THE EFFECT OF REAL EXCHANGE RATE DEPRECIATION ON IMPORT TAX REVENUE IN KENYA, 1970-2009

BY

ALEX OGUSO OCHIEN'G

X50/73733/2009

SUPERVISORS

DR. KAMAU GATHIAKA

DR. ODHIAMBO SULE

A Research Paper submitted to the School of Economics in partial fulfilment of the requirements for the award of Master of Arts Degree in Economics of University of Nairobi

November 2011

DECLARATION

This research paper is my original work and has not been presented for a degree in any other university.

Alex Oguso Ochien'g

Signature ..... Date 24/11/2011

Approval

This research paper has been submitted for examination with our approval as the University Supervisors:

Dr. Kamau Gathiaka

Signature ..... Date 24/11/11

Dr. Odhiambo Sule

Signature ..... Date 24/11/11

DEDICATION

This paper is dedicated to my late Grandma Rebecca Salome Oguso, my mum Millicent Anyango Oguso, my dear Sheba, Becky and the entire Oguso family for their immense moral and financial support throughout my endeavour to attain education to this level. Your patience, understanding and unrelenting support is highly appreciated.

ACKNOWLEDGEMENT

I am greatly indebted to the Almighty God for giving me the wisdom, strength and capability to pursue my studies to this level. Am extremely grateful to my supervisors Dr. Kamau Gathiaka and Dr. Odhiambo Sule for devoting much of their time to guide me through in writing this research paper. Their comments, valuable suggestions and constructive criticism have greatly helped in the writing of this paper and in improving the quality of this paper.

Let me also extend my sincere gratitude to my lecturers and former course mates at School of Economics, University of Nairobi and especially those who attended my proposal presentation at the School of Economics Seminar. Thanks for the positive criticism, comments and knowledge shared.

Lastly, I wish to thank my dear Sheba and my daughter Rebecca Junior for their moral support and encouragement while pursuing my studies.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey-Fuller
CIF	Cost. Insurance and Freight
CIT	Corporate Income Tax
ECM	Error Correction Model
ECT	Error Correction Term
EMS	European Monetary System
GDP	Gross Domestic Products
IMF	International Monetary Funds
KRA	Kenya Revenue Authority
KIPPRA	Kenya Institute of Public Policy Research and Analysis
LCU	Local Currency Unit
LDC	Less Developed Countries
NER	Nominal Exchange Rates
OLS	Ordinary Least Squares
PAYE	Pay As You Earn
RER	Real Exchange Rates
SDR	Special Drawing Rights
TMP	Tax Modernisation Programme
TOT	Terms of Trade
VAT	Value Added Tax

ABSTRACT

Taxation play a critical role in raising the resources needed for financing government activities in developing countries. On the other hand, the volatility of real exchange rate (RERs) has generated significant concern among academics and policy makers in view of its effects on macroeconomic variables such as tax revenue generation. This study therefore focuses on the effects of real exchange rates on import tax revenues in Kenya. The specific objectives of the study were to determine the nature of the real exchange rates depreciations in Kenya from 1970 to 2009 and to establish the effects of the depreciations on the import tax revenues in Kenya from 1970 to 2009. The study formulated a dynamic specification for the real custom duties function incorporating the error correction term which was then estimated using the ordinary least squares. The results showed that import price indices, inflation rates and lagged real custom duties have a negative effect on the real custom duties. A liberalized exchange rate regime as introduced in Kenya in 1993 was found to have a positive effect on the real custom duties. Results also showed that real exchange rate has a statistically significant negative effect on custom duties. An increase in the real exchange rate (depreciation) leads to imports being expensive hence discouraging imports. Consequently, import volumes decline reducing revenue from the imports. It is desirable to have a real exchange rate devoid of destabilizing effects on the economy.

CHAPTER ONE

1.0 INTRODUCTION

This section lays the foundation of the research study. It presents the background of the study, statement of the research problem, the research objectives and significance of the study.

1.1 A Brief Overview of the Kenyan Economy

Kenya is a regional financial and transportation hub for East Africa. After independence, Kenya realized rapid economic growth through public investments, encouragement of agricultural production and incentives for private industrial investments. The government protected domestic infant industries and promoted exports mainly of agricultural products. The major drivers of the economic growth currently are agriculture and forestry, wholesale and retail trade, transport and communication, manufacturing, and financial intermediation (Republic of Kenya, 2011).

The real GDP for Kenya in 2010 expanded by 5.6 per cent after the suppressed growths of 1.5 and 2.6 per cent in 2008 and 2009 respectively. During this year, average annual inflation was 4.1 per cent down from a high of 10.5 per cent in 2009.Total revenue (including grants) was Kshs 643.3 billion in 2009/10 and is expected to increase by 19.8 per cent to Kshs 770.7 billion in 2010/11 (Republic of Kenya, 2011).

Kenya has a mixed market economy. The local currency is the Kenya shilling. The US dollar/ Kenya shilling is the major exchange rate in the economy. From 1993 to 2011 the US dollar/Kenya Shilling exchange rate averaged 75.95 reaching a historical high of 106.85 in October 2011 and a record low of 36.23 in January 1993. In the recent years, the Kenya shilling has been on a depreciating trend against the world's major currencies. For instance, in 2009 the Kenyan shilling depreciated against the US dollar from an average annual rate of Kshs 75.95 to Kshs 79.23. In 2010 the Kenya shilling continued to depreciate against the major world currencies as reflected by the trade weighted exchange rate index which rose by 2.4 per cent from 718.19 as at December 2009 to 735.13 as at December 2010. It weakened against Japanese Yen and US Dollar by 16.6 and 2.9 per cent respectively as at December 2010. According to the Central Bank of Kenya monthly reports, the Kenya shilling has depreciated by 23.75 percent against the US dollar during the last 12 months up to October 2011. It is therefore evident that Kenya has been faced with frequent depreciations of the exchange rate with negative impacts on the Kenyan economy.

Kenya has undergone various exchange rate regimes since independence. The phases include a fixed exchange rate regime between 1970-1982; a crawling peg regime between 1982-1990; and a dual exchange rate coupling a market (interbank) determined rate with an official crawling peg regime between 1990 - October 1993. Since October 1993, the country has had a floating exchange rate regime (Kabubi, 1995). This shift in the exchange rate regimes since 1970 has also been accompanied by fluctuations on real exchange rates over the period. The fluctuations of the real exchange rates impact directly on the importation of goods and services and consequently on the import tax revenue generated. In view of this, it is of great interest to study the effects of these trends on the Kenyan economy, particularly, on the import tax revenue. The Kenyan economy is highly reliant on consumption of imports both for industrial and domestic use. Additionally, the import tax revenues generated from the importation of these goods and services play a significant role in total revenue generation. Taxation of imports is also used as a policy tool to protect the domestic industries. This lays the foundation for this study which seeks to determine the nature of the real exchange rate depreciations and to investigate the effects of the depreciations of the real exchange rate on import tax revenue in Kenya.

1.2 Importance of Import Taxes to the Kenyan Economy

In Kenya tax revenue contributes about 85% of the total budgetary revenues and is derived from two broad tax categories, namely, direct tax and indirect tax (Republic of Kenya, 2000). Indirect taxes in Kenya are composed of the customs duties, export taxes, excise and value added taxes. They form the largest proportion in the total tax revenue at more than 65% of the total tax collected (Kabubi, 1995). The import taxes contribute significantly to the total revenue generated in the economy and are also imposed on certain imports with the aim of protecting the domestic infant industried. From Table 1, it can be noted that import taxes were second to income taxes from 1963 to 1973 before being overtaken by sales taxes. Despite the fact that the import taxes percentage of total tax receipts have decline over the years, they still remain significant as shown by VAT on imports and Import duties indicated in Table 2. In this study, customs duties and import taxes are used interchangeably. Custom duties are levies collected on goods that enter a country. They also capture the services delivered by non-residents to residents. In recognition of the fact that custom duties has continued to form a considerable part of overall Government tax receipts, the government in 2010/11 proposes to institute several measures aimed at improving the performance of the customs services. These will include the introduction of automated valuation database system to strengthen the

customs valuation function, and rolling out of an electronic cargo tracking system to enable effective monitoring of all transit goods (Republic of Kenya, 2011). Total imports duty grew by 15.3 per cent in 2010 compared to 14.9 percent in 2009. The major sources of import revenue in Kenya are industrial machinery, crude petroleum, motor vehicles and transport equipment, minerals, iron and steel, chemicals, food and manufactured goods (Republic of Kenya, 2011).

Kenya's tax revenues and their composition from 1963 to 2003 are indicated in Table 1 and Figure 1 in this section. The measures used for this explanation are the share of given taxes in total tax revenues.

Table 1: Tax Structure in Kenya as a Percentage of Total Tax Revenue

TYPE OF TAX	PERIOD							
	Pre-tax modernisation period				Post-tax modernisation period			
	1963-1967	1968-1972	1973-1977	1978-1982	1983-1987	1988-1992	1993-1997	1998-2003
Total revenue	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Import duty	39.8	31.5	23.2	24.6	20.3	15.7	16.7	16.9
Excise duty	17.0	17.2	11.0	10.7	9.0	10.5	16.9	16.6
Income tax	38.3	44.6	38.8	33.2	32.7	32.6	38.3	32.3
Sales tax/VAT	0.0	2.9	24.2	28.3	32.2	36.1	24.3	25.2
Others	5.0	3.8	2.8	3.2	5.8	5.0	3.8	9.0

Source: Economic Surveys (various issues)

Fig 1. Tax Structure in Kenya as a Percentage of Total Tax Revenue

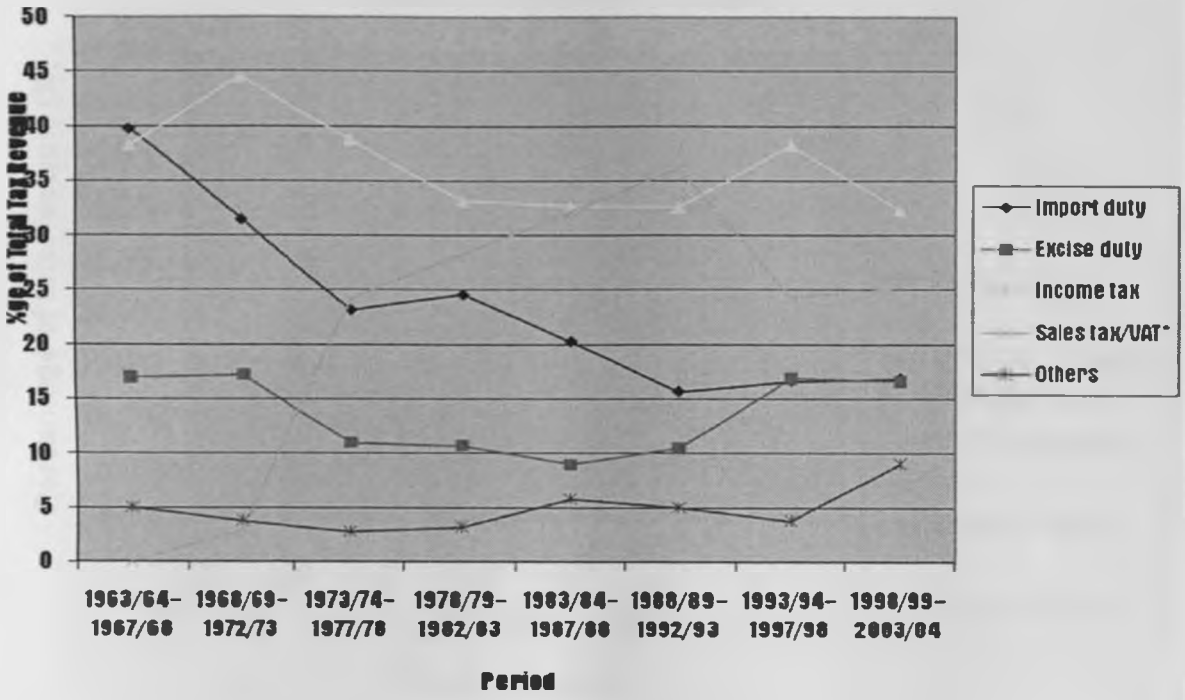
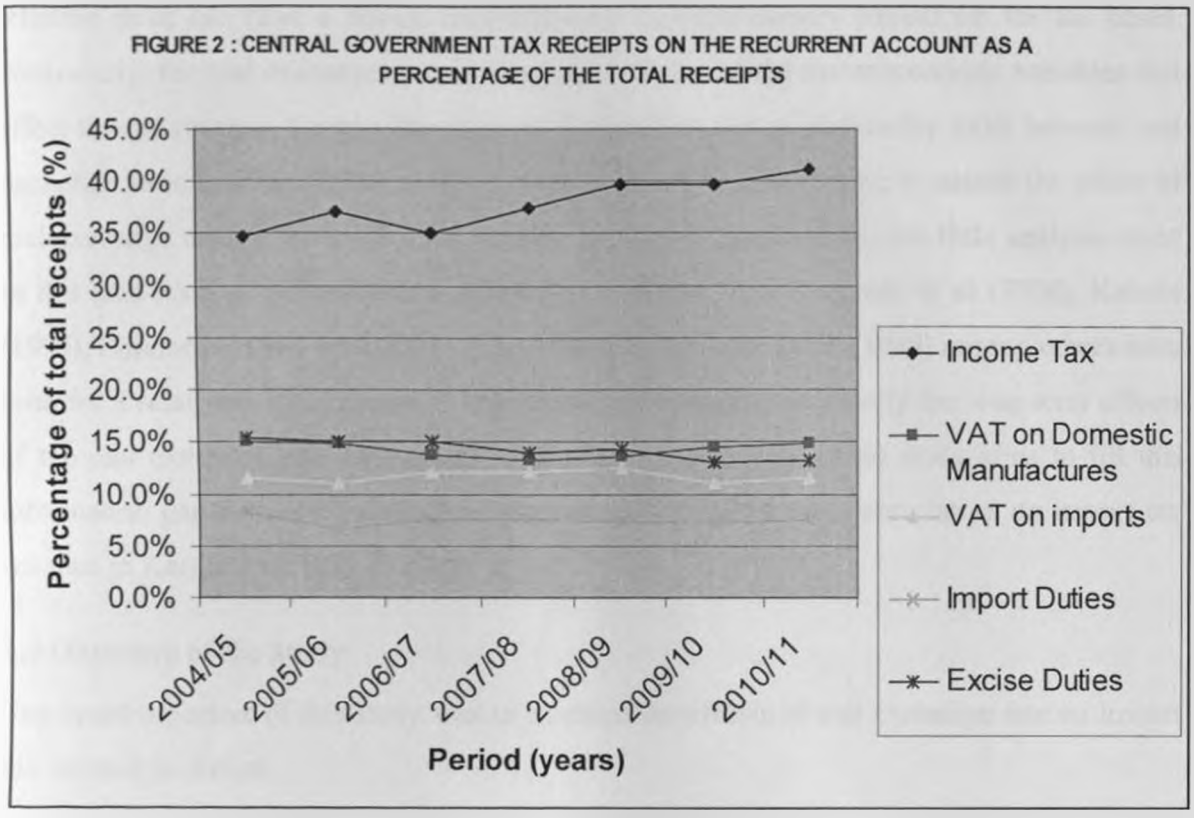


Table 2 : CENTRAL GOVERNMENT TAX RECEIPTS ON THE RECURRENT ACCOUNT AS A PERCENTAGE OF THE TOTAL RECEIPTS

TYPE OF TAX	PERIOD						
	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Income Tax	34.7%	37.0%	35.1%	37.4%	39.7%	39.6%	41.2%
VAT on Domestic Manufactures	15.1%	14.9%	13.8%	13.2%	13.5%	14.4%	14.9%
VAT on imports	11.5%	10.9%	12.1%	12.1%	12.4%	11.0%	11.6%
Import Duties	8.2%	6.6%	7.5%	7.5%	7.4%	7.2%	7.5%
Excise Duties	15.4%	15.1%	15.1%	14.0%	14.3%	13.0%	13.2%
TOTAL RECEIPTS	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Economic Surveys (Various Issues).

