18*** | 0.28*** | 0.05*** |
| Expenditure parameter (β) | -0.14*** | 0.08*** | 0.00 | 0.11*** | 0.02*** | 0.00 | -0.00 | -0.06*** | -0.00 | -0.00 |
| Squared expenditure term (λ) | -0.01*** | 0.01*** | 0.00*** | 0.01*** | 0.00*** | 0.00*** | -0.00*** | -0.00*** | 0.00 | 0.00*** |
| Elasticity of Household ID | -0.00 | -0.00*** | 0.00** | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.00** | -8.41*** |
| Observations | 20404 | 20404 | 20404 | 20404 | 20404 | 20404 | 20404 | 20404 | 20404 | 20404 |

***, **, and * indicate statistical significance at 1 percent, 5 percent, and 10 percent, respectively. In parenthesis are standard errors.

**Source:** Author's computation 2019.

The results in Table 4.2 support the suitability of the QUAIDS model for the estimated data set since out of the ten coefficients of the quadratic expenditure terms (λ's) estimated, nine are statistically significant at 1 per cent level of significance except for one case of soda. The significance of the quadratic expenditure terms is a strong indication of the need for a rank three matrix (QUAIDS) as opposed to a rank two matrix (AIDS). Therefore, QUAIDS model was found to be preferred for the survey data set.

From Table 4.2, 77 out of the 88 coefficients estimated were found to be statistically significant at 1 per cent level of significance. The estimated coefficients were meant to aid the study in computation of the expenditure elasticities and Marshallian own and cross price elasticities.

### 4.2.4 Elasticities

The estimation of elasticities is of utmost importance for the empirical analysis of the effects of VAT reforms on household welfare. Elasticities are used to estimate the consumers' behavioral features. Consequently, own price elasticities and cross-price elasticities are indicators of the responsiveness of the consumers to price changes. Therefore, there was need to estimate expenditure elasticity, own and cross price elasticities of the ten food items selected for the study. These were obtained from the post-estimation of the demand system in Table 4.2 which gave both uncompensated and compensated price elasticities. Table 4.3 provides the expenditure elasticities for the ten food items. Table 4.4 and Table 4.5 provide the uncompensated and compensated elasticities, respectively.

**a) Expenditure Elasticities**

Expenditure elasticities for the ten food items were obtained as a postestimation of the estimated demand system in the study. According to Tomek & Robinson (2003), an expenditure elasticity is an indicator of the sensitivity of the expenditure on a good to variations in real income. As a result, commodities with high expenditure elasticity imply that high proportion of additional real income of the consumer will be spent on them.

**Table 4.3. Expenditure Elasticities for the Selected Food Items**

| Food item | Expenditure elasticity. |
|---|---|
| Tea leaves | -0.317 |
| Sugar | 2.560 |
| Beans | 1.294 |
| Salad | 2.586 |
| White-bread | 1.240 |
| Rice | 1.859 |
| Cooking fat | 0.823 |
| Spices | -1.439 |
| Soda | 1.012 |
| Maize | 1.737 |

**Source:** Author's computation 2019.

From Table 4.3 coefficients of eight food items have positive expenditure elasticities which represents normal goods whereas coefficients of two food items, namely tea leaves and spices, have negative expenditure elasticities. This means that as the real incomes of the members of the surveyed households increase, they spend more proportion of the additional real income on the consumption of sugar, beans, salad, white-bread, rice, soda and maize. The corresponding expenditure elasticities are 2.56, 1.29, 2.59, 1.24, 1.86, 1.20 and 1.74, respectively. The coefficients of these food items have positive expenditure elasticities which are all greater than unity, implying they are highly expenditure elastic. Positive expenditure elasticity is associated with normal goods as observed by Maganga, Phiri, and Mapemba (2014) and Tefera (2012), implying that the seven food items are normal goods. From Table 4.3, The coefficients of sugar and salad have the highest expenditure elasticities of 2.56 and 2.59 respectively, this can be attributed to the fact that they are purely processed food items and household cannot supplement their consumtpion with farm produce.

However, the coefficient of cooking fat was found to be relatively inelastic with expenditure elasticity 0.82, meaning it is a necessity. On the other hand, the coefficients of tea leaves and spices exhibited negative expenditure elasticities of -0.32 and -1.44, which is associated with inferior goods. Tea leaves (-0.32) was found to be relatively inelastic such that as household's real income increases, their expenditure on tea leaves reduces, probably because they can now afford to spend on its substitutes like coffee, drinking chocolate and beverages with additional income. Spices (-1.44) had a negative high elasticity, meaning that households' expenditure on them drops with increase in income. The most popular spice was Royco, which some households use in vegetables to give them the taste of meat which most households are not able to afford. With an increase in their real income, they reduce their use of spices and instead purchase meat.

Further, the expenditure elasticities for the coefficients of seven out of the ten food items estimated were greater than unity, with one close to unity implying that most households are consuming less than their desired quantities therefore should their real income increase, they would spend a larger proportion of the additional real income on these food items. This could be attributed to high prices of the commodities which can be linked to frequent VAT reforms in the country which largely result to increase in commodity prices.

**b) Uncompensated (Marshallian) Elasticities**

The uncompensated elasticities of demand illustrate the variations in quantity demanded of a commodity, in this case the ten food items, occasioned by variations in prices, holding money income constant. Table 4.4 give the results for uncompensated elasticities.

**Table 4.4 Uncompensated Elasticities**

| | Tea leaves | Sugar | Beans | Salad | White-bread | Rice | Cooking fat | Spices | Soda | Maize |
|---|---|---|---|---|---|---|---|---|---|---|
| Tea leaves | **-1.131** | 0.567 | 0.078 | 0.866 | -0.046 | 0.015 | 0.086 | -0.317 | -0.046 | -0.011 |
| Sugar | 1.233 | **-1.044** | -0.371 | -0.803 | -0.813 | -0.074 | -0.103 | 0.152 | -0.273 | -0.066 |
| Beans | 0.666 | -1.104 | **-2.035** | -0.797 | -0.348 | 0.023 | -0.286 | -0.001 | -0.230 | 0.021 |
| Salad | 1.110 | -.372 | -0.219 | **-0.724** | -0.616 | -0.052 | -0.554 | 0.141 | -0.225 | 0.006 |
| White-bread | -0.066 | -0.546 | -0.082 | -0.484 | **-1.778** | -0.075 | -0.225 | -0.069 | -0.225 | -0.019 |
| Rice | 0.850 | -0.822 | 0.058 | -0.929 | -0.767 | **-2.033** | -0.061 | 0.137 | -0.408 | -0.146 |
| Cooking fat | 0.071 | -0.046 | -0.147 | -0.609 | -0.420 | -0.012 | **-1.537** | -0.205 | -0.163 | 0.005 |
| Spices | -1.062 | 0.005 | -0.110 | 0.633 | -0.312 | -0.071 | -0.233 | **-1.595** | -0.250 | -0.098 |
| Soda | -0.089 | -0.731 | -0.217 | -0.631 | -0.806 | -0.164 | -0.284 | -0.193 | **-3.168** | -0.058 |
| Maize | 1.018 | -1.494 | 0.066 | -0.875 | -0.498 | -0.314 | 0.074 | 0.065 | -0.273 | **-2.165** |

**NOTE:** The entry in row i, column j of the matrix indicates the percentage change in the quantity of good i consumed for 1 percent change in the price of good j.
**Source:** Author's computation 2019.

From Table 4.4, all the own price elasticities for the coefficients of ten food items had the expected negative signs therefore the results were consistent with the consumer demand theory which states that all other factors held constant, a rise in the price of a commoditiy leads to a decline in quantity demanded of the commodity. The results show the own price elasticities for the coefficients of tea leaves, sugar, beans, salad, white-bread, rice, cooking fat, spices, soda, maize as -1.13, -1.04, 2.04, -0.72, -1.78, -2.03, -1.53, -1.60, -3.17, -2.17 respectively. Similar results were obtained by Tefera (2012) in a study that evaluated the impact of rising food prices in Ethiopia on the welfare of households in the

rural areas, and Maganga, Phiri and Mapemba (2014) when they estimated the food demand system for the rural Malawi, they found all the own price elasticities to have negative signs. The own price elasticities is lowest for the coefficient of salad and highest for the coefficient of soda, meaning that any slight increase in the price of soda will result to a substantial decline in its consumption ceteris paribus. Whereas for the coefficient of salad, an increase in its price will only lead to a marginal decline in its consumption. Luxury commodities are highly responsive to changes in prices. Therefore, based on the results obtained, soda can be regarded as a luxurious food item.

Nevertheless, cross price elasticities from table 4.4 exhibits both positive signs and negative signs. This implies that the expenditure items are either complements for those with negative signs and substitutes for those with positive signs. From the results, the coefficients of white-bread and soda have the highest number of complements. Whereas, the coefficient of tea leaves had the highest number of substitutes. This is true as there are quite a number of beverages that are often used in Kenya instead of tea, for instance coffee, drinking chocolate, soda among others. The cross-price elasticities were generally lower than the own price elasticities as expected. Cross-price elasticity is essential in understanding the demand for a commodity when the prices of its related commodities changes. Whereas the own-price elasticity determines the changes in demand for a commodity when its price changes.

**c) Compensated (Hicksian) Elasticities**

The compensated elasticities of demand represent the changes in quantity demanded of a commodity as a result of changes in price of the commodity with consideration to the

price effect only, holding "real income" constant. Table 4.5 gives the results of the compensated elasticities.

**Table 4.5: Compensated Elasticities**

| | Tea leaves | Sugar | Beans | Salad | White -bread | Rice | Cooking fat | Spices | Soda | Maize |
|---|---|---|---|---|---|---|---|---|---|---|
| Tea leaves | **-1.049** | 0.607 | 0.093 | 0.906 | 0.013 | 0.021 | 0.116 | -0.300 | -0.030 | -0.007 |
| Sugar | 0.555 | **-0.713** | -0.499 | -1.137 | -1.300 | -0.128 | -0.350 | 0.015 | -0.411 | -0.094 |
| Beans | 0.327 | -1.269 | **-1.971** | -0.964 | -0.591 | -0.004 | -0.410 | -0.069 | -0.299 | 0.006 |
| Salad | 0.428 | -0.704 | -0.348 | **-0.3877** | -1.105 | -0.106 | -0.803 | 0.004 | -0.365 | -0.022 |
| White-bread | -0.394 | -0.707 | -0.144 | -0.646 | **-1.543** | -0.101 | -0.344 | -0.135 | -0.292 | -0.033 |
| Rice | 0.362 | -1.060 | -0.034 | -1.170 | -1.118 | **-1.994** | -0.239 | 0.038 | -0.508 | -0.167 |
| Cooking fat | -0.145 | -0.152 | -0.188 | -0.715 | -0.575 | -0.029 | **-1.458** | -0.248 | -0.207 | -0.004 |
| Spices | -0.684 | -0.039 | 0.820 | -0.041 | -0.041 | -0.095 | 1.672 | **-1.672** | -0.172 | -0.082 |
| Soda | -0.358 | -0.862 | -0.267 | -0.764 | -0.999 | -0.186 | -0.382 | -0.247 | **-3.113** | -0.070 |
| Maize | 0.559 | -1.718 | -0.020 | -1.101 | -0.827 | -0.351 | -0.093 | -0.027 | -0.368 | **-2.146** |

**NOTE:** The entry in row i, column j of the matrix indicates the percentage change in the quantity of good i consumed for 1 percent change in the price of good j.
**Source:** Author's computation 2019.

Table 4.5 illustrates the results for compensated elasticities, just like the results in table 4.4 for the uncompensated elasticities, the own-price elasticities are captured in the diagonal entries whereas the cross-price elasticities are captured in the non-diagonal entries. In addition, all the diagonal entries in table 4.5 exhibit a uniform negative sign whereas for the non-diagonal entries some have a positive sign while others have a negative sign. This is because consumers respond the same way to changes in price of a given commodity whereas they respond differently to changes in the price of a substitute or compliment good as observed by (Van Oordt, 2016 ).

As noted by Abdulai (2002) in a study of the household demand for food in Switzerland, the compensated price elasticities being a measure of substitution effect net income give more precise indication of substitution among commodity groups. The results of this study are similar to the results of Abdulai (2002) and Tefera (2012) as the own-price elasticities and cross price elasticities from the compensated elasticity matrix are relatively smaller in absolute terms compared to those from the uncompensated elasticity matrix. Since some signs of compensated elasticities were found to be different from those of uncompensated elasticities is an indication that expenditure effects significantly affect consumer demand decisions. Most of the cross-price elasticities were found to be negative, implying that most of the food items are compliments. Therefore any slight change in price of any of the ten food items studied will have an effect on the welfare of the households depending on the direction of the change. An increase in price, would have a negative effect on welfare, less of the commodities will be purchased, whereas a reduction in price would have a positive effect on welfare of households, as more of the commodities will be purchased. Therefore, policy makers, especially with respect to VAT reforms which affect commodity prices should always put this into consideration.

### 4.2.5 Welfare Effect of VAT Reforms

The aim of this study in the first objective was to evaluate the welfare effect of Kenya's VAT reforms on households. Having conveniently estimated the price elasticities of the QUAIDS model. The study attempted to predict the household expected reactions after VAT reforms. Therefore, there was need for assessment of the induced price changes assuming producer prices do not respond to VAT changes hence invariant supply. The

results of expenditure elasticity, uncompensated own price elasticity and compensated own price elasticities from QUAIDS are shown in Table 4.6

**Table 4.6: Budget Elasticity, Uncompensated Elasticity and Compensated Elasticities**

| Commodity | Expenditure elasticity | Uncompensated elasticity (own) | Compensated elasticity (own) |
|---|---|---|---|
| Tea leaves | -0.317 | -1.13 | -1.05 |
| Sugar | 2.560 | -1.04 | -0.71 |
| Beans | 1.294 | -2.04 | -1.97 |
| Salad | 2.586 | -0.72 | -0.39 |
| White-bread | 1.240 | -1.78 | -1.54 |
| Rice | 1.859 | -2.03 | -2 |
| Cooking fat | 0.823 | -1.53 | -1.46 |
| Spices | -1.439 | -1.60 | -1.67 |
| Soda | 1.020 | -3.11 | -3.11 |
| Maize | 1.737 | -2.15 | -2.15 |

**Source:** Author's computation 2019.

Table 4.6 show that the expenditure elasticities for the coefficients of eight out of the ten food items estimated have a positive sign. These include sugar (2.56), beans (1.29), salad (2.59), white-bread (1.240, rice (1.86), cooking fat (0.82), soda (1.02), and maize (1.74). the positive sign implies that as the real income of households in Kenya increase, they will consume more of the commodities. This is an indication that during the period the survey was carried out, the surveyed households were under-consuming these commodities. This could be because their income was not adequate to meet their consumption needs or because the prices for these commodities were quite high. To improve the welfare of these households, there is need to either increase their income or

reduce the prices of these commodities which are just representatives of households' consumption.

An increase in the prices of these commodities and other commodities consumed by households in Kenya without a corresponding increase in their real income would make them worse off and result have a negative effect on their welfare. Whereas a reduction in the prices of these household goods holding their income constant or together with increase in their income would make them better off and result to a positive effect on their welfare. Considering the VAT reforms in Kenya from 1991 to 2018, it can be concluded that the net effect of these reforms have been general increase in prices of consumer goods and service. Therefore, these reforms can be said to have resulted to negative effect on the welfare of the consumers.

