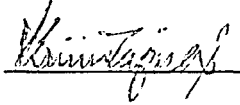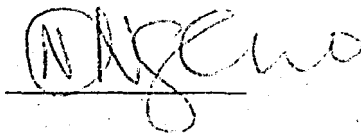This research paper is my original work and has not been presented for a degree in any other university.

DANIEL KIMARI KAGIRA

This research paper has been submitted for examination with my approval as University supervisor.

DR. N. NG'ENO

THE EFFECTS OF REAL EXCHANGE RATES ON KENYA'S AGRICULTURAL EXPORTS.

BY

DANIEL KIMARI KAGIRA

DEDICATION

I dedicate this Research paper to my dear Parents, Solomon Kagira and

Esther Wanjiru Kagira.

ACKNOWLEDGEMENTS

ABSTRACT

The real exchange rate (RER) plays a central role in the profitability of tradables, which include the agricultural exports. In most of the developing economies, agriculture has a larger tradable component than other sectors.The RER provides a long term signal for resource allocation among the different sectors of the economy and is therefore likely to affect their cperformance.This study is an attempt to establish the part played by real exchange rate of the Shilling on the performance of agricultural exports in Kenya.It explains how the real exchange rate of the Shilling influences the performance of agricultural exports through its effect on the price incentive structure.

The study presents a methodology which can be used to measure effects of real exchange rate on agricultural exports. The study focused on the impact of RER on agricultural export prices relative to prices of non-traded home goods, non-agricultural products and the local food. This study investigated whether there is a relationship between real exchange rate movements and implicit agricultural export tax, agricultural export prices relative to prices of non-traded home goods, non-agricultural products and local food during 1970-90.This study also investigated the link between the RER movements and foreign incomes, weather, real agricultural exports and individual export commodities such as coffee and tea.In this study the equations estimated were recursive and hence Ordinary Least Squares (OLS) was the most appropriate method of estimation.

The findings of the study indicate that the real exchange rate depreciated in real terms during the study period 1970-90.The results also indicate that the real exchange rate exerts an independent statistical influence on most of the relative prices considered in the study.The results further indicate that real exchange rate exerts an independent statistical influence on the domestic prices of the individual traditional export

commodities. In addition, the study established that agricultural export taxes influence the performance of agricultural exports. The study concludes that agricultural exports in general are responsive to changes in RER. The study established that real depreciation of the exchange rate of the Shilling was associated with improvement of the agricultural export prices in 1970s. There was also an increase in real agricultural exports and volumes of tea and coffee in the same period.

The study however could not solely attribute the poor performance of agricultural exports in the 1980s to changes in real exchange rate of the Shilling. During this period the real exchange rate exhibited an upward trend (ie depreciated in real terms) while the real agricultural exports had a downward trend. Therefore the study concludes that, RER partly explains the performance of agricultural exports. The RER is also a partial indicator of the competitiveness of the agricultural exports sector.

Various policy implications are drawn from the results of the study. The study recommends real exchange rate as one of the critical variables that needs to be monitored by policy makers. The aim should be to maintain the RER at a level that can encourage agricultural exports sector and economic growth. The study also recommends a low tax policy on agricultural exports to induce the farmers (producers) to put more effort on agricultural exports.

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TERMS AND ABBREVIATIONS

GDP   -   Gross Domestic Product

SSA   -   Sub-Saharan Africa

IFPRI -   International Food Policy Research Institute.

FAO   -   Food Agricultural Organization.

RER   -   Real Exchange Rate.

COCOBOD -   Cocoa Marketing Company of the Ghana Cocoa Board.

LIST OF VARIABLES

E -   Nominal exchange rate (ie shillings per US dollar)

P_A -   Domestic aggregate agricultural product price.

P_{AH} -   Domestic non-traded agricultural goods price.

P_{AX} -   Domestic price of agricultural export commodities.

P_{CC} -   Domestic price of coffee.

P_{TT} -   Domestic Price of tea.

P_H -   Domestic aggregate non-traded goods price.

P_N -   Domestic aggregate non-agricultural product price.

P_{SN} -   Domestic price of sheanuts in Ghana.

P_F -   Domestic aggregate food price.

R -   Real exchange rate.

W -   National average annual rainfall.

W_c -   Average annual rainfall in the coffee growing zone.

W_T -   Average annual rainfall in the tea growing zone.

X_A -   Real aggregate agricultural exports.

X_{cc} -   Volume of exports of coffee.

X_{TT} -   Volume of tea exports.

Y -   Foreign aggregate real income of Kenya's trading partners.

P^*_{cc} -   Domestic price of cocoa in Ghana.

P^*_{cf} -   Domestic price of coffee in Ghana.

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CHAPTER 1

1.0: INTRODUCTION

1.1: BACKGROUND

Agriculture is the most important sector in Kenya's economy. It contributes over 25 per cent of the total GDP and about 64 per cent of the value of the country's exports which comprises of raw materials and processed agricultural products (Kenya, Economic Survey 1991).In addition, the majority of Kenya's population live in the rural areas and depend on agriculture for their livelihood (May,1990).Table 1 shows that this sector employed about 80 per cent of the total labour force in 1980, but the rate had dropped to about 76 per cent in 1992.

Table 1 : Shares of Labour Force by Sector (Percentage) for Selected Years.

	1965	1973	1980	1989	1990'	1991	1992
AGRICULTURE	86.1	83.6	81.0	77.0	77.0	77.0	76.0
INDUSTRY	5.1	6.0	6.8	-	-	-	-
SERVICES	8.8	10.4	12.1	-	-	-	-
TOTAL	100.0	100.0	100.0	-	-	-	-

Source: Trends in Developing Economies (1991), A World Bank Publication, Washington D.C and African Development Report (1992), ADB, Abidjan, Cote D' Ivoire.

Despite the significant contribution by the agricultural sector to the overall economic growth of the country its performance has not been satisfactory.The share of agriculture in GDP declined from 33.1% in 1965 to 28% in 1990 (Central Bank of Kenya,Economic Report,1970 and FAO, Country Tables, 1993).The agricultural growth rate in Kenya has continued to fall over the years as shown in Table 2.

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Table 2: Growth Rates of Agricultural Sector (% per year) for
Selected Years

1965-73	1973-80	1989	1990	1991	1992
6.2	4.2	4.0	3.5	-1.1	-4.1

Source: Trends in Developing Economies (1991), and Kenya Economic
Survey (1993)

It can be observed from this Table that over the period,
1965-73, the sector grew by 6.2% while the rate dropped to 4.2
per cent between 1973 and 1980. In 1990, the growth rate fell to
3.5 per cent per annum. In the years, 1991 and 1992, the growth
of the sector declined at a rate of -1.1 per cent and -4.1 per
cent respectively.

The performance of agriculture has evoked various policy
responses from the Government. Some have taken the form of direct
government intervention with the aim of influencing the structure
of incentives. They include sector-specific infrastructural
investments as well as administrative price fixing in
agricultural input and output markets. Other more general
macroeconomic policies have direct and indirect incentives on
agriculture. These policies either reinforce or counteract those
directed solely at agriculture. To be more specific, the
Government has created commodity marketing boards to facilitate
the marketing of the crops and delivery of inputs such as seeds
and fertilizers. In the case of cereals, the National Cereals
Produce Board (NCPB) buys the produce from farmers and
facilitates the delivery of inputs to the farmers. The government
has also put up agricultural research centres in an effort to
come up with high quality seeds and variety of crops which are
high yielding. The Government has set up training institutes for
agricultural officers.

The government has also put in place measures to help

improve agricultural exports.For example, the government has provided various agricultural incentives including an increase in the producer prices of various export crops and subsidizing major inputs to make them affordable to farmers. The Government also provides credit facilities through agricultural financial institutions such as Agricultural Finance Corporation (AFC).But efforts to improve agricultural exports in Kenya in the past decades through such policy reforms have met limited success.This is borne out by the fact that even with government efforts, real agricultural exports declined in real terms by 28.70 per cent in 1980s.This suggests that other policies such as exchange rate policy, need to be investigated to establish the part they play in the performance of agricultural exports.

The poor performance of the agricultural sector has been attributed to various factors. Like other countries in Sub-Saharan Africa, lower commodity prices have a greater impact on the decline of export performance hence stagnation in economic growth.Other factors include sluggish world economic growth in the late 1980s and early 1990s, poor rains, high input costs and deterioration of physical infrastructures.However,the poor performance of agricultural exports may not be solely blamed on these factors.Further explanation for the decline in export performance should therefore be sought in macroeconomic policies and particularly exchange rate policies pursued by the Government during the period.

The Real Exchange Rate (RER) has been established to have an effect on the agricultural growth and in particular agricultural exports.An explanation of how the performance of agricultural exports might be affected by the real exchange rate is given below.This study postulates that RER has played a hand in the poor performance of agricultural exports.

The objective of this study is to establish the effect of real exchange rate on Kenya's agricultural exports through its influence on agricultural price incentives. The study is motivated by the fact that export is a major source of foreign exchange, on which most of the developing countries including

Kenya depend on. Export receipts cover a considerable part of the needs of the developing countries for capital equipments, technical services and other goods essential to the accumulation process. An increase in exports help to achieve greater capacity utilization, permits the exploitation of economies of scale, generate incentives for technological improvement and brings efficient growth due to comparative advantage (Roy, 1991). This study is also motivated by the fact that most of the studies reviewed in this study indicate that exchange rate policies in most developing countries have negative impact on the agricultural growth.This study will therefore attempt to establish whether this is the case in Kenya.

1.2 Real Exchange Rate (RER) and Agricultural Performance.

The exchange rate is the rate at which a country has to give up its own currency, in order to acquire currencies of other countries. It simultaneously determines the local currency value of the country's exports. Like most other prices, this rate can be determined by market forces. When this is the case, the country's foreign exchange rate is determined in international currency markets by supply and demand of its currency. This rate reflects the country's balance between exports, imports and international capital flows.

The real exchange rate[1] is essentially the real worth of foreign exchange in terms of a given domestic currency (Fosu, 1992).This rate is an important determinant of the agricultural sector's performance. This is especially true if tradable goods constitute a significant proportion of output in the sector.Trade and macro-economic policies influence agriculture through their effects on the real exchange rate.In Kenya, the share of tradables in agricultural output has traditionally been significant. Agricultural products contribute over half of Kenya's total exports. The degree of tradability of agricultural output make agricultural incentives particularly dependent on the real exchange rate movements (Valdes, 1989).The real exchange rate is therefore likely to be very important in agricultural export supply response.

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The literature (see for instance Oyejide, 1987) has established that exchange rate overvaluation[2] has negative effects on the agricultural growth and in particular agricultural exports. Oyejide observed that the exchange rate overvaluation has direct and indirect impact on exports. For instance, foreign exchange rate overvaluation implies that export crops traded on world market are undervalued and their producers are penalised while domestic consumers are subsidized. Thus currency overvaluation acts as an implicit tax on agricultural producers but provides a subsidy for consumers of agricultural products.

On the other hand, Cleaver (1984) noted that exchange rate overvaluation is rarely intended by the Governments. It is most often the result of expansionary fiscal and monetary policy directed at maximizing economic growth. A side effect of expansionary monetary and fiscal policy is price inflation which when more rapid than the price inflation of principal trading partners causes real exchange rate to appreciate. When this happens, the producers of exports will get less in terms of price compared to the domestic products.