FIGURE 2 : CENTRAL GOVERNMENT TAX RECEIPTS ON THE RECURRENT ACCOUNT AS A PERCENTAGE OF THE TOTAL RECEIPTS



From Table 1 and Table 2, it can be noted that import duty has played a significant role in contributing to the total tax revenue generated in the Kenyan Economy. However, the share of this tax has been diminishing over the years as depicted in figure 1 and figure 2. In the early 1960s, trade taxes constituted 40 percent of total tax revenue or 4.2 percent of GDP. This ratio then continued to fall and stood at around 25 percent of total revenues before the Tax Modernisation Programme (TMP) which were undertaken to reform the tax system in the 1980s. The TMP led to a further reduction of the ratio of the trade taxes to roughly 17 percent of total tax revenue (Karingi et al, 2005). Kenya has also changed its trade policy to embrace free trade so as to face the challenges of globalisation in as far as export competitiveness is concerned. This has left the country exposed to external shocks and to exchange rate depreciations which have had an impact on its import tax revenue generation over the years.

1.3 The Problem Statement

The Kenyan economy has been experiencing persistent budget deficits over the years despite the tax reforms that have mainly focussed on the tax structure with the general objective of raising the tax revenue, economic efficiency and ensuring equity and fairness in the tax system. Additionally, other macroeconomic variables have had effects on the Kenyan tax policy and tax revenue generation. Macroeconomic variables, for instance, exchange rates and

inflation rates can have a strong contractionary or expansionary impact on the tax bases. Particularly, the real exchange rate is recognised as one of the macroeconomic variables that affect the tax revenue. Despite the apparent recognition that a relationship exist between real exchange rates and import tax revenue, little analyses has been done to assess the effect of real exchange rate on the import tax revenue in Kenya. Additionally, the little analyses done in this area such as the studies by Morande & Habbel (1991), Ayoki et al (2008), Kabubi (1995), Emmerij (1990), Easterly (1991), Eberill (1999) and Tanzi (1989) among others have been for a relatively short period of time hence not bringing out clearly the long term effects of the real exchange rate depreciations on import tax revenue. This study aims to fill this information gap by investigating the effects of real exchange rate depreciation on import tax revenue in Kenya from 1970 to 2009.

1.4 Objective of the Study

The broad objective of this study was to examine the effects of real exchange rate on import tax revenue in Kenya.

The specific objectives of the study were:

i) To determine the nature of the real exchange rate depreciation in Kenya from 1970 to 2009

ii) To establish the effects of the depreciation of the real exchange rate on the import tax revenue in Kenya from 1970 to 2009

iii) To make appropriate policy recommendations based on the study findings.

1.5 Significance of the study

Real exchange rate is now widely used by developing countries in their macroeconomic adjustments. Considering the reliance of the developing countries on import taxes to raise revenue and protect the domestic infant industries, a study on the effects of real exchange rate of import tax revenue receipt is of great importance. This study provides useful information on the effects of the real exchange rates and other variables such as inflation rates, import price indices, lagged custom duties and liberalisation of exchange rate regime in 1993 on the import tax revenues. The results of this study are also useful in improving policy design, implementation, monitoring and evaluation in exchange rate management. Moreover, the findings of this study forms part of the contribution to the existing knowledge on the effects of real exchange rates on tax revenues.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter presents a review of theoretical and empirical literature. It provides a review of literature on the effects of real exchange rate on tax revenue generation and on import tax revenue generation in particular. The impact of other variables such as inflation rates and trade liberalisation which lead to liberalisation of exchange rate regimes is also discussed in this section.

2.1 Theoretical Literature

The role of taxation in raising the resources needed for financing government activities in developing countries is widely recognised (Adedoyin, 1997). According to Rolph and Break (1961), a tax is a compulsory transfer of money (or occasionally of goods and services) from private individuals and groups to the government, in return for which the taxpayer receives nothing of material value. Taxes comprise the explicit and implicit costs incurred by economic agents in their support of government activities. Taxes are therefore transfers of money to the public sector, but they exclude loan transactions and direct payments for publicly – produced goods and services (James and Nobes, 1992). Indirect taxes can be defined as those taxes which fall primarily on the sales of goods and services while direct taxes are taxes which are imposed directly on the income earned by individuals and companies. Direct taxes are composed of individual income taxes and corporate taxes.

Boskin and McLure (1990) noted that the taxation of imports was historically one of the first levies to arise. They added that the relative ease of collection at customs offices located at the border, the common impression that it was foreigners who were being taxed, and the natural support of domestic producers protection by the tariffs – are perhaps sufficient reasons to explain the early emergence of customs tariffs as important revenue sources. However, the fluctuations in the real exchange rates have also influenced the taxation of imports.

Volatility of real exchange rate (RERs) has generated significant concern among academics and policy makers in both developed and developing countries. In the last few years, real exchange rate (RER) behaviour has gained prominence in policy discussions. Policymakers have become increasingly worried by the wide swings experienced by real exchange rates over the years in both developed and developing countries. This has been because of the realisation that increased volatility of RERs leads to welfare losses, macroeconomic

instability and balance of payments problems. Dornbusch and Frewel (1987) defined the exchange rate as the rate at which a country has to give up its own currency in order to acquire another country's currency. Exchange rates can be categorized as nominal or real. Nominal exchange rate is a monetary concept that measures the relative price of two currencies, that is, the price of foreign currency in terms of domestic currency. The real exchange rate is the nominal exchange rate that takes the inflation differentials among the countries into account. This means that the RER of a nation measures not only nominal changes in its exchange rates but also changes in relative inflation rates. Obadan (1994) defined the real exchange rate as the price in real terms of a real dollar or foreign currency that a country uses for its international transactions. According to Hatzipanayotou and Michael (1997), the RER, usually defined either as a country's relative price of a composite traded good to a non-traded good, or as the ratio of the foreign to the domestic price level, is frequently viewed as a proxy for a country's international competitiveness.

2.1.1 The Exchange Rate Regimes in Kenya

According to Gandolfo (1973), a large number of exchange regimes are possible in theory. This is due to the fact that between the two extremes of perfectly fixed and perfectly flexible exchange rates there are a range of intermediate regimes of differing flexibility. For instance, historically we have various exchange rate regimes which include fixed exchange rate regimes such as the gold standard/gold exchange standard, managed or dirty floating, the Bretton Woods System which belonged to the category of the limping gold exchange standard, crawling peg or gliding parities and wider band exchange regimes. A perfectly flexible exchange rates regime, also known as floating exchange rate regime, is characterised by the fact that the monetary authorities of the country which adopt it do not intervene in the foreign exchange market. Therefore the exchange rate of the currency with respect to foreign currency is left completely free to fluctuate in either direction and by any amount on the basis of the demands for and supplies of foreign exchange. On the other hand, perfectly fixed exchange rates comprises of various cases such as the gold standard, where each national currency has a precisely fixed gold content. In this case the exchange rate between any two currencies is automatically and rigidly fixed by the ratio between the gold content of the two currencies which is called mint parity. In the case of the managed or dirty float exchange rate system, the exchange rates are flexible, so that no officially declared parities exist, but the monetary authorities intervene more or less intensely to manage the float (Gandolfo, 1973).

Williamson (1976) aptly coined the name "nonsystem" to denote the current situation where each country can choose the exchange rate regime that it prefers and notify its choice to the IMF. Some countries peg their exchange rate to a reference currency (usually the Dollar, the French Franc and other strong currencies). Others peg their currency to a composite currency such as the IMF's Special Drawing Rights (SDR).

Since independence, Kenya has undergone various foreign exchange rate regimes which include fixed exchange rate regime, managed float, and floating exchange rate regime. The study by Ndung'u (1993) indicated that in 1971, Kenya experienced a severe deterioration in trade, which led to the first balance of payment crisis. This was accompanied by an expansionary fiscal and monetary policy. Another major shock came from the oil price rise in 1973/74. He added that in this time the economy was so hard hit that signs of instability were quite evident. In the period from 1973 to 1975, inflation rose from 9.3% to 19.2%, domestic credit increased by over 60% and governments external and internal borrowing increased. Ndung'u (1993) observed that this led to a devaluation of the Kenyan shilling in 1975. Were et al, 2001 affirmed that the trade and current account deficits that had remained relatively low in the 1960s and 1970s reached unprecedented levels during 1978 to 1981. They noted that, by 1982, it was clear that the macroeconomic policies pursued had glaring loopholes and was unsustainable, forcing the government to change course. Consequently, the government started to liberalize the economy, following typical structural adjustment policies. As an intermediate step, the exchange rate policy was changed to a crawling one.

In 1990s, liberalization was intensified in both financials and goods market and the exchange rate regime operated under a dual system in 1992 since there was an "official" exchange rate and a "market" rate. The latter operated on the basis of the Foreign Exchange Bearer Certificates, which would be purchased at the official exchange rate from the Central Bank in foreign exchange, without having to declare the source of the foreign exchange, and then marketed as any paper asset (Ndung'u and Ngugi, 1999). When the certificates were suspended in January 1993, exporters were allowed to retain specified proportions of their foreign exchange earnings, while importers were required to purchase their foreign exchange from commercial banks (Ndung'u, 2000).

According to Were et al. 2001, by March 1993, speculations in the foreign exchange market were prevalent. The market was characterised by uncertainty, especially in regard to future exchange rate transactions such as importation on trade credit. In an attempt to avert the

ensuing crisis, the official exchange rate was devalued three times in the first half of the year. Ndung'u (2000) noted that in April 1993, both import and foreign exchange licensing were eliminated and 100% retention accounts introduced. However, the supply and demand for foreign exchange in the trade account did not immediately respond to market forces as would have been expected. Initially, the exchange rate depreciated faster than the gradual devaluation on the official rate, partly because of the backlog of demand and expectations of backtracking on the policy (Ndung'u, 2000). By November 1993, the government had abolished the official exchange rate and allowed the public to hold foreign exchange. In response to the widening interest differential, exchange rate expectations and the general stability, holders of foreign exchange abroad took advantage of the liberalized regime by bringing funds back. Although devaluation of the shilling partly led to exceptionally high export earnings, imports remained depressed and real investments declined.

In summary, Kabubi (1995) noted that the exchange rate regime in Kenya has had several phases over the years; a fixed exchange rate regime, 1970-1982; a crawling peg regime, 1982-1990; a dual exchange rate system with a market (interbank) determined rates and an official crawling peg regime, 1990 - October 1993; and a floating exchange rate regime from October 1993. The exchange rate regime determines the ability of the economy to effectively respond and adjust to exogenous shocks. Besides, the exchange rate movements influence exports and imports of goods and services, which are key macroeconomic variables (Were et al 2001). The various exchange rate regimes adopted in the Kenyan economy and consequently the varied real exchange rates over the period have had an impact on the import tax revenues collected over the same period in Kenya which this study focuses on.

According to Oloo (2002), when Kenya adopted a floating exchange rate system in 1993 as the foreign exchange market was liberalized, it meant that there was no predetermined price at which the shilling exchanges with other currencies. Therefore, when the demand for the shilling increases, the price in terms of other currencies, tend to rise and the shilling becomes stronger. Oloo (2002) also noted that floating exchange rates have not been of great success in terms of avoiding misalignment, and that unless managed, they can be very volatile. It is of interest to find out whether the volatility of exchange rate which are associated with floating exchange rate regime are attributable to major budgetary deficits, fluctuations in tax revenue , inflation, capital flight and low output. For instance, Tanzi (1989) presents several wide-ranging hypotheses of the relationship between various macroeconomic variables, including

inflation and exchange rates, and tax revenue. This kind of relationship especially between the real exchange rates and import tax revenue is what this study focuses on.

2.1.2 Theoretical Review of the Effects of Real Exchange Rates and Other Related Variables on the Import Tax Revenue

According to Khan (1986), exchange rate is the centrepiece of an adjustment effort because it is an efficient expenditure –switching and expenditure –reducing policy instruments. It is a direct and powerful method of manipulating domestic expenditure and relative prices hence a very important tool in the allocation of scarce resources in the economy. Viewed in a broader sense, the exchange rate is the nationwide price signal and measures the outcome of economic management (Ndung'u, 1995).