The 2013 VAT ACT saw a number of consumer goods which were initially zero-rated or exempted from VAT moved to the tax bracket and taxed at the standard rate of 16%. This meant that some commodities and services had their prices increase by 16% since most producers in Kenya transfer the entire tax burden to the consumers. The recent imposition of VAT tax of 8% on fuel in Kenya to fully implement the 2013 VAT ACT saw prices of almost all commodities in Kenya rise. This is because fuel is a major input in production of goods and services in Kenya. From Table 4.6 the compensated and uncompensated own price elasticities for the ten commodities under study found all the own-price elasticities to be negative. This is an indicator that if price of any of the commodities increases, then consumers response is to cut down their expenditure on the commodities

by reducing the amount consumed. This is another indicator of welfare loss occasioned by VAT reforms that resulted to rise in prices. This also affected the welfare of most households in Kenya negatively. In conclusion, VAT reforms have adversely affected the welfare of households in Kenya.

#### 4.2.5.1 Simulation of the Effects of VAT Reforms on Household Welfare in Kenya.

The demand system estimation results obtained in this study were applied for tax policy simulation. The estimated Marshallian (uncompensated) elasticities were used to simulate the effect of VAT reforms on household expenditure. It was assumed that all the ten food items were initially zero rated, then as a result of VAT reforms, they were now taxed at a standard rate of 16 per cent. Further, it was assumed that changes in VAT rates were fully reflected in prices of the affected commodities. Therefore, it was expected that the prices of these commodities would increase by 16 per cent. The household's behavioral response to quantity demanded is shown in Table 4.7.

**Table 4.7: Simulated Mean Expenditure Quantity Demanded by Households Post VAT Reforms**

| Food Item | Average Quantity Per Households (Before VAT reform) | Uncompensated elasticity (own) | Reduction in average quantity per household following 16% increase in unit price-VAT reform. | Average Quantity Per Households (After VAT reform) |
|---|---|---|---|---|
| Quantity of tea (gms) | 53.343 | -1.13 | -9.64444 | 43.69872 |
| Quantity of sugar (kg) | 1.682 | -1.04 | -0.27987 | 1.402049 |
| Quantity of beans (kg) | 0.479 | -2.04 | -0.15635 | 0.322661 |
| Quantity of salad (ml) | 94.844 | -0.72 | -10.9261 | 83.91823 |
| Quantity of Whitebread (gms) | 400.632 | -1.78 | -114.1 | 286.5323 |
| Quantity of white rice (kg) | 2.383 | -2.03 | -0.77401 | 1.609029 |
| Quantity of cooking fat (gms) | 8.721 | -1.53 | -2.13492 | 6.586167 |
| Quantity of spices (gms) | 8.618 | -1.60 | -2.20626 | 6.411954 |
| Quantity of soda (ml) | 300.455 | -3.11 | -149.506 | 150.9484 |
| Quantity of maize (kg) | 1.496 | -2.15 | -0.51471 | 0.981544 |

**Source:** Author's computation 2019.

Table 4.7 shows that households respond to price increases of commodities, in this case, following VAT reform of movement of zero-rated commodities to 16 per cent tax rate category by reducing the quantity demanded. The magnitude of the reduction in quantity demanded was found to correspond to own price elasticity, in this case Marshallian as shown in Table 4.7. The coefficient of Soda exhibited the highest own price elasticity of (-3.11) in absolute terms and dropped the most in terms of average volume consumed per household, from 300.45 milliliters to 150.95 milliliters. The reduction in quantity consumed by households is thought to result in decline of household welfare. Whereas, the coefficient of Salad which was found to have the lowest own price elasticity in absolute terms dropped from 94.84 milliliters to 83.92 milliliters of average volume consumed per household.

### 4.3 Effect of Tax Reforms on VAT Collection Efficiency in Kenya.

This section presents the second objective of the study which sought to determine the effect of Tax reforms on VAT collection efficiency in Kenya. The first subsection presents the descriptive statistics of the variables used, unit root test results and diagnostic tests performed. The second subsection presents the estimated VAT collection efficiency for Kenya and the last subsection presents the results from the estimated model and discussions

#### 4.3.1 Descriptive Statistics

Table 4.8 presents the summary statistics on the various variables used.

**Table 4.8: Summary Statistics for the Variables used in Estimation of the Determinants of VAT Collection Efficiency.**

| Variable | Obs. | Mean | Median | Maximum | Minimum | Std. Dev. |
|---|---|---|---|---|---|---|
| VAT Revenue (KES Billlion) | 27 | 63.50 | 4.02 | 208.00 | 7.88 | 6.17 |
| Final Consumption (KES Billlion) | 27 | 238.00 | 207 | 422.00 | 134 | 82.90 |
| VAT Standard Rate (%) | 27 | 16.52 | 16 | 18 | 15 | 1.05 |
| Number of VAT rates | 27 | 3.74 | 3 | 9 | 2 | 1.63 |
| Gross Domestic Product growth (%) | 27 | 3.73 | 4.15 | 8.41 | -0.79 | 2.4 |
| Shadow economy % GDP | 27 | 33.19 | 33.35 | 36.24 | 28.68 | 1.97 |
| Trade as % GDP | 27 | 55.20 | 54.23 | 72.86 | 36.75 | 8.42 |
| Agriculture output as a % GDP | 27 | 26.34 | 26.34 | 32.13 | 20.51 | 2.82 |

**Source: Authors Computations, (2019)**

From Table 4.8 VAT revenue ranged from KES 7.8 billion to KES 208 billion with a mean of KES 63.5 billion between 1991 and 2017. During the same period, final private consumption averaged KES 238 billion with a maximum of KES 422 billion and a minimum of KES 134 billion. Since VAT is a consumption tax, it was observed that the total VAT revenue increased over time with the period between 1991 and 1994 recording the lowest values of VAT revenue and the period 2014 to 2017 recording the highest values of VAT revenue. The increase in VAT revenue overtime can be attributed to a number of factors as observed by Wawire (2017) namely the establishment of KRA as an autonomous authority to manage tax collection, various tax reforms in the country, GDP growth, population growth among others. Although agriculture has been hailed as the backborne of Kenya's economy, the growth of its output has not been meaningfull as can be observed in the value of its standard deviation of 2.82 per cent over the period of 27 years. This can be attributed to a number of factors such as reliance on rain-fed farming which has been adversely affected by climate change, lack of value addition by farmers therefore low returns on agricultural outputs which demotivates farmers from producing more, use of outdated farming techniques among others.

The maximum number of VAT rates as shown in table 4.8 was nine. This was in the year 1991 when there were numerous VAT rates meant for different categories of goods and services. The existence of numerous VAT rates was largely blamed for the low level of compliance by tax payers as argued by (Moyi & Muriithi, 2003; Karingi &Wanjala, 2004). Therefore, as part of tax reforms, Kenya embarked on VAT rates rationalization programme so that by the year 2017, there were only two VAT rates; That is the standard

rate of 16 per cent and zero percent rate for zero-rated goods and services. On the other hand, the standard VAT rate has remained fairly stable with the minimum rate being 15 per cent and the maximum rate being 18 per cent for the 27 year period under study. This is bacause most goods and services are taxed at the standard rate, and therefore, policy makers are often careful with reviewing the standard rate by a bigger margin because of the devastating effect it may cause. On one hand, increasing the VAT standard rate by a bigger margin can make most goods and services unaffordable to most consumers, therfore, they may be forced to do without the goods. This can adversely affect their welfare and at the same time deny the government the expected revenue. On the other hand, reducing the VAT standard rate by a bigger margin, will also have a likely effect of reducing the VAT revenue received by the government and this may cripple service delivery by the government.

### 4.3.2 Stationarity Test Results

Stationarity tests were conducted to avoid obtaining spurious regression results. The use of non-stationary data in time series analysis may give an indication that there is a significant relationship among variables when in actual sense there is none (Granger & Newbold, 1974). The study therefore, conducted the tests for stationarity for each variable series using the Augmented Dicky Fuller (ADF) test and the results were verified using the Phillips-Perron (PP) test which corrects for serial correlation using a non-parametric correction to the standard statistics. The test results are presented in Table 4.9.

**Table 4.9 Unit Root Test Results for Variables used in the VAT C-efficiency**

| | Augmented Dickey Fuller (ADF) | | Philip-Perron (PP) | | |
|---|---|---|---|---|---|
| VARIABLE | P-value at levels | P-value at 1st Difference | P-value at levels | P-value at 1st Difference | Order of Integration |
| No. of VAT rates | 0.0005* | | 0.004* | | I(0) |
| GDP Growth | 0.0311** | | 0.0442** | | I(0) |
| Shadow Economy % GDP | 0.2165 | 0* | 0.1881 | 0* | I(1) |
| Agriculture % GDP | 0.8478 | 0.0088* | 0.7113 | 0.0095* | I(1) |

** and ** denotes rejection of the hypothesis at 1% and 5% significant level*
Source: Author's Computation, (2019).

The unit root test results in Table 4.9 show that some variables were stationary at levels while others were stationary at first difference. The two tests found the number of VAT rates and GDP growth to be stationary at levels whereas shadow economy as a percentage of GDP and agriculture as a percentage of GDP were found to be non-stationary at levels but stationary at first difference. Therefore, all the variables were integrated of order (0) and order (1), none of the variable series was integrated of order (2). The Autoregressive Distributed Lag (ARDL) model was found to be the best modelling technique for evaluating the effect of tax reforms on VAT C-efficiency, since it is suitable for variables that are integrated of different orders but none integrated of order (2).

### 4.3.3 Diagnostic Test Results for the ARDL Model

A number of diagnostic tests were conducted to ensure that the model was statistically sound. There was need to conduct the ARDL bound test, since the ARDL modelling technique was adopted. Following Pesaran, Shin and Smith (2001) bound test based on Wald F-statistic was performed to establish whether there was evidence of long-run

cointegration relationship among the variables used. The results of bound test are presented in Table A6 of Apendix 1. The value of F statistics obtained was found to be greater than the critical upper bound values which was an evidence of existence of long-run cointegration relationship among dependent and independent variables. The lags of (1,0,1,1,0,0,1) included in the model were automatically generated by the system based on Akaike Information Criterion (AIC) together with Schwartz Information Criterion (SIC).

The study carried out the Durbin-Watson d-statistic test for serial correlation. The results are shown in Table A8 of Appendix 1. The d value was found to be 3.225 which lies within the acceptable range of 2 to 4 which is an evidence of the absence of serial correlation. The results were corroborated by Breusch-Godfrey LM test for autocorrelation shown in Table A9 of Appendix 1. The P-values for ARCH $X^2$ obtained was 0.000 an evidence of absence of serial correlation.

To test whether the variance of the errors in the regression model were constant, White test for heteroskedasticity was conducted following White (1980). The results as shown in Table A10 of Appendix 1 found the P-values for Heteroskedasticity, Skewness and Kurtosis to be 0.406, 0.796 and 0.139 which were statistically insignificant. Therefore there was evidence of absence of Heteroskedasticity, Skewness and Kurtosis. Consequently, the variance of the errors were found to be constant and the data set normally distributed. The results for the test for Heteroskedasticity were verified using ARCH LM test as shown in Table A11 in Appendix 1. The P-value for ARCH $X^2$

statistic was found to be 0.207 as a result the null hypothesis of homoscedasticity could not be rejected at one percent level of significance. It was therefore concluded that there was no problem of Heteroskedasticity.

The test for specification error was carried out using Ramsey RESET test to ascertain whether non-linear combination of regressors used in the ARDL model for objective two of the study have any ability in explaining the variations in VAT collection efficiency. The test results are shown in Table A12 in Appendix 1. The calculated F-statistic was found to be 0.694. Consequently, the null hypothesis of no specification error was not rejected. This supported that the linear functional form of the ARDL model was correctly specified. The stability of the model was tested using CUSUM stability test as shown in figure A1 of Appendix 1. The estimates were found to be within the acceptable region within 95 per cent level of confidence supporting the stability of the parameters. The model was therefore accepted for use in explaining the effect of tax reforms on VAT collection efficiency.

### 4.3.4 Estimation of VAT Collection Efficiency

There was need to estimate the VAT collection efficiency for Kenya over the 27 years period in order to determine its performance over time. The values of the VAT collection efficiency that were obtained at this stage, were used as the dependent variable in the model to evaluate the effect of tax reforms on the VAT collection efficiency in Kenya. To obtain the values of VAT collection efficiency, the study estimated the VAT – C efficiency model as specified in equation 3.27 in chapter three. Therefore, following C-

efficiency ratio model developed by Keen (2013), total VAT revenue for each year was divided by the product of the year's VAT standard rate and the year's value of final private consumption to obtain the results shown in table A2 in appendix1.

The trend of VAT collection efficiency over the 27 year period is as shown in figure 4.1

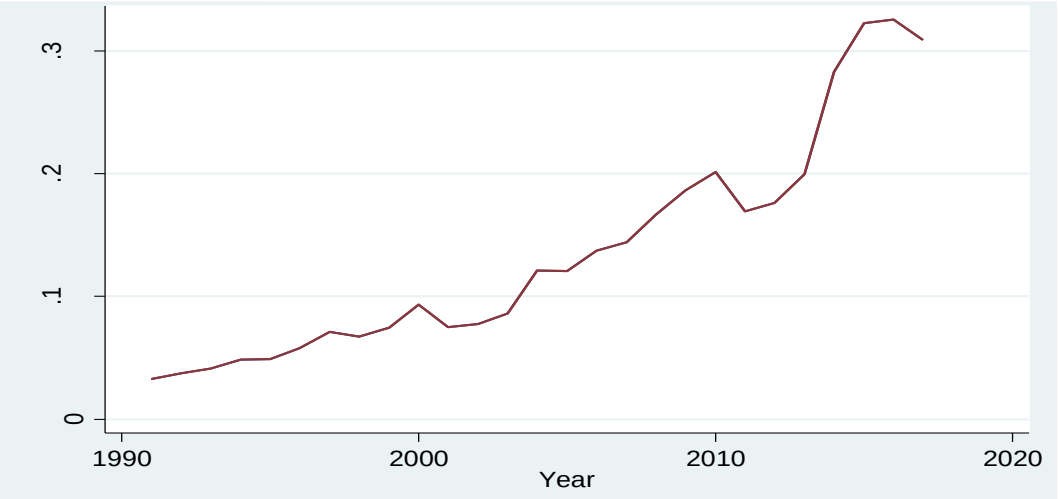


**Figure 4.1: VAT C-Efficiency trend.**
Source: Constructed from the study data.

Results in figure 4.1 show that VAT collection efficiency has been improving over time. The notable years with remarkable improvement include the year 1996 and 1997 when the VAT C-efficiency crossed the 5.0 per cent mark and was recorded at 5.78 per cent and 7.12 per cent respectively. This can be attributed to the establishment of KRA in 1995 as an automous authority to handle tax collections in Kenya. Again in the year 2014, there was a remarkable improvement of VAT C-efficiency when it was recorded at

28.28 per cent up from the year 2013 when the value was 19.98 per cent. This can be attributed to the major VAT reforms that were conducted in the country in the year 2013 that led to the enactment of the VAT ACT of 2013. The said reforms were characterised by the removal of the reduced VAT rate of 12 per cent that applied to supply of electicity and hotel services together with removal of a number of goods and services from the VAT zero-rated category to exempt category. The momentum of improvement of VAT collection efficiency was sustained till the year 2015 when the value improved further to 32.28 per cent and later in 2016 the improvemt was marginal to 32.57 per cent. However, in the year 2017 the VAT C-efficiency value declined to 30.89 per cent. It is worth noting that based on the results that were obtained in Table A2 of Appendix 1, Kenya's VAT has still been underperforming, because according to Keen (2013), for a VAT tax to be considered to be performing well, its VAT C-efficiency should be atleast at 60 per cent and above. The best that Kenya has achieved so far has been around half of this. The results of Kenya's VAT c-efficiency supported the argument by Cheeseman and Griffiths (2005) that despite the numerous tax reforms in Kenya, the VAT was still underperforming.