The real exchange rate determines how much in local currency is received by the exporter in return for foreign currency earnings. If the exchange rate is overvalued, the exporter will receive less in local currency for exported products than would be otherwise the case. If the exporter is the farmer himself, the farmers incentives to produce export crops will decline or he may be encouraged to smuggle these crops to a neighbouring country.

Fosu (1992) and Bautista (1987) have observed that a decline (appreciation) in RER tends to stimulate a decline in the price of tradable goods relative to the price of non-tradable goods[3]. The result is a movement of resources away from the production of tradable goods, including agricultural exports. A continued shift of productive resources away from the production of agricultural export commodities ultimately precipitates continued decline in agricultural export performance.

Bautista (1990) observed that real exchange rate changes affects agricultural production incentives indirectly. The distortion of agricultural incentives affects domestic output in

the static sense through induced lower efficiency of resources as well as in the longer run through the negative effects on agricultural labour supply, capital formation and technological innovation. Restriction on foreign trade affect relative prices and production incentives through the real exchange rate which in turn affects the domestic prices of tradable goods (including agricultural exports) relative to non-tradable goods. For example, import duties and quotas directly raise the domestic price of import competing products relative to exportables, encouraging a shift away from export production. The same policy instrument have an effect of reducing the demand and supply for imports which lowers the price of foreign exchange, making the domestic prices of tradable goods fall relative to non-tradable goods and hence indirectly biasing production incentive against both import competing and export goods.

Bautista further observed that a country's monetary and fiscal policies, foreign borrowing and nominal exchange rate management may critically affect the RER and hence the profitability of agricultural tradable goods production. The study gave an example of Indonesia where the increased inflow of oil resources in the mid-1970s squeezed the profitability of non-oil tradable goods sector and particular the agricultural export sector, both by directly biding resources away from them and by the appreciation of the RER induced by increase in money supply and inflation rate while nominal exchange rate was held. By allowing the currency to appreciate against other currencies the policies resulted in exchange rate overvaluation which substantially reduced the agricultural export production incentives.

Fosu (1992), acknowledged that RER has an influence on the agricultural price incentive structure and particularly in relation to agricultural export prices. Given that price incentives structure is an important determinant of inter-sectoral (and inter-commodity) resource flows, which in turn determines the levels of sectoral and commodity output, then it can be rightly argued that RER is a major determinant of the volume of agricultural exports.

The exchange rate is one of the three critical and closely related average price indicators in the economy. The others are inflation (the average price change of goods in the domestic market) and the interest rate (the domestic price of capital). In Kenya, the exchange rate determines the price of the Kenyan goods relative to foreign goods in both the domestic and export markets. When the Shilling appreciates, Kenyan goods becomes expensive and lose out to foreign goods domestically and abroad. As a result, Kenya's export proceeds fall. At the same time, when the Shilling appreciates, it becomes less profitable to produce tradeable goods, that is goods that can be exported or imported such as agricultural products and manufactured goods. This causes investible funds to be channelled to non-tradeable sectors such as real estate development and land speculation or simply find their way out of the country to seek better returns elsewhere.

On the other hand, when the Shilling depreciates, the competitiveness of Kenyan tradeable goods at home and abroad is restored. Also the profitability of producing tradeable goods would be restored and investible funds would shift back into manufacturing, agriculture and tradeable services thereby boosting exports and competing away some imports from the domestic market. In this way, the performance of tradeable goods including agricultural exports is likely to be affected.

The effectiveness of the real exchange rate (RER) on the performance of the agricultural exports would depend on the degree of the farmers' responsiveness to the price incentive structure. In Kenya, single crop price response studies have been conducted on the supply of coffee, maize, cotton and wheat (Maitha, 1970; Maitha, 1974; Gichuhi and Dunn, 1984, and Kere, Mwangi and Ogutu, 1986). The estimated single crop price elasticities suggest that Kenyan farmers are highly responsive to agricultural price incentive structure. They respond positively to annual crop price changes. The supply response for individual crops is crucial for efficient use of resources within agriculture.

Bond (1983) estimated aggregate supply elasticities with the Nerlove model for nine Sub-Saharan African countries - Ghana,

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Ivory Coast, Kenya, Liberia, Madagascar, Senegal, Tanzania, Uganda and Upper Volta for the period, 1963-81. The effect of real agricultural producer prices (average producer prices of major agricultural products deflated by the general consumer price index) on aggregate farm output was found to be positive for all these countries. This shows that farmers in these countries respond to price changes and this is reflected in the output. This analysis implies that real exchange rate is likely to affect the performance of agricultural exports through its influence on the price incentive structure.

1.3   An Overview of the Agricultural Export Performance in Kenya
Since independence, the performance of Kenya's agricultural sector has been impressive compared to other developing countries. Between 1964 and 1973, Kenya's agricultural sector grew at a rate of 4.6 per cent per annum. However, the growth rate fell to 3.5 per cent between 1975 and 1985. This growth rate was reasonably higher than in most developing countries. During 1964-85, the growth rate for the agricultural sector was higher than the population growth which registered 3.9 per cent.

During the period, 1970-80, Kenya's agricultural exports grew from US$150 million to US$700 million an increase of more than 300 per cent. In 1970, the agricultural exports accounted for over 75 per cent of total export earnings in the country. However, this share dropped to 65 per cent in 1979 and to 51 per cent in 1980 (Schluter, 1984). In terms of quantities, total agricultural exports contributed over 60 per cent of total exports in Kenya between 1970 and 1990 .

However, Kenya did not succeed in diversifying its agricultural products away from coffee and tea. Coffee's share grew from 30-40 % to 40-50 % of gross value of agricultural exports between the first and the second halves of 1970s and tea continued to provide an additional 20-25% (Schluter,1984).Between 1970 and 1980, the total tonnage exported for both crops grew by more than 80 per cent. For example, the value of coffee exported by Kenya between 1970 and 1980 rose from Kshs. 445 million to Kshs. 2,163 million while that of tea rose from Kshs. 254 million

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to Kshs. 1,160 million during the same period.Between 1981 and 1991 the value of coffee rose from KShs. 2197 to KShs. 4222 million while that of tea rose tremendously from KShs. 1225 to KShs. 7417 million.

The share of tea to total exports rose from 17 % in the period, 1970-1980 to 23.2 % in the period,1981-1991 while that of coffee declined from 31 % to 13 % .The share of fresh and processed fruits and vegetables declined slightly from 5.4 per cent to 4.8 per cent during the decade,1970-80.Between 1981 and 1991 their share also dropped from 16.2 % to 10 %.Therefore,tea performed better than both coffee and horticultural products in the period,1970-91(Table 3).

Table 3: Value of Agricultural Commodities Exported by Kenya, 1970-1991 (KShs. Million)

Year	Coffee	Tea	Horticult. Products	Total Exports
1970	445.3	254.1	78.0	1432.1
1971	390.8	237.5	70.7	1463.7
1972	495.5	328.3	94.1	1811.8
1973	715.7	339.3	101.8	2452.7
1974	768.5	387.5	110.1	3258.9
1975	704.0	459.0	155.3	3379.4
1976	1867.0	635.2	283.3	5375.8
1977	4087.2	1435.6	405.1	9460.9
1978	2495.2	1263.7	361.5	7399.3
1979	2295.2	1257.0	405.8	7723.9
1980	2163.0	1160.0	474.5	9864.3
1981	2196.6	1224.6	1650.8	10182.4
1982	2892.6	1551.1	768.5	10913.6
1983	3202.3	2468.4	1098.8	12917.3
1984	4073.1	3788.8	1083.9	15096.3
1985	4612.7	3828.2	1058.3	15520.2
1986	7768.6	3455.5	1323.1	19055.5
1987	3892.2	3267.1	1542.8	15058.2
1988	4894.7	3707.6	1882.4	18184.0
1989	4076.6	5438.0	1819.4	19996.8
1990	4489.9	6327.7	2560.5	24158.9
1991	4221.5	7416.6	2799.4	30051.1

Source: Constraints on Kenya's Food and Beverage Exports,Schluter M.(1984),IFPRI,Washington D.C., Economic Survey (1992),& Central Bank of Kenya, Economic Report (1992).

Agriculture remained the core foreign exchange earner in the 1980s. But, the contribution of agricultural GDP continued to deteriorate from 33% to 28% between 1980 and 1990 (Table

4).During the same period, the contribution of agricultural exports as a percentage of total exports generally improved from 54% to 61% in 1990. However, between 1986 and 1990, the contribution dropped from 74% to 61%.

Table 4:   Selected Indicators ·(Percentage)

YEARS	Agricultural GDP as a % of Total GDP ·	Agric. Export as a % of Total Exports	Agric. Pop. as a % of Total Population
74 - 76	35	59	83
79 - 80	33	54	81
85	34	69	79
86	33	74	79
87	32	70	78
88	32	69	78
89	33	67	77
90	28	61	77
91	28	-	76
92	29	-	-

Source: FAO, Economic and Social Department, Country Tables (1984 and 1993) and Economic Survey (1993).

Between 1980 and 1990, the value of agricultural exports registered a decline as shown by the value index in Table 5.The decline was particularly severe towards the end of 1980s and early 1990s.In addition, the volume of nominal agricultural exports improved during the same period.Real agricultural exports declined from 235.3 million to 178.0 million kilogrammes, a decline of 24.2 per cent.This study will try to establish whether the changes in real exchange rate of the Shilling during the period played part in the poor performance of the agricultural

1.4 Statement of the Problem

Like in many other developing countries, Kenya's agricultural exports have generally declined in real terms during the period, 1970-90. As noted earlier, various reasons have been adduced for the decline of real agricultural exports, either in aggregate or with reference to specific export commodities. However, in most studies the contribution of the real exchange rate to the performance of the agricultural exports has not been given adequate attention.

The central pillar of export success is sound macroeconomic policies and stable real exchange rate which the government must pursue to keep exports profitable and production efficient. Management of real exchange rate is a key incentive to both the exporters and producers. Past studies (see for instance, Tshibaka, 1986; Bautista, 1987 and Fosu, 1992) have shown that, as a sector of an economy or the economy as a whole becomes more open, the real exchange rate of the domestic currency becomes an important determinant of the sectoral or aggregate output. It is important to note that, an economy becomes more open when the share of tradable goods relative to non-tradable goods.

Kenya's economy is highly open. Hence variations in the real exchange rate is likely to explain a substantial proportion of the generally declining trends in the agricultural exports. However, this has not been given adequate attention. An equally important issue which has also not received adequate attention is the effect of the real exchange rate on the agricultural price incentives. As demonstrated earlier, the real exchange rate indirectly affects the performance of agricultural exports through the price incentive structure, with the reasonable assumption that farmers responds to the prices of agricultural exports. In addition, the high degree of tradability of agricultural output makes agricultural price incentives particularly dependent on RER movements (Valdes, 1989). This is likely to have an effect on the agricultural exports performance.

This study hopes to fill this information gap by emphirically investigating the effects of the real exchange rate

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on agricultural exports, with a particular emphasis on beverage exports (Coffee and Tea) between 1970 and 1990.

1.5: Objectives of the Study

The primary objective of this study is to measure the effects of the real exchange rate on agricultural price incentives and agricultural export performance in Kenya.