Macroeconomic changes have an influence on tax revenue. Tanzi (1989) carried out a study on the impact of macroeconomic policies on the level of taxation and the fiscal balance in developing countries. He presents several wide-ranging hypotheses of the relationship between various macroeconomic variables, including inflation and exchange rates, and tax revenue. He observes that there is often an inverse relationship between a country's tax revenue and the real level of its official exchange rate. The appreciation of the real exchange rate leads to a decrease in the tax to GDP ratio, ceteris paribus. He argues that overvaluation has a direct effect by suppressing import and export bases measured in domestic currency terms. This reduces collections of international trade taxes, sales and excise taxes, which are usually levied on domestic goods and imports consumption. Overvaluation also has indirect effects by reducing the incentive to produce goods for export, encouraging capital flight and currency substitution, weakening the balance of payments, encouraging black markets, and encouraging trade restrictions. The study also pointed out that in LDCs where specific taxes play a significant role and where collection lags are generally sizeable, inflation causes a negative impact on the real tax revenue.

According to Tanzi (1989) a fair proportion of excise duties are collected from imported goods such as cars, tobacco, beverages and alcohol. Real devaluation raises the domestic value of these goods. An overvalued exchange rate, if it is accompanied with Balance of Payment problems, induces the government to impose stringent restrictions on the imported manufactured goods which are regarded as non essential in favour of importation of raw materials and capital input which are considered essential. This implies that the structure of

import will change in favour of goods with low or zero import duties and sales taxes and against those with high import duties and sales taxes. The change in the structure is costly in many countries in terms of losses in tax revenue (Tanzi, 1989). He concludes that even in heavily indebted countries, where it is generally assumed that devaluation weakens the fiscal balance through its effect on debt service, higher revenues may offset increases in debt service so that the overall effect of devaluation is largely an empirical question.

Tanzi (1977) noted that the exchange rate also affects tax revenue through inflation. The exchange rate causes inflation and this is known as the pass-through effect. The pass-through effect is based on the assumption that induced increases in the prices of imported inputs and final goods following a real devaluation will be passed on to domestic prices. This proposition has its roots in the cost-push theory of inflation. Tanzi was of the view that for countries with insignificant local import competing industries, a real devaluation raises local prices of the imported materials and commodities. In face of rising import prices, the exporting and import competing firms may raise the prices. Tax receipt do not keep pace with inflation because progressive income taxes produces only a small share of tax revenue and many are levied at the specific rate with lags in collection.

Krugman and Taylor (1978) pointed out that many developing countries derive substantial proportion of their revenue from imports and export taxes. Thus a nominal devaluation that succeeds in depreciating the real exchange rate will increase the real tax burden on the private sector by increasing the real value of the trade taxes for a given level of imports and exports. However, the results depend on the presence of an ad valorem than specific taxes on foreign trade. To the extent that nominal devaluation results in increase in the domestic price levels, the presence of specific taxes would reverse the effects emphasized by Krugman and Taylor, since the real value of non indexed specific taxes would fall as a result of an increase in the general price level brought about by nominal devaluation.

Emmerij (1990) in a study conducted in Mexico and Korea on the implication of the real exchange rate found that devaluation slightly reduced real tax receipt in both countries during 1980's. This was attributed to the shifting away from the tax base in Korea and short run contractionary output response in Mexico. Emmerij (1990) defined the real exchange rate as the exchange rate of the US Dollars per domestic currency weighted for changes in domestic versus the US consumer price index. This imposes purchasing power parity assumption. Like

Tanzi (1989), the study found an inverse relationship between the tax revenue and the real devaluation in Columbia. The inverse relationship was attributed to the negative correlation between the RER and quantitative imports restrictions or due to a highly elastic demand.

Easterly (1991) conducted a study on the public sector deficit in developing countries. He concluded that public revenue is boosted by real depreciation from higher surpluses of traded goods producing firms and from direct and indirect taxation of production or sale of traded goods. Real exchange rate depreciation raises public expenditure by increasing foreign indirect payments and the cost of traded goods, capital and intermediate goods acquired by the public sector. Hence, the net effect of the real exchange rate on the deficit, in real terms as a share of GDP, depends on the relative weights on the traded and non-traded items in public expenditure and revenue.

Morande and Habbel (1991) estimated behavioural equation for tax revenue functions for Zimbabwe. The equations were estimated using Ordinary Least Squares estimation technique. Real depreciation of exchange rate, GDP and the ratio of inflation were found to be positively related to the direct tax revenue including the import tax revenue. Dummy variables representing the 1978 to 1980 pre-independence conflict contributed to erosion in tax revenue while other dummies were not significant. The real exchange rate depreciation, the GDP and inflation rate had some positive effect on the indirect tax revenue as well. For the custom duties, the relevant tax base which was import volume had a marginal tariff rate about 10 percent for 1970/71 – 1981/82 periods. Changes in the tax regime reflected by the dummies raised revenue through custom duties gradually above 10 percent level.

Nashashibi and Bazzoni (1994) did a study on the exchange rate strategies and fiscal performance in sub-Saharan Africa. The study investigated the relationship between the fiscal performance and movements in the exchange rates, the terms of trade, and other macroeconomic aggregates in 28 sub-Saharan Africa countries over the 1980-1991 periods. They found fiscal performance between the variable exchange rate and fixed exchange rate countries. The overall budget deficit for the fixed exchange rate countries worsened during the study period while it improved in the variable exchange rate countries. This revelation raised questions such as; to what extent have changes in the RER affected tax revenue and government expenditure in the variable exchange rate and fixed exchange rate countries? What are the major factors contributing to the deterioration in revenue performance in the fixed exchange rate countries and to the relative success of the variable exchange rate

countries? In an attempt to address these questions, Nashashibi and Bazzoni established the tax base profile of a typical sub-Saharan country. An analysis of major component of the tax base in selected African countries – Cameroon, Cote de Vouré, Kenya, Mali and Tanzania revealed that the imports and the formal segment of the traded goods sector constitutes most of the share of the tax base. They are either directly taxed through customs or indirectly through sales and excise taxes. They established that imports, exports and import substitution in the formal sector constitute a bulk of the tax base in sub-Saharan countries. They also analysed the factors that affect these activities like the terms of trade, the exchange rate, inflation and efficiency factors associated with trade regime, and tax structure and administration. The analysis revealed that the terms of trade (TOT) deterioration in different countries affected the tax base differently. The study concluded that deterioration in TOT could have positive effect on the tax base depending on the relative impacts of the decline in export prices and increase in import prices.

In 2001, Adam et al examined the effect of exchange rate regimes on tax revenue performance using a panel of twenty two Sub-Saharan Africa countries over 1980-1996. In their study, they distinguish two variables for the exchange rate; one reflects the equilibrium exchange rate and the other reflecting the degree of misalignment of the exchange rate. The study also analyzed the effects of trade openness as a proxy of trade liberalization and other macroeconomic variables on tax revenue and tax major components. Based on their estimations, they concluded that the poor cumulative relative revenue performance of the Franc zone countries was mainly attributable to differences in environmental and structural factors, and to their different responses to changes in the equilibrium real exchange rate, but that misalignment of the exchange rate also played a role.

Kabubi (1995) carried out a study on the effects of real exchange rates on the tax revenue in Kenya for the period 1964 to 1992. He noted that the negative relationship between the real exchange rate appreciation and the tax revenue is related to the direct effects of the real exchange rate appreciation on the import duty, export taxes, sales, excise and income taxes. Most developing countries like Kenya rely heavily on the import and export taxes. These taxes provide the most direct link between the real exchange and the real tax revenue. Import duties in most cases are levied on an ad-valorem basis and their tax base, import volume, is determined by the domestic value of imported products measured at the official exchange rate. However, if the country in question has plenty of foreign reserves or has unlimited

access to foreign loans or both, a fall in domestic prices of the imported goods accompanying the appreciation of the real exchange rate might lead to high import volume .This could offset the negative effects of the overvaluation if the price elasticity of import is greater than unity.

Using a panel of eighty developing and developed countries, covering 1976-1998, Khattry and Row (2002) examined the argument that trade liberalization depress the tax revenue share of GDP. Applying a fixed-effects regression framework, they found out that trade liberalization is negatively related to total tax revenue and international trade tax revenue. They also found out that low-income and upper middle-income countries have experienced declining tax revenue as a result of declining income and trade tax revenues and the structural characteristics have been significant in explaining the decline.

In 1999, Eberill et al established their study based on a panel of twenty seven developing countries from Africa, Asia, and the Western Hemisphere, covering the period 1980-1992 and a panel of 105 countries, over the period 1980-1995, measuring the impact of trade liberalization on foreign trade tax revenue. Based on their estimation results, they concluded that tariff reforms have not resulted in lowering the trade tax revenue. They also found out that depreciation of the exchange rate is significantly related to high foreign trade tax revenues.

A study by Agbeyegbe et al (2006) examined the relationship between trade liberalization, exchange rate, and tax revenue applying a pooling of twenty two Sub-Saharan Africa countries over the period 1980-1996. In this study, two proxies were used to measure the trade liberalization. In their study, they also examined the influences of other socio-economic variables on the tax revenue and its major components. Employing generalized method of moment regression, they found out that the relationship between trade liberalization and tax revenue is sensitive to the proxy used to measure trade liberalization. They also noted that exchange rate appreciation and higher inflation show some linkage to lower tax revenue and major tax components. Based on their empirical findings, they concluded that trade liberalization associated with appropriate macroeconomic policies could be carried out in a way that preserves tax revenue yield.

In their study of increasing tax revenue in sub-Saharan Africa, Cheeseman and Griffiths (2005) used Kenya as a case study to study the impact of liberalisation on the international trade tax. They noted that one might not expect a reduction in tariffs in a country like Kenya

to increase tax revenue, as it implies a fall in revenue from international trade that has historically been the largest source of tax revenue for poorer countries. They also noted that in Kenya, tax revenue rose from Kshs 59,840 million in 1993 to Kshs 181,924 million in 2001. In part, this was due to increases in tax revenues from VAT, but a large part came from an increase in revenue from international trade. According to them, from Kshs 7,143 million in 1993, the tax revenue collected from trade and international transactions rose to Kshs 37,444.3 million in 2001. Cheeseman and Griffiths (2005) explained that the increase in tax revenue from trade resulted from two factors. The first is that demand for imports proved to be highly elastic. As a result, the reduction in tariff barriers led to a sharp rise in the quantity of imports. This meant that although the Kenyan government was receiving less tax revenue per item imported, the quantity of imports increased so sharply that total revenue increased. This may have been reinforced by increased returns from VAT as a result of the increased number of imports being sold within Kenya. The phenomenon of trade liberalisation resulting in an increase in revenue through increased imports is not unique to Kenya. As Glenday notes 'within many customs systems there is major potential for increasing revenues that, under certain circumstances, can even lead to increases in revenue yields as import duty rates are lowered on average' (Glenday, 2000).

According to Cheeseman and Griffiths (2005), it is true that so far the reduction in tariffs has been successful, as increased imports have compensated for the reduction in tariffs and resulted in a rise in tax revenue from trade. However, the positive impact of liberalisation in 1993 was in large part a consequence of the fact that tariffs had previously been extremely high. As a result the reduction of tariff rates led to a massive increase in the quantity of imports. At the same time a weaker currency, falling costs of inputs and a reduction in export tariffs made Kenyan products more competitive and increased the quantity of exports enough to compensate for the lowering of export tariffs. These processes, combined with the increased investment in the country as a result of the optimism that greeted the transition to multi-party politics, created a situation within which trade liberalisation could be realised at the same time as increases in tax revenue. Now that the tariff rate has been dramatically reduced, future reductions in tariff rates are unlikely to have the same effect (Cheeseman and Griffiths, 2005). They added that trade liberalisation may have important benefits in terms of improving efficiency, restructuring the economy and promoting growth but liberalisation should not be pursued at any cost. Further liberalisation would reduce the revenue available to the Kenyan government and would consequently undermine the ability of any government to

maintain development programmes. In view of this, the study argued that international actors should encourage the Kenyan government to operate selected tariffs to generate sufficient tax revenue to invest in expanding the tax base in the long-term, and divert funds from expensive projects such as computerisation of the tax system to projects aimed at increasing the ability of Kenyan citizens to pay tax.

2.2 Empirical Literature Review

Various empirical studies have been used to examine the determinants of tax revenue and import tax revenue in particular. For instance, Emmerij (1990) conducted an empirical study on the implication of the real exchange rate on the real tax receipts. Sims test of causality was applied to establish the causal relationship between the tax revenue and the real exchange rate. The hypothesis of unidirectional causality running from taxes to the real exchange rate was rejected. The causal inferences from the Sims test allowed him to use the real exchange rate as an exogenous variable in the model. The study utilised simultaneous equations model to determine the short run price and output response of the tax revenues following an exogenous change in real exchange rate. The model was estimated using quarterly data for Korea and Mexico covering first quarter of 1980 to the first quarter of 1988 for Korea and the second quarter for Mexico. The model was estimated using the two stage least square technique in double logarithm version. He found that real devaluation develop the strongest impact on the tax receipt with a lag of four quarters. For Mexico, he found out that the real devaluation develops the strongest impact on the tax receipts with a lag of five quarters. For Korea and Mexico, he found out that the overall impact of the real exchange rate on the real tax revenue to be slightly negative. The elasticity was 0.05 for Korea and 0.14 for Mexico.

In a study of the existing tax system of developing countries, Tanzi (1987) used data on total tax revenue for eighty six nations, Kenya included. The study discussed the relationship between total tax revenue and Gross Domestic Product, the empirical importance of various tax sources at different levels of per capita income, and the factors that may lead a country to prefer one type of tax rather than another. The eighty-six country sample was quite comprehensive; it included most developing countries with per capita incomes ranging from about $100 to about $ 6,000 (in 1981 prices). According to the study results, import duties were found to be far the single most important revenue source; they contributed 4.2% of GDP and 25% of the total tax revenue. Import duties generated more than one fourth of total tax revenue in almost half of the eighty-six countries. As a percentage of GDP, import duties are

most important in the group of twenty-two countries with per capita incomes below $350. They are least important for the countries with incomes of $ 1,700 or more. By region, they are most important in the Middle East and in Africa, where they generate about twice as much revenue as in other regions. The study found out that import duties are positively influenced by the openness of the economy and negatively influenced by the level of per capita income and by the country's reliance on domestic taxes on goods and services. The importance of imports as a tax base is inversely related to the level of income; the effective tax rate on imports averages about 21 percent for the low-income countries and about 8.5 percent for the high-income countries. The behaviour of the effective tax rate on import values can result either from a systematic reduction of the statutory levels of import duties as per capita income rises, or from progressively more generous exemptions and exonerations from customs duties without any necessary change in the statutory rates (Tanzi, 1987).