From figure 4.1 it can be seen that the VAT C-efficiency growth has been on an upward trend but with a lot of ups and downs in some years. Therefore, there was need to establish the effect of tax reforms on the VAT C-efficiency to smoothen its growth.

**a) The Short-Run Effects of Tax Reforms on VAT Collection Efficiency in Kenya.**

The estimated VAT collection efficiency values obtained for each study period were therefore used as the dependent variable in the ARDL model 3.28 in chapter three and the general results were obtained as presented in Table A4 of Appendix 1. In the ARDL model, the dependent variable was the estimated values of VAT collection efficiency for each study period and the independent variables included were the first lag of VAT C-efficiency, VAT reforms, number of VAT rates, GDP growth, shadow economy as a percentage of GDP, trade as a percentage of GDP, and agriculture as a percentage of GDP. Before utilizing it, the ARDL model was subjected to a number of diagnostic tests. The short-run effect of tax reforms on VAT collection efficiency in Kenya were extracted from Table A4 of Appendix 1. The short-run results are shown in table 4.10.

**Table 4.10: The Short-run ARDL Results of the Effects of Tax Reforms on VAT Collection Efficiency**

| VARIABLES | Coefficient | t-Statistic | P-Value |
|---|---|---|---|
| First lag of VAT collection efficiency | 0.85*** | 9.36 | 0.00 |
| VAT reforms | 0.02*** | 3.21 | 0.01 |
| Number of VAT rates | -0.02*** | -3.26 | 0.01 |
| First lag of the number of VAT rates | 0.01 | 1.62 | 0.13 |
| GDP growth% | -0.14 | -0.68 | 0.51 |
| First lag of GDP growth% | -0.25 | -1.38 | 0.19 |
| Shadow economy % GDP | -66.15** | -2.46 | 0.03 |
| Trade % GDP | -0.21*** | -2.90 | 0.01 |
| Agriculture % GDP | 0.12 | 0.48 | 0.64 |
| First lag of Agriculture % GDP | -0.51* | -2.04 | 0.06 |
| _Constant | 0.51*** | 3.77 | 0.00 |

*Note: ***, **, and *, denote significance at 1%, 5% and 10% levels respectively*

**Source:** Author's computation 2019.

The coefficient of the first lag of VAT collection efficiency was found to be positive and statistically significant. Therefore, a percentage point change in the first lag of VAT collection efficiency is associated with a 0.85 percentage increase in VAT collection efficiency on average all factors held constant at one per cent level of significance. This is because an improvement in VAT collection efficiency in the previous time period is expected to spillover to the following time period. This is consistent with the findings of Aizenman and Jinjarak (2008) who associated improvement of VAT collection efficiency to a good tax structure and argued that if the previous period's tax structure was good and resulted to improvement in VAT collection efficiency, then all factors held constant, that would be reflected in the following time period.

Table 4.10 shows that the coefficient of VAT reforms had the expected positive sign and was statistically significant at one percent level, however, the value of the coefficient was quite low compared to the coefficients of the other independent variables used in the study. This is an indication that the VAT reforms that have been conducted in Kenya have not bore the expected fruit of significantly improving the VAT collection efficiency. The results indicate that the presence of significant tax reforms in the current period improves the VAT collection efficiency for the period by 0.02 per cent at one per cent level of significane, all factors held constant. This is consistent with tax reform theories which expect reforms to improve efficiency of tax systems.

Further, it was established that the present number of VAT rates, which is also an element of tax reforms, impacted on the VAT collection efficiency negatively. As the results on table 4.10 show that the coefficient of the current number of VAT rates had the expected negative sign and stitistically significant at one per cent level of significance. This means that as the number of VAT rates increase, VAT collection efficiency declines and as the number of VAT rates reduces, VAT collection efficiency improves. The finding is consistent with the argument that was advanced by Karingi and Wanjala (2005) who justified VAT rationalization process leading to the number of VAT rates in Kenya being reduced from 15 in 1991 to four by 1994 and to three by 1998 in an attempt to boost revenue generation and ensure efficiency in VAT administration. High number of VAT rates is associated with complex administration resulting to high administrative cost and ease of evasion because of misclassification of various commodities. However, the coefficient of the first lag of the number of VAT rates was found to be statistically insignificant. This is consistent with economic theory because the number of VAT rates only affects the VAT collection efficiency for the same time period.

The coefficients of GDP growth and the lagged value of GDP growth both had the expected negative sign, but were statistically insignificant. The negative sign means that as the economy grows, the adminstration of taxes becomes more complex therefore resulting to decline in the VAT collection efficiency. The reason why the coefficient of GDP growth could have been statistically insignificant is because overtime, changes in the growth of Kenya's GDP has been marginal.

The coefficient of shadow economy as a percentage of GDP was found to be statistically significant at five percent level of significance and had the priori expected sign of negative. The high value of -66.15 means that an increase in the value of shadow economy by one percentage of the GDP reduces the VAT collection efficiency by 66.15 percent all factors held constant, suggesting that of all the variables considered in the model, the shadow economy as a perentage of GDP is seen to be the main determinant of VAT collection efficiency. Similar results of high magnitude of the coefficient of shadow economy as a percentage of GDP were found by Aizenman and Jinjarak (2008); Alm and Embaye (2013). On the same note, Ueda (2017) found that a one per cent increase in the value of shadow economy resulted to a 0.44 per cent fall in the value of the VAT collection efficiency.

The coefficient of trade as a percentage of GDP was found to have the expected sign of negative and statistically significant at one per cent level of significance. The results show that a one percent increase in the value of trade as a percentage of GDP, led to a 0.21 per cent decline in VAT collection efficiency. As the volume of trade grows in an economy, it was expected that tax administration became more complex and the informal trade and shadow economy were also expected to grow at the same time impacting negatively on the VAT collections efficiency. The same argument was advanced by Aizenman and Jinjarak (2008). Decline in VAT collection efficiency is also an indicator of the inefficiency of the tax authority. It demonstrates that either the tax authority is not flexible in terms of human and physical resources to handle growth of tax base, or the level of tax evasion and avoidance rises with growth of trade in Kenya.

The coeficient of the first lag of agriculture as a percentage of GDP had the expected negative sign and was statistically significant at 10 per cent level of significance. The results imply that a one percent growth in agriculture as a percentage of GDP in the current period will lead to a 0.51 percent decline in the value of VAT collection efficiency in the following period. This is in line with theory which expects that there is a negative relationship between agriculture growth and VAT collection efficiency in developing economies because agriculture is largely informal and not taxed. Therefore, as agriculture grows, the volume of untaxed agricultural output also grows at the same time resulting to decline in VAT collection efficiency. This is because although private final consumption rises, but a large proportion of agricultural output is not taxed. The coefficient could have been insignificant because the growth of agricultural output in Kenya has been quite stagnant for some time with even some years with negative growth. This has been attributed to a number of factors namely; overreliance on rain-fed agriculture whose production has been adversely affected by recent climatic changes leading to unpredictable rainfalls, the use of outdated production methods resulting to low productivity, political instability especially during every election year with the most notable one being the post-election violence of 2007/08 among others.

**b) The Long-run Effects of Tax Reforms on VAT Collection Efficiency in Kenya.**

The long-run determinants of VAT collection efficiency in Kenya were extracted from Table A6 of Appendix 1. The long-run results are shown in table 4.11 as obtained after estimating the long run form of equation 3.29 in chapter three.

**Table 4.11: The Long-run ARDL Results of the Effects of Tax Reforms on VAT Collection Efficiency.**

| VARIABLES | Coefficient | t-Statistic | P-Value |
|---|---|---|---|
| VAT reforms | -0.133 | -1.38 | 0.187 |
| Number of VAT rates | -0.075 | -1.69 | 0.113 |
| GDP growth% | -2.509 | -0.89 | 0.387 |
| Shadow economy % GDP | -427.329* | -1.84 | 0.085 |
| Trade % GDP | -1.324** | -2.30 | 0.036 |
| Agriculture % GDP | -2.527 | -1.33 | 0.204 |

*Note: ***, **, and *, denote significance at 1%, 5% and 10% levels respectively*

**Source:** Author's computation 2019.

From the results in Table 4.11 in the long-run, only the coefficients of the first lags of shadow economy as a percentage of GDP and trade as a percentage of GDP were found to be negative and statistically significant at 10 percent and percent levels respectively. This is consistent with the short-run results where the coefficients of the shadow economy as a percentage of GDP and trade as a percentage of GDP were found to be negative and statistically significant at five per cent and one percent levels respectively.

The results in Table 4.11 show that an increase in the volume of shadow economy as a percentage of GDP in the long run by one percent results to a decline in the VAT collection efficiency by 427 percent all other factors held constant. This is consistent with tax theories that consider hidden economic activities to be a major source of tax leakages within economies that lack strict policy measures to regulate such activities. Corruption and tax evasion which are indicators of existence of shadow economy have been quite rampant in Kenya. This was supported by the arrest and arraignment in court of about 40 KRA staff members accused of abetting tax evasion in the month of May, 2019.

Similarly, an increase in trade volume as a percentage of GDP in the long run by one per cent leads to a decline in VAT collection efficiency by 1.324 per cent all other factors held constant. This can be attributed to increase in the cost of VAT collection as trade volume expands as well as increase in tendency to evade tax as tax obligation of traders increase with trade expansion. It is also important to note that trade in agricultural products forms a substantial part of trade in Kenya and as observed by Aamir, Qayyum, Nasir, Hussain, Khan and Butt, (2011) trade in agricultural products in the developing countries is largely informal and untaxed. Since agricultural products could be responsible for expansion in volume of trade in Kenya, a corresponding improvement in VAT collection efficiency may not be expected.

In the long-run, coefficients of the first lags of VAT reforms, number of VAT rates, GDP growth, shadow economy as a per centage of GDP and agriculture output as a per centage of GDP were found to be statsitically insignificant. Meaning that these variables did not influence VAT collection efficiency in Kenya in the long run.

For the case of VAT reforms whose coefficient was found to be statistically significant at one percent level for significance in the short run, in the long run it could be insignificant for a number of reasons. One, laxity on the part of tax administrators in continual implementation of new tax policies. Two, the tax payers may have found ways of evading the recently enacted new tax policies, and finally the previously enacted tax policies may have become obsolete in terms of revenue generation as a result of changing economic dynamics.

Similarly, the coefficient of the number of VAT rates was found to be statistically insignificant in the long-run unlike the short-run case where it was statistically significant. In both cases, the sign was negative as expected, implying that increase in the number of VAT rates leads to a decline in VAT collection efficiency. This had been attributed to a rise in cases of tax evasion and complexity in the administration of so many VAT rates. In the long run, it is expected that the revenue administration will have already made necessary adjustments to be able to efficiently administer the increased number of VAT rates therefore explaining the statistical insignificance of its coefficient.

The coefficient of GDP growth was found to be negative and statistically insignificant in the long-run just like in the short-run case. This contradicts the findings of Tagkalakis (2014) who found the coefficient of GDP growth to be positive (0.63) and statistically significant for Greece. For this case, the author argued that the deterioration in the ability to fight tax evasion is associated economic downturns.

Both the coefficients of agricultural output as a percentage of GDP and shadow economy as a percentage of GDP had the expected negative signs but were statistically insignificant in the long run. This could be because the growth of the two variables in Kenya has been marginal, almost stagnant. As a result, could not significantly determine VAT collection efficiency in the long-run.

### 4.4 Determinants of VAT Compliance Gap in Kenya

To estimate the determinants of VAT compliance gap, the study utilized data on the actual VAT revenue collected and the targetted VAT revenue for every year obtained from Kenya Revenue Authority. The difference between the actual VAT revenue collected and the targetted VAT revenue by KRA was considered to be the VAT compliance gap in Kenya and not policy gap because this was the VAT revenue that was expected within the prevailing VAT policy framework. The values of the VAT compliance gap obtained were then used as the dependent variable in the ARDL model in equation 3.31 in chapter three. The variables included as independent variables were the standard VAT rates, shadow economy as a percentage of GDP, VAT reforms, number of VAT rates, manufacture value added growth, population growth, import as a percentage of GDP, final consumption as a percentage of GDP, and export as a percentage of GDP. The output of the regression is in Appendix II, table A13.

#### 4.4.1 Descriptive Statistics for Estimation of the Determinants of VAT Compliance Gap

Table 4.12 presents the descriptive statistics for the variables used in the estimation of the determinants of VAT compliance gap in Kenya.

**Table 4.12: Descriptive Statistics for the Variables used in Estimation of the Determinants of VAT Compliance Gap in Kenya**

| Variable | Mean | Std.Dev. | Min | Max |
|---|---|---|---|---|
| VAT compliance gap % of GDP | -0.076 | 0.225 | -0.891 | 0.219 |
| Shadow economy % of GDP | 33.192 | 1.938 | 28.680 | 36.240 |
| Manufacture value added growth % | 2.413 | 2.704 | -2.320 | 8.208 |
| Population growth % | 2.784 | 0.179 | 2.523 | 3.267 |
| Import % of GDP | 23.708 | 6.545 | 10.938 | 33.014 |
| Final consumption % of GDP | 90.044 | 4.254 | 78.093 | 93.704 |
| Exports % of GDP | 15.703 | 7.380 | 3.539 | 27.450 |
| Agriculture output % of GDP | 25.412 | 2.582 | 20.707 | 29.708 |

**Source:** Author's computation 2019.

From table 4.12, on average, VAT compliance gap as a percentage of GDP was -0.0756 per cent meaning that for the study period, value of actual VAT revenue collected slighlty surpassed the value of targeted VAT revenue. This can be attributed to a number of tax reforms in the country and specifically those targetting VAT. The standard deviation for the VAT compliance gap as a percentage of GDP with a value of 0.225 percent was found to be quite high compared to the mean which was -0.076 percent and also higher than the maximum value which was 0.220 percent. This is an indication that there was a lot of variation in the VAT compliance gap during the study period, thus justifying an examination of the determinants of the VAT compliance gap in Kenya. For a good performing VAT, the absolute value of the minimum value of VAT compliance gap should be greater than the maximum value of the VAT compliance gap. However, from table 4.12 that is not the case since 0.076 is less than 0.220. this is clear indication that Kenya's VAT has been underperfroming.

The growth of shadow economy as a percentage of GDP in Kenya over the study period was also found to have been fairly stable with a mean of 33.19 percent, a standard deviation of 1.94 percent, minimum value of 28.68 and a maximum value of 36.24 percent. A lower value of shadow economy is preferred by the revenue authority since it measures the value of underground economy which is not subjected to taxation. The higher the value of shadow economy, the more taxes the government is losing which can lead to a higher VAT compliance gap.

The manufacturing value added growth during the study period averaged 2.413 percent with a standard deviation of 2.704 percent and a minimum of -2.320 percent and a maximum of 8.20 percent. The highest growth in terms of manufacture value added to be achieved in Kenya since 1991 to 2018 was 8.204 percent. It is expected that when the manufacturing value added growth is on the positive trend, the VAT compliance gap as a percentage of GDP is expected to reduce holding all other factors constant. This is because the manufacturing sector in Kenya is largely formal and it is easier for the tax authority to tax every additional output in the sector. The minimum growth was negative, implying that there were periods when the value addition growth in the manufacturing sector fell below the previous period's.

Population growth rate during the period under study had a mean of 2.784 percent, with a standard deviation of 0.179 percent, minimum of 2.523 percent and a maximum of 3.267 percent. As population growth rises, the effect on the VAT compliance gap can go either way depending on the readiness of the revenue authority to handle it. In a case where the

revenue authority is not well prepared, the rise in population growth would result to widening tax gap as the tendency to evade tax will be on the rise with a growing population. On the contrary, in a case where the revenue authority is well prepared for population growth, the rise in population will lead to narrower VAT compliance gap as the revenue authority is able to efficiently collect VAT revenue from the rising population.