The specific objectives are:

1. To measure movements of the RER of the Shilling for the period, 1970-90.
2. To describe time profiles of price incentive structures for agricultural exports; real aggregate agricultural exports and traditional agricultural exports (coffee and tea).
3. To measure the quantitative effects of the RER movements on the price incentives structure for the agricultural exports over the period,1970-1990.
4. To estimate the quantitative effects of the RER on agricultural exports.
5. To make policy recommendations for improving agricultural export performance.

1.6: Significance of the Study

Although agricultural exports are important to Kenya's economic development, their performance have not been impressive and have generally shown a downward trend and particularly over the period, 1980-90. If the reversal of this downward trend is to be sustained over the coming years, then reasons for the decline have to be identified. As observed earlier, the decline in agricultural exports have been attributed to various factors. These reasons comprise both domestic and external factors.

The domestic factors include the inadequate infrastructure and supply of inputs, low and declining real domestic producer prices for agricultural export commodities among others. On the other hand, the external factors emanate from structure of the international commodity market. As in other developing countries, the terms of trade in the world market tend to restrict Kenya's exports. The supply of Kenya's agricultural export commodities

is limited by the low price offered at the market and respond little to the incomes of the foreign markets. All these contribute to the poor performance of agricultural exports.

Most of these factors are related to real exchange rate of the domestic currency. Thus, real exchange rate is considered to be among the major factors contributing to the decline but its role in stimulating export performance has largely been neglected. This study attempts to narrow the gap by contributing an emphirical analysis on the effects of the RER on agricultural exports through its influence on the price incentive structure.

The agricultural sector contributes significantly to the external performance of the economy. This sector generates and saves scarce foreign exchange by producing food and other agro-based raw materials which otherwise would have been imported. In addition, the sector generates foreign exchange and in doing so, contributes the largest share to Kenya's balance of trade and overall balance of payments.This sector's performance is therefore crucial to the overall growth of the economy.The stagnation of the sector translates into slower GDP growth, and decline in export earnings. This study will help generate information which will be useful in designing appropriate measures on how to improve the performance of agricultural exports. This will go along way to help the government meet its policy objectives.

CHAPTER 2

2.0: LITERATURE REVIEW

2.1: Theoretical and Empirical Literature

Oyejide (1986), observed that changes in exchange rate policy have significant consequences for a country's domestic relative prices and economic growth through their effects on the real exchange rate. Oyejide defined the real rate of exchange as the terms of trade between the traded and non-traded sectors of the economy, which provides the signal for resource movements. Oyejide further observed that exchange rate policy affects the domestic price of traded goods and non-traded agricultural commodities through its influence on the entire domestic cost structure.

Oyejide, noted that the real rate of exchange is determined, in general, by trade policy of the country and foreign prices. In this context, trade policy refers to import tariffs and export taxes. Domestic trade policy creates a wedge between domestic and foreign prices. If an export tax is imposed, the domestic price of the importable good is reduced relative to its foreign prices. This reduces the incentives for domestic consumption. This causes a reduction in exports and a shift of resources away from the exportable goods sector. If these resources flow into the production of non-tradables, the supply of these goods increase relative to their demand, with a consequent decline in their prices and increase in the RER. The removal of, or reduction in, export taxes or an increase in export tariffs would have the opposite effect.

Oyejide's analysis was based on the postulate that changes in the exchange rate policies influence the economy's level and structure of production incentives, especially the prices, and that these determine the intra and inter-sectoral flow of resources. However the study failed to account the fact that, variations in exchange rate policy or real exchange rate do not necessarily translate into relative price changes.Whether or not exchange rate policy or a change in real exchange rate have an

effect on the price incentive structure depends on the linkage between the variations in the exchange rate policies and the price incentives structure (Fosu, 1992). The notion that changes in exchange rate policy may not be transmitted into changes in production incentives and especially commodity prices has been studied by economists. For example, Jabara and Schwartz (1987), observed that, market imperfections, among other factors, could cause a break in the transmission mechanism between exchange rate policy and commodity prices. Under such conditions, commodity pricing by private producers may be conducted in such a way as to offset any potential price effects by changes in exchange rates policy, on producers.

Where no opportunities for arbitrage exists because of market imperfections, price revisions involve costs and therefore firms producing brand-name traded and manufactured goods tend to revise prices only when changes in demand and cost appear to be permanent. If changes in demand and cost are perceived by such firms to be ephemeral, then prices may not be changed in response to exchange rate changes. This implies that the effects of exchange rate changes are not passed on (Fosu, 1992).

Valdes (1989), argues that, the best way of studying how a government's macroeconomic decisions and policies affects agriculture is to evaluate the effects of such policies on the RER. This is due to the fact that correct RER alignment is required if a country is to take advantage of the growth opportunities offered by international trade. Valdes defines RER as the ratio of the price of tradables to the price of non-tradables. The price of tradables are determined by world market prices, nominal exchange rates and trade policies. On the other hand, prices of non-tradables (home goods) are determined 4domestically, by changes in domestic supply and demand. Valdes argues that, RER plays a central role in the profitability of tradables and exportables (such as coffee and tea) in agriculture. It is indeed, through RER that trade and macroeconomic management of the economy, affects agriculture. RER provides a long time signal for the allocation of the resources among various sectors. Valdes suggests that RER is perhaps the

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most influential price affecting incentives for agriculture.

Balassa (1990) indicated that exports in general and agricultural exports in particular are responsive to price incentives in Sub-Saharan Africa (SSA). The agricultural exports were found to be responsive to changes in the RER. The regression coefficients of the RER variable for agricultural exports were uniformly higher for SSA countries than for all developing countries. This indicated that changes in RER affected exports of SSA countries more than other countries. This was against the popular notion that changes in RER would have less of an effect on exports of SSA countries than in countries at higher levels of development. This, Valdes attributed to the fact that, most of the African countries overvalue their exchange rates. As a result, considerable losses were registered in export market shares of 4 SSA countries, namely, Tanzania, Kenya, Ghana and Ivory Coast, for the 1974 - 78 and 1979 - 81 period. The data showed a 1% average decrease in Tanzania's market shares in it's traditional agricultural exports in 1974 - 78, followed by a 19% decline in 1979-81. The study attributed this loss to the increasing overvaluation of the RER. The study established that the ratio of exports to agricultural value added in Tanzania would have been 18% higher in 1982, if the exchange rate remained at 1973 level in real terms. Yet the appreciation of the RER by 44% in 1973-83 period followed an appreciation of 32% between 1965 and 1973. He concurred that changes in RER did not fully reflect the adverse effect of the incentive system on agricultural exports which contributed to the decline in the ratio of the exports to the agricultural value added in Tanzania from 41% in 1973 to 14% in 1982. Other important influences were the increase in marketing margins of the parastatals that led to reductions in the ratio of producer to border prices, in particular of coffee and tea; increasing charges of agricultural inputs and deterioration of transport facilities.

In Kenya, the ratio of agricultural exports to value added was 33% in 1973 and 31% in 1982. The relative constancy of this share was attributed to the constancy of the real exchange rate and lack of discrimination against exports in agricultural

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sector. Thus, prices for export crops moved in parallel fashion during the period. In Ghana, between 1970 and 1982, the ratio of exports to agricultural value added fell from 32% to 2%. High industrial protection and increasing overvaluation of the exchange rate contributed to these results. Thus, between 1975 and 1982, the real exchange rate appreciated by 80% in Ghana. Other factors contributing to the decline include deterioration of physical infrastructure and scarcity of imported inputs.

The study used a simple model consisting of foreign export demand and domestic export supply equations to estimate the effects of price incentives and of other relevant variables on exports. The study postulates that foreign demand for a country's exports (X^F) is affected by changes in its international competitiveness. This is indicated by changes in the index of the RER, derived as the nominal exchange rate (R) adjusted for changes in the prices of traded goods (defined in terms of whole sale prices) in foreign countries (P^F_T) and in the domestic economy (P^D_T). The study introduced foreign incomes (Y^F) as an additional variable affecting exports. As a result, the foreign demand for exports was simplified as:

$$X^F = \frac{f(\,R.P^F_T\,,\;Y^F\,)}{P^D_T} \qquad (1)$$

The supply of a country's exports (X^D) is affected by changes in relative incentives of traded versus non-traded goods. This is indicated by an index of relative price indices for traded goods (P^D_T) and for non-traded goods (P^D_N). The study further introduced a domestic capacity variable (C^D). A country's supply of exports was therefore specified as :

$$X^D = g(P^D_T\,/P^D_N\,,\;C^D) \qquad (2)$$

Finally, the equilibrium condition was specified as:

$$X^D = X^F \qquad (3)$$

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This system of equations could not be successfully estimated directly, hence a reduced form of equation was estimated. In view of existence of correlation between exports and domestic capacity, the export-output ratio was used as the dependent variable. The estimated equation was specified as:

$$X = h(R.P_T /P_T^D , P_T^D /P_{Ni} , C^D, Y^F) \qquad (4)$$

The index of relative prices in the domestic economy was found to be statistically insignificant and was therefore omitted from the reported results. Balassa defined domestic capacity as the domestic value of GDP. On the other hand, the GDP of developed countries was used as a proxy for the world income.

Estimation was done by expressing all variables in terms of rates of exchange between successive years and by combining time series observations for the individual countries. The study showed that exports in general and agricultural exports in particular are highly responsive to changes in RER. The study found that exports are more responsive to price incentives in SSA than in other developing countries.

Tshikala (1986), studied the effects of trade and exchange rate policies on agriculture in Zaire. The centrality of the real exchange rate in the economic development process was emphasized by the study. A falling real exchange rate makes exportable goods less profitable. This leads producers of both farm and non-farm exports to direct resources to other activities. As a result, the exportable sector contracts and the ability of the country to earn enough foreign exchange is reduced. In addition, outflow of capital is encouraged. The effects of trade and exchange rate policies on the relative prices have substantial impact on the structure of incentives. The domestic price of farm and non-farm tradable goods relative to all exportables would increase by about 0.52% as a result of a 1% rise in the domestic price of all importables relative to all exportables. This result, implies that in Zaire, a uniform (average) tariff of say, 10% on all imports is equivalent to a tax of 5.2% on all exports. This further implies that at least

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half of the burden associated with protection of importables against foreign competition is borne by farm and non-farm exportable goods.

Tshikala, noted that the real exchange rate (E_o/P_h) plays a crucial role in both export oriented and import competing farm and non-farm activities. To determine the domestic price movements and the exchange rate policy, the study considered two types of price movements. First, Tshikala described the movements of domestic prices for home, exportable and importable goods the relation to the real exchange rate. Secondly, the study considered the way domestic prices of exportables and importables relative to home goods move with the RER overtime.

To arrive at the above conclusions the study used the following equations:-

$$\frac{P_x}{P_h} = (E_o/P_h) P_x^* (1 - t_x)(1 - d_x) \qquad (5)$$

$$\frac{P_m}{P_h} = (E_o/P_h) P_m^* (1 + t_m)(1 + d_m) \qquad (6)$$

$$\frac{P_m}{P_x} = \frac{P_m^*}{P_x^*} (1 + t_m) \times \frac{(1 + d_m)}{(1-t_x)(1-d_x)} \qquad (7)$$

Where, P_x denotes the price paid to exportable crop producer in domestic currently; P_h-home goods price; P_m^* -importable goods price; P_x^* - exportable crop World price in foreign exchange; E.- official exchange rate; t_x - export tax; d_x - domestic parallel market price distortion; t_m - import tariff.