Ayoki et al (2008) carried out a study in Uganda focusing on the link between tax reforms and revenue mobilisation between 1997 and 2004. They computed the elasticity and buoyancy indexes for the pre- and post - reform period as well as the combined period based on the primary data mainly from Uganda Revenue Authority (URA); Uganda Bureau of Statistics; Ministry of Finance, Planning and Economic Development; and Bank of Uganda. The OLS results revealed a positive relationship between exchange rate depreciation and volumes of imports. A coefficient of 3.393 (1% level of significance, R^2= 0.889) was obtained. The study found out that the importers seemed to respond to exchange rate depreciation by purchasing more foreign exchange (because of uncertainty about the stability of the shilling). This would lead to volumes of the imports going up. Then the importers try to maximize the gains from the increased value of imports (measured in domestic prices) arising from exchange rate depreciation. The study also found out that the coefficients on the exchange rate are positive and significant for import (1.331) and overall tax/GDP (0.447) equation. They indicated that the import revenue was therefore found to be highly sensitive to changes in the exchange rate. Depreciation of the Uganda shilling by one percent against the US dollar would increase import revenue by a one percent point of GDP, income tax by 0.13% and overall tax revenue by 0.4% point of GDP. Exchange rate depreciation was found to cause an upward shift in the relative prices of goods and services leading to increased import receipt and revenue in local currency. In other words, the real value of imports measured in domestic prices increased as exchange rate depreciates. However, higher duty rates could lead to a lower import volume (hence offsetting the positive revenue impact of depreciation) if price elasticity of imports is

greater than one. The estimation of aggregate price elasticity of imports was 0.176. Depreciation had a positive impact on the import prices shown by coefficient of 0.209. These findings suggested that changes in the exchange rate over the years under study did not have negative impact on imports (Ayoki et al, 2008).

Kabubi (1995) carried out a study on the effects of real exchange rates on the tax revenue in Kenya for the period 1964 to 1992. He used a model consisting of three separate behavioural equations for the tax revenue and the separate tax functions were modified to suit the Kenyan situation. The Gross Domestic Product was used as a proxy for the tax base, with inflation rate and the real exchange rate as the determinants. In this study, real exchange rate was found to have an expansionary effect on real direct tax revenue and customs duties, and was found to be significant at 5% for the former and 10% for the latter. On the other hand, the real exchange rate impact on the other indirect tax revenue was found to be negative. From the study, conclusions were drawn that indicated that any policy that increases the real exchange rate (depreciation) may worsen or improve the fiscal position. He noted that the net effect of the real exchange rate will depend on whether the positive effect that the real exchange rate have on the direct tax and the custom duties outweighs the negative effect on the other indirect tax revenue, or vice versa. If the expansionary effect is larger than the contractionary effect, then, real exchange rate depreciation would improve the fiscal position and the opposite of this will ensue if the latter is larger than the former. The study concluded that it is imperative for the fiscal policy makers to consider the fiscal impact of the real exchange rate while making important fiscal decisions.

In an assessment of the tax revenue performance before and after liberalization of exchange rate in Kenya from 1972 to 2000, Oloo (2002) found out that real exchange rate had a positive effect on custom duties and it was found to be significant at 5% level. This may result from the fact that an increase in the real exchange rate would increase exports thereby improving access to foreign exchange necessary to import. The ability to export increases the ability to import, all other factors held constant, and hence depreciation also raises the import tax revenue by increasing the domestic value of imports. Oloo (2002) noted that all other variables were found to be significant at 5% level of significance except the constant and import price indices, which were found to be insignificant. The import price indices were found not to be significant as a result of the increase on counterfeit goods coming from the Eastern countries and smuggling practices to evade taxation. Inflation rate was significant at 5% level of significance with a negative effect on the import tax. He added that the dummy

variable, D1 that was meant to capture the elections of 1992, was insignificant. The dummy, D2, meant to capture the effect of introduction of the liberalised exchange rate regime was significant at 5% with a positive sign.

2.3 Overview of literature

A review of the literature reveals the significance of the trade taxes, and the import taxes in particular, in raising tax revenues in developing countries such as Kenya. These taxes provide the most direct link between the real exchange rate and the real tax revenue. The studies by Krugman & Taylor (1978), Nashashibi & Bazzoni (1994) and Tanzi (1987) pointed out that many developing countries derive substantial proportion of their revenue from imports and export taxes. The developing countries tend to rely more on the import taxes mainly with a dual purpose of raising revenue and protecting the domestic infant industries. These studies among others confirm the emphases put on the import taxes in raising revenue in the developing countries.

The literature review shows that different studies have come up with differing results on the relationship between RER and real tax revenue. The findings of the studies conducted by Morande & Habbel (1991), Ayoki et al (2008), Kabubi (1995) , Oloo (2002) concurred on the fact that increase in real exchange rate (depreciation) have a positive expansionary effect on the real tax revenue particularly on the customs duties and other direct tax revenue. To the contrary, studies by Emmerij (1990), Easterly (1991), Eberill (1999) and Tanzi (1989) indicated that increase in real exchange rate (depreciation) have a negative effect or inverse relationship with real tax revenue. The reasons for the conflicting findings were the circumstances prevailing in the countries under study such as the presence of ad valorem than specific taxes on foreign trade (Krugman & Taylor, 1978), short run contractionary output in the case of Mexico and the shifting away from the tax base in Korea among others. It is also worth noting that the net effect of the real exchange rate will depend on whether the positive effect that the real exchange rate have on the direct tax and the custom duties outweighs the negative effect on the other indirect tax revenue, or vice versa. The other studies reviewed in this section also reveal that inflation rates and trade liberalisation, which led to various countries liberalising their exchange rate regimes, have a significant impact on the import tax revenue.

Most of the studies reviewed were mostly multi-country studies. This study, however, will be a single country study. The choice of doing a single country study will enable the examination of the influence of RER depreciation on the import tax revenue and also more observations.

The time period (1970-2009) considered by this study is longer than that covered by the studies reviewed and also covers about two decades before the liberalisation of foreign exchange rate regime and almost two decades after the liberalisation of the foreign exchange rate regime in Kenya. This will provide an appropriate long term analysis of the effects of real exchange rates on import tax revenue in Kenya. In view of the fact that many macroeconomic time series data are variant with respect to time, this study will depart from most of the previous studies by employing the current statistical estimation techniques by performing tests for stationarity, cointegration, autocorrelation, normality among others.

CHAPTER THREE

3.0 METHODOLOGY

This chapter explains the conceptual framework, the specification of the model, the estimation procedure and the techniques that have been used in data collection and analysis. It also provides information on data sources and data types that have been used in this study.

3.1 Conceptual Framework

The conceptual framework gives the relationship between the independent variables and the dependent variables. In this study, the dependent variable is the custom duties while the independent variables identified from the literature review include import price indices, inflation rates, real exchange rates, lagged custom duties and the liberalisation of foreign exchange rates market. This study has made use of the descriptive analysis and econometric analysis of the times series data collected on the variables under study. The descriptive analysis involves the use of graphs to determine the nature of the real exchange rates depreciations in Kenya during the period under study. The model used in this study borrows from the work of Emmerij (1990) and Kabubi (1995). In the empirical study on the implication of the real exchange rate on the real tax receipts, Emmerij (1990) applied the Sims test of causality to establish the causal relationship between the tax revenue and the real exchange rate. The results allowed him to use the real exchange rate as an exogenous variable in the model. The study utilised simultaneous equations model to determine the short run price and output response of the tax revenues following an exogenous change in real exchange rate. The study used the following model to study the import taxes response to exogenous change in real exchange rates:

$t_{4,t} = f(M_t, e_{t-n}, P_{t-n}, t_{4,t-n}, AD_4, MD_4)$.....(i)

$M_t = f(Y_t, M_{t-n})$.....(ii)

Where $t_{4,t}$ = import taxes

M_t = imports

e_{t-n} = lagged real exchange rate

P_{t-n} = lagged inflation rate

$t_{4,t-n}$ = lagged import taxes

M_{t-n} = lagged imports

Y_t = GDP (proxy for the personal and corporate income)

AD = Additive Dummy to account for the impact of tax legislation on the tax yield and

AD = 1 for the sub period after tax reform

= 0 for the sub period before the tax reform

MD =Multiplicative Dummy to account for the impact of tax legislation on the tax base and

MD = 1 for the sub period after tax reforms

= 0 for the sub period before tax reforms

In this study, the equation for import taxes was specified as a function of the imports (M_t), lagged real exchange rate (e_{t-n}), lagged inflation rate (P_{t-n}), lagged import taxes (t_{t-n}), additive dummy to account for the impact of tax legislation on the tax yield (AD) and a multiplicative dummy to account for the impact of tax legislation on the tax base (MD). The model was estimated using quarterly data for Korea and Mexico covering first quarter of 1980 to the first quarter of 1988 for Korea and the second quarter for Mexico. The model was estimated using the two stage least square technique in double logarithm version. He found that real devaluation develop the strongest impact on the import tax receipt with a lag of four quarters.

Additionally, in studying the effects of real exchange rates on the tax revenue in Kenya, Kabubi (1995) used a model consisting of three separate behavioural equations for the tax revenue. The first equation in the model was a behavioural equation for the direct tax revenue. The Gross Domestic Product (GDP) was used as a proxy for the tax base, inflation rate and the real exchange rate as the determinants. The second behavioural equation, which is of our interest in this study, was for the custom duties (import taxes). The custom duties were regressed on the import duties (proxy for import tax base), the real exchange rate and the inflation rate. The equation was specified as follows:

$$CD_t = \beta_0 + \beta_1 M_t + \beta_2 \Pi_t + \beta_3 RER_t + \beta_4 CD_{t-1} + \varepsilon_t \quad \text{..... (iii)}$$

Where CD = custom duties in time t

M_t = import price index in time t

Π_t = inflation rate in time t

RER_t = real exchange rate in time t

CD_{t-1} = Lagged custom duties

ε_t = disturbance term which is assumed to be a white noise

β_0 = autonomous custom duties

$\beta_1, \beta_2, \beta_3, \beta_4$ = coefficients

According to the model used by Kabubi (1995), the most important factors affecting the import tax revenue are the import price indices, the real exchange rates, inflation rate and the lagged custom duties. These are the main variables that have been incorporated in the model for the present study.

3.2 Model Specification

This section provides the model specification for the import tax revenue and real exchange rate together with other variables identified in the literature to have effects on the import tax revenue. The custom duties have been used as a proxy for import tax revenues.

The study adopted a single equation model for the custom duties which is given as:

$$CD_t = \beta_0 + \beta_1 IPI_t + \beta_2 INF_t + \beta_3 RER_t + \beta_4 LCD_{t-1} + \beta_5 D_1 + \varepsilon_t \quad \text{..... (iv)}$$

To normalize the data for ease of interpretation of the coefficients, the model was modified by taking its logarithm. The modified single equation model is:

$$\text{Ln } RCD_t = \beta_0 + \beta_1 \text{ LnIPI}_t + \beta_2 \text{ LnINF}_t + \beta_3 \text{ LnRER}_t + \beta_4 \text{ LnRLCD}_{t-1} + \beta_5 D_1 + \varepsilon_t \text{ .... (v)}$$

Where RCD = Real Custom Duties in time t

IPI_t = Import price index in time t

INF_t = Inflation rate in time t

RER_t = Real exchange rate in time t

$RLCD_{t-1}$ = Lagged real custom duties

D_1 = Dummy variable for liberalization of exchange regime (1= post 1993 period).

ε = error term which is assumed to be a white noise

β_0 = autonomous custom duties

$\beta_1, \beta_2, \beta_3, \beta_4$ = coefficients

The model was logged to make it less sensitive to extreme observations when applying OLS estimation. This ensures normality of the residuals and the interpretation of the estimated parameters as elasticities. This transformation is justified since it makes the error term to be homoskedastic and normally distributed. It also ensures that the OLS yields best linear unbiased estimators. It is also worth noting that using real variables helps to eliminate collinearity between the explanatory variables. The real custom duties were obtained by dividing the nominal values by the consumer price index for the respective years and then lagged to obtain the real lagged custom duties

3.3 Definition and Measurement of Variables

The variables under study were the custom duties used a proxy for import tax, import price indices, inflation rates, real exchange rates, the lagged values of the custom duties and the dummy variable to capture the introduction of liberalised exchange rates regime. Custom duties (CD) are all levies collected on goods that enter the country or services delivered by non-residents to residents. They include levies imposed for revenue or protection purposes and determined on a specific or ad valorem basis as long as they are restricted to imported goods or services. Import price indices (IPI), on the other hand, measures the changes in the prices of imports of merchandise into a country. The index numbers for each period relate to prices of imports coming into the country during the period.

Inflation refers to a sustained rise in the general level of prices of goods and services in a given economy over a period of time, say one fiscal year. Inflation can also be viewed as a decline in the real value of money, that is, a loss of purchasing power in the internal medium of exchange and unit of account in the economy. Consequently, the rate of inflation (INF) refers to the rate of the general sustained rise in price level which reduces the purchasing power of a country's currency. In Kenya, price levels are measured by the Consumer Price Indices. The Consumer Price Index (CPI) is a key macroeconomic indicator used to monitor price movements and how they affect policy decisions. It is defined as a measure of the

weighted aggregate change in retail prices paid by consumers for a given basket of goods and services. It is based upon a weighted basket of goods and services purchased by consumers, as determined by the expenditure survey. The prices are updated through monthly price surveys covering goods and services in the basket. The baskets used in the construction of CPI are normally updated after every ten years, because households' incomes and expenditures change over time (Republic of Kenya, 2008). The Government of Kenya uses the Laspeyres formula to compute the CPI. The Laspeyres formula is presented as follows:

$$I_t = \sum W_i \times \frac{Pti}{Poi} \quad \text{..... (vi)}$$

Where I_t is the index at time t,

Pti is the price of the commodity i at time t,

Poi is the price of the commodity i at the base period.