The average value of import as a percentage of GDP during the study period was found to be 23.708 percent, with a standard deviation of 6.545, a minimum of 10.938 percent and a maximum of 33.014 percent of the GDP. The standard deviation for the value of import as a percentage of GDP was relatively high an indication that Kenya is a net importing country. It is expected that as the value of import as a percentage of GDP rises, the VAT gap is supposed to narrow because imported goods are subjected to VAT at the specified rates except for a few commodities which are either zero-rated or exempted from VAT for one reason or another. All imported commodities must be declared at their various points of entry into the country therefore VAT evasion for imported commodities is quite minimal.

For final consumption as a percentage of GDP, the mean was found to be 90.044, with a standard deviation of 4.254, a minimum of 78.092 and a maximum of 93.704 percent of GDP. Just like population growth, again, the effect of the rise in final consumption on the VAT compliance gap again is dependent on the preparedness or the efficiency of the revenue authority. In a case where the revenue authority is efficient, the rise in the value

of final consumption as a percentage of GDP should lead to a narrower tax gap and vise versa. However, Kenya being largely an agricultural economy, in a case where the rise in final consumption is as a result of subsistence consumption from agricultural output which is outside the tax bracket, then we can have a case where despite the efficiency of the revenue authority, a rise in final consumption leads to widening of VAT compliance gap.

From table 4.12 the mean for the value of export as a percentage of GDP was found to be 15.703 percent, lower than the mean value of import which was 23.708 percent of GDP confirming that Kenya is a net importing country. The standard deviation was found to be 7.380 percent of GDP and the minimum value was 3.539 and the maximum was 27.500 percent of GDP. It is important to note that according to Kenya's tax policy, exports are exempted from tax. Depending on the discipline of the tax payers, there are usually cases where some tax payers disguise goods as exports but end up being consumed locally. In such a case, as the value of exports rises, the VAT compliance gap also widens holding all other factors constant.

The average value of agricultural output as a percentage of GDP was found to be 25.412 percent of GDP, with a standard deviation of 2.581 and a minimum of 20.707 percent and a maximum of 29.708 percent. Agriculture being largely subsistence in Kenya, a good proportion of agricultural output is not taxed in Kenya. Therefore, a rise in agricultural output as a percentage of GDP is mostly associated with a widening of VAT compliance gap.

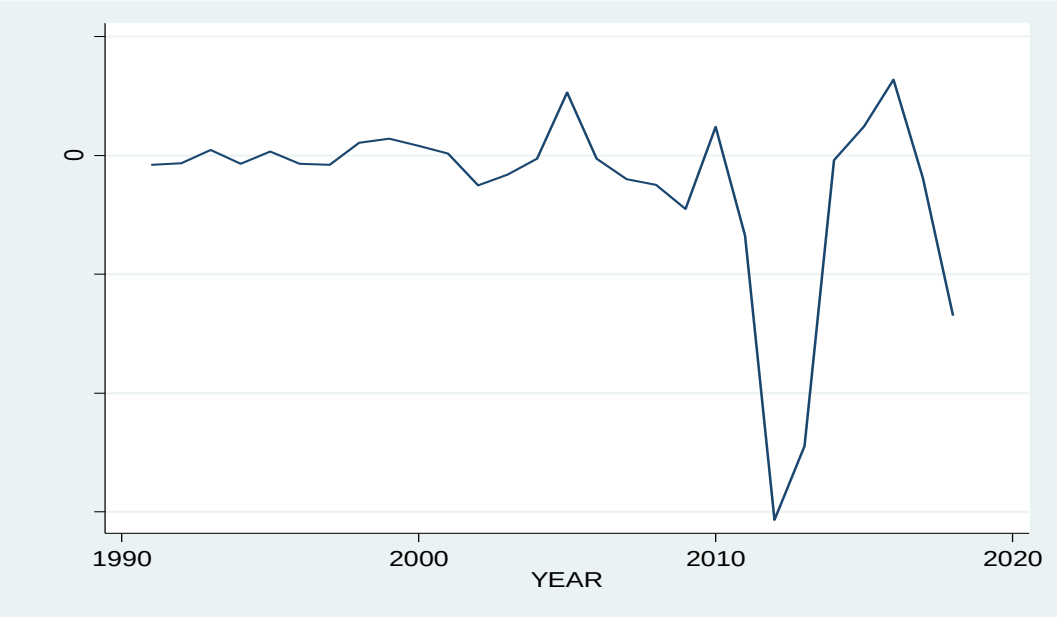


**Figure 4.2 VAT compliance gap trend.**
Source: Author's computation (2019)

Figure 4.2 shows that VAT compliance gap has been characterized by upward and downward trend for the period under study. Prior to the year 2000, the VAT compliance gap was fairly steady as can be seen from figure 4.2. However, after the year 2000 the VAT compliance gap was characterized by sharp drops and rises. In the year 2013, after the enactment of the VAT ACT of 2013, there was a sharp negative drop in VAT compliance gap, an indication that the tax reforms of the year 2013 were instrumental in reducing the VAT compliance gap. After a short period of time there was a sharp rise in the VAT compliance gap to the positive side which is not desirable, an indication that the tax reforms of the year 2013 were only effective in managing the VAT compliance gap just for a short period of time. This can be attributed to a number of factors, laxity on the part of revenue authority in monitoring strict implementation of the new tax policies over a longer period of time and also the behavior change by tax payers in case they manage to

come up with new tactics for evading the new tax policies over time. As can be noted from figure 4.2, the upward and downward movement of the VAT compliance gap went on beyond the year 2013 to the year 2018. Therefore there was need to investigate the determinants of such movement of the VAT compliance gap.

### 4.4.2 Unit Root Test Results

The study tested for non-stationarity of each variable to determine their order of integration. For stationarity robust check, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) were employed in testing for unit root. The test results for all the variables are reported in Table 4.13.

**Table 4.13: Unit Root Test Results for Variables for Estimation of the Determinants VAT Compliance Gap**.

| | **Augmented Dickey Fuller (ADF)** | | **Phillip-Perron (PP)** | | |
|---|---|---|---|---|---|
| **VARIABLE** | **P-value at level** | **P-value at 1st diff** | **P-value at level** | **P-value at 1st diff** | **Order of integration** |
| VAT compliance gap % of GDP | 0.0790 | 0.0019 | 0.0627 | 0.0029 | I(1) |
| Standard VAT rates | 0.0254 | | 0.033 | | I(0) |
| Shadow economy % of GDP | 0.2002 | 0 | 0.1727 | 0 | I(1) |
| Manufacture value added growth % | 0.0045 | | 0.0045 | | I(0) |
| Population growth % | 0 | | 0.0005 | | I(0) |
| Import % of GDP | 0.9615 | 0 | 0.9634 | 0 | I(1) |
| Final consumption % of GDP | 1 | 0.0304 | 1 | 0.0365 | I(1) |
| Exports % of GDP | 0.986 | 0.0014 | 0.9825 | 0.0013 | I(1) |
| Agriculture output % of GDP | 0.9934 | 0 | 0.9965 | 0 | I(1) |

** and ** denotes rejection of the hypothesis at 1% and 5% significant level*
**Source:** Author's computation 2019.

The unit root test results in table 4.13 show that some variables were stationary at levels while others were stationary at first difference. These results were confirmed by two different tests for stationarity namely ADF and PP tests. The two tests found the standard VAT rates, population growth percentage, and manufacture value added growth percentage to be stationary at levels whereas VAT compliance gap as a percentage of GDP, shadow economy as a percentage of GDP, value of import as a percentage of GDP, final consumption as a percentage of GDP and agriculture as a percentage of GDP were found to be non-stationary at levels but stationary at first difference. Therefore, all the variables were integrated of order (0) and order (1) none was integrated of order (2). Consequently, ARDL was found to be the best modelling technique for establishing the determinants of VAT compliance gap since it is suitable for variables that are integrated of different orders but none of the variables integrated of order (2).

### 4.4.3 Diagnostic Test Results for the ARDL Model

Diagnostic tests were conducted to ensure unabiasedness of the results obtained on the determinants of VAT compliance gap in Kenya. Subsequently, the results obtained in Table 4.14 were subjected to the diagnostic tests discussed in the following section:

The ARDL bound test was carried out because the modelling technique adopted to address the third objective of this study was ARDL having established that the variables used were integrated of order (0) and (1) but none of order (2).

The bound test based on Wald F-statistic following Pesaran et al. (2001) was performed to establish whether there was evidence of long-run cointegration relationship between the dependent and independent variables. The results of bound test are presented in Table B3 of Apendix 2. The value of F statistics obtained was found to be less than the critical upper bound values which was evidence of absence of long-run cointegration relationship among dependent and independent variables. Consequently, the short-run model, ARDL model in table 4.14 was estimated. There was no need to estimate the long-run (VECM) model because of the absence of long-run cointegration as was established by the ARDL bound test. The lags of (1,1,1,1,1,0,1,0,0,1,0) included in the model were automatically generated by the system based on Akaike Information Criterion (AIC) together with Schwartz Information Criterion (SIC).

The Durbin-Watson d-statistic test for serial correlation was also conducted. The results are shown in table A15 of Appendix II. The d value was found to be 2.659 which lies within the acceptable range of 2 to 4 which is an evidence of the absence of serial correlation. The Durbin-Watson d-statistic results were validated by Breusch-Godfrey LM test for autocorrelation in table A16 of Appendix 11. The P-values for ARCH $X^2$ obtained was 0.002 which was an evidence of absence of serial correlation.

White test for heteroskedasticity was done following White (1980) to test the constancy of the variance of the errors in the regression model. The results obtained are shown in table A17 of Appendix II. From the results, P-values for Heteroskedasticity, Skewness and Kurtosis were found as 0.407, 0.769 and 0.287 respectively which were statistically

insignificant. Hence, it was concluded that there were no cases of Heteroskedasticity, Skewness and Kurtosis. Accordingly, the variance of the errors were found to be constant and the data set normally distributed. These results were supported using ARCH LM test shown in Table A18 in Appendix II. The P-value for ARCH $X^2$ of 0.1049 was obtained therefore, the null hypothesis of homoscedasticity could not be rejected at one percent level of significance. It was therefore concluded that there was no problem of Heteroskedasticity.

Ramsey RESET test was employed to test for the specification error to determine whether a non-linear combination of regressors used in the ARDL model for the third objective of the study was capable of explaining the variations in VAT compliance gap. Findings of the test are shown in table A19 in Appendix II. The calculated F-statistic obtained was 0.0731. Thus, the null hypothesis of no specification error was not rejected. This supported that the linear functional form of the ARDL model was correctly specified.

The stability of the model was tested using CUSUM stability test as shown in figure A3 of Appendix II. The estimates were found to be within the acceptable region within 95 per cent level of confidence confirming the stability of the parameters.

### 4.4.4 The ARDL Results on the Determinants of VAT Compliance Gap in Kenya

The results of the determinants of VAT compliance gap in Kenya were extracted from Table A13 of Appendix II. The short-run results are shown in Table 4.14.

**Table 4.14: The Short-run ARDL Model Results on the Determinants of VAT Compliance Gap in Kenya**

| VARIABLES | Coefficient | t-Statistic | P-Value |
|---|---|---|---|
| First lag of VAT compliance gap % of GDP | -0.192 | -1.03 | 0.33 |
| Standard VAT rates | 0.097** | 2.66 | 0.026 |
| First lag of standard VAT rates | 0.073 | 1.82 | 0.102 |
| Shadow economy % of GDP | 0.011 | 0.38 | 0.71 |
| First lag of shadow economy % of GDP | 0.039 | 1.41 | 0.193 |
| VAT reforms | 0.150* | 1.86 | 0.096 |
| First lag of VAT reforms | 0.221** | 2.95 | 0.016 |
| Number of VAT rates | -0.022 | -0.4 | 0.701 |
| First lag of number of VAT rates | -0.187** | -2.94 | 0.017 |
| Manufacturing value added growth % | 0.032** | 2.42 | 0.039 |
| Population growth % | -4.910*** | -4.44 | 0.002 |
| First lag of population growth % | 2.341** | 2.28 | 0.049 |
| Import % of GDP | 0.066** | 2.95 | 0.016 |
| Final consumption % of GDP | -0.122*** | -4.46 | 0.002 |
| Exports % of GDP --. | -0.087** | -2.55 | 0.031 |
| First lag of exports % of GDP | -0.026 | -0.88 | 0.403 |
| Agriculture output % of GDP | -0.084** | -2.46 | 0.036 |
| _cons | 16.508** | 2.45 | 0.037 |

*Note: ***, **, and *, denote significance at 1%, 5% and 10% levels respectively*

**Source:** Author's computation 2019.

The results from ARDL model in Table 4.14 found the coefficients of population growth and final consumption as a percentage of GDP to be statistically significant at one percent level with negative signs. On the other hand, coefficients of the standard VAT rates, first lag of VAT reforms, first lag of the number of VAT rates, manufacturing value added growth percentage, the first lag of population growth percentage, import as a percentage

of GDP, export as a percentage of GDP, and agriculture output as a percentage of GDP were found to be statistically significant at five percent level of significance with either negative of positive signs, and coefficient of VAT reforms significant at 10 percent level. The coefficients of the first lag of the VAT compliance gap as a percentage of GDP, the first lag of the VAT standard rates, shadow economy as a percentage of GDP, the first lag of the shadow economy as a percentage of GDP, number of VAT rates and first lag of exports as a percentage of GDP were found to be statistically insignificant with either positive or negative signs.

The coefficients of VAT reforms and its first lag were found to be positive and statistically significant at 10 percent and five percent level respectively. The value of the coefficient of VAT reforms was found to be 0.15 meaning that implementation of VAT reforms in the current period resulted to widening of VAT compliance gap for the same period holding all other factors constant. Similarly, first lag of VAT reforms obtained was 0.221 which meant that the VAT reforms for the previous period led to increase in VAT compliance gap in the following period all other factors held constant. Therefore, both tax reforms in the current period and the previous period resulted to widening of VAT compliance gap. Although this was against the expectations of the policy makers. It is in agreement with economic theory of excess burden of tax considering the nature of VAT reforms that have been undertaken in Kenya so far. Most of the reforms tend to increase the tax rate. For example, the enactment of the year 2013 VAT ACT saw a number of goods and services which were previously zero-rated or exempted from VAT now being taxed at the standard rate of 16 percent. This was clearly a massive increase in

VAT rate to the affected commodities. Similarly, the introduction of eight percent VAT on petroleum products in the year 2018, again this led to increase in the prices of fuel products. Therefore, reform of the VAT tends to widen the VAT compliance gap in Kenya as it puts a greater burden on tax payers therefore they either stop consuming the affected products, reduce the quantities they consume, or they find ways of evading paying VAT. This means that VAT reforms in Kenya did not result to decrease in VAT compliance gap. This is in agreement with the findings of Muriithi and Moyi (2003) who also found out that tax reforms in Kenya had a positive impact on the overall tax structure but did not improve the responsiveness of VAT to improvements in income.

The coefficient of the standard VAT rates was found to be 0.097 and statistically significant at five percent level of significance with the expected positive sign. This implies that a one percent increase in the standard VAT rate leads to 0.097 per cent widening of the VAT compliance gap. This result is similar to results obtained by Agha and Haughton (1996) who found that a percentage point increase in VAT rate reduced the VAT compliance by 2.7 percent and Zídková (2014) who found that a one percent increase in the standard VAT rate led to a 0.01 percent increase in VAT compliance gap. Wawire (2017) also advocated for reduction of VAT rates arguing that lower rates would boost compliance level thereby reducing VAT compliance gap. This also conforms with economic theory of excess burden of tax which postulates that an increase in tax rate put a heavier burden on the tax payers, therefore some of them look for ways of evading the tax which results to widening of the VAT compliance gap. This explains why policy makers in Kenya have been quite cautious with reviewing the standard VAT rate

regularly and with a bigger margin. In fact, for the study period (1991-2018) the country has only had four different VAT standard rates of 15 percent, 16 percent, 17 percent and 18 percent. The current standard rate of 16 percent has been in place for at least five years without being reviewed.