Expressions (5) and (6) show that real exchange rate, E_o/P_h plays a crucial role in both export-oriented and import competing farm and non-farm activities. The RER provides a measure of relative prices of importables and exportables to home goods in the economy. Expression (7) implies that the domestic price of importables relative to exportables is a function of world prices, trade regime, and other price policy measures. These equations show how trade, exchange rate and other price policies

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affect the structure of relative prices facing the economy through their effects on the domestic price of tradables. The analysis by Tshikala clearly suggests that trade, exchange rate and other price policies initiated in Zaire had far-reaching negative effect on exportable goods production. These polices also tended to substantially reduce the incentive to produce exportables relative to home goods. However, the study had several limitations. The lack of data on individual policy variables (t_x, t_m, d_x and d_m) for Zaire did not allow for a detailed description of how domestic prices were affected overtime by these policy variables. The model for estimating the incidence of commercial and exchange rate policies on the structure of relative prices was based on the assumption that real income, productive capacity (measured by given stocks of capital, labor an technology) and international prices are constant. In addition, the model assumes that balance of trade is in equilibrium. All these are restrictive assumptions and do not reflect the real situation. Historical data invalidate these assumptions and call for inclusion of these variables in regression equations.

.Bautista (1987) observes that developing countries have relatively open economies in which the agricultural sector is of substantial, if not dominant, importance. Government policies that promote agricultural production in general or affect relative incentives within agriculture can therefore have significant economy wide effects. It is reasonable to expect that trade and exchange rate policies even if specifically directed to other sectors of the economy, can exert an important influence on agricultural incentives and performance. The domestic price structure is influenced by trade and exchange rate not only through the effects on relative prices of tradable goods but also through the effects on the domestic prices of tradable goods relative to home goods.

Bautista observed that agriculture in Philippines has a high degree of tradability given the dominance of export and import-competing products. Overvaluation of the domestic currency resulting from a protective trade regime acts as a tax on

tradable goods, depressing their prices (in domestic currency terms) relative to home goods. This distorts the incentive structure and penalizes agriculture by encouraging resource movement toward home goods production. Because home goods are a large part of non-agricultural production, the effect of the exchange rate overvaluation in domestic relative prices also encourages a shift in resources toward non-agricultural production. The exchange rate therefore plays an intermediary role in transmitting the effects of trade policy on agricultural production incentives.

The study estimated the RER effects arising from trade restrictions, terms of trade movements and trade imbalances. The transmission of RER effects to the domestic price structure was also analyzed. The study focussed on the impact of RER on agricultural prices relative to the prices of home goods and non-agricultural products. These two relative price measures are partial indicators of the price competitiveness of agricultural sector, reflecting the relative profitability of producing agricultural products vis-a-vis home goods and non-agricultural products. Their link to RER movements and the behaviour of domestic agricultural prices relative to prices of home goods and non-agricultural products during 1950 - 84 were investigated using the following equations:

$$\text{Log } P_a/P_h = \text{Constant} + \log r + \log T_{AX} \qquad (8)$$

$$\text{Log } P_A/P_{NA} = \text{Constant} + \log r + \log T_{AX} + \log T_{NX} + \log T_M \qquad (9)$$

Where, r denotes real exchange rate, P_a/P_h represents the domestic price index of agricultural products relative to home goods; P_a/P_{na}, represent agricultural products relative to non-agricultural products; T_{ax}, agricultural products relative to non agricultural products; T_{ax}, agricultural export tax; T_m, import tariff; T_{nx} is implicit tax on non-agricultural exports. Because the export tax and tariff variables also affect RER. Two Stage Least Squares estimation is used. The results of the study are summarized by Table (6):-

Table 6: **Estimated Equations for Relative Agricultural Prices as Dependent Variables.**

Independent Variable	Dependent Variable	
	Log P_a/P_h	Log P_a/P_{na}
Constant	- 0.404	- 0.373
Log r	0.398 (9.220)	0.329 (6.180)
Log T_{ax}	0.336 (1.680)	0.446 (2.330)
Log T_{nx}	-	-0.112 (-0.930)
Log T_m	-	-0.418 (-2.370)
R^2	0.884	0.779

Source: Bautista (1987)
NB: Numbers in parentheses are t- values.

The first column of the Table shows a coefficient estimate of 0.398 for the exchange rate variable, implying that a 10% increase in RER (or a real depreciation of 10%) will push up the relative price of agricultural products vis-a-vis home goods by slightly less than 4%. The same 10% increase in RER will lead to a 3.3% rise in domestic agricultural price relative to price of non-agricultural products according to coefficient estimate in the second column. This is understandably a smaller effect because non-agricultural output also includes tradable goods although to a lesser extent than agricultural output. This study shows that the RER is at least a partial indicator of the competitiveness of agriculture which is borne out by the significant relationships obtained emphirically between the RER and the relative agricultural prices.

Cleaver (1984), studied the impact of price and exchange

rate policies in agriculture in Sub-Saharan African (SSA). The study cited exchange rate overvaluation as one possible reason for variation in agricultural growth between African countries. The study noted that exchange rate overvaluation is rarely intended by the Governments. It is most often the result of expansionary fiscal and monetary policy directed at maximising the economic growth. The study started with the hypothesis that agricultural exports are curtailed by overvalued exchange rates. The study noted that the exchange rate determine how much in local currency is received by the exporter in return for foreign currency earnings. If the exchange rate is overvalued, the exporter will receive less in local currency for the exported produce than would otherwise be the case. This study defines the real exchange rate to be the nominal rate adjusted for the domestic inflation rate.

At empirical level, the study separated 31 countries of SSA for which data was available into two groups. The countries were divided into those with a positive rate of currency depreciation during 1970 - 81, and those having a real rate of currency appreciation. Real rates of depreciation or depreciation were obtained by adjusting for the rate of domestic price inflation. The study expected the countries with real rate of currency depreciation to have higher rates of agricultural growth. This assertion was confirmed by the result of the study. The estimated equation and the results obtained in the regression are represented in the equation that follows:

Agricultural = 1.8 + 0.15 Rate of + 0.11 % of + 1.0 Population 1.5 Public Involvement
Growth depreciation Public Growth in input supply
Expenditure
(1.0) (1.5) (1.6) (1.7) (2.3)

$$R^2 = 0.34 \qquad F(4,26) = 4.79$$

NB: t - values are in the parentheses.

The results from this study indicated that all variables were significant at the 90 per cent level or above except the

constant term. A 1 per cent per annum increase in the rate of currency depreciation is associated with a 0.15 per cent increase in agricultural growth. In conclusion, the study observed that currency overvaluation has a negative effect on agricultural growth. The currency depreciation had a significant but not very large impact on agricultural growth. However, the study noted that the exchange rate regime explained little of the variation observed in agricultural growth among the countries under study.

Fosu (1992), in a study on Ghana, provided concrete statistical evidence for the relationships between the relative agricultural prices and the real exchange rate. A rigorous econometric modelling was used. The emphirical effects of the real exchange rate on the structure of agricultural price incentives established that the real exchange rate exerts an independent statistical influence on the three relative price ratio, domestic agricultural price to the non-agricultural home goods price (P_A/P_H), domestic price for agricultural export commodities to non-agricultural price, P_{AX}/P_N and domestic price for agricultural exports to the domestic price of local food, P_{AX}/P_F at 5 per cent level. A 10% increase (decrease) in the real exchange rate stimulates a 7.5% increase (decrease) in P_{AX}/P_F, while it leads to an increase (decrease) of 7.5%, 4.2% and 3.95% in the price ratios, P_{CC}/P_F, P_{CF}/P_F and P_{SN}/P_F, producer price of cocoa to domestic aggregate food price and producer price of sheanuts to domestic food price.

Similarly, a 10% appreciation (depreciation) of real exchange rate causes a 4.0% decline (increase) in P_{AX}/P_N. The effect of the RER on domestic aggregate agriculture to non-agriculture price ratio was found to be statistically significant at 10% level. A 10% increase (i.e depreciation) of RER precipitated a 1.8% fall in domestic aggregate agricultural terms of trade. The study further shows that nominal exchange rate changes influence various Government policies. A 10% nominal devaluation of the cedi (official currency in Ghana) resulted in a 7.8%, 8.3% and 6.8% increase respectively in domestic producer prices of cocoa, coffee and sheanuts, administered by the parastatal marketing Board (Cocobod).

The study demonstrated that the RER appreciation registered during 1960-67, was associated with declines in real aggregate agricultural exports, volume of exports of cocoa and coffee and the share of exports in real aggregate agricultural output. Fosu found that, during 1960-87, the RER decline was associated with simultaneous declines in real total agricultural exports, volume of cocoa and coffee and of exports in agricultural GDP.

The study computed the elasticities of agricultural exports with respect to RER of cedi. All the computed elasticities were less than unity, implying that the response of agricultural exports to a change in the RER was not yielding at all. For example, a 10% depreciation (appreciation) of the RER stimulated a 1.82% increase (decrease) in cocoa exports and a 4.4% increase (decrease) on coffee exports. An increase in the production of particular individual traditional exports conferred larger elasticities on individual products than aggregate agricultural exports, the elasticity of which is equal to zero.

The weak response of aggregate agricultural and sheanut exports to changes in RER was attributed to lack of response to the relative prices. The inelastic response to changes in RER suggested that reliance on changes in RER to stimulate increase in agricultural exports was not adequate. There was need to complement RER policy with effective measures to provide improved infrastructure at farm level, for the handling of the agricultural exports for transport from production areas and ports and for facilitating and advising exporters.

Bautista (1990) like other studies on this subject, showed that RER changes indirectly affect agricultural production incentives. This distortion of agricultural incentives affect domestic output in the static sense through induced lower efficiency of resource use as well as in the longer run through the negative effects on agricultural labor supply, capital formation and technological innovation. The study argued that restriction of foreign trade affects relative prices and production incentives in two ways. One is through the differential effect on domestic prices of tradable goods. The other is through the effect on the RER which inturn affects the

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domestic price of tradable goods relative to home (non-tradable) goods. For example, import duties and quotas directly raise domestic price of import competing products relative to exportables, encouraging a shift away from export production. The same policy instruments have the effect of reducing the demand for imports which lowers the price of foreign exchange, making the domestic prices of tradable goods fall relative to home goods and hence indirectly biasing production incentives against both import competing and export goods.

The study also noted that a country's monetary and fiscal policies, foreign borrowing and nominal exchange rate management may critically affect the RER and hence the profitability of agricultural tradable production. In Indonesia, for example, the increased inflow of oil revenues in the mid 70s led to the Dutch disease syndrome and squeezed profitability in the non-oil tradable goods sectors, both by directly bidding resources away from them and by the appreciation of the RER induced by increase in money supply and inflation rate while nominal exchange rate was held fixed.

Bautista (1985), investigated the effects of the real exchange rate policies on relative incentives in Philippine economy, with special attention to agricultural sector. The findings indicated that during 1950-61, the direct effect of the prevailing import and foreign exchange controls had the most influence on domestic agricultural price relative to non-agricultural products. At the same time, the indirect effect through the RER also contributed significantly to the decline in the relative price of agricultural products vis-a-vis home goods.