W_i is its weights

The overall CPI uses prices of all consumer goods and services within a defined basket. The average annual inflation is usually computed as percentage change of a twelve months average of the CPI. The year on year inflation rate, is calculated as percentage change of the CPI between the current month and the same month a year ago (Republic of Kenya, 2008). Inflation rate has been used to capture the tax revenue response to changes in general price levels.

Real exchange rate (RER) can be defined as the nominal exchange rate that takes the inflation differentials among the countries into account. Bautista (1987) broadly defines the RER as the real worth of foreign exchange in terms of a given domestic currency. Its importance stems from the fact that it can be used as an indicator of competitiveness in the foreign trade of a country. This study follows the convention of using the Wholesale Price Index (WPI) of a large economy as a proxy for the foreign price level. The assumption here is that the WPI has a significantly higher proportional content of tradables against non-tradables. Thus is a good proxy for the foreign prices. The WPI of choice is that of USA. The study assumes no effect of purchasing power parity since the USA Wholesale Price Index used refers to a mix of agricultural and industrial goods at various stages of production and distribution, including import duties. The USA Wholesale Price Index is used as opposed to the USA Consumer Price Index which has been used in some studies. The Laspeyres formula is generally used to compute the Wholesale Price Indices in USA. The choice of USA Wholesale Price Indices as

a proxy for the foreign prices can be justified by the size of the US economy and the bilateral exchange rate arrangements made with the US dollar by most small economies including Kenya. The domestic price level has been proxied by the Consumer Price Index (CPI). The assumption being that the CPI is weighted heavily by non-tradable goods and services thus a good proxy for the domestic price levels. In view of these, the formulae for the calculation of the RER, adopted in this study, is given as:

$$\text{RER} = En \times \frac{WPI(US)}{CPI(KENYA)} \quad \text{..... (vii)}$$

Where En is the nominal exchange rate

$WPI(US)$ is the wholesale price index for USA

$CPI(KENYA)$ is the consumer price index for Kenya

The dummy variable (D_1) has been used in the model to capture the effect of trade liberalisation from 1993 which led to the liberalisation of the foreign exchange rate market. Trade liberalization often entails a reduction and unification of tariffs and relaxation of quantitative barriers, and may be accompanied or supported by currency devaluation and domestic tax reform. In general, trade liberalisation refers to government policy changes that will reduce the distortion of trade flows caused by government intervention. In the model for this study, we introduce the error term (ε) because we believe that Real Custom Duties (RCD) is not an exact linear combination of the independent variables (IPI, INF, RER, $RLCD_{t-1}$, D_1). This is because the observed variables in the real world are very sensitive to a large number of other factors and would therefore likely need a very large number of independent variables to complete all of the factors that influence the custom duties (import tax revenue).

3.4 Estimation Procedure

The model specified in equation (v) in this chapter was estimated by the Ordinary Least Squares (OLS) method. This study made use of annual time series data for the period 1970-2009. The study took into account the recent development in time series econometrics to avert the problems of spurious results and inconsistent estimates upon regression by performing tests for stationarity, cointegration, autocorrelation, and normality among others tests whose results are discussed in chapter four.

Before estimating the model, each series was tested for unit roots using the Augmented Dickey-Fuller test. The aim was to determine whether the variables follow a non-stationary trend and are in fact of the order of 1 denoted as $I(1)$ or whether the series are stationary, that

is. of the order of 0 denoted as $I(0)$. If the series are non-stationary the use of classical methods of estimation such as OLS could lead us to mistakenly accept spurious relationships, and thus their results would be meaningless. In cases where the series are non-stationary around their mean, then the way forward is to differentiate the series (Dickey and Fuller, 1979). On the evidence of non stationarity in each variable and the same order of integration of all the variables, the study pursued the cointegration methodology and the subsequent estimation of the associated error correction model (Engle and Granger, 1987). In this study the results for the unit root test indicated that all the variables except Ln INF were non-stationary. The variables were therefore differenced and subjected to the same tests. The results of the Augmented Dickey – Fuller Test for Unit Root after differencing showed that the series were stationary after the first differencing implying that the variables are integrated of order one, that is, I(1). The test for cointegration showed that the residual from the regression using the ADF test was stationary. Therefore, this implied that there was a cointegrating relationship among the variables. The presences of a cointegrating relationship (long-run equilibrium) among the variables indicated that the Error Correction Model (ECM) provided a better fit than the one without the error correction term. This necessitated the formulation of the dynamic specification for the real custom duties function incorporating the error correction term. In the error correction model, the one period lagged residual for annual data acted as the error correction term (ECT). The dynamic specification was then estimated using the ordinary least squares.

3.5 Data sources and Type

The study made use of annual time series data for the period 1970 to 2009 which were collected from various sources. These sources include the Kenya Revenue Authority publications, Central Bank of Kenya Quarterly and Annual reports, Economic Surveys and Statistical Abstracts published by the Kenya National Bureau of Statistics (KNBS). These were complemented by data from World Bank and International Monetary Fund (IMF) international statistics.

CHAPTER FOUR

4.0 DATA ANALYSIS AND RESULTS

This chapter presents the study findings and the analyses of the regression results. The econometric tests carried out before the regression that include tests for normality, stationary tests, cointegration analysis and diagnostic tests are also discussed in this chapter. The statistical analysis is carried out using STATA 10 software.

4.1 Descriptive Statistics

The descriptive statistics capture the measures of distribution that include the mean, median, standard deviation, skewness and kurtosis. The mean and median locate the centre of the relative frequency distribution. Mean is the average value of the series, obtained by adding up the series and dividing by the number of observations. Median is the middle value (or average of the two middle values) of the series when the values are ordered from the smallest to the largest. The results in Table 3 indicate that the mean and median are very close implying that the data does not suffer from the outlier problem. The median is a robust measure of distribution that is less sensitive to outliers than the mean.

Table 3 also indicates the measures of dispersion that include maximum and minimum values (which determine the range), standard deviation, skewness and kurtosis. The standard deviation on the other hand measures the dispersion or spread in series. When divided by the mean it gives the coefficient of variation which measures relative variability or volatility with the highest coefficient being the most volatile.

Table 3: Variable Statistics

VARIABLE	LnRCD	LnIPI	LnINF	LnRER	LnRLCD	D1
Mean	5.980389	5.716630	2.323565	4.528430	5.986870	0.425000
Median	6.033337	5.518396	2.431840	4.599918	6.033337	0.000000
Maximum	6.493406	7.204149	3.828182	4.834232	6.493406	1.000000
Minimum	5.323567	4.465908	0.441043	3.892704	5.323567	0.000000
Std. Dev.	0.285303	0.882784	0.731670	0.206288	0.276350	0.500641
Skewness	-0.564164	0.265257	-0.748403	-1.469093	-0.552117	0.303433
Kurtosis	2.567225	1.590944	3.637531	5.013541	2.689435	1.092072
Jarque-Bera	2.434032	3.778142	4.411456	21.14547	2.192971	6.680795

The study used Jarque- Bera statistics test which uses the mean based coefficient of skewness and kurtosis to check the normality of the variables used. Skewness is the tilt (or lack of it) in a distribution. Skew should be within the +2 to -2 range when the data are normally distributed. Kurtosis on the other hand refers to the peakedness of a distribution and should be within +2 to -2 range when the data are normally distributed. Negative kurtosis indicates too many cases in the tails of the distribution. Positive Kurtosis indicates too few cases in the tails (Jarque, 1980). In this study, the essential Jarque – Bera test statistic has a Chi-square distribution. From Table 3, all the variables are normally distributed since all their skewness is within the range of +2 to -2 and their probabilities are less than the Jarque – Bera Chi-Square distribution.

4.2 Stationarity Test

It is important to test whether the time series data used is stationary or not. It is therefore necessary to correct the situation if non-stationary data is used in the study. This can be done by differencing to eliminate non-stationarity. Non-stationary series is integrated of order equal to or greater than one. Stationary series, on the other hand, is integrated of order zero, noted as I(0). If the series is integrated of order equal to or greater than one, then it should be differenced to obtain a series of I(0) which is a stationary series.

4.2.1 Unit Root Test

The unit root test indicates whether the variables are stationary or not. To test the level of integration of the variables, this study uses the Augmented Dickey Fuller (ADF) test. The aim is to determine whether the variables follow a non-stationary trend and are in fact of the order of 1 denoted as $I(1)$ or whether the series are stationary, that is, of the order of 0 denoted as $I(0)$. If the series are non-stationary the use of classical methods of estimation such as OLS could lead us to mistakenly accept spurious relationships, and thus their results would be meaningless.

In cases where the series are non-stationary around their mean, then the way forward is to difference the series. ADF procedure is based on the following equation (Dickey and Fuller, 1979):

$$\Delta y_t = \beta_1 + \beta_2 y_{t-1} + \sum_{i=1}^{\rho} d_i \Delta y_{t-i} + v_t \quad \text{..... (viii)}$$

Where y = is the variable of interest , that is, import price indices (IPI), inflation rate INF), real exchange rate (RER) and lagged real custom duties ($LRCD_{t-1}$), v_t is the white noise

residual of zero mean and constant variance. Δ is a first-difference operator, ρ is the number of optimal lags, t= time and $\{\beta_1, \beta_2, d_i\}$ is a set of parameters to be estimated.

The null and alternative hypotheses in unit root tests are given as:

H0: $\beta_2 = 0$ (y is non-stationary/a unit root process)

H_1: $\beta_2 \neq 0$ (y is stationary)

The unit root hypothesis of the Augmented Dickey-Fuller can be rejected if the t-test statistic from these tests is negatively less than the critical value tabulated. In other words, by the Augmented Dickey Fuller (ADF) test, a unit root exists in the series y (implies non-stationary) if the null hypothesis of β_2 equals zero is not rejected (Gujarati, 1995). In the Augmented Dickey Fuller (ADF) test applied in this study, the regression software (STATA 10) automatically produced the t-statistic. The t-statistic was then compared with t-critical. If t-statistic (calculated) is less than t- critical, then we reject the null hypothesis of non-stationarity and accept the alternative hypothesis that the series are stationary. Table 4 indicates the results for the unit root test before differencing.

Table 4: Augmented Dickey – Fuller Test for Unit Root (Lag Length = 1)

VARIABLE	TEST STATISTIC	1% CRITICAL VALUE	5% CRITICAL VALUE	10% CRITICAL VALUE	CONCLUSION
Ln RCD	-1.252	-3.662	-2.964	-2.614	Non-stationary
Ln IPI	-0.190	-3.662	-2.964	-2.614	Non-stationary
Ln INF	-4.013	-3.662	-2.964	-2.614	Stationary
Ln RER	0.801	-3.662	-2.964	-2.614	Non-stationary
Ln RLCD	-1.320	-3.662	-2.964	-2.614	Non-stationary
D_1	-0.822	-3.662	-2.964	-2.614	Non-stationary

The results in Table 4 indicate that all the variables except Ln INF are non-stationary since the ADF t-statistic is greater than the ADF t- critical values at 1%, 5% and 10% levels of significance. The variables are therefore differenced and subjected to the same tests.

Table 5: Augmented Dickey – Fuller Test for Unit Root after Differencing (Lag Length = 1)

VARIABLE	TEST STATISTIC	1% CRITICAL VALUE	5% CRITICAL VALUE	10% CRITICAL VALUE	CONCLUSION
dLnRCD	-5.541	-3.668	-2.966	-2.616	Stationary
dLnIPI	-5.316	-3.668	-2.966	-2.616	Stationary
dLnINF	-6.660	-3.668	-2.966	-2.616	Stationary
dLnRER	-3.861	-3.668	-2.966	-2.616	Stationary
dLnRLCD	-5.666	-3.668	-2.966	-2.616	Stationary
dD_1	-4.301	-3.668	-2.966	-2.616	Stationary

The results of the ADF test after differencing are presented in the Table 5 with the letter'd' before every variable used to indicate that the variables have been differenced. The results show that the ADF t-statistics for all the variables are less than the t-critical values. Therefore, we reject the null hypothesis of non-stationarity and conclude that the series are stationary after differencing. The first differencing of all the variables is stationary which implies that the variables are integrated of order one, that is, I(1). The series in Table 5 are therefore integrated of order zero, I(0) and are confirmed to be stationary.

4.3 Cointegration Analysis

Cointegration analysis tests the existence of a long run relationship between the dependent variables and its explanatory variables. If two or more variables are integrated of the same order and their differences has no clear tendency to increase or decrease then this will suggest that their differences are stationary. If non-stationary series have a long-run relationship, they

will be stationary. If the linear combination of the residual from the variables is integrated of order zero, then this will be a case of cointegration. This test is important because failure to find cointegration between variables will be a manifestation of the existence of spurious regression in which case the valid influence will not be realised (Green, 2003).

The null and alternative hypotheses in the cointegration test are given as:

H_0: No cointegration; Non- stationarity

H_1: Cointegration; Stationary

The above hypotheses are tested by generating the residuals and testing whether they are stationary or not. If the residuals are stationary, then the two series are cointegrated. In this study, the regression equation was estimated using the Engle –Granger two step procedure. The first step was to estimate a long-run equation using OLS with variables which are integrated of order one, I(1) in their levels. The results for the OLS are indicated on Table 6:

Table 6: OLS Regression Results

Source	SS	df	MS	Number of obs = 39
				F(5, 33) = 2.21
Model	.32215202	5	.064430404	Prob > F = 0.0763
Residual	.960239092	33	.029098154	R-squared = 0.2512
				Adj R-squared = 0.1378
Total	1.28239111	38	.033747135	Root MSE = .17058

dlnRCD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dlnIPI	-.3590207	.1286131	-2.79	0.009	-.620686	-.0973554
dlnINF	-.0063072	.0334611	-0.19	0.852	-.0743844	.06177
dlnRER	-.2689682	.3514635	-0.77	0.450	-.984026	.4460896
dlnRLCD	-.3355826	.1624154	-2.07	0.047	-.6660192	-.0051459
dD_1	.4481466	.2137184	2.10	0.044	.0133333	.88296
_cons	-.0060886	.0300204	-0.20	0.841	-.0671656	.0549885

In order to avoid spurious regression, residual based cointegration test was used, where the stationarity of the residuals implies a cointegration relationship among the variables in the long run equation. The results for the ADF test of the residual are given in Table 7.