The coefficient of the first lag of the number of VAT rates was found to be -0.187 and statistically significant at five percent level of significance. This had the expected sign of negative. The results imply that a one percent increase in the number of VAT rates in the previous period leads to a decline of the VAT compliance gap in the current period by 0.187. This was the expectation of the study considering the structure of Kenya's VAT overtime. In the past when Kenya had increased number of VAT rates, most of the other rates were less than the standard VAT rate. This implies that some commodities are taxed at lower rate than the standard rate, effectively reducing the burden of tax payers who use such products. Consequently, they do not have any reason to try and evade taxes thereby improving the overall VAT compliance level in the country.

The coefficient of the manufacturing value added growth was found to be 0.032 and statistically significant at five percent level of significance. This means that a one percentage point increase in the manufacturing value added growth led to a 0.032 percent increase in the VAT compliance gap all other factors held constant. This is not supposed to be the case in Kenya considering that the manufacturing sector in Kenya is largely formal therefore with an effective tax authority in place, it is expected that the growth in the manufacturing value added should result to decline in the VAT compliance gap. This

is an indicator of laxity on the part of KRA in enforcing tax compliance in the manufacturing sector in Kenya or it could also mean that most of the manufactured output are exported therefore exempted from VAT.

The coefficient of the population growth percentage was found to be -4.910 and statistically significant at one percent level of significance. The negative sign implied that a one percent increase in population growth reduced the VAT compliance gap by 4.910 percent holding all other factors constant. This was similar to the findings of Wawire (2017) who attributed the positive improvement in VAT revenue as a result of population increase to rise in demand for taxable goods and introduction of Electronic Tax Register (ETR) in 2005 as an effort by KRA to target tax payers and hence enhance VAT compliance. However, the coefficient of the first lag of population growth was found to be positive 2.341 and statistically significant at five percent level. This meant that a one percentage point increase in the population for the previous period led to a 2.341 percent increase in the VAT compliance gap in the following period. This can be attributed to rise in cases of tax evasion. As population increases, the level of dependency rises, all other factors held constant. Therefore, a higher burden on the tax payers as the volume of goods they consume also rises. As a result of high cost of living, tax payers may look for ways to evade tax or divert their consumption to less expensive non-taxed commodities resulting to a rise in the VAT compliance gap. This can also be attributed to lack of preparedness by the revenue authority to handle tax collection from and increasing population.

The coefficient of import obtained from the results in Table 4.14 was 0.066 and statistically significant at one percent level of significance. The expected sign was negative, because import being closely monitored, it is expected that as the volume of import increase the tax gap should reduce as all taxable goods do not escape the tax dragnet. However, for the case of Kenya, the sign was found be positive implying that as the volume of imports increased, the VAT gap also widened, this is an indicator of the inefficiency of the Kenya Revenue Authority to effectively collect VAT from imported commodities. It is also an indicator of rising cases of tax evasion especially at the entry point of goods into the country. Another unlikely explanation is that maybe Kenya has been increasingly importing zero-rated and exempted commodities, this does not hold water because as a result of the VAT reforms, the number of exempted and zero-rated commodities has been greatly reduced.

The coefficient of the final consumption was found to be -0.122 and significant at one percent level of significance. This implies that a one percent increase in the volume of final consumption led to a 0.122 decline in the VAT compliance gap. The negative sign was expected implying that as the volume of final consumption increased the level of VAT compliance gap decreased ceteris paribus. This is consistent with theory, since VAT is a consumption tax, therefore theory postulates a positive relationship between volume of final consumption and VAT revenue. These results were similar to Barbone et al. (2013) who found a negative relatiohsip between VAT compliance gap and the volume of final consumption.

The coefficient of export was found to be -0.087 and statistically significant at five percent level of significance. This implies that as the volume of exports increased, the VAT compliance gap reduced in Kenya. Although exports are exempted from VAT, a probable explanation for this scenario is that exports bring more income to the tax payers. Following the theory of tax avoidance, with more income, the tendency to avoid paying taxes declines. This is consistent with the findings of Wawire (2017) and Zídková (2014) who found that improvement in trade opennes resulted to additional VAT revenue.

The coefficient of agricultural output as a percentage of GDP was found to be -0.084 and statistically significant at five percent level of significance. This implied that as agricultural output as a percentage of GDP grew, the VAT compliance gap reduced. Although, the study expected the sign to be positive because agriculture in Kenya is largely informal and often thought to escapes the tax bracket. However, based on the results obtained, since agriculture employs about 70 percent of Kenya's tax payers either directly or indirectly, then it can be assumed that their earnings improves with growth of agriculture therefore they are able to pay taxes with ease.

The first lag of VAT compliance gap had the expected negative sign though not statistically significant with a value of -0.192 indicating that lower level of VAT compliance gap leads to much lower level of VAT compliance gap in the following period. However, since in the case of Kenya, the coefficient of the lagged value of VAT compliance gap was found not to be statistically significant is an indicator of

inconsistency on the part of Kenya revenue authority in ensuring maximum VAT compliance and weaker like institutions to enforce tax laws.

Finally, the coefficient of shadow economy as a percentage of GDP was found to have the expected positive sign but was statistically insignificant. Barbone et al. (2013) found corruption perception index to have a positive sign but statistically insignficant. Shadow economy and corruption go hand in hand. The results reveal that as the size of shadow economy as a percentage of GDP grows, the level of VAT compliance gap also grows. This means that the revenue authority collects less revenue since transactions undertaken in the context of the shadow economy are outside the tax bracket.

# CHAPTER FIVE

# SUMMARY, CONCLUSION, AND POLICY IMPLICATIONS

## 5.1 Introduction

This chapter presents the summary of the study, conclusions, policy implications, contribution to knowledge and areas for further research.

## 5.2 Summary

Value Added Tax has been adopted by many countries due to its higher revenue potential, less distortions and wide tax base. Kenya introduced VAT in 1990 to replace sales tax. At its inception, multiple rate VAT with 15 different rates was adopted. However, Kenya experienced challenges in administration of the VAT, some of which were attributed to the numerous numbers of VAT rates leading to misclassification of some taxable commodities, low compliance level, and massive evasion. These challenges marked the beginning of a series of tax reforms on the Kenya's VAT which have been undertaken regularly. The tax reforms included reduction of the number of VAT rates from 15 to two by year 2017 which increased to three in the year 2018. Review of the standard rate, removal of a number of commodities mostly basic commodities from the exempt and zero-rated categories to taxable category at the prevailing standard rate. The main objective of these reforms was to boost its revenue generation potential by expanding its tax base, enhancing its efficiency and reduce its gap. Despite these reforms, KRA still continued to regularly miss the potential VAT revenue, the VAT compliance gap continued to widen over time and its performance compared to most of the African countries was quite poor. Further, there was also a concern on the effect the reforms

could have had on the household welfare in Kenya, especially on the low-income households that spend a larger proportion of their income on consumption since the net effect of these tax reforms has been increase in prices of basic commodities. Therefore, there was a need to conduct a study to evaluate the possible effects of the tax reforms on household welfare in Kenya, to assess the efficiency of the Kenya's VAT post reforms and to establish the determinants of the Kenya's VAT compliance gap.

To address these objectives, the study used the KIHBS data of 2015/16 collected by KNBS, Value Added Tax Revenue both actual and potential for the years 1991 to 2018 were obtained from Kenya Revenue Authority, macroeconomic variables data set obtained from the World Bank data base, and data on Kenya's shadow economy obtained from a report by the International Monetary Fund (IMF).

To evaluate the effect of Value Added Tax reforms on the welfare of households in Kenya, cross-sectional data obtained from KIHBS for 2015/16 was used. The study estimated the QUAIDS model based on the iterated feasible generalized non-linear least square technique. The quantities and prices of ten food items namely; tea leaves, sugar, beans, salad, white-bread, rice, cooking fat, spices, soda and maize as was reported by 21,210 households in the survey were used to estimate their expenditure elasticity and uncompensated own and compensated own price elasticities. The uncompensated and compensated own price elasticities for the ten food items estimated were all found to be negative. This implied that any increase in prices of these commodities without a corresponding rise in the real income of households, led to the reduction in quantities

consumed of these food items. Further, the expenditure elasticities for seven food items namely; sugar, beans, salad, white-bread, rice, maize and soda were found to be positive and greater than unity, implying that households were under-consuming these food items, this could be because of their high prices as a result of VAT reforms. Whereas, the expenditure elasticity for tea leave and spices were found to be negative, an indication that these were inferior goods. This meant that as income of consumer rises, less of these two food items would be consumed probably because most of their substitutes are expensive and would now be affordable to consumers. The expenditure elasticity for cooking fat was found to be positive and slightly less than unity, an indication that households would only increase their expenditure on this food item marginally with increase in income.

To establish the effects of tax reforms on VAT revenue collection efficiency in Kenya, the study employed time series data for a period of 27 years. The VAT C-efficiency model was used to estimate VAT collection efficiency. The Values of the Kenya's VAT collection efficiency obtained were then used in an Autoregressive Distributed Lag (ARDL) model as dependent variable to establish its determinants.

The determinants of VAT compliance gap in Kenya were estimated using time series data on an Autoregressive Distributed Lag (ARDL) model with VAT compliance gap as the dependent variable. The regression results revealed that on average, all other factors held constant, the standard VAT rates, VAT reforms, first lag of VAT reforms, manufacture value added growth, first lag of population growth, and import as a percentage of GDP

led to widening of the VAT compliance gap. These results implied that an increase in the standard VAT rate increased burden on taxpayers therefore they either consumed less of the taxable commodities, diverted their consumption to cheaper alternatives or got ways of evading VAT, the same reason is applicable to VAT reforms whose net effect has been general rise in prices of the affected commodities. Further, the growth of manufacturing value added and imports were not expected to result to widening of tax gap. The former is largely formal in Kenya and can be closely monitored and the latter is also strictly monitored at the point of entry into the country. Therefore, the growth of the two should be accompanied by narrowing of the VAT compliance gap, unless most of the additional manufacturing output or imported products are exempted from VAT which is not the case for Kenya. Therefore, these results point to laxity on the part of KRA and rising cases of tax evasion. Whereas, on average, all other factors held constant, first lag of VAT compliance as a percentage of GDP, first lag of the number of VAT rates, population growth percentage, final consumption as a percentage of GDP, export as a percentage of GDP, first lag of exports as a percentage of GDP, and agriculture output as a percentage of GDP reduced the VAT compliance gap. Increase in the number of VAT rates was found to reduce the VAT compliance gap because increasing the number of rates imply that some products are taxed at a lower rate than the standard VAT rate and others are even taxed at zero per cent. This reduces the tax burden on the taxpayers. Therefore, they consume more of the products with the reduced rates with no incentive to evade taxes thereby improving VAT compliance gap. Population growth as a percentage GDP also resulted to improvement in compliance gap because its growth led to increase in consumption of taxable commodities, the same reason applies for increase in final

consumption as a percentage of GDP. Growth in agricultural output as a percentage of GDP and export as a percentage of GDP resulted to narrowing of the VAT gap because although most agricultural output are not taxed and exports are fully exempted from VAT, their growth resulted to increase in income of the consumers who were engaged in either of the two. Therefore, they did not feel a bigger burden paying taxes. This led to rise in their consumption of taxable commodities thereby improving VAT compliance in Kenya.

### 5.3 Conclusions

Based on the findings, the following conclusions are made. VAT reforms in Kenya have led to decline in household welfare. This is because the negative own price elasticities on the ten food items indicate that all things held constant, households reduce their consumption of these food items when their prices increase as a result of VAT tax levied on them. The elastic expenditure response for the seven food items (sugar, beans, salad, white-bread, rice, maize and soda) indicate that welfare would be increasingly enhanced with increase in real income of households, which would be the case when taxes are not levied on the product or levied at lower tax rates. The negative expenditure elasticities of tea leaves and spices indicate that the poor consume more of them probably because their substitutes are unaffordable to them. Therefore, as their income increases or as tax rates are reduced, they consume less of these commodities.

The study's findings on the effect of tax reforms on collection efficiency of Kenya's VAT showed that the VAT tax reforms have had significant positive effect on the Kenya's VAT collection efficiency. This is because the positive significant coefficients of VAT reforms in the ARDL model indicate that all things held constant, the VAT reforms implemented during the study period which include reduction of the number of VAT rates, establishment of KRA, introduction of Electronic tax register, setting of VAT registration threshold, introduction of KRA pin for tax payers, review of the VAT standard rate, reduction of the number of exempt and zero rated items, introduction of withholding tax among others had led to significant improvement in collection efficiency of the VAT. Further, the study established that overtime, there has been improvement in macroeconomic fundamentals that impact positively on the VAT collection efficiency such as improvement in GDP growth, improvement in trade, improvement in agriculture however, these were found to have affected the Kenya's VAT collection efficiency negatively instead of positively. This is an indication that KRA has failed to reap additional VAT revenue that may have accompanied the improvement in these macroeconomic variables in Kenya. It could also be an indicator that these improvements were accompanied by rising cases of tax evasion in Kenya.

On the determinants of VAT compliance gap in Kenya, the study results showed that VAT reforms was a major contributing factor to the widening of the VAT compliance gap in Kenya. This was against the expectations of the policy makers who designed these reforms. This can be attributed to the nature of the tax reforms undertaken in Kenya so far. These reforms focused on improving revenue generation capacity of VAT without

considering their effect on welfare of tax payers. Since the net effect of the tax reforms was increase in prices of the affected commodities, this may have increased the tax burden on tax payers prompting them to switch their consumption to commodities that are not taxed or devise ways of evading tax on the taxable commodities. This resulted to failure by the KRA to achieve its VAT revenue target. Improvement in macroeconomic fundamentals in Kenya such as growth in value of import as a percentage of GDP and population growth in the long run, and manufacture value added growth as a percentage of GDP were found to widen the VAT compliance gap, this was not supposed to be the case, and is a pointer to rising cases of tax evasion or failure on the revenue authority to collect additional tax revenue that accompany them. Further, the results of the study showed that increase in the number of VAT rates would improve the VAT compliance gap in Kenya. This could be because additional rates would mean that some rates are set below the standard rates, which will ease the burden of tax payers, therefore, they will not have incentive to evade paying taxes. Population growth in the current period was found to impact positively on the VAT compliance, meaning that VAT compliance gap for the current period declined with growth in population.

### 5.4 Policy Implications

Basic food items consumed by most households, especially the low- income ones, ought to be zero rated or taxed at reduced rates that are below the standard VAT rate, to make them affordable to most households. This implication is supported by the findings of the study that eight out of the ten food items whose elasticities were estimated were found to have positive expenditure elasticities implying that an increase in household income or a

reduction of their prices would make consumers better off since they would consume more of them, thus an improvement in their welfare.

The policy makers can also boost the productivity of the VAT revenue through a moderate reduction of the tax rates. This would reduce the tax burden of consumers hence encourage them to consume more of the affected commodities hence more tax revenue to the KRA.

There is need to put into consideration the welfare of the households when undertaking tax reforms to win the support of tax payers in implementation of the reforms as opposed to just focusing on improving the revenue generation capacity of a tax system. There is need to focus on additional reforms that would guarantee improvement of VAT collections efficiency such as proper staffing and training of the KRA staff to have the capacity to collect VAT taxes due, strictly monitor implementation of tax reforms and detect tax evasion and avoidance. Therefore, VAT administration in Kenya should be modernized to curb all avenues of tax evasion and strictly supervised to ensure tax payers do not devise newer ways of evading the VAT tax. The findings of the study revealed that presence of the significant VAT reforms led to improvement of VAT collection efficiency in Kenya. Although, the estimated VAT collection efficiency was found to be around 30 per cent which was way below the recommended 60 per cent and above.