AS trade became restrictive, the effects on the RER due to trade deficits and terms of trade assumed increased importance. During the 1975-1980, these three influences on the RER effectively lowered the domestic agricultural price by 19% relative to home goods and by 25% relative to the non-agricultural products. This reinforced the effect of falling international commodity prices at the same time, resulting in a precipitous decline in relative agricultural prices in Philippines from mid 1970's to the early 1980's.

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Apart from nominal exchange rate changes, there were other important influences on the behaviour of agricultural prices relative to the prices of home goods, and non-agricultural products. There was significant changes in foreign prices of the country's principal export commodities and the various factors responsible for sustaining massive trade deficits since 1974 including various aspects of macroeconomic policy. All these, Bautista observed had a bearing on the RER indicating, that it is a basic determinant of domestic agricultural prices relative to those of home goods and non-agricultural products. Bautista also observed that the RER bears a positive relationship to the relative domestic prices of agricultural products.

2.2 Overview of the Literature

From the literature reviewed, there is a general consensus that RER influences the agricultural price incentive structure, particularly in relation to agricultural export prices. This influence in turn, affects the agricultural performance. Since incentive structure is an important determinant of inter-sectoral (and inter-commodity) resource flows, which in turn determine the levels of sectoral and commodity, it could be argued that the RER is likely to be the major determinant of the volume of agricultural exports.

The studies reviewed have shown that RER changes indirectly affect agricultural production incentives and particularly the prices. When these prices are distorted, the output of agricultural products will be affected through reduced allocative efficiency in the static sense (given factor supplies and technologies) but also more importantly, through the longer run negative effects on agricultural labor supply, investment and technological change. All these factors are likely to be affected by relative price changes, for example, higher prices for products will attract more private capital, both physical and human into agriculture. Moreover, the higher rates of returns for agricultural projects will attract more Government expenditure. These projects might include rural infrastructural facilities and agricultural research and extension to develop and disseminate

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improved technologies. Finally, farmers will adapt new technologies only if they can expect their incomes to improve hence it is important for agricultural technological diffusion and productivity growth that price incentives are in place.

Most of these studies have suggested that RER is not the only factor that influence the performance of agricultural sector and agricultural exports in particular. As a result, they have suggested that it is not adequate to use RER as the only policy to help improve agricultural exports. There is a need to complement real exchange rate policy with effective measures to provide improved infrastructure at farm level, for the handling of agricultural exports for transport from production areas and at the ports, and for facilitating and advising farmers.

Most of the studies reviewed define RER as the price of tradables relative to that of non-tradables. To make the analysis of RER simple, they generally aggregate all production into two sectors, tradables and non-tradables. These aggregation simplifies the discussion and helps illuminate some important issues. However, this has been criticised on the ground that it has limited empirical relevance. This is due to the fact that there are no products that can be classified as tradables and non-tradables. To illustrate, a television set is a tradable product, but the price of a television set quoted in a department store reflects inputs, such as location, which are not tradable.

Most of the studies use regression analysis to explain the observed changes in relative prices with respect to RER. They fail to show the composition of the various relative prices used. For example, according to Bautista (1987), non-agricultural outputs also include tradable goods, although to a lesser extent than agricultural output. Under such circumstances, it becomes very difficult to define non-agricultural price index. In this case, researchers should clearly define what constitutes non-agricultural price as opposed to agricultural price. Most of these studies fail to show how the measured RER, that is, how they computed the RER used in their regression analysis.

CHAPTER 3

3.0 : RESEARCH METHODOLOGY

The methodology used in this study heavily draws on the empirical work of Fosu (1992).However, the model was modified to suit the needs of this study.For example,this study drops some variables which are not applicable in the Kenyan context.Fosu(1992),used a dummy variable to take on a value of zero during the structural adjustment period and unity otherwise,to capture the relative effects of the structural adjustment era.This study drops this variable given that the Kenyan government started serious implementation of structural adjustment programs in early 1990s.In the measurement of the real exchange rate,Fosu (1992) allocates equal weights to Ghana's trading partners.But relevant literature suggests that where each trading partner's share in the sum of imports and exports is available, this should be considered in the weighting exercise. This study has introduced the weights as shown in equation (12).

3.1: Measurement of Real Exchange Rate

Various studies have used different measurements for real exchange rate. For instance, Bautista (1987), defined real exchange rate to represent, for a given year, the foreign price of tradable goods relative to the home goods expressed in domestic currency.That is :

$$(10) \qquad r = RP^* / P_h$$

where, r denotes real exchange rate; R, nominal exchange rate; P^*, index of foreign prices in US dollars of tradable goods while P_h denotes index of home goods[4] prices. Bautista assumed that the foreign prices were exogenous to the small country.

Oyejide (1986), argues that general macroeconomic management policies impinge on agriculture though changes in the real rate of exchange, which plays a critical role in the

profitability of both export oriented and import-competing agriculture. The real rate of exchange measures the real terms of trade between traded and non-traded goods. This rate can be measured in a number of ways. One is the internal price level of tradable goods divided by that of non-tradable goods. Another is the nominal exchange rate multiplied by a foreign price index and divided by an internal price index. A third measure is the ratio of the nominal exchange rate to an index of the internal wage rate. In both the second and third measures, the nominal exchange rate is the predominant internal variable in determining domestic prices of tradables, whereas the wage rate is the primary input to services, which constitute the bulk of non tradables. In this analysis, RER referred to the ratio of prices of tradable goods to price of non tradables.

Cleaver (1984),defined the real exchange rate to be the trade weighted change of the exchange rate adjusted for the difference between domestic inflation rate and trade weighted average of inflation rate of trading partners.

This study adopts the measurement procedure similar to the one used by Fosu (1992).RER is defined as:

(11) $\qquad R_t = P^{-1}_{h,t}(E_t \ P_{f,t})$

Where t denotes time; P_h, is an index of home goods price; E, nominal exchange rate of the Shilling in Shillings per US dollar and P_f is the weighted index of foreign prices in US dollars.The local food component of the national consumer price index is employed as a proxy[5] for index of home goods price, P_h.The local food consumer price index (CPI) time series data is obtained from various issues of Kenya, Economic Survey and Central Bank of Kenya's Economic Reports.

In the present study, as Fosu (1992), wholesale prices are used as proxies for foreign goods prices.However, unlike Fosu (1992), foreign price index was measured in this study as follows :

$$(12) \quad P_{f,t} = a_{US,t} \cdot WP_{us\,t} + \sum_{j=1}^{n} a_{j,t} \cdot e_{usj,t} \cdot WP_{j,t}$$

where, $WP_{us,t}$ is the national wholesale price index for US in year t; $WP_{j,t}$ is the national wholesale price for the jth trading partner of Kenya other than United States in year t, and n is the number of such trading partners, $e_{usj\,t}$ denotes an index of the nominal exchange rate (US dollar per unit of domestic currency) of the jth trading partner, and a_j denotes each trading partner's share in the sum of imports and exports. It should be noted that P_f is very useful in that it incorporates the relative importance of each trading partner in the aggregate trade picture of the Kenyan economy.

In this study, 7 trading partners are considered, namely United Kingdom, Italy, Germany, USA ,Canada, Japan, Netherlands,and France. These selected trading partners account for over 60 per cent of Kenya's total trade in the study period (Economic Survey,various Issues). Fosu (1992), presents a number of reasons why empirical studies employ some direct measure of the RER based on equation (11) rather than the ratio of domestic tradable price to domestic non-tradable price (equation 10) and other definitions identified above. First, Fosu argues that the idea of price relation between tradable and non-tradable goods breaks down in situations where no clear distinction exists between tradable and non tradable goods. Secondly, in circumstances where import-competing goods are not substitutes of imports, or where the ad valorem effect of subsidies and trade barriers change, the domestic price of tradable goods is not linked to the world market price and changes in domestic tradable hence non-tradable price ratio may not accurately be reflected in changes in the real exchange rate (R) as defined in equation (11). Finally, domestic pressures can change both the price of tradables and non tradables and therefore terms of trade. In such a situation, importable and exportable goods prices cannot be combined to obtain an aggregate tradable goods

results.

3.2: Agricultural Price Incentives

This study starts with hypothesis that changes in the RER exert profound effects on the structure of price incentives which in turn, influence the volume of agricultural exports. Hence, agricultural export producers respond. indirectly to RER changes. It is important to compute the competitiveness of the agricultural sector relative to other sectors. This will help to show whether this sector has been affected by the price changes in other sectors. For example, if the price of the goods of other sectors increase relative to those of agricultural sector, it is expected that some of the producers and exporters shift to those goods which are now more profitable to produce. This is likely to affect the agricultural sector.

The effect of price incentives on the direction of inter-sectoral resource flows is well understood. The relative price changes indicate the profitability of the products in that sector . It will also indicate the profitability of that commodity relative to other competing commodities within the agricultural sector itself. All these have a bearing on the performance of the agricultural sector as this might facilitate the shifting of production to the more profitable sectors or commodities. Since response flows between sectors determine the sectoral economic performance, it is clear that price incentives also play a significant role.

In this study, two partial indicators are employed to gauge the competitiveness of Kenya's agricultural sector. The first is the ratio of the domestic aggregate agricultural price index to the domestic aggregate non-agricultural price index (P_A/P_N). This indicator reflects the relative profitability of producing agricultural commodities as against non-agricultural products.

The second indicator is the ratio of domestic agricultural price index to non-agricultural home goods price index (P_A/P_H). This ratio reflects the relative profitability

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of agricultural products against non agricultural non tradable (home) goods.Note that, non-agricultural price index comprise the prices of those goods with no relation to agriculture.On the other hand, the non-agricultural home-goods include the prices of those with no relation to agriculture but whose prices are determined from the domestic economy.

In the first case, time series data on domestic agricultural price index covering the period of study is obtained from World Bank's, World Tables (1992). Similarly, the time series data on domestic non-agricultural price index (P_N) is obtained from the same source. With reference to the second case, index of the domestic average wage rate is used as a proxy for the non agricultural home goods price[6].

In order to delineate the agricultural export price incentive structure, three indicators are used. The first is the ratio of the domestic price index for agricultural export commodities and the domestic non-agricultural price index (P_{AX}/P_N). The second indicator is the ratio of domestic price index for agricultural exports and domestic price of local food (P_{AX}/P_F). The third indicator is the ratio of the domestic agricultural export price index and price index of non-agricultural home goods (P_{AX}/P_H). All these ratios are expected to show the direction which the prices of agricultural exports changes vis-a-vis non-agricultural prices, non-agricultural home goods prices and local food prices reflecting the relative profitability of producing them. The variable P_{AX} is used here as an index of the weighted producer prices of coffee and tea which constitute the bulk of agricultural exports in Kenya.

3.3: ECONOMETRIC MODELLING

To quantify the effects of real exchange rate on the structure of agricultural price incentives and exports in this study, econometric models is used. In this section, the theoretical foundation and structure of econometric models are presented.This is followed by methods of estimation.

3.3.1: Real Exchange Rate and Price Incentive Structure

As indicated above, one the aims of this study is to examine the extent to which real exchange rate has influenced the relative prices.The effects of RER on the following price ratios are determined by the study :

(a) Domestic aggregate agricultural price to domestic aggregate non-agricultural price (P_A/P_N).

(b) Domestic aggregate agricultural price to domestic aggregate non-tradable goods price (P_A/P_H).

(c) Domestic aggregate agricultural export price to domestic non-agricultural price (P_{AX}/P_N).