Table 7: ADF Test for Residuals

Augmented Dickey-Fuller test for unit root Number of obs = 37

	Test Statistic	---------- Interpolated Dickey-Fuller --------- 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.674	-3.668	-2.966	-2.616

MacKinnon approximate p-value for Z(t) = 0.0001

The results in Table 7 show that the test statistic is -4.674 which is less than the critical values at 1%, 5% and 10% levels of significance. This shows that the residual from the regression using the ADF test is stationary. Therefore, we reject the null hypothesis of no cointegration and conclude that there is a cointegrating relationship among the variables. The presences of a cointegrating relationship (long-run equilibrium) among the variables indicate that the Error Correction Model (ECM) provides a better fit than the one without the error correction term.

The second step in the Engle-Granger procedure is to estimate the corresponding ECM, based on the long run cointegrating relationship to observe the short-run dynamics (Engle and Granger, 1987). The study estimated the ECM using the residual from the long-run equation. The ECM is based on stationary data and includes the lagged residuals of the long-run equation, which is also I(0) when the variables have cointegrating relationship. The study then ran a short run error correction model (ECM). In the error correction model, the one period lagged residual for annual data acts as the error correction term (ECT). The results of the error correction model are as presented in Table 11 in this chapter.

4.4 Diagnostic Tests

Diagnostic tests are necessary to indicate whether the model is consistent or not. The following diagnostic tests were carried out in this study.

4.4.1 Jarque-Bera Normality Test for the Residuals

This test is done to confirm that the variables used in the analysis are normally distributed. The study used Jarque - Bera statistics test which uses the mean based coefficient of skewness and kurtosis to check the normality of the residuals. The test uses the first four moments of distribution, that is, mean, standard deviation, skewness and excess kurtosis. The distribution is distributed at Chi-Square statistic. Normality test uses the null hypothesis of normality

against the alternative hypothesis of non-normality. A sufficiently low probability value of the estimated Jarque-Bera Chi-Square statistics leads to acceptance of the null hypothesis of a normal distribution (Jarque, 1980). Table 8 shows the results for the Jarque- Bera test on the residuals:

Table 8: Jarque – Bera Test on the Residuals

	RESIDUAL
Mean	5.69
Median	0.006512
Maximum	0.307360
Minimum	-0.473235
Std. Dev.	0.158964
Skewness	-0.472387
Kurtosis	3.569991
Jarque-Bera	1.978420
Probability	0.371870
Observations	39

The results in Table 8 indicate that the probability value of the residual is less than the Jarque-Bera Chi-square statistic. This shows that the residuals are normally distributed at 5% significance level. We therefore conclude that the error term is normally distributed and hence the regression obeys the OLS assumption of consistency and efficiency.

4.4.2 Test for Multicollinearity

In this study, the test for the problem of multicollinearity was also done on the explanatory variables. Multicollinearity is a situation where the measured variables (independent variables) are too highly correlated to allow precise analysis of their individual effects. Multicollinearity may lead to inconsistent results in terms of size and sign. In addition it also becomes difficult to identify separate effects of variables involved. To test for multicollinearity, a correlation matrix was generated. Correlation matrix is an important indicator that tests the linear relationship between the explanatory variables. It also helps to

determine the strengths of the variables in the model. Table 9 shows the correlation matrix of the variables.

Table 9: Correlation of Variables

corr lnRCD lnIPI lnINF lnRER lnRLCD D_1

	lnRCD	lnIPI	lnINF	lnRER	lnRLCD	D_1
lnRCD	1.0000					
lnIPI	-0.6274	1.0000				
lnINF	-0.0375	0.0065	1.0000			
lnRER	0.5744	-0.7006	0.0266	1.0000		
lnRLCD	0.7882	-0.5545	0.0064	0.5821	1.0000	
D_1	-0.4417	0.9200	-0.0962	-0.5991	-0.3881	1.0000

The results in Table 9 show that Import Price Indices (IPI) are highly negatively correlated with Real Custom Duties, Real Exchange Rates and highly positively related with the dummy variable (D1). The lagged real custom duties are highly positively correlated with the real custom duties. This problem of high correlation brings about multicollinearity. In this study, differencing was done to make the variables stationary and this also eliminated the problem of multicollinearity as shown by the results in Table 10.

Table 10: Correlation of Variables after Differencing

. corr dlnRCD dlnIPI dlnINF dlnRER dlnRLCD dD_1 (obs = 39)

	dlnRCD	dlnIPI	dlnINF	dlnRER	dlnRLCD	dD_1
dlnRCD	1.0000					
dlnIPI	-0.3211	1.0000				
dlnINF	-0.0634	0.0360	1.0000			
dlnRER	-0.0458	0.1390	0.1194	1.0000		
dlnRLCD	-0.1809	-0.1092	0.1179	0.0765	1.0000	
dD_1	0.0973	0.2821	0.0947	0.4505	0.3113	1.0000

4.4.3 Test of Autocorrelation

The Durbin – Watson test was conducted in this study to test for autocorrelation. This study uses the Durbin – Watson test since there is no higher lagged order of the dependent variable which has been included as explanatory variable. Durbin-Watson tests for serial correlation of order 1 (AR(1)). The results for the Durbin – Watson test are given as:

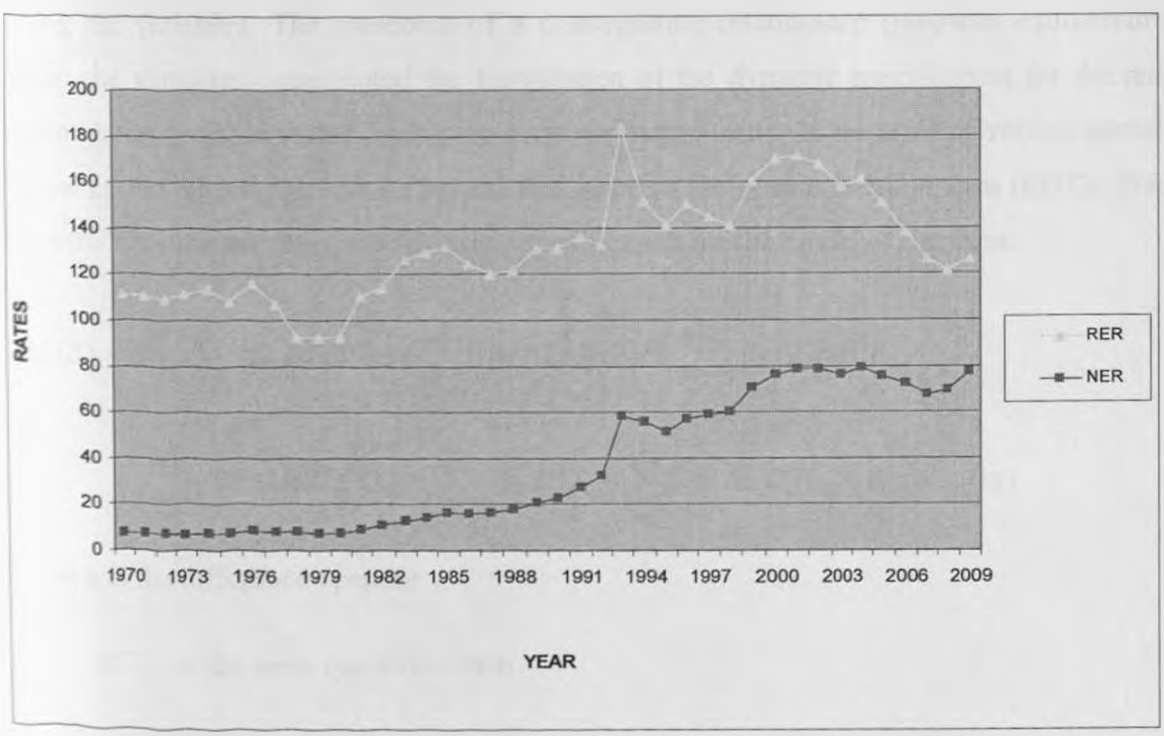
Durbin-Watson d-statistic (7, 39) = 2.171066

The Durbin – Watson statistic of 2.171066 which is closer to 2 signifying that there is no serial correlation between the dependent variable and the residual of the estimated equation. The residuals are therefore taken to be independent and identically distributed as N(0,δ). The residuals are used as the Error Correction Term (ECT).

4.5 Descriptive Analysis

The first specific objective of the study was to determine the nature of the real exchange rates depreciations in Kenya during the period under study. The times series data obtained for nominal exchange rate and the computed real exchange rates values were analysed using line graph in Figure 3 to show their trend during this period.

Figure 3: Trend Analysis of NER and RER



The data collected for the nominal exchange rates and computed real exchange rates, provided in appendix 2, were used to carry out the trend analysis of the NER and RER. The results in Figure 3 show that the real exchange rates have been more volatile than the nominal exchange rates over the study period. For the period before 1993, the real exchange rate was less volatile as compared to the period after 1993 when the foreign exchange rate controls were gradually relaxed as Kenya liberalised its foreign exchange rate regime and embraced a flexible exchange rate regime. Between 1993 and 1994 the Kenyan shilling appreciated in value as shown by the sharp upward trend over this period. This was followed by depreciation in the Kenya shilling between 1994 and 1995 as shown by the sharp drop in the trend over this period. In the period thereafter, Kenya has experienced fluctuations in real exchange rates with the Kenya shilling being on a depreciating trend since 2002 to date.

4.6 Regression Results

The non-stationarity of all the variables except the exchange rates and the presence of a cointegrating relationship among the variables necessitated the first differencing and the inclusion of the error correction term in the model. The model made use of Autoregressive Distributed Lag (ADL), (1,1) meaning that both the dependent and independent variables are lagged once. The test for cointegration showed that the residual from the regression using the ADF test was stationary. Therefore, this implied that there was a cointegrating relationship among the variables. The presences of a cointegrating relationship (long-run equilibrium) among the variables necessitated the formulation of the dynamic specification for the real custom duties function incorporating the error correction term. In the error correction model, the one period lagged residual for annual data acted as the error correction term (ECT). This led to the formulation of an error dynamic specification for the model of the form:

$$LnRCD_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta LnIPI_{t-i} + \sum_{i=1}^{p} \beta_2 \Delta LnINF_{t-i} + \sum_{i=1}^{p} \beta_3 \Delta LnRER_{t-i} +$$

$$\sum_{i=1}^{p} \beta_4 \Delta LnRLCD_{t-i} + \sum_{i=1}^{p} \beta_5 \Delta D_1 + \sum_{i=1}^{p} \beta_6 \Delta ECT_{t-i} + \varepsilon_t \ldots\ldots (ix)$$

Where Δ is the difference operator

ECT_{t-1} is the error correction term

All the other variables are as defined in equation v.

One of the advantages of using the error correction model is that it gives a clear distinction between the short run and long run relationships in the model. The error correction term, ECT_{t-i} is derived from the long run cointegrating relationship. Therefore, the estimated coefficient of ECT_{t-i} which is β_6 measures the long –run equilibrium relationship while the other coefficients measure the short run causal relation. This leads us to the following equation:

$$dlnRCD = \beta_0 + \beta_1 dlnIPI + \beta_2 dlnINF + \beta_3 dlnRER + \beta_4 dlnrLRCD + \beta_5 dD_1 + \beta_6 \textit{lagresid} \ldots (x)$$

Where *lagresid* is the error term (ECT) and d denotes the first differences of the variables. The error correction dynamic specification model was estimated using the OLS and the results of the estimation are reported in Table 11.

Table 11: Results for the Error Correction Model

gen lagresid = _n-1

. reg dlnRCD dlnIPI dlnINF dlnRER dlnrLRCD dD1 lagresid

Source	SS	df	MS
Model	.407963716	6	.067993953
Residual	.874427396	32	.027325856
Total	1.28239111	38	.033747135

Number of obs	= 39
F(6, 32)	= 2.49
Prob > F	= 0.0434
R-squared	= 0.3181
Adj R-squared	= 0.1903
Root MSE	= .16531

dlnRCD	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
dlnIPI	-.3511176	.1247146	-2.82	0.008	-.6051529	-.0970823
dlnINF	-.0090265	.0324624	-0.28	0.783	-.0751503	.0570972
dlnRER	-.4924274	.3631857	-1.36	0.185	-1.232212	.2473576
dlnLRCD	-.4070247	.1624728	-2.51	0.018	-.737971	-.0760785
dD1	.5419643	.2137672	2.54	0.016	.1065349	.9773938
lagresid	-.0045834	.0025864	-1.77	0.086	-.0098517	.000685
_cons	.0778951	.0556091	1.40	0.171	-.035377	.1911671

From the regression results in Table 11, the model is given as:

$$dlnRCD = 0.0779 - 0.3511 dlnIPI - 0.0090\, dlnINF - 0.4924\, dlnRER - 0.4070\, dlnLRCD + 0.5420 dD_1 - 0.0046\, \textit{lagresid} \ldots\ldots (xi)$$

4.7 Discussion of the Results

The models made use of the variables in their logarithm forms therefore the coefficients are reported as elasticities except that for the dummy variable. Table 11 which give the ECM regression results indicate that the R-squared is equal to 0.3181. The R-squared gives information about the goodness of fit of a model. The results on R-squared shows that 31.8% of the changes in real custom duties are explained by the import price indices, inflation rate, real exchange rate, lagged real custom duties and the dummy variable capturing the liberalisation of the exchange rate regime in 1993. This means that the other factors not included in the model account for 68.2% of the changes in the real custom duties. The adjusted R-squared which is a modification of R-squared that adjusts for the number of explanatory terms in a model is equal to 0.1903. This indicates how well the model predicts responses for new observation which is at 19.03% in this study. R-squared always increases when a new term is added to a model, but adjusted R-squared increases only if the new term improves the model than would be expected by chance. The probability of F-statistics is 0.0434 which is below 0.05 meaning that on average all the coefficients of the variables of the regression analysis are jointly significant at 5% level of significance and explains the variations in real custom duties. The R-squared is equal to 0.3181 which is less than the Durbin – Watson statistic of 2.171066. This signifies that there is no spurious regression. If the R-squared could have been more than the Durbin – Watson statistic, it would have signified the presence of spurious regression. The positive intercept of 0.0779 shows that if all variables that affect the real custom duties are zero or held constant, the value of real custom duties will be positive.