Policy makers should consider introducing more reduced rates and strengthen the capacity of KRA to administer slightly increased rates, this will reduce the burden on tax payers hence motivate them to reduce on tax evasion, avoidance and increase their consumption of taxable commodities and with strict supervision from the empowered KRA cases of misclassifications associated with increased rates will be minimal hence improvement in overall VAT collection efficiency. The study found that the reduction in the number VAT rates resulted to improvement in VAT collection efficiency, this may have informed the decision of the policy makers in Kenya to reduce the number of VAT rates from 15 in 1991 to the 3 in 2018. However, since despite this, Kenya's VAT collection efficiency is still not at the expected level.

There is need for adoption and strict implementation of a policy of zero tolerance for corruption in Kenya. Corruption has been very rampant in Kenya and is responsible for loss of large amount of tax revenue by the government. Both taxpayers and revenue officials found guilty of corruption should be prosecuted and jailed to deter the vice from being accepted as a norm as has been the case in Kenya during the study period. The findings of the study that growth of the shadow economy in Kenya was one of the factors responsible for the deterioration of VAT collection efficiency. This goes hand in hand with corruption.

There is need for promotion or adoption of organized large-scale farming and shift from agricultural sector to industrial sector to guarantee tax payers reasonable income and revenue to the government since industrial sector is largely formal hence easy to collects

its tax revenue. Higher income to the tax payers would boost their consumption level in the economy. The study established that growth in the agricultural sector resulted to decline in VAT collection efficiency. The explanation was that agriculture in Kenya is largely for subsistence consumption and most agricultural products are not taxed. The study established that growth in the agricultural sector resulted to decline in VAT collection efficiency. The explanation was that agriculture in Kenya is largely for subsistence consumption and most agricultural products are not taxed.

Policymakers in Kenya should consider reducing the standard VAT rate and broaden its base in order to boost compliance. There is also need for strict enforcement of the tax by the KRA. These measures would guarantee the revenue authority additional revenue. There is also need for KRA to devise ways of taxing the online market which has become more popular in Kenya and across the globe, this would broaden the VAT base further. The findings on the determinants of VAT compliance gap in Kenya established that higher standard VAT rates widened its compliance gap and lower rates narrowed the compliance gap.

Policy makers should increase the number of VAT rates to a number that is manageable to KRA so as to boost its compliance gap. Increased number of VAT rates was found to boost VAT compliance. This was thought to be the case because with more rates, some rates end up being lower than the standard VAT rates thus reduce the burden on taxpayers.

There is need for radical changes of KRA human resource from top management to junior staff as a measure of anti-corruption reform and boost its efficiency. Further, KRA has made a step to digitize most of its processes, which is a plus, however, some of its systems are quite complex, there is need to simplify the systems and conduct adequate civic education of the taxpayers on the usage of the systems to popularize them. This would boost VAT compliance. The improvement of key macroeconomic variables in Kenya such as population growth, growth of import as a percentage of GDP, growth of manufacture value added were found to widen VAT compliance gap. This is not supposed to be the case where the revenue authority is efficient and tax evasion and avoidance are properly managed. This is a clear pointer to inefficiency of KRA and rampant cases of tax evasion in Kenya.

### 5.5 Contribution to Knowledge

The study has demonstrated that VAT reforms have had a negative effect on welfare of households in Kenya but has also recommended ways through which the reforms can be designed in a manner to improve welfare of the households as they achieve their main objective of boosting productivity of VAT revenue. As such, this study reveals that policy makers should design tax reforms with household welfare also in mind because in a case where the household welfare is adversely affected negatively, they may cut down their consumption of the affected commodities by a larger margin therefore denying the government the expected revenue.

Unlike the previous studies on taxes, this study estimated Kenya's VAT collection efficiency and evaluated its performance post the reforms. The study further estimated the VAT compliance gap and estimated its determinants. The precise estimates for VAT collection efficiency and VAT compliance gap together with their determinants are important to policy makers since they provide the basis for policy intervention.

This is the first study in Kenya to make use of the Quadratic Almost Ideal Demand System (QUAIDS) to estimate household demand to establish the effect of VAT reforms on household welfare. Therefore, it contributes to literature in this area.

### 5.6 Areas of Further Research

The study estimated the effect of VAT reforms on household welfare based on estimation of household expenditure on food items only because of lack of data on expenditure on non-food items that could fit the Quadratic Almost Ideal Demand System (QUAIDS) model. Further, the study estimated Kenya's VAT compliance gap but not policy gap due to unavailability of data. Therefore, the study recommends the following two areas for further research subject to availability of data:

i) Estimation of a Quadratic Almost Ideal Demand System (QUAIDS) model for Kenya with both expenditure on food items and non-food items to give a more comprehensive reflection of consumer response to price changes occasioned by VAT reforms.

ii) Estimation of Kenya's VAT policy gap and recommend the optimal tax policy for the country to ensure optimal performance of her VAT.

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# APPENDICES

## Appendix 1

*Table A1 Raw Data for Time Series Variables*

| YEAR | VAT COMPLIANCE GAP | VAT REFORMS | STANDARD VAT RATES | SHADOW ECONOMY %GDP | NO. VAT RATES | TRADE OPENNES % GDP) | POPULATION GROWTH |
|---|---|---|---|---|---|---|---|
| 1991 | -0.046805221 | 1 | 18 | 34.75 | 9 | 37.33065 | 3.266606636 |
| 1992 | -0.038357795 | 0 | 18 | 35.01 | 8 | 38.73736 | 3.192368462 |
| 1993 | 0.026439386 | 0 | 18 | 31.63 | 6 | 54.73079 | 3.116147698 |
| 1994 | -0.040555248 | 0 | 18 | 32.21 | 4 | 51.45391 | 3.037834024 |
| 1995 | 0.019476565 | 0 | 18 | 31.68 | 4 | 53.82295 | 2.961421937 |
| 1996 | -0.036456564 | 1 | 15 | 34.08 | 4 | 41.64087 | 2.887991306 |
| 1997 | -0.041355679 | 0 | 15 | 34.68 | 3 | 40.65334 | 2.824544699 |
| 1998 | 0.054970454 | 1 | 17 | 36.24 | 3 | 36.93061 | 2.77822566 |
| 1999 | 0.070949631 | 1 | 16 | 35.46 | 4 | 35.5071 | 2.751842512 |
| 2000 | 0.039148704 | 1 | 15 | 34.3 | 4 | 38.0863 | 2.740135801 |
| 2001 | 0.008482895 | 1 | 18 | 34.45 | 4 | 39.55026 | 2.731774582 |
| 2002 | -0.117737544 | 0 | 18 | 35.54 | 4 | 40.77574 | 2.723965819 |
| 2003 | -0.073172332 | 0 | 18 | 35.92 | 4 | 41.17221 | 2.722998123 |
| 2004 | -0.012590631 | 1 | 16 | 34.64 | 3 | 44.96166 | 2.728493279 |
| 2005 | 0.219010222 | 1 | 16 | 33.32 | 3 | 49.45095 | 2.737271423 |
| 2006 | -0.010470278 | 0 | 16 | 32.27 | 3 | 41.56587 | 2.746430784 |
| 2007 | -0.072064059 | 0 | 16 | 33.35 | 3 | 40.89737 | 2.752069036 |
| 2008 | -0.088527532 | 0 | 16 | 32.93 | 3 | 44.93299 | 2.751559064 |
| 2009 | -0.157489224 | 0 | 16 | 33.62 | 3 | 39.6133 | 2.743207843 |
| 2010 | 0.078018271 | 0 | 16 | 31.54 | 4 | 43.155 | 2.728405712 |
| 2011 | -0.204582477 | 0 | 16 | 29.93 | 4 | 48.95249 | 2.711825998 |
| 2012 | -0.890940101 | 0 | 16 | 30.11 | 3 | 44.53569 | 2.693169397 |
| 2013 | -0.670583995 | 0 | 16 | 29.99 | 3 | 40.31791 | 2.668121659 |
| 2014 | -0.010280606 | 1 | 16 | 28.68 | 2 | 39.88939 | 2.636116355 |
| 2015 | 0.060759721 | 0 | 16 | 33.43 | 2 | 34.3702 | 2.599336534 |
| 2016 | 0.148547697 | 0 | 16 | 33.18 | 2 | 27.93939 | 2.560925398 |
| 2017 | -0.042812251 | 0 | 16 | 33.19 | 2 | 29.93729 | 2.523110563 |
| 2018 | -0.289854465 | 1 | 16 | 33.24 | 3 | 1.165484 | 2.628347945 |

| YEAR | GDP | FINAL CONSUMPTION | AGRICULTURE | EXPORTS | IMPORT | MANUFACTURE VAD | VAT REVENUE |
|---|---|---|---|---|---|---|---|
| 1991 | 1,713,484,064,500.00 | 78.092899 | 27.978419 | 3.5387239 | 11.111108 | 1.3626074 | 78,787 |
| 1992 | 1,699,784,862,900.00 | 79.629005 | 27.265876 | 4.0858879 | 10.938374 | 1.4481009 | 99,231 |
| 1993 | 1,705,788,456,400.00 | 79.781344 | 26.280926 | 7.6086166 | 14.585656 | 1.664544 | 114,567 |
| 1994 | 1,750,698,190,800.00 | 84.444677 | 26.394781 | 8.4768916 | 16.602157 | 2.0651875 | 116,467 |
| 1995 | 1,827,837,743,800.00 | 91.212449 | 26.492401 | 8.2957654 | 18.682925 | 2.1287995 | 118,389 |
| 1996 | 1,903,635,237,100.00 | 89.884489 | 26.574916 | 9.1078182 | 18.265607 | 4.2861678 | 122,066 |
| 1997 | 1,912,675,637,400.00 | 92.155813 | 25.638589 | 9.1367395 | 20.097765 | 4.6590231 | 133,115 |
| 1998 | 1,975,606,753,700.00 | 93.138443 | 26.879507 | 8.6860264 | 20.368318 | 4.7070602 | 154,044 |
| 1999 | 2,021,152,166,500.00 | 93.703973 | 28.13723 | 9.3480261 | 19.614844 | 4.5520571 | 164,920 |
| 2000 | 2,033,272,922,900.00 | 92.49234 | 27.612271 | 10.275673 | 19.87198 | 4.9102115 | 168,564 |
| 2001 | 2,110,128,738,200.00 | 92.612364 | 29.708379 | 11.087132 | 22.876264 | 4.7284793 | 182,609 |
| 2002 | 2,121,668,178,300.00 | 93.008341 | 28.513737 | 12.150198 | 20.184081 | 4.7939165 | 183,428 |
| 2003 | 2,183,885,578,800.00 | 92.927779 | 28.374664 | 12.482808 | 19.596973 | 5.0316281 | 201,699 |
| 2004 | 2,295,357,645,500.00 | 90.272542 | 27.468639 | 14.773395 | 20.937861 | 5.5522067 | 229,277 |
| 2005 | 2,430,936,757,000.00 | 89.693745 | 27.727936 | 16.603043 | 22.724428 | 6.1359885 | 274,252 |
| 2006 | 2,588,279,000,000.00 | 90.98397 | 26.492894 | 16.535659 | 26.746421 | 9.1288845 | 297,699 |
| 2007 | 2,765,595,000,000.00 | 90.011987 | 26.05631 | 17.050725 | 26.134376 | 9.9496492 | 360,191 |
| 2008 | 2,772,019,000,000.00 | 89.780986 | 24.70048 | 20.310467 | 29.396624 | 10.834882 | 433,915 |
| 2009 | 2,863,688,000,000.00 | 91.46576 | 23.360401 | 20.032629 | 30.831012 | 11.961219 | 480,569 |
| 2010 | 3,104,401,000,000.00 | 90.153366 | 23.714559 | 21.08906 | 30.747864 | 11.490687 | 534,403 |
| 2011 | 3,294,026,000,000.00 | 90.001536 | 22.877658 | 24.461434 | 32.813858 | 13.291152 | 634,903 |
| 2012 | 3,444,339,295,200.00 | 91.179159 | 22.550123 | 27.499898 | 33.013549 | 13.61956 | 707,360 |
| 2013 | 3,646,821,306,900.00 | 92.979483 | 22.457609 | 25.926075 | 31.042332 | 13.891879 | 800,486 |
| 2014 | 3,842,185,783,000.00 | 91.661893 | 22.246532 | 25.728099 | 32.522058 | 14.002425 | 963,823 |
| 2015 | 4,061,901,451,000.00 | 92.027578 | 22.167466 | 25.670239 | 31.123453 | 14.498027 | 1,069,597 |
| 2016 | 4,300,302,280,500.00 | 91.512037 | 21.923137 | 23.373007 | 27.553075 | 15.204488 | 1,200,159 |
| 2017 | 4,510,391,160,900.00 | 93.509831 | 21.238201 | 23.935596 | 28.468991 | 14.375624 | 1,365,269 |
| 2018 | 4,656,474,763,835.64 | 92.917599 | 20.707484 | 22.410615 | 26.981087 | 13.943518 | 1,436,742 |

## Table A2 QUAIDS Model Complete Results

Quadratic AIDS model

| | |
|---|---|
| Number of obs | = 20404 |
| Number of demographics | = 0 |
| Alpha_0 | = 10 |
| Log-likelihood | = 92925.125 |

| | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| alpha | | | | | | |
| alpha_1 | -.1395902 | .0167666 | -8.33 | 0.000 | -.1724521 | -.1067283 |
| alpha_2 | .085828 | .014785 | 5.81 | 0.000 | .0568499 | .114806 |
| alpha_3 | .0633909 | .009445 | 6.71 | 0.000 | .044879 | .0819027 |
| alpha_4 | .1693656 | .0138439 | 12.23 | 0.000 | .1422321 | .196499 |
| alpha_5 | .4101797 | .0133523 | 30.72 | 0.000 | .3840096 | .4363497 |
| alpha_6 | .0668983 | .006053 | 11.05 | 0.000 | .0550347 | .0787619 |
| alpha_7 | .1986905 | .0095292 | 20.85 | 0.000 | .1800135 | .2173674 |
| alpha_8 | -.1883149 | .0073961 | -25.46 | 0.000 | -.2028109 | -.1738189 |
| alpha_9 | .2791773 | .0085233 | 32.75 | 0.000 | .262472 | .2958825 |
| alpha_10 | .0543749 | .0046818 | 11.61 | 0.000 | .0451987 | .0635512 |
| beta | | | | | | |
| beta_1 | -.1452402 | .0050457 | -28.78 | 0.000 | -.1551296 | -.1353508 |
| beta_2 | .0797331 | .0045112 | 17.67 | 0.000 | .0708912 | .0885749 |
| beta_3 | .0014875 | .0028796 | 0.52 | 0.605 | -.0041565 | .0071314 |
| beta_4 | .111631 | .0043506 | 25.66 | 0.000 | .103104 | .120158 |
| beta_5 | .0186577 | .0043956 | 4.24 | 0.000 | .0100424 | .0272729 |
| beta_6 | .0027183 | .0017991 | 1.51 | 0.131 | -.0008079 | .0062446 |
| beta_7 | -.0027128 | .0031756 | -0.85 | 0.393 | -.0089368 | .0035112 |
| beta_8 | -.0627661 | .0024749 | -25.36 | 0.000 | -.0676169 | -.0579154 |
| beta_9 | -.0022212 | .002703 | -0.82 | 0.411 | -.0075191 | .0030766 |
| beta_10 | -.0012872 | .001402 | -0.92 | 0.359 | -.0040349 | .0014606 |