(d) Producer price of coffee to domestic aggregate non-agricultural price (P_{cc}/P_N).

(e) Producer price of coffee to domestic aggregate food price (P_{cc}/P_F).

(f) Producer price of coffee to domestic aggregate non-tradable goods price (P_{cc}/P_H).

(g) Producer price of tea to domestic aggregate food price (P_{TT}/P_F).

(h) Producer price of tea to domestic aggregate non tradable goods price (P_{TT}/P_H).

The focus here is on the RER effects and their transmission to the domestic price structure and the impact of agricultural prices relative to the prices of home goods and non agricultural products. We are also concerned with the impact of RER on the producer prices of coffee and tea . All these relative price measures are partial indicators of the price competitiveness of agricultural sector and individual commodities such as tea and coffee, reflecting relative profitability of producing agricultural exports vis a vis home goods, food crops and non agricultural products. Below is an explanation of how these relative prices may be affected by RER changes.

The theoritical relationships between the relatives prices and RER are derived as follows : the economy can be divided into six markets, namely agricultural exports (Ax), agricultural imports (Am), agricultural non-tradable (home)

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goods (A_H), non-agricultural exports (Nx), non-agricultural imports (Nm) and non-agricultural home goods (N). The domestic prices of home goods, A_H and N_H are seen to be determined solely by domestic demand and supply conditions and are not directly related to foreign prices. The prices of exportable goods, Ax and Nx are those whose prices are directly linked to corresponding foreign prices. Foreign goods whose prices are directly related to corresponding foreign prices are perceived as importable goods.

Transport and handling costs aside[7], the relationship between domestic prices and foreign prices of exportables ($P_{ix,f}$) and importables ($P_{im,f}$) can be written respectively as:

(13) $P_{ix} = E \cdot P_{ix,f} (1 - T_{ix})$, $\quad i = A, N$

(14) $P_{im} = E \cdot P_{im,f} (1 + T_{im})$, $\quad i = A, N$

Where E is the nominal exchange rate; T_{ix} denotes implicit export tax, T_{im} denotes implicit tariff.

Let us model the aggregate agricultural price as a Cobb - Douglas aggregation of the agricultural export price (P), the agricultural imports price (P_{AM}) and the agricultural non-tradable or home goods price (P_{AH}):

(15) $P_A = P_{AX}^{\text{ßAX}} \cdot P_{AM}^{\text{ßAM}} \cdot P_{AH}^{1-\text{ßAH}-\text{ßAM}}$

where ßAX denotes the geometric weight of P_{AX} in P. $(0 \leq \text{ß}_{..} \leq 1)$ and so on. The analogue of equation (15) for non-agricultural price (P_N) can be written as :

(16) $P = P_{NX}^{\text{ßNX}} \cdot P_{NM}^{\text{ßNM}} \cdot P_{NH}^{1-\text{ßAH}-\text{ßAM}}$

Similarly, the aggregate home-goods price (P_H) can be written as:-

(17) $P_H = P_{AH}^{\text{ßAH}} \cdot P_{NH}^{1-\text{ßAH}}$

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Substituting (13) and (14), given that i=A into (15), we get;

(18) $P_A = [E.P_{AX,f}(1-T_{AX})]^{\text{ßAX}} \ [E.P_{AM,f}(1+T_{AM})]^{\text{ßAM}}.P_{AH}^{1-\text{ßAX}-\text{ßAM}}$

But, by definition, the real exchange rate, R, as indicated above is given by:

$R = E.P_f \ .P_H^{-1}$

where P_f denotes the aggregate foreign price of Kenya's trading partners. This real exchange rate equation can be rearranged, to obtain the following equation;

(19) $E = R.P_H.P_f^{-1}$

It should be noted that this rearrangement is done purely to make the substitution easier and does not serve any other purpose.

Substituting (17) into (19) gives;

(20) $E = R.P_{AH}^{\text{ßAH}} \ .P_{NH}^{(1-\text{ßAH})} \ .P_f^{-1}$

Substituting (20) into (18), we get;

(21) $P_A = [R.P_{AH}^{\text{ßAH}}.P_{NH}^{1-\text{ßAH}}.P_f^{-1} \ .(P_{AX,f}).(1-T_{AX})]^{\text{ßAX}} \ \ x$
$[R.P_{AH}^{\text{ßAH}}.P_{NH}^{(1-\text{ßAH})} \ .P_f^{-1}.(P_{AM,f}).(1+T_{AM})]^{\text{ßAM}} \ . \ P_{AH}^{1-\text{ßAX}-\text{ßAM}}$

Similarly, substituting (13) and (14), and given that i=N, into (16) and further substituting (20) into the result, we get:

(22) $P_N = [R.P_{AH}^{\text{ßAH}}.P_{NH}^{1-\text{ßAH}}.P_f^{-1} \ . \ P_{NX,f}(1-T_{NX})]^{\text{ßNX}} \ \ x$

$[R.P_{AH}^{\text{ßAH}}.P_{NH}^{1-\text{ßAH}}.P_f^{-1} \ .P_{NM,f}.(1+T_{NM})]^{\text{ßNM}}.P_{NH}^{1-\text{ßNX}-\text{ßNM}}$

Dividing (21) by (22) and taking the natural logarithms of the

result, gives :

$$(23) \quad \ln(P_A/P_N) = (ßAX+ßAM-ßNX-ßNM).\ln R + ßAX\ln(1-T_{AX}) +$$

$$ßAM\ln(1+T_{AM}) + ßAX\ln(P_{AX \, f}) + ßAM\ln(P_{AM} \cdot P_f^{-1}) -$$

$$ßNX.\ln(P_{NX \, f}.P^{-1}_{\, f}) - ßNM.\ln(P_{NM \, f}.P_f^{-1}) -$$

$$ßNX.\ln(1-T_{NX}) - ßNM.\ln(1+T_{NM}) + [ßAH.$$

$$(ßAX+ßAM-ßNX-ßNM) + (1-ßAX-ßAM).\ln P_{AH}] +$$

$$[(1-ßAH).(ßAX+ßAM-ßNX-ßNM) - (1-ßNX-ßAM).$$

$$\ln P_{AH} \, [(1-ßAH).(ßAX+ßAM-ßNX-ßNM) -$$

$$(1-ßNX-ßNM) \,].\ln P_{NH}$$

Equation (23) explains the natural logarithm of $(P_A/P_.)$ in terms of real exchange rate, implicit agricultural import tarrifs, inter alia. The marginal elasticity of $(P/P.)$ with respect to the RER is equal to:

$$(ßAX + ßAM - ßNX - ßNM).$$

Since $ß_{ij} \geq 0$, it follows that the marginal elasticity is positive, zero or negative when $(ßAX + ßAM) > (ßNX + ßNM)$, $(ßAX + ßAM) = (ßNX + ßNM)$, or $(ßAX + ßAM) < (ßNX + ßNM)$ respectively. This implies that given the shares of tradables in the domestic aggregate agricultural price is greater (less) than the share of tradables in the domestic aggregate non-agricultural price, an increase in R (i.e, a depreciation of the domestic currency) generates an increase (decrease) in the agricultural price to non-agricultural price ratio $(P./P.)$. On the other hand, given that the shares of tradables in domestic non agricultural price, a depreciation of the domestic currency (namely an increase in R) has no effect on the

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relative agricultural price (P_A/P_N).

Similarly, a domestic currency appreciation (decrease in R) would generate a fall (rise) in the relative agricultural price (P_A/P_N) when the share of tradables in the domestic agricultural price is greater (less) than the share of tradables in the domestic non agricultural price. If the shares of tradables in the domestic agricultural price is equal to the shares of tradables in the domestic non agricultural price, then an appreciation of domestic currency does not have any effect on the relative agricultural price.

It is also worth noting that, ßAX + ßAM = 1 - d_{AH} and ßNX + ßNM = 1 - d_{NH} given that d_{AH} and d_{NH} represent the respective shares of non tradables in the domestic agricultural price and non agricultural price. Thus, if the share of non-tradables in the agricultural price is equal to the share of non-tradables in the non-agricultural price, then changes in real exchange rate, do not have any effect on the relative agricultural price (P_A/P_N), since in this case, $1-d_{AH}$ = $1-d_{NH}$, implying that ßAX + ßAM - ßNX - ßNM = 0.

The equation which explains the agricultural price to home goods price ratio (P_A/P_H) is derived as follows: If we divide equation (21) by (17) and taking the natural logarithms of the result, we get:

(24) $\ln(P_A/P_H)$ = (ßAX + ßAM).lnR + ßAX.$(1-T_{AX})$ + ßAM.ln$(1+T_{AM})$

+ ßAX.ln$(P_{AX,f}.\ P_t^{-1})$ + ßAM.ln$(P_{AM}..P.^{1})$ +

[(1-ßAH).(1-ßAX-ßAM)].lnP_{AH} + [(1-ßAH)

.(ßAX+ßAM-1)].lnP_{NH}

This equation shows that elasticity of price ratio (P/P) with respect to real exchange rate is equal to ßAX + ßAM. Given that, ßAX + ßAM are non-negative, then this elasticity is always positive. As indicated above, ßAX + ßAM = 1 - d_{AH} and hence, ßAX + ßAM cannot be greater than 1 and thus, we can

specify that, $0 \leq \text{ßAX} + \text{ßAM} \leq 1$. When the share of
agricultural in aggregate home goods price is equal to zero
(i.e, $d_{AH} = 0$), $\text{ßAX} + \text{ßAM} = 1$, implying that a 1 per cent
depreciation of real exchange rate (i.e, an increase in R)
generates a 1 per cent increase in the agricultural price
relative to the aggregate home goods price, cateris paribus.
When the share of agriculture in aggregate home goods price is
equal to unity ($\text{ßAX} + \text{ßAM} = 0$), it implies that a change in R
exerts no effect on the agricultural price to home goods price
ratio.

In order to derive the relationship between agricultural
export price to aggregate non-agricultural price (P_{AX}/P_N) and
real exchange rate (R), the following procedure is undertaken.
Substitute (20) into equation (13), with i = A, and the result
is divided by equation (22). Then, take the natural logarithms
of the result to get equation (25):

(25) $\ln(P_{AX}/P_N) = (1-\text{ßNX}-\text{ßNM}).\ln R + \ln(1-T_{AX}) + .\ln(P_{AX.t}.P_f^{-1})$

$+ [\text{ßAH}(1-\text{ßNX}-\text{ßNM})\ln P_{..} - [\text{ßAH}(1-\text{ßNX}-\text{ßNM})]$

$.\ln P_{NH} - \text{ßNX}.\ln(P_{NX.t}.P_f^{-1}) - \text{ßNX}.\ln(1-T_{..}) -$

$\text{ßNM}.\ln(P_{NM.t}.P_f^{-1}) - \text{ßNM}.\ln(1-T_{..})$

From this equation, the elasticity of the price ratio
P_{AX}/P_N, with respect to R is equal to (1 - ßNX - ßNM). Given
that (ßNX + ßNM) lies between zero and one, when the share of
tradables in non agricultural price is equal to zero (i.e ßNX
+ ßNM = 0), the elasticity of P_{AX}/P_N with respect to R is
unity, which implies that a 1% increase (decrease) in the real
exchange rate generates a 1% increase (decrease) in P_{AX}/P_N.
When the share of tradables in the non-agricultural price is
equal to unity (i.e ßNX + ßNM = 1), the elasticity of P_{AX}/P_N
with respect to R is equal to 0, and changes in RER do not
exert any effect on P_{AX}/P_N. It could be inferred that the
smaller (larger) the share of tradables in the domestic non-

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agricultural price, the larger (smaller) the magnitude of the effect of a change in the RER on P_{AX}/P_N. It is interesting to note that, the smaller (larger) the share of tradables in non-agricultural price, the larger (smaller) is the share of home goods in the non-agricultural price (i.e d_H). Hence, it could be argued that the larger (smaller), the share of home goods in the agricultural price, the larger (smaller) the magnitude of the effect of a change in RER on P_{AX}/P_N.