The study used student's t - test to test for the significance of the estimated coefficients. For 5% significance level with the degree of freedom of 32, the critical value for the t-test is 1.697 (or -1.697). Additionally, for 10% significance level with the degree of freedom of 32, the critical value for the t-test is 1.310 (or -1.310). The import price indices (IPI) were found to be statistically significant, at both 5% and 10% levels of significance, in determining the real custom duties collected in Kenya. The results show that holding other independent variables constant, a 1% increase in the import price index will lead to a decrease in the value of the real custom duties by 0.3511%. This can be explained by the fact that higher import price levels leads to low import volumes as the imports will reduce thus reducing the custom duties collected from the importation of goods and services.

The study results show that inflation rate is statistically insignificant at 5% and 10% levels of significance. The study results indicate that holding other independent variables constant, a 1% increase in inflation rate will lead to a decrease in value of real custom duties by 0.0090%. This is because an increase in inflation rate in Kenya is highly associated with an increase in inflation rate in the international market. As noted before, the major sources of import revenue in Kenya are industrial machinery, crude petroleum, motor vehicles and transport equipment, minerals, iron and steel, chemicals, food and manufactured goods (Republic of Kenya, 2011). This mean that an increase in prices of the imports which are mainly inputs into the local industries and food items will lead to a cost-push inflation which will be passed on to the consumers by the manufacturers in the domestic market. This in turn will discourage the consumption of imports and import related products thus leading to a decrease in import volumes. Since these items constitute the major sources of import revenue in Kenya, the real custom duties will be affected negatively by the increase in inflation rate. This is in agreement with the studies done by Tanzi (1977), Agbeyegbe et al (2006) and Oloo (2002).

This study also showed that real exchange rate has a statistically significant effect on the real custom duties. The study found out that real exchange rate is statistically significant at 10% level of significance but statistically insignificant at 5% level of significance. The study results also show that holding other independent variables constant, a 1% increase in real exchange rates will lead to a decrease in value of real custom duties by 0.4924 %. This is because an increase in the real exchange rates (depreciation) will lead to the imports becoming expensive to the domestic consumers hence discouraging imports. This will lead reduction in import volumes thus leading to reduced real custom duties earned from the imports. This result is in agreement with the studies done by Emmerij (1990), Easterly (1991), Eberill (1999) and Tanzi (1989) which indicated that increase in real exchange rate (depreciation) have a negative effect or inverse relationship with real tax revenue.

The lagged real custom duties were found to have a statistically significant effect on the real custom duties at both 5% and 10% significance levels. From the study findings, a 1% increase in the lagged real custom duties will lead to a decrease in real custom duties by 0.4070%. This implies that the lagged real custom duties have a negative effect on the real custom duties collected. The dummy variable (D_1) used in this study to capture the effect of the introduction of liberalized exchange rate regime in 1993 was not transformed into a logarithmic form. The

dummy variable was found to be statistically significant at both 5% and 10% levels of significance. The study results indicate that the coefficient of the dummy variable (D_1) is + 0.5420. To estimate the percentage effect of a dummy variable regressor on the level of the dependent variable (Gardener and Shah, 2002), we use the exact interpretation of dummy variable given by the following equation:

$$g = 100\left(\exp\left(u - \frac{v(u)}{2}\right) - 1\right) \quad \text{..... (xii)}$$

Where g is the estimate of the percentage impact of the dummy variable on the variable being explained.

u is the estimated coefficient of the dummy variable

$v(u)$ is the estimated variance of u

$$g = 100\left(\exp\left(0.5420 - \frac{0.250641}{2}\right) - 1\right)$$

$$g = 100\left(\exp(0.41668) - 1\right) = 51.7\%$$

The positive coefficient of the dummy variable shows that the introduction of liberalized exchange rate regime in 1993 has a positive effect on the real custom duties. The results in equation xiii show that when there is liberalisation of the foreign exchange rate market, the real custom duties will increase by 51.7%. Similarly, the graphical analysis in Figure 3 showing the trend of the NER and RER during the study period indicate that for the period before 1993, the real exchange rate was less volatile as compared to the period after 1993 when the foreign exchange rate controls were gradually relaxed as Kenya liberalised its foreign exchange rate regime and embraced a flexible exchange rate regime. These fluctuations in RER have also impacted on the real custom duties as discussed earlier in this section.

The study shows that the error correction term (*lagresid)* is significant at both 5% and 10% levels of significance and negative with a relatively speed of adjustment of about 0.0046 % suggesting that about 0.0046% of the deviations from the long run equation are made up within one time period. The negative coefficient of the error correction term implies that there is a feedback mechanism in the short- run.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Summary and Conclusions

The focus of this study was to examine the effects of real exchange rates depreciation on import tax revenues in Kenya. The specific objectives of the study were to determine the nature of the real exchange rates depreciation in Kenya from 1970 to 2009 and to establish the effects of the depreciations in the real exchange rates on the import tax revenues (custom duties) in Kenya from 1970 to 2009. The literature review identified other variables such as inflation rates and trade liberalisation as having a significant impact on the custom duties. These variables together with the import price indices and lagged real custom duties were incorporated in the model used to study the effects of real exchange rates depreciations on the real custom duties. The real exchange rate was computed using the nominal exchange rates, USA Wholesale Price Indices as a proxy for the foreign prices and the Consumer Price Indices for Kenya as a proxy for the domestic prices.

The econometric tests carried out before the regression included tests for normality, stationary tests, cointegration analysis and diagnostic tests. As discussed in Chapter Four all the variables were found to be normally distributed since all their skewness were within the range of +2 to -2 and their probabilities were less than the Jarque – Bera Chi-Square distribution. The residuals were also found to be normally distributed at 5% significance level. The results for the unit root test indicated that all the variables except Ln INF were non-stationary. The variables were therefore differenced and subjected to the same tests. The results of the Augmented Dickey – Fuller Test for Unit Root after differencing showed that the series were stationary after the first differencing implying that the variables are integrated of order one, that is, I(1). The test for cointegration showed that the residual from the regression using the ADF test was stationary. Therefore, this implied that there was a cointegrating relationship among the variables. The presences of a cointegrating relationship (long-run equilibrium) among the variables indicated that the Error Correction Model (ECM) provided a better fit than the one without the error correction term. This necessitated the formulation of the dynamic specification for the real custom duties function incorporating the error correction term. In the error correction model, the one period lagged residual for annual data acted as the error correction term (ECT). The dynamic specification was then estimated using the ordinary least squares.

The models made use of the variables in their logarithm forms therefore the coefficients were reported as elasticities except that for the dummy variable. The empirical results and analysis presented in the previous chapter show that import price indices, inflation rate, real exchange rates and lagged real custom duties have a negative effect on the real custom duties. However, the dummy variable used to capture the introduction of liberalized exchange rate regime in 1993 was found to have a positive effect on the real custom duties.

The import price indices (IPI) impacts negatively on the real custom duties since higher import price levels leads to low import volumes thus reducing the custom duties collected from the importation of goods and services. Additionally, the inflation rate also have a negative effect on the real custom duties in view of the fact that inflation rate in Kenya is highly associated with the "imported inflation". This is because the increase in prices of the imports which are mainly inputs into the local industries and food items lead to a cost-push inflation which is eventually passed on to the consumers in domestic market. This in turn discourages the consumption of imports and import related products thus leading to a decrease in import volumes. The lagged real custom duties were also found to have a statistically significant negative effect on the real custom duties. We therefore conclude that an increase in import price indices, inflation rate and lagged real custom duties lead to a decrease in the real import tax revenue.

The dummy variable (D_1) used in this study to capture the effect of the introduction of liberalized exchange rate regime in 1993 was found to be statistically significant with a positive effect on the real custom duties. This shows that when there is liberalisation of the foreign exchange rate market, the real custom duties will increase. This is in agreement with the study findings of Cheeseman and Griffiths (2005) in which they indicated that the reduction in tariffs has been successful, as increased imports have compensated for the reduction in tariffs and resulted in a rise in tax revenue from trade. The positive impact of liberalisation in 1993 was in large part a consequence of the fact that tariffs had previously been extremely high. As a result, the reduction of tariff rates led to a massive increase in the quantity of imports. At the same time a weaker currency, falling costs of inputs and a reduction in export tariffs made Kenyan products more competitive and increased the quantity of exports enough to compensate for the lowering of export tariffs. These processes, combined with the increased investment in the country as a result of the optimism that greeted the transition to multi-party politics, created a situation within which liberalisation of trade

and foreign exchange rate regime could be realised at the same time as increases in import tax revenue.

The study also showed that the error correction term (*lagresid)* is significant with a negative coefficient. The negative coefficient of the error correction term implies that there is a feedback mechanism in the short- run. The error correction model helps to correct disequilibrium in the short-run and therefore the negative coefficient in the results is a confirmation that there is no disequilibrium of the variables in the short-run. The t-value for the error correction term was found to be significant statistically thus re-confirming cointegration between the variables in the real custom duties model.

The variable of much interest in this study is the real exchange rates (RER). Like any other price, exchange rate can be fixed or alternatively allowed to freely fluctuate. In a floating exchange rate system, the domestic currency is said to be depreciating or appreciating in value with respect to one or more foreign reference currencies. Currency depreciation is the loss of value of a country's currency with respect to one or more foreign reference currencies. It is most often used for the unofficial increase of the exchange rate due to market forces. Its opposite is appreciation which refers to an increase in the value of that country's currency. Since Kenya relaxed controls in the foreign exchange market, its foreign exchange rate has been determined by supply and demand of its currency in relation to the foreign currencies. For instance, when the shilling becomes stronger, its value relative to other currencies rises. This benefits the domestic consumers and the business community particularly those whose production processes use large quantities of imported inputs. At the same time, the Kenyan goods and services become expensive for the foreign consumers. As a result, the foreign consumers of local goods will buy less and export earnings in the local currency are also bound to be low. When the shilling depreciates prices of imports rises for the domestic consumers putting downward pressure on import volumes. This study showed that real exchange rate has a statistically significant negative effect on the real custom duties. This is because an increase in the real exchange rates (depreciation) will lead to the imports becoming expensive to the domestic consumers hence discouraging imports. This will lead reduction in import volumes thus leading to reduced real custom duties earned from the imports. This result is in agreement with the studies done by Emmerij (1990), Easterly (1991), Eberill (1999) and Tanzi (1989) which indicated that increase in real exchange rate (depreciation) have a negative effect or inverse relationship with real tax revenue. We

therefore conclude that the real exchage rates have a negative effect on the import tax revenue and therefore the government need to have proactive policies to check on this impact in view of the current depreciation of the Kenyan Shilling in relation to other major world currencies.

5.2 Policy Implications

The results of this study are quite informative and arguably point out some issues of policy concern. The study has established the significance of custom duties contribution to total tax revenue in Kenya and identified some of the factors that affect the performance of the custom duties as source of revenue to the government. The study findings have great policy ramifications which need to be addressed by policy makers and the various government agencies in order to improve on the performance of the custom duties as a source of revenue.

The study results indicate that increase in inflation rates, import price indices and increase in real exchange rates (depreciation) has negative effects on real custom duties. Therefore, it is desirable to have a real exchange rate policy which strikes a balance between the need for having a real exchange rate which is at a sustainable long-run level and need to prevent destabilizing effects on the domestic price levels. The Central Bank of Kenya, which is the country's monetary authority, should employ a nominal exchange rate management policy which follows a purchasing power parity approach, anchored on non- inflationary fiscal and monetary policies. This implies that there is need to rationalize government expenditure and control money supply to check on the inflationary pressures in the economy. The government can also consider increasing controls in the exchange rate market by having some real exchange rate rules. In the real exchange rate rules, the official exchange rate should be changed in accordance with some rule, which sometimes link changes in the official exchange rate to the difference between domestic and foreign rates of inflation. This has the advantage of helping to keep the real effective exchange rate close to its purchasing power parity (the level at which unit of currency can buy the same bundle of goods in all countries) and to maintain international competitiveness in the face of high domestic inflation. However, where real exchange rates rules need to be adopted, a cautious application is suggestive, as the rules can easily lead to a loss of control over the domestic inflationary process. The adoption of a purchasing power parity approach and RER rule prevents the nominal exchange rate from serving as a nominal anchor for the domestic price levels.

The depreciation of the shilling having inflationary effects sometimes raises the growth of total expenditure more than total revenue, hence perpetuating financial deficits, this implies that the floating exchange rate that eventually leads to volatile depreciation, significantly affects both the revenue and expenditure sides of the budget. Hence, the Central Bank need to adopt a restrictive monetary policy to complement the floating exchange rate policy adopted. It is imperative for the fiscal policy makers to consider the fiscal impact of the elasticities of the determinants of tax revenues, real exchange rate inclusive, while making important fiscal decisions. The positive and significant signs of the coefficient for the dummy variable meant to capture the liberalisation of the exchange rate market/regime support the view that reforms aimed at liberalizing exchange rate and increasing revenue are indeed compatible and are worth being pursued.

5.3 Limitations of the Study

This study was faced with some limitations which should be highlighted. First, the sample period is limited to 1970-2009 because of the non availability of well authenticated data for the year 2010. The data for 2010 were either unavailable for some variables or the ones available were estimates. However, the period covered in the study was sufficient to enable examine the effects of real exchange rates on real custom duties. Secondly, due to the shortage of reliable quarterly data for most of the variables under consideration for the entire period, the periodicity of all the data used in this investigation is annual. The study also relied much on secondary data which face limitations such as change in methods of collection or measurement errors. Additionally, the use of the CPI for Kenya and the WPI for USA as proxies for the domestic prices for the nontradables and foreign prices for the tradables respectively was also another limitation for this study. These were used due to unavailability of data for the actual prices for the tradables and the nontradables over the period under study.