| | | | | | | |
|---|---|---|---|---|---|---|
| gamma | | | | | | |
| gamma_1_1 | .0798093 | .0063929 | 12.48 | 0.000 | .0672795 | .0923391 |
| gamma_2_1 | .0154082 | .0046003 | 3.35 | 0.001 | .0063918 | .0244246 |
| gamma_3_1 | .0102677 | .0027388 | 3.75 | 0.000 | .0048998 | .0156356 |
| gamma_4_1 | .013716 | .004259 | 3.22 | 0.001 | .0053684 | .0220635 |
| gamma_5_1 | -.0874128 | .0036967 | -23.65 | 0.000 | -.0946581 | -.0801675 |
| gamma_6_1 | .0004652 | .0017205 | 0.27 | 0.787 | -.002907 | .0038373 |
| gamma_7_1 | -.0068791 | .0025631 | -2.68 | 0.007 | -.0119026 | -.0018556 |
| gamma_8_1 | -.0060751 | .0020858 | -2.91 | 0.004 | -.0101632 | -.0019871 |
| gamma_9_1 | -.0209428 | .0023883 | -8.77 | 0.000 | -.0256238 | -.0162618 |
| gamma_10_1 | .0016434 | .0013115 | 1.25 | 0.210 | -.000927 | .0042139 |
| gamma_2_2 | .3071287 | .0103774 | 29.60 | 0.000 | .2867894 | .327468 |
| gamma_3_2 | -.0559933 | .0046231 | -12.11 | 0.000 | -.0650544 | -.0469323 |
| gamma_4_2 | -.0133987 | .0058172 | -2.30 | 0.021 | -.0248002 | -.0019972 |
| gamma_5_2 | -.1147344 | .0039038 | -29.39 | 0.000 | -.1223858 | -.107083 |
| gamma_6_2 | -.0134693 | .0029087 | -4.63 | 0.000 | -.0191704 | -.0077683 |
| gamma_7_2 | -.0234332 | .0027925 | -8.39 | 0.000 | -.0289065 | -.01796 |
| gamma_8_2 | -.041718 | .0024144 | -17.28 | 0.000 | -.0464502 | -.0369859 |
| gamma_9_2 | -.0455571 | .0029711 | -15.33 | 0.000 | -.0513804 | -.0397339 |
| gamma_10_2 | -.0142327 | .0019703 | -7.22 | 0.000 | -.0180945 | -.010371 |
| gamma_3_3 | .1485314 | .0038432 | 38.65 | 0.000 | .1409989 | .156064 |
| gamma_4_3 | -.0369762 | .0033594 | -11.01 | 0.000 | -.0435604 | -.0303919 |
| gamma_5_3 | -.0253945 | .0023893 | -10.63 | 0.000 | -.0300774 | -.0207116 |
| gamma_6_3 | .0000602 | .0017677 | 0.03 | 0.973 | -.0034044 | .0035249 |
| gamma_7_3 | -.0188545 | .0016295 | -11.57 | 0.000 | -.0220482 | -.0156608 |
| gamma_8_3 | -.0074068 | .0014925 | -4.96 | 0.000 | -.010332 | -.0044816 |
| gamma_9_3 | -.0143862 | .0018229 | -7.89 | 0.000 | -.0179591 | -.0108134 |
| gamma_10_3 | .0001522 | .0012044 | 0.13 | 0.899 | -.0022084 | .0025127 |
| gamma_4_4 | .3044366 | .0061076 | 49.85 | 0.000 | .2924659 | .3164072 |
| gamma_5_4 | -.0923885 | .0034567 | -26.73 | 0.000 | -.0991635 | -.0856136 |
| gamma_6_4 | -.0110326 | .0021175 | -5.21 | 0.000 | -.0151829 | -.0068823 |
| gamma_7_4 | -.0824628 | .0023602 | -34.94 | 0.000 | -.0870886 | -.077837 |
| gamma_8_4 | -.0372884 | .0021113 | -17.66 | 0.000 | -.0414265 | -.0331504 |
| gamma_9_4 | -.0396843 | .0024533 | -16.18 | 0.000 | -.0444926 | -.034876 |
| gamma_10_4 | -.004921 | .0015071 | -3.27 | 0.001 | -.0078748 | -.0019672 |
| gamma_5_5 | .494638 | .004041 | 122.40 | 0.000 | .4867177 | .5025583 |
| gamma_6_5 | -.0184817 | .0015324 | -12.06 | 0.000 | -.0214852 | -.0154783 |
| gamma_7_5 | -.060401 | .0019668 | -30.71 | 0.000 | -.0642558 | -.0565462 |
| gamma_8_5 | -.0355034 | .0017674 | -20.09 | 0.000 | -.0389673 | -.0320394 |
| gamma_9_5 | -.0536681 | .002005 | -26.77 | 0.000 | -.0575978 | -.0497384 |

| | | | | | | |
|---|---|---|---|---|---|---|
| gamma_10_5 | -.0066535 | .0011368 | -5.85 | 0.000 | -.0088816 | -.0044254 |
| gamma_6_6 | .0633527 | .0016099 | 39.35 | 0.000 | .0601973 | .0665081 |
| gamma_7_6 | -.0031078 | .0010317 | -3.01 | 0.003 | -.0051299 | -.0010857 |
| gamma_8_6 | -.0040284 | .0009491 | -4.24 | 0.000 | -.0058885 | -.0021683 |
| gamma_9_6 | -.0100393 | .0011721 | -8.57 | 0.000 | -.0123365 | -.007742 |
| gamma_10_6 | -.003719 | .0007784 | -4.78 | 0.000 | -.0052446 | -.0021934 |
| gamma_7_7 | .2350511 | .0019149 | 122.75 | 0.000 | .231298 | .2388042 |
| gamma_8_7 | -.019135 | .0012129 | -15.78 | 0.000 | -.0215122 | -.0167577 |
| gamma_9_7 | -.0206238 | .0013407 | -15.38 | 0.000 | -.0232516 | -.017996 |
| gamma_10_7 | -.0001539 | .000769 | -0.20 | 0.841 | -.0016612 | .0013534 |
| gamma_8_8 | .1683928 | .0014919 | 112.87 | 0.000 | .1654688 | .1713169 |
| gamma_9_8 | -.0141526 | .0012235 | -11.57 | 0.000 | -.0165505 | -.0117547 |
| gamma_10_8 | -.0030851 | .0007082 | -4.36 | 0.000 | -.0044732 | -.001697 |
| gamma_9_9 | .2228442 | .0020055 | 111.12 | 0.000 | .2189135 | .2267748 |
| gamma_10_9 | -.0037899 | .0008541 | -4.44 | 0.000 | -.005464 | -.0021159 |
| gamma_10_10 | .0347597 | .0007681 | 45.25 | 0.000 | .0332542 | .0362651 |
| lambda | | | | | | |
| lambda_1 | -.0135027 | .0003024 | -44.65 | 0.000 | -.0140953 | -.01291 |
| lambda_2 | .0081724 | .0003295 | 24.80 | 0.000 | .0075267 | .0088181 |
| lambda_3 | .0008431 | .0002069 | 4.08 | 0.000 | .0004376 | .0012485 |
| lambda_4 | .0063041 | .000318 | 19.82 | 0.000 | .0056809 | .0069274 |
| lambda_5 | .0018252 | .0003142 | 5.81 | 0.000 | .0012093 | .0024411 |
| lambda_6 | .0010108 | .0001288 | 7.85 | 0.000 | .0007584 | .0012632 |
| lambda_7 | -.001002 | .0002312 | -4.33 | 0.000 | -.0014551 | -.0005488 |
| lambda_8 | -.0044927 | .0001833 | -24.51 | 0.000 | -.0048519 | -.0041335 |
| lambda_9 | .0002096 | .0001946 | 1.08 | 0.281 | -.0001718 | .000591 |
| lambda_10 | .0006321 | .0001003 | 6.30 | 0.000 | .0004355 | .0008287 |

**Table A3 VAT C-Efficiency Results**

| Year | VAT C-Efficiency % | | Year | VAT C-Efficiency % |
|---|---|---|---|---|
| 1991 | 3.27 | | 2005 | 12.08 |
| 1992 | 3.73 | | 2006 | 13.76 |
| 1993 | 4.14 | | 2007 | 14.40 |
| 1994 | 4.84 | | 2008 | 16.69 |
| 1995 | 4.92 | | 2009 | 18.63 |
| 1996 | 5.78 | | 2010 | 20.16 |
| 1997 | 7.12 | | 2011 | 16.96 |
| 1998 | 6.74 | | 2012 | 17.62 |
| 1999 | 7.46 | | 2013 | 19.98 |
| 2000 | 9.32 | | 2014 | 28.28 |
| 2001 | 7.52 | | 2015 | 32.28 |
| 2002 | 7.77 | | 2016 | 32.57 |
| 2003 | 8.60 | | 2017 | 30.89 |
| 2004 | 12.12 | | | |

Source: Author's Computations, (2018)

## Table A4 General ARDL Model

```
. ardl VATCE REF NOVRT GDPG SHDGDP TRDGDP AGRGDP, maxlags(1) aic

ARDL(1,0,1,1,0,0,1) regression

Sample: 1992 - 2017                             Number of obs   =         26
                                                F(  10,     15) =      87.65
                                                Prob > F        =     0.0000
                                                R-squared       =     0.9832
                                                Adj R-squared   =     0.9720
Log likelihood =  79.412942                     Root MSE        =     0.0150
```

| VATCE | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| VATCE | | | | | | |
| L1. | .8452032 | .0903021 | 9.36 | 0.000 | .6527287 | 1.037678 |
| REF | .0205509 | .0064047 | 3.21 | 0.006 | .0068996 | .0342022 |
| NOVRT | | | | | | |
| --. | -.0208994 | .0064097 | -3.26 | 0.005 | -.0345612 | -.0072375 |
| L1. | .0093221 | .0057652 | 1.62 | 0.127 | -.0029662 | .0216104 |
| GDPG | | | | | | |
| --. | -.1379992 | .202052 | -0.68 | 0.505 | -.5686628 | .2926644 |
| L1. | -.2504351 | .181495 | -1.38 | 0.188 | -.6372826 | .1364123 |
| SHDGDP | -66.14909 | 26.94041 | -2.46 | 0.027 | -123.5712 | -8.726968 |
| TRDGDP | -.2088438 | .0719119 | -2.90 | 0.011 | -.3621204 | -.0555672 |
| AGRGDP | | | | | | |
| --. | .1227404 | .2567513 | 0.48 | 0.640 | -.424512 | .6699928 |
| L1. | -.513845 | .2518301 | -2.04 | 0.059 | -1.050608 | .0229182 |
| _cons | .509651 | .1350614 | 3.77 | 0.002 | .2217745 | .7975275 |

## Table A5 System Generated Lags for Estimation of ARDL Model

```
e(lags)[1,7]
     VATCE      REF    NOVRT     GDPG   SHDGDP   TRDGDP   AGRGDP
r1       1        0        1        1        0        0        1
```

## Table A6 Long-run ARDL Model Results

```
. ardl VATCE REF NOVRT GDPG SHDGDP TRDGDP AGRGDP, ec1 lags(1,0,1,1,0,0,1)

ARDL(1,0,1,1,0,0,1) regression

Sample: 1992 - 2017                             Number of obs   =         26
                                                R-squared       =     0.7014
                                                Adj R-squared   =     0.5023
Log likelihood =  79.412942                     Root MSE        =     0.0150
```

| D.VATCE | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| ADJ | | | | | | |
| VATCE | | | | | | |
| L1. | -.1547968 | .0903021 | -1.71 | 0.107 | -.3472713 | .0376777 |
| LR | | | | | | |
| REF | | | | | | |
| L1. | .1327605 | .0959398 | 1.38 | 0.187 | -.0717303 | .3372513 |
| NOVRT | | | | | | |
| L1. | -.0747903 | .0443655 | -1.69 | 0.113 | -.169353 | .0197724 |
| GDPG | | | | | | |
| L1. | -2.509317 | 2.817452 | -0.89 | 0.387 | -8.514573 | 3.495939 |
| SHDGDP | | | | | | |
| L1. | -427.3285 | 231.8001 | -1.84 | 0.085 | -921.3987 | 66.74169 |
| TRDGDP | | | | | | |
| L1. | -1.349148 | .587251 | -2.30 | 0.036 | -2.600843 | -.0974517 |
| AGRGDP | | | | | | |
| L1. | -2.526567 | 1.900366 | -1.33 | 0.204 | -6.577101 | 1.523967 |
| SR | | | | | | |
| REF | | | | | | |
| D1. | .0205509 | .0064047 | 3.21 | 0.006 | .0068996 | .0342022 |
| NOVRT | | | | | | |
| D1. | -.0208994 | .0064097 | -3.26 | 0.005 | -.0345612 | -.0072375 |
| GDPG | | | | | | |
| D1. | -.1379992 | .202052 | -0.68 | 0.505 | -.5686628 | .2926644 |
| SHDGDP | | | | | | |
| D1. | -66.14909 | 26.94041 | -2.46 | 0.027 | -123.5712 | -8.726968 |
| TRDGDP | | | | | | |
| D1. | -.2088438 | .0719119 | -2.90 | 0.011 | -.3621204 | -.0555672 |
| AGRGDP | | | | | | |
| D1. | .1227404 | .2567513 | 0.48 | 0.640 | -.424512 | .6699928 |
| _cons | .509651 | .1350614 | 3.77 | 0.002 | .2217745 | .7975275 |

## Table A7 ARDL Bound Test Results

**Pesaran/Shin/Smith (2001) ARDL Bounds Test**

H0: no levels relationship F = 4.647
t = -1.714

Critical Values (0.1-0.01), **F-statistic**, Case 3

| | [I_0] L_1 | [I_1] L_1 | [I_0] L_05 | [I_1] L_05 | [I_0] L_025 | [I_1] L_025 | [I_0] L_01 | [I_1] L_01 |
|---|---|---|---|---|---|---|---|---|
| k_6 | 2.12 | 3.23 | 2.45 | 3.61 | 2.75 | 3.99 | 3.15 | 4.43 |

accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), **t-statistic**, Case 3

| | [I_0] L_1 | [I_1] L_1 | [I_0] L_05 | [I_1] L_05 | [I_0] L_025 | [I_1] L_025 | [I_0] L_01 | [I_1] L_01 |
|---|---|---|---|---|---|---|---|---|
| k_6 | -2.57 | -4.04 | -2.86 | -4.38 | -3.13 | -4.66 | -3.43 | -4.99 |

accept if t > critical value for I(0) regressors
reject if t < critical value for I(1) regressors

k: # of non-deterministic regressors in long-run relationship
Critical values from Pesaran/Shin/Smith (2001)

## Table A8 Durbin Watson D-statistic Test Results

| estat dwatson |
|---|
| Durbin-Watson d-statistic( 19, 25) = 3.22541 |

## Table A9 Breusch-Godfrey LM Test Results

```
. estat bgodfrey, lags (1)

Breusch-Godfrey LM test for autocorrelation
```

| lags(*p*) | chi2 | df | Prob > chi2 |
|---|---|---|---|
| 1 | 16.970 | 1 | 0.0000 |

H0: no serial correlation

## Table A10 White Test Results

```
White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(24)     =     25.00
         Prob > chi2  =    0.4058

Cameron & Trivedi's decomposition of IM-test
```

| Source | chi2 | df | p |
|---|---|---|---|
| Heteroskedasticity | 25.00 | 24 | 0.4058 |
| Skewness | 12.90 | 18 | 0.7975 |
| Kurtosis | 2.20 | 1 | 0.1385 |
| Total | 40.09 | 43 | 0.5980 |