To derive the relationship between the coffee producer price to non-aricultural price ratio (P_{cc}/P_N) and RER, we can disaggregate the agricultural export price into coffee (P_{cc}) and non-coffee (P_{ncc}), components with shares bcc and (1-bcc) respectively (0 < bcc ≤ 1). Assuming that price aggregation is of Cobb-Douglas form, then we write :

(26)
$$P_{cc} \quad P_{AX}^{b_{cc}} . P_{ncc}^{1(1-b_{cc})}$$

Substituting for P_{AX} and P_{ncc} , the result will be :

(27)
$$P_{cc} = [R \quad P_{AH}^{\beta AH} . P_{NH}^{1-\beta AH} \quad (\quad$$
$$(1 - T_{AX})^{b^{-1}cc}] X [R . P_{AH}^{\beta AH} \quad$$
$$(P_{ncc} \quad P_{f}^{1}) (1 - T_{ncc})]$$

If you divide equation (27) by (22) and take the natural logarithms of the result, we will get the following equation:

(28)
$$Ln (P_{cc} / P_N) = (1 - \beta NX - \beta NM) \quad Ln$$
$$Ln (1 - T_{AX}) + (b_{cc} - 1)$$
$$Ln (P_{ncc} . f \quad P_{f}^{-1})$$
$$Ln (P_{NX} . f \quad P_{f}^{1}) - \beta N$$
$$Ln (1 + T_{NH}) - \beta AH (1 - \beta NX -$$
$$LnF_{AH} - \beta AH (1 - \beta NX - \beta NM$$

Then, dividing equation (27) by (17) and taking the natural
logarithms of the result, we get :

(29)
$$Ln(P_{cc}/P_H) = LnR + b^{-1}cc \ldots$$
$$b^{-1}cc \cdot Ln(P_{AX,f} \cdot P_f^{-1}) \ldots$$
$$LnP_{AH} - (1-\beta AH) \cdot LnP_{NH} \ldots$$
$$(1-b^{-1}cc) \times Ln(1-T_{nc}) \ldots$$
$$(1-b^{-1}cc) \cdot Ln(P_{cc} \ldots)$$

A comparison of equation (29) and (28) reveals that
whereas the elasticity of P_{cc}/P_H with respect to R, is equal to
unity, the elasticity of P_{cc}/P_N is equal to $(1-\beta NX-\beta NM)$. It is
evident that whereas the latter elasticity is equal to the
corresponding elasticity of P_{AX}/P_H, the former is equal to
corresponding elasticity of P_{AX}/P_N and the implications
identified earlier still remains in force in equations (28)
and (29).

In order to derive the effect of the RER on P_{AX}/P_F, the
agricultural price can be disaggregated into food export price
$P_{AX(F)}$ and agricultural non-food price ($P_{AX(NF)}$), with respective
shares equal to hF and (1-hF). In addition, we can also
disaggregate the food price P_F into its export ($P_{AX(F)}$) and non-
tradable ($P_{AH(F)}$) and import ($P_{AM(F)}$) components with respective
shares equal to g_{FX}, g_{FH} and $(1-g_{FX}-g_{FH})$. Suppose that, Cobb-
Douglas aggregation of price prevails. Given that $P_{AX(F)}$ and
$P_{AX(NF)}$ can be respectively defined as:

$$P_{AX(F)} = E \cdot P_{AX(F),f} \cdot (1-T_{AX(F)})$$

$$P_{AX(NF)} = E \cdot P_{AX(NF),f} \cdot (1-T_{AX(NF)})$$

where
$$E = R \cdot P_{AH}^{\beta AH} \cdot P_{NH}^{\beta NH} \cdot F$$

We can write the following equations :

$$[R \cdot P_{AH}^{\beta AH} \cdot P_{NH}^{1-\beta AH}(P_{AX(F)} \cdot t \\ (1-T_{AX(NF)})]^{1-HF}$$

$$P_t = [R \cdot P_{AH}^{\beta AH} \cdot P_{NH}^{1-\beta AH}(P_{AX(F)} \cdot t \\ (1-T_{AX(F)})]^{gFX} \cdot P_{AH(F)} \\ \cdot [R \cdot P_{NH} \cdot (P_{AM(F)} \cdot t \cdot P_f^{-1}) \\ (1-T_{AM(F)})]^{1-gFX-gFH}$$

Dividing equation (27) by P_F and taking the natural logarithms of the result, will give the following equation:

(30)
$$Ln(P_{cc}/P_t) - g_{FX} \cdot LnR + D \\ Ln(1-T_{AX}) + b^{-1}cc \cdot Ln(P_{AX} \cdot t \cdot P_t^{-1}) \\ (1-b^{-1}cc)Ln(1-T_{ncc}) - (1-b^{-1}) \\ Ln(P_{am} \cdot t \cdot P_t^{-1}) \cdot g_{FX} \cdot Ln(1-T_{AX}) \\ Ln(1-T_{AH(F)}) \cdot (1-g_{FX}-g_{FH}) \cdot Ln \\ \beta AH \cdot g_{FH} \cdot LnP_{AH} + g_{FH}(1-\beta AH)$$

The implication of this equation is similar to the one identified above.

The analogues of (28), (29) and (30) could be derived for tea, with similar implications.

At empirical level, since the focus of this study is the effect of the real exchange rate, and for reasons of data availability, the following econometric functions which are analogues of (23) to (25), (28), (29) and (30) are estimated to determine the quantitative effect of the real exchange rate

on the structure of agricultural price incentives.

(31) $\ln (P_A/P_N) = f_1 (\ln R, \ln(1-T_{AX}), e_1)$

(32) $\ln (P_A/P_H) = f_2 (\ln R, \ln(1-T_{AX}), e_2)$

(33) $\ln (P_{AX}/P_N) = f_3 (\ln R, \ln(1-T_{AX}), e_3)$

(34) $\ln (P_j/P_N) = f_{4j} (\ln R, \ln(1-T_{AX}), e_{4j})$

(35) $\ln (P_j/P_H) = f_{5j} (\ln R, \ln(1-T_{AX}), e_{5j})$

(36) $\ln (P_j/P_F) = f_{6j} (\ln R, \ln(1-T_{AX}), e_{6j})$

Where j = Coffee (P_{cc}), Tea (P_{TT})

The variable e_j denotes stochastic error terms which satisfy the classical normal regression assumptions. Using the nominal exchange rate (shillings per one US dollar), the aggregate domestic agricultural export price index (P_{AX}) and the unit value index of agricultural exports $(P_{AX,f})$ obtained from F.A.O., Production Year Book, $(1-T_{AX})$ is generated via Equation (13) with i=A.

3.3.2: Real Exchange Rate and Agricultural Exports

The real exchange rate of a domestic currency does not influence the agricultural exports directly. It influences agricultural exports through its effect on the incentive structure (Fosu, 1992).

Therefore, to quantify the effect of the exchange rate on the agricultural exports, this study specifies export functions, which depend inter alia on relative prices. These functions are combined with relative price functions (31) to (36), above, to generate the effects of the RER. The following econometric export functions will be employed:-

(37) $\ln X_{A,t} = X_A (\ln X_{A,t-1}, \ln (P_{AX}/P_F)_t, \ln (P_{AX}/P_N)_t,$

$$\ln W_t, \ln Y_t, U_{1,t})$$

Where, $X_{A,t}$, $X_{A,t-1}$ represent the real aggregate agricultural exports in the current period and in the previous period;

P_{AX}/P_F represent agricultural export price relative to aggregate food price, P_{AX}/P_N, denotes agricultural export price relative to non agricultural price, W_t, denotes national average annual rainfall, Y_t, denotes the income of Kenya's trading partners while $U_{1,t}$ represents a stochastic error term.

(38) $\text{Ln } X_{cc,t} = X_{cc} (\text{Ln } X_{cc,t-1}, \text{Ln } (P_{cc}/P_F)_t, \text{Ln } W_{\cdots}, \text{Ln } Y_t,$

$$U_{2,t})$$

Where, X_{cc}, denotes volume of coffee exports; P_{cc}/P_F, coffee producer price relative to food price; W_c, average annual rainfall in coffee belt; Y_t, is as defined above and $U_{2,t}$ is a stochastic error term.

(39) $\text{Ln } X_{TT,t} = X_{TT} (\text{Ln } X_{TT,t-1}, \text{Ln}(P_{TT}/P_F)_t, \text{Ln}W_{T t}, \text{Ln } Y_t, U_{3,t})$

Where X_{TT}, denotes volume of tea exports, W_T, Y_t, P_{TT}/P_F and $U_{3,t}$ are as defined above.

3.3.3: Model Estimation

The following sets of equations constitutes a recursive system: equations (37), (33) ; equations (38), (36) for j=coffee and equations (39) and (36) for j= Tea. A system of equations is recursive if each of the endogenous variables can be determined sequentially. From econometrics literature, ordinary least squares (OLS) method is the most appropriate for estimating each of the equations in a recursive system (Johnston (1984), Pindyck and Rubinfeld (1991)).

This method is employed in the present study. Ordinary least squares is the appropriate estimation procedure because most of the explanatory variables in the equations to be estimated are pre-determined and therefore are not correlated with error terms. The rest of the equations are also estimated using OLS method.

3.4: DATA SOURCES

This study makes use of secondary, annual time series data for the period between 1970 and 1990.Data is obtained from Statistical Abstracts; Economic Survey; Coffee and Tea Boards of Kenya, Annual Reports; Central Bank of Kenya, Economic reports and world Bank and IMF publications which include World Bank Tables, and IMF,International Financial Statistics.

CHAPTER 4

4.0:DATA ANALYSIS AND REGRESSION RESULTS

4.1: THE TIME PROFILLES OF THE REAL EXCHANCE RATE (RER) AGRICULTURAL PRICE INCENTIVES, AND AGRICULTURAL EXPORTS.

In this section, the behaviour of the real exchange rate (RER) of the Shilling during the study period is described. This section also examines the behaviour of the agricultural exports, by providing their time profiles between 1970 and 1990. Finally, the time profiles of the real aggregate agricultural exports and the specific traditional agricultural export commodities (Tea and Coffee) are described.

4.1.1: Time profile of the real exchange Rate (RER) of the Shilling.

The time profile of RER of the Shilling as measured per equation 11, in chapter 3 is depicted in figure 1 (in Appendix 1). Figure 1 shows that there was a general upward trend in RER between 1970 and 1990. However, the RER registered a decline between 1976 and 1981. A sharp increase in RER was recorded between 1985 and 1990.Table 7 below summarises the percentage increase (+) or decrease (-) in the real exchange rate over the years.

Table 7 :

Changes (in Percentage) of the RER of the Shilling.