5.4 Suggestion for Further Research

The study focussed on the effects of real exchange rate depreciation on import tax revenue leaving out other types of taxes such as export taxes, excise duties, value added taxes, income taxes among others. Additionally, the study findings indicate that the variables incorporated in the model only explain 31.8% of the changes in real custom duties. This shows that there are other variables that need to be captured in the model. Suggestions for further studies is therefore advisable to focus on other types of taxes or include all types of taxes especially for a longer period than that covered by this study in order to establish the long term effects of

the variables under study on other types of taxes in Kenya. Additionally, there is need to incorporate more variables in the model that would include liberalisation of the goods market, foreign direct investments, effects of the Structural Adjustment Programmes, economic intergration, performance of import-substituting industries among others.

REFERENCES

Adams, C.S. (1992). Recent Developments in Econometric Methods: An Application to the Demand for Money in Kenya.African Economic Research Consortium Special Paper No. 15 Nairobi, Kenya.

Adam, C., Bevan. D. & Chambas, G. (2001). Exchange Rate Regimes and Revenue Performance in Sub-Saharan Africa. *Journal of Development Economics,* 64: 173-213.

Adedoyin, S. (1997). Financial Liberalization and Bank Restructuring In Sub-Saharan Africa, African Economic Research Consortium Plenary Sessions, 1994-1995 Cambridge: Cambridge University Press.

Agbeyegbe, T. D., Stotsky, J. & WoldeMariam, A. (2006). Trade Liberalization, Exchange Rate Changes, and Tax Revenue in Sub-Saharan Africa. *Journal of Asian Economics,* 17(2): 261-284.

Ayoki, M., Obwona, M. & Ogwapus, M. (2008). *Tax Reforms and Domestic Revenue Mobilisation in Uganda*. Kampala, Uganda: Fountain Publishers Limited.

Bautista, R.M. (1987). Production Incentives in Philippine Agriculture: Effects of Trade and Exchange Rate Policies. *IFPRI Research Report, No.59*, Washington D.C.: International Food Policy Research Institute.

Boskin, M.J. & McLure Jr, C.E. (1990). World Tax Reform: Case studies of Developed and Developing Countries. Francisco, California: International Centre for Economic Growth.

Carlos, A. et al (1981). Taxation in Sub-Saharan Africa (Tax Policy and Administration, and a Statistical Evaluation). Washington DC: International Monetary Funds.

Cheeseman, N. & Griffiths, R. (2005). Increasing Tax Revenue in the Sub-Saharan Africa: The Case of Kenya. *The Oxford Council of Good Governance, Economic Analysis No.6*, October 2005.

Dornbusch, R. & Frewel J. (1987). "The Flexible Exchange Rate System: Experience and Alternatives". NBER Working Paper No. 2464, December, 1987.

Easterly W. (1991). Macroeconomics of Public Sector Deficits. *WPS ,October 1991.*

Eberill, L., Stotsky, J. & Gropp, R. (1999). Revenue Implications of Trade Liberalization *IMF Occasional Paper 99/80*. Washington: International Monetary Fund.

Elbadawi, I. A. & Soto R. (1995). Real Exchange Rate and Macroeconomic Adjustment in Sub-Saharan Africa and other Developing Countries Paper Presented at African Economic Research Consortium. Workshop, December 1995, Johannesburg.

Emmerij. L. (1990). Tax Revenue Implications of the Real Exchange Rates; Econometric Evidence from Korea and Mexico. *Development Centre Technical Papers,* February 1990.

Engle. R.F. & Granger C.W.J. (1987). Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica*, Vol. 55:251-276.

Gandolfo, G. (1973). *International Economics II, International Monetary Theory and Open Economy Macroeconomics.* Springer –Verlag.

Glenday G. (2000). "Trade Liberalisation and Customs Revenues: Does Trade Liberalisation Lead to Lower Customs Revenues? The Case of Kenya". Harvard University Development Discussion Paper 764.

Greene, W. (2003), *Econometric Analysis,* 5th edition, Prentice Hall.

Gujarati, D. N. (1995). *Basic Econometrics* (3rd Edition). New York, USA: McGraw-Hill Press.

Hatzipanayotou, P. & Michael S. M. (1997). Real Exchange Rate Effects of Fiscal Expansion under Trade Restrictions. *The Canadian Journal of Economics / Revue canadienne d'Economique, Vol. 30*, No. 1 (Feb., 1997), pp. 42-56.

James, S. & Nobes C. (1992). *The Economics of Taxation* (4th Edition). New York, USA: Prentice Hall.

Jarque, C.M. and A.K. Bera (1980), *Efficient Tests for Normality, Homoskedasticity and Serial Independence of Regression Residuals*, Economic Letters.

Kabubi, J. M. (1995). The Effects of Real Exchange Rate on Tax Revenue in Kenya (Unpublished Masters Thesis). Department of Economics, University of Nairobi, Nairobi, Kenya.

Karingi S., Wanjala B., Nyamunga J., Okello A., Pambah E. & Nyakang'o E. (2005). "Tax Reform Experience in Kenya". Kenya Institute of Public Policy Research and Analysis, Working Paper No.13, Nairobi, Kenya.

Khan, M. (1986). Developing Exchange Rate Policy Responses to Exogenous Shocks. *American Economic Review, 76*: 84-87.

Khattry, B. & Row, J. M. (2002). Fiscal Faux: An Analysis of the Revenue Implications of Trade Liberalization. *World Development, 30(8):* 1431-1444.

Krugman P. & Taylor L. (1978). Contractionary Effects of Devaluation. *Journals of International Economics Vol. 8*, August 1978, pp. 445-456.

Morande & Habbel (1991). *Public Sector Deficits and Macroeconomic Performance in Zimbabwe*. Oxford: Oxford University Press.

Mundell, R.A. (1961). Flexible Exchange Rates and the Theory of Employment. *Canadian Journal of Economics and Political Science*, 27, pp 509-517

Nashashibi, K. & Bazzoni, S. (1994). Exchange Rate Strategies and Fiscal Performance in Sub-Saharan Africa. *IMF Staff Papers Vol. 41*, No. 1, March, pp. 76-122.

Ndung'u, N.S. (2000). "The Exchange Rate and Interest Rate Differential in Kenya: A Monetary and Fiscal Policy Dilemma". Kenya Institute of Public Policy Research and Analysis Discussion Paper No. 1, Nairobi, Kenya.

_____ (1995). Price and Exchange Rate Dynamics in Kenya. An Empirical Investigation: 1970-1993, A Paper Presented at the Africa Economic Research Consortium. Workshop, May/June 1995, Nairobi, Kenya.

_____ (1993), Dynamics of the inflationary process in Kenya (Unpublished PhD Thesis), Goteborg University, Germany.

Ndung'u, N.S. & Ngugi R.W. (1999). Adjustment and Liberalization in Kenya: The Financial and Foreign Markets. *Journal of International Development 2*: 465-491

Obadan, M.I. (1994). *Real Exchange Rates in Nigeria: A Preliminary Study. Monograph Series No.6.* Ibadan, Nigeria: National Centre for Economic Management and Administration

Oloo, M.A. (2002). An Assessment of Tax Revenue Performance Before and After Liberalization of Exchange Rate In Kenya: 1972 - 2000 (Unpublished Masters Thesis), University of Nairobi, Nairobi, Kenya.

Republic of Kenya (Various Issues). *Economic Surveys.* Nairobi, Kenya: Kenya National Bureau of Statistics.

_____(2008). *The 2008 Consumer Price Index (CPI).* Nairobi, Kenya: Kenya National Bureau of Statistics.

Rolph, E. R. & Break, G.F. (1961). *Public Finance.* New York, USA: Rnal Press Company.

Rutherford, D. (1992). *Dictionary of Economics.* London : Routledge.

Tanzi V. (1989).The Impact of Macroeconomic Policies on the Level of Taxation and the Fiscal Balance in Developing Countries. *IMF Staff Paper Vol. 36* :633-656.

_____ (1987). "Quantitative Characteristics of the Tax systems of Developing Countries", in Newbery D. and Stern N. (eds), *The Theory of Taxation for Developing Countries.* World Bank Research Publication, USA: Oxford University Press: pp 205-241.

_____ (1977). Inflation, Lags in Collection and the Real Value of Tax Revenue. *IMF Staff Papers, Vol. XXIV* No. 1, March 1977.

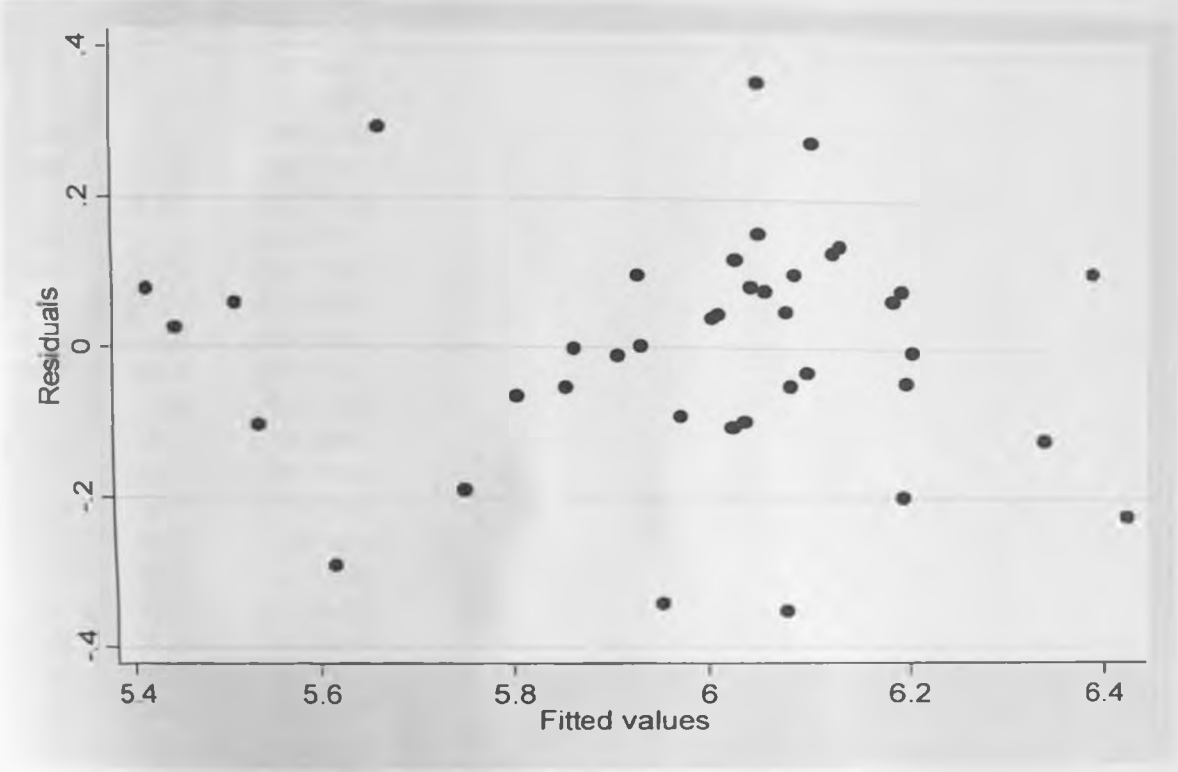
Were M., Geda A., Karingi S. & Ndung'u N.S. (2001). Kenya's Exchange Rate Movement in a Liberalized Environment: An Empirical Analysis, Kenya Institute of Public Policy Research and Analysis, Discussion Paper No. 10, Nairobi, Kenya.

Williamson, J. (1976). The Benefits and Costs of an International Monetary Nonsystem, Reflections on Jamaica. *Essays in International Finance No. 115*, International Finance Section, Princeton University.

APPENDIX 1

Test for Heteroskedasticity

The residuals are plotted versus fitted values



In a large sample, you'll ideally see an envelope of even width when residuals are plotted against the fitted values. In a small sample, residuals will be somewhat larger near the mean of the distribution than at the extremes. Thus, if it appears that residuals are roughly the same size for all values of the fitted values (x) or, with a small sample, slightly larger near the mean of x, it is generally safe to assume that heteroskedasticity is not severe enough to warrant concern. If the plot of residuals shows some uneven envelope of residuals, so that the width of the envelope is considerably larger for some values of x than for others, a more formal test for heteroskedasticity should be conducted. In this case there is no pattern on this graph around zero (the mean), it therefore means there is no serious problem of heteroskedasticity.

APPENDIX 2

Nominal Exchange Rates and Computed Real Exchange Rates

YEAR	NER	RER
1970	7.14	103.9984
1971	7.14	103.5478
1972	7.14	102.168
1973	7.02	103.9962
1974	7.13	106.5293
1975	7.34	100.574
1976	8.37	107.7028
1977	8.28	98.4781
1978	7.73	84.72797
1979	7.48	85.45014
1980	7.42	84.97662
1981	9.05	101.348
1982	10.92	103.3792
1983	13.13	112.9885
1984	14.41	115.1146
1985	16.43	115.5806
1986	16.23	108.1401
1987	16.45	103.5547
1988	17.75	103.5231
1989	20.57	110.6615
1990	22.91	108.37
1991	27.51	108.6141
1992	32.22	100.4843
1993	58	125.742
1994	56.05	95.54413
1995	51.43	89.41813
1996	57.11	93.34917
1997	58.73	86.14977
1998	60.37	80.92006
1999	70.33	89.89564
2000	76.18	93.64583
2001	78.56	92.34856
2002	78.75	88.70406
2003	75.94	82.05428
2004	79.17	81.37841
2005	75.55	75.55
2006	72.1	65.93675
2007	67.32	58.78161
2008	69.18	52.54379
2009	77.34	49.04332

Source: Economic Surveys (Various Issues), IMF. International Financial Statistics and data files