**Table A 11 ARCH-LM Test Results**

```
. estat archlm
LM test for autoregressive conditional heteroskedasticity (ARCH)
```

| lags(*p*) | chi2 | df | Prob > chi2 |
|---|---|---|---|
| 1 | 1.590 | 1 | 0.2074 |

H0: no ARCH effects *vs.* H1: ARCH(*p*) disturbance

*Table A12 Ramsey RESET Test Results*

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of VATCE
       Ho:  model has no omitted variables
                   F(3, 3) =      0.53
                  Prob > F =      0.6939
```

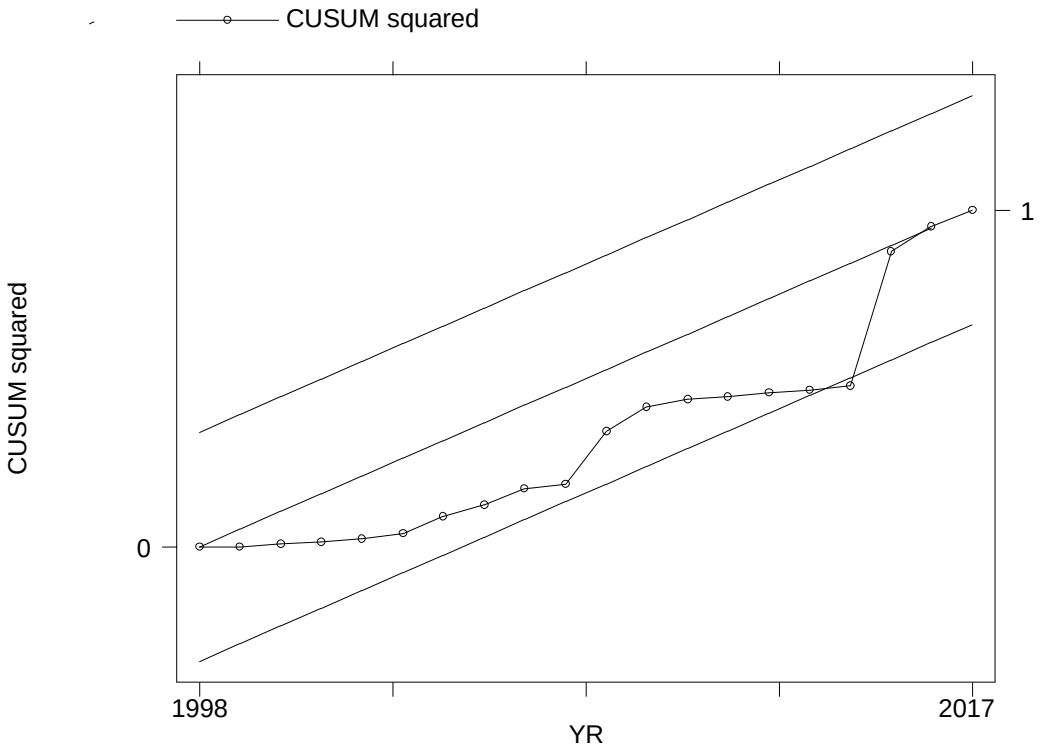


**Figure A1 CUSUM Stability Test Results**

HISTOGRAM NORMALITY TEST

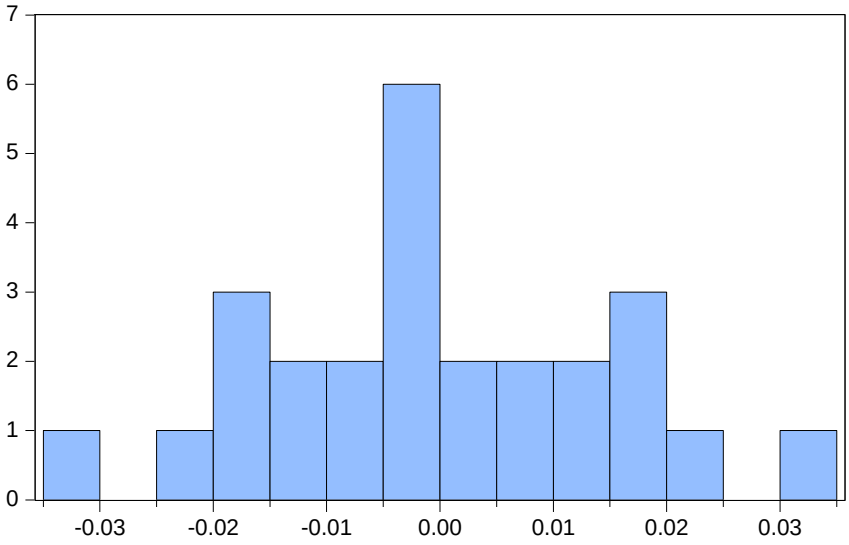


**Figure A2 Histogram Normality Test Results**

# Appendix II

## Table A13 General ARDL Model Results for the Estimated Determinants of VAT Compliance Gap in Kenya

```
. ardl VATCOMPLIANCEGAP STANDARDVATRATES SHADOWECONOMYGDP REF NOVATRATES manufacturevalueaddedgrowth popgrowth
>  IMPORT FINALCONSUMPTION Exports agriculture, maxlags(1) aic

ARDL(1,1,1,1,1,0,1,0,0,1,0) regression

Sample:       1992 -       2018                 Number of obs   =         27
                                                F(  17,      9) =       6.18
                                                Prob > F        =     0.0043
                                                R-squared       =     0.9211
                                                Adj R-squared   =     0.7720
Log likelihood =  36.251221                     Root MSE        =     0.1095
```

| VATCOMPLIANCEGAP | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| VATCOMPLIANCEGAP | | | | | | |
| L1. | -.1915081 | .1857784 | -1.03 | 0.330 | -.6117681 | .2287518 |
| STANDARDVATRATES | | | | | | |
| --. | .0967788 | .0363568 | 2.66 | 0.026 | .0145341 | .1790235 |
| L1. | .0727714 | .0399995 | 1.82 | 0.102 | -.0177138 | .1632566 |
| SHADOWECONOMYGDP | | | | | | |
| --. | .0108085 | .0281896 | 0.38 | 0.710 | -.0529608 | .0745777 |
| L1. | .0391106 | .0277993 | 1.41 | 0.193 | -.0237758 | .1019971 |
| REF | | | | | | |
| --. | .1500354 | .0805977 | 1.86 | 0.096 | -.0322891 | .33236 |
| L1. | .2213402 | .0750922 | 2.95 | 0.016 | .0514698 | .3912105 |
| NOVATRATES | | | | | | |
| --. | -.0220394 | .0556635 | -0.40 | 0.701 | -.1479589 | .1038802 |
| L1. | -.1867191 | .0636039 | -2.94 | 0.017 | -.3306011 | -.0428371 |
| manufacturevalueaddedgrowth | .0316996 | .0131043 | 2.42 | 0.039 | .0020556 | .0613436 |
| popgrowth | | | | | | |
| --. | -4.910189 | 1.1069 | -4.44 | 0.002 | -7.414171 | -2.406208 |
| L1. | 2.340948 | 1.026425 | 2.28 | 0.049 | .0190121 | 4.662884 |
| IMPORT | .065924 | .0223219 | 2.95 | 0.016 | .0154284 | .1164197 |
| FINALCONSUMPTION | -.1224275 | .0274462 | -4.46 | 0.002 | -.184515 | -.06034 |
| Exports | | | | | | |
| --. | -.0874482 | .034325 | -2.55 | 0.031 | -.1650967 | -.0097997 |
| L1. | -.0258689 | .0294899 | -0.88 | 0.403 | -.0925797 | .040842 |
| agriculture | -.0838409 | .0340621 | -2.46 | 0.036 | -.1608946 | -.0067871 |
| _cons | 16.508 | 6.744305 | 2.45 | 0.037 | 1.251323 | 31.76468 |

## Table A14 ARDL Bound Test Results

```
. estat btest

note: estat btest has been superseded by estat ectest
      as the prime procedure to test for a levels relationship.
      (click to run)

Pesaran/Shin/Smith (2001) ARDL Bounds Test
H0: no levels relationship            F =  1.744
                                      t = -2.801

Critical Values (0.1-0.01), F-statistic, Case 3

        |  [I_0]   [I_1]  |  [I_0]   [I_1]  |  [I_0]   [I_1]  |  [I_0]   [I_1]
        |    L_1     L_1  |    L_05    L_05  |   L_025   L_025  |    L_01    L_01
--------+-----------------+-----------------+-----------------+----------------
 k_10   |   1.83    2.94  |   2.06    3.24  |   2.28    3.50  |   2.54    3.86
accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors

Critical Values (0.1-0.01), t-statistic, Case 3

        |  [I_0]   [I_1]  |  [I_0]   [I_1]  |  [I_0]   [I_1]  |  [I_0]   [I_1]
        |    L_1     L_1  |    L_05    L_05  |   L_025   L_025  |    L_01    L_01
--------+-----------------+-----------------+-----------------+----------------
 k_10   |  -2.57   -4.69  |  -2.86   -5.03  |  -3.13   -5.34  |  -3.43   -5.68
accept if t > critical value for I(0) regressors
reject if t < critical value for I(1) regressors

k: # of non-deterministic regressors in long-run relationship
Critical values from Pesaran/Shin/Smith (2001)
```

**Table A15 Durbin-Watson D-statistic Results**

| . estat dwatson |
|---|
| Durbin-Watson d-statistic( 20,  27) = 2.65925 |

**Table A16 Breusch-Godfrey LM Test Results**

```
. estat bgodfrey, lags (1)

Breusch-Godfrey LM test for autocorrelation
```

| lags(*p*) | chi2 | df | Prob > chi2 |
|---|---|---|---|
| 1 | 9.762 | 1 | 0.0018 |

H0: no serial correlation

**Table A17 White Test Results**

```
. estat imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(26)     =     27.00
         Prob > chi2  =    0.4093

Cameron & Trivedi's decomposition of IM-test
```

| Source | chi2 | df | p |
|---|---|---|---|
| Heteroskedasticity | 27.00 | 26 | 0.4093 |
| Skewness | 14.25 | 19 | 0.7688 |
| Kurtosis | 1.14 | 1 | 0.2865 |
| Total | 42.39 | 46 | 0.6243 |

**Table A18 ARCH-LM Test Results**

```
. estat archlm
LM test for autoregressive conditional heteroskedasticity (ARCH)
```

| lags(*p*) | chi2 | df | Prob > chi2 |
|---|---|---|---|
| 1 | 2.629 | 1 | 0.1049 |

H0: no ARCH effects *vs.* H1: ARCH(*p*) disturbance

.

**Table A19 Ramsey RESET Test Results**

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of VATCOMPLIANCEGAP
       Ho:  model has no omitted variables
                   F(3, 4) =      5.17
                  Prob > F =      0.0731

.
```

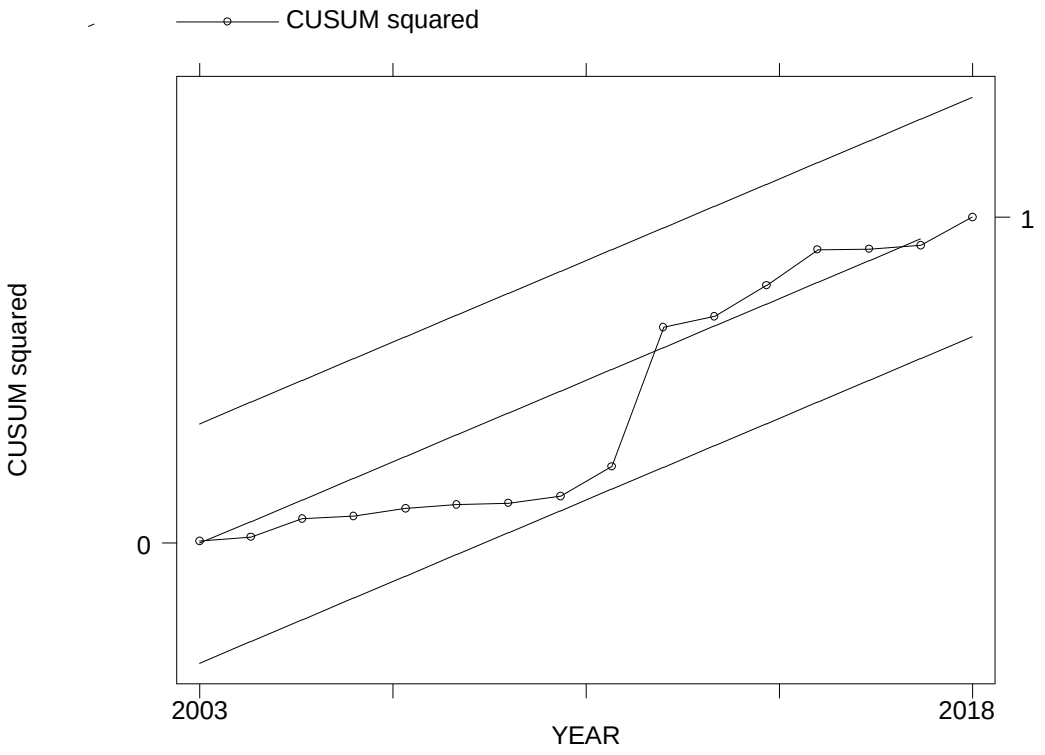


**Figure A3 CUSUM Stability Test Results**

**Kenya National Bureau of Statistics (KNBS) Report on Kenya Household Expenditure Share (2016)**

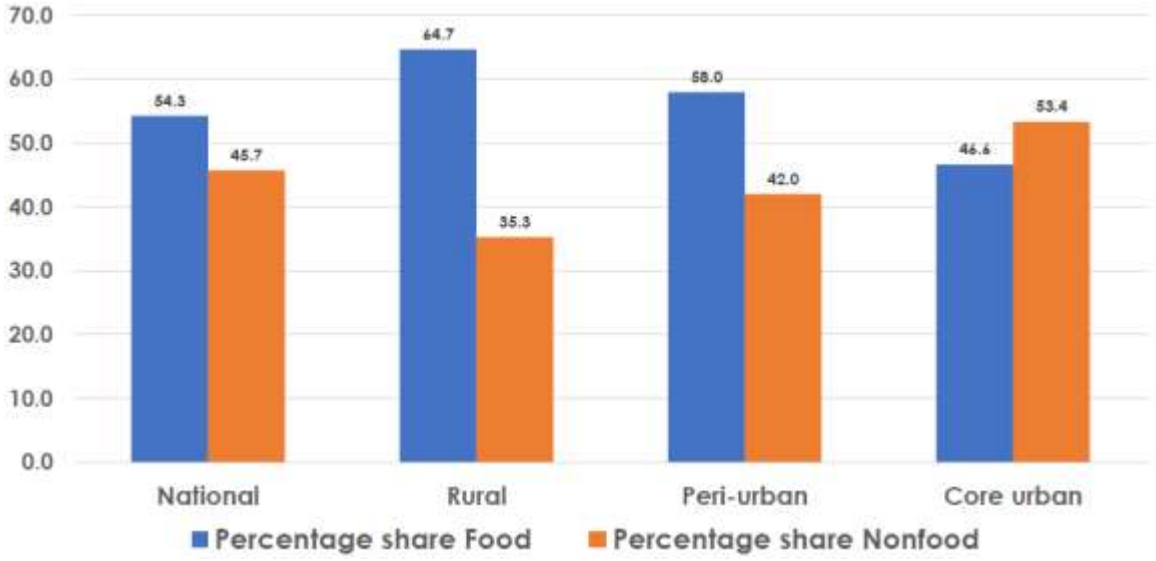


**Figure A4 Food share in total household expenditure**

**Source of data:** KNBS, 2015/16 Kenya Integrated Household Budget Survey