Period	Percentage Change
1970 - 74	+41.6
1974 - 75	-6.4
1975 - 76	+7.4
1976 - 78	-8.3
1978 - 79	+0.4
1979 - 81	-6.5
1981 - 82	+5.5
1982 - 83	+9.6
1983 - 84	-10.3
1984 - 90	+57.6
1970 - 90	+99.9

Source : Basic Data are from the International Financial
Statistics, IMF (various issues); the Kenya,
Economic Survey (various issues) and the Central
Bank of Kenya, Economic Reports (1993).

From Table 7, it can be observed that the largest annual
percentage rise in the RER, was recorded in the period between
1984 and 1990 and is equal to +57.6 per cent. The smallest
rise is equal to +0.4 per cent, and was recorded between 1978
and 1979. On the other hand, the largest annual percentage
decline in the rate of exchange rate was equal to -10.3,
recorded in 1983 - 84, while the lowest decline was -6.4 per
cent, recorded in the period, 1974 - 75.

The behaviour of the real exchange rate of the Shilling
can further be observed by considering the compound growth

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rates of the RER for the decades of the 1970s, 1980s and the period 1970-90 as seen in Table 8.

Table 8:   Percentage Growth of Real Exchange Rate (RER).

PERIODS	GROWTH
1970S	+ 27.0
1980S	+ 53.5
1970 - 1990	+ 35.6

Source :   Basic Data are from the International Financial
           Statistics, IMF (various issues); the Kenya,
           Economic Survey (various issues) and the Central
           Bank of Kenya, Economic Reports (1993).

From this Table, it can be observed that the growth rate of the real exchange rate was positive both in 1970s and 1980s. This implies that the Shilling depreciated in real terms in both periods. In the period, 1970-90, the growth rate of the RER was more than 30 per cent implying that the real exchange rate of the Shilling depreciated in real terms in the same period.The observation that the RER demonstrated an upward trend during 1970 to 1990, is further borne out by the emphirical linear regression result in the equation below. The figures in the parentheses are t-values and T denotes trend term.

$$R = 11.0575 + 0.2884T^a$$
$$(14.3998)   (4.7153)$$
$$R^2 = 0.5392 \qquad F\text{-ratio} = 22.23^a$$

a - the trend term and the coefficients are significant
    at 5 % level of significance.

Hence, the value of the Shilling depreciated in real terms during the period, 1970-1990.

<u>4.1.2</u>: <u>Time Profiles of the Agricultural Price Incentives and</u>
     <u>Agricultural Exports</u>

     As mentioned earlier, price incentives are relevant in
determining the direction of intersectoral resource flows.
This is due to the fact that, relative prices indicate
relative profitability of production in one sector or of a
commodity as against competing sectors or other commodities.
In this way, price incentives play a significant role in
determining sectoral economic performance. In this section,
the time profiles of P_A/P_N (Price of agricultural goods to non-
agricultural goods) and P_A/P_H (price of agricultural goods to ·
non-traded home goods), during the study period are presented
in Figure 2 (in Appendix 1). The growth rates of P_A/P_N and P_A/P_H
are presented in Table 9.

Table 9: Compound Growth Rates of P_A/P_N and P_A/P_H (in
         Percentage)

Period	P_A/P_N Growth	P_A/P_H Growth
1970s	+ 4.07	+ 1.8
1980s	- 0.56	- 0.5
1980-85	0.116	+ 0.5
1970-90	+ 1.11	+ 0.38

Source :   Basic Data from World Bank Tables (1992), and the
              Year Book of Labour Statistics, ILO (1993).

     Figure 2, shows that over the period, there was a general
upward trend for both P_A/P_N and P_A/P_H. This is further borne out
by the compound growth rates indicated in Table 9. From the
Table, it can be seen that between 1970 and 1990, the growth
rate for P_A/P_N was 1.11 percent.However, the growth rate
declined by 0.56 percent per annum in 1980s. Similarly, there
was an upward trend for P_A/P_H over the period [1970-90] ,and
the growth rate was 0.38 percent. However, the growth rate
for P_A/P_H declined by 0.5 percent in 1980s. These results
indicate that over the study period [1970-90],the terms of

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trade favoured the agricultural sector. These results further indicate that, although the terms of trade favoured the agricultural sector in 1970s, they turned against it in 1980s. Figure 1 shows that there was a sharp increase in the relative price ratios of agricultural to non-agricultural goods (P_A/P_N) and agricultural to home goods (P_A/P_H). This can be attributed to the sharp increase in the prices of agricultural export goods and in particular coffee following the coffee boom of 1977.

In order to describe the agricultural export price incentive structure, the study used three indicators, namely P_{AX}/P_N, P_{AX}/P_H, P_{AX}/P_F [domestic price index for agricultural export commodities to non-agricultural goods; domestic agricultural export price index to the price index of non-traded home goods and domestic index for agricultural exports to domestic price of local food respectively]. Complete time series data on the world prices of non-traditional agricultural export commodities and their share in total agricultural exports were not readily available. For this reason, their domestic prices were not included in computation of domestic agricultural export price index [PAX]. The time profiles of P_{AX}/P_N, P_{AX}/P_H, and P_{AX}/P_F and their compound growth rates are presented in figure 3 (in Appendix 1) and Table 10.

Table 10: Compound Growth Rates (per cent) of P_{AX}/P_N, P_{AX}/P_H, P_{AX}/P_F

Period	PAX/PN	PAX/PH	PAX/PF
1970s	+ 7.47	+ 5.98	+ 4.65
1980s	+ 1.10	+ 1.14	+ 0.55
1980 - 85	+ 6.02	+ 6.7	+ 2.02
1970 - 90	+ 3.82	+ 3.59	+ 2.75

Source: Computed from Basic Data Obtained from the Kenya, Economic Survey (various issues), Central Bank of Kenya, Economic Reports (1992) and Year Book of Labour Statistics, ILO (1993).

This Table shows that, over the entire period (1970 - 90) it was a little more profitable[8] to produce agricultural export commodities than to produce non-traded home goods and local food. This conclusion is drawn from the fact that between 1970 and 1980, the P_{AX}/P_N rose by 3.82 per cent per annum while P_{AX}/P_H and P_{AX}/P_F rose by 3.59 and 2.75 per cent respectively. It is worth noting that the growth rates of P_{AX}/P_N, P_{AX}/P_H and P_{AX}/P_F were higher in 1970s than in 1980s. This can be explained by the fact that during the 1970s the prices of agricultural export commodities were very high and in particular coffee due to the 1977 coffee boom in Kenya. In 1970s, the growth rate for P_{AX}/P_N was 7.47 per cent per annum while the rates for P_{AX}/P_H and P_{AX}/P_F were 5.98 and 4.65 per cent respectively. However, in 1980s the growth rates (in percentage) reduced to 1.10, 1.14 and 0.55 for P_{AX}/P_N, P_{AX}/P_H and P_{AX}/P_F, respectively. This confirms the fact that the terms of trade favoured agricultural exports more in 1970s than in 1980s.

Figure 3 shows that there was a sharp increase in the following price ratios, P_{AX}/P_N, P_{AX}/P_H and P_{AX}/P_F. As observed above, there was a sharp increase in the price of coffee making the aggregate price of agricultural exports to rise more than the relative prices of food and home goods.

Finally, in this section we examine the time profiles and growth rates for the real agricultural exports and Kenya's exports of traditional commodities, namely tea and coffee. The time profile of real agricultural exports is depicted in Figure 4 (in Appendix 1) while the growth rates are presented in Table 11, below.

Table 11: Growth Rates (Per Cent) of Real Agricultural Exports

Period	Growth Rate
1970s	+73.74
1980s	-28.70
1970 -1990	+19.97

Source: The Basic Data are from Kenya, Economic Survey
(Various Issues) and Central Bank of Kenya, Economic
Reports (1993).

Figure 4 (in Appendix 1) shows that there was a general upward trend for the real agricultural exports.However,the real agricultural exports declined between 1973 and 1976.This can be attributed to the decline in average annual rainfall, which during this period declined from 1193 to 965 millimeters (Statiscal Abstract,1977).Note that, real exports(in quantities) are obtained by dividing the nominal exports by $P_{..}$ (agricultural export prices).

Figure 4 also shows that there was a sharp increase in real exports between 1980 and 1981, followed by a decline between 1981 and 1984.This decline can also be explained by decline in rainfall during the period,from 1120 to 661 millimeters.The conclusions drawn from Figure 4 can further be attested by the growth rates indicated in Table 11 above.Between 1970 and 1990 the real agricultural exports registered a positive growth rate of 19.97 per cent per annum.At the same time, the growth rates for the real agricultural exports rose in 1970s by 73.74 per cent while it declined in 1980s by 28.70 per cent per annum.Therefore a conclusion can be drawn to the effect that real agricultural exports declined in real terms in 1980s as earlier noted in Chapter one.

The time profiles of tea and coffee are depicted in Figure 5 (in Appendix 1) while the compound growth rates are presented in Table 12, below.

Table 12: Compound Growth Rates (per cent) of Traditional Agricultural Export Commodities.

Period	Coffee	Tea
1970s	+ 4.96	+10.93
1980s	+ '2.98	+ 6.97
1980 - 85	+ 5.18	+ 6.83
1970 - 90	+ 9.67	+18.06

Source: The Basic Data are from Kenya, Economic Survey (various issues); Statistical Abstract, Coffee and Tea Boards of Kenya, Annual Reports and Accounts (various issues).

Figure 5 (in Appendix 1) shows that there was a general upward trend for both tea and coffee exports during the period, 1970 - 90. This conclusion is further borne out by growth rates indicated in Table 12. Coffee exports rose over the period 1970 - 90, registering a positive compound growth rate of 9.67 per cent per annum. At the same time, the compound growth rates for the coffee exports rose in 1970s and 1980s by 4.96 and 2.98 per cent per annum, respectively. This shows that coffee exports increased more in 1970s than in 1980s.

On the other hand the tea exports rose more than the coffee exports by registering a growth rate of 18.06 per cent per annum, during the period, 1970 - 90. In 1970s and 1980s, the tea exports rose by 10.93 and 6.97 per cent, respectively. These results indicate that the compound growth rates for tea exports were higher than those ones of coffee through out the entire period (1970 - 90). Infact the growth rate for tea exports doubled the one for coffee exports, during this period (1970 - 90) as shown in Table 12. This can be attributed to the fact that, the government embarked on a campaign to help the small scale tea growers to improve their production. Over

the period the tea production by small scale tea growers has doubled and now these tea growers form the back bone of the tea industry [Economic Survey(various issues) and Tea Board of Kenya, Annual Reports(various issues)].

4.2: Real Exchange Rate Effects on Agricultural Price Incentives - Emphirical Economic Results

A comparison of the real exchange rate of the Shilling, as seen in figure 1, with time profiles of P_A/P_N and P_A/P_H, shows that the real exchange rate variable, P_A/P_N and P_A/P_H had an upward trend during the period, 1970 - 90. This suggests that there was a positive relationship between the real exchange rate variable, P_A/P_N and P_A/P_H over the entire period (1970 - 90). This implies that a real depreciation of the real exchange rate was associated with improved agricultural prices and in particular for agricultural exports. However, it is interesting to note that between 1977 and 1981, the time profiles for the real exchange rate, P_A/P_N and P_A/P_H indicate a downward trend. This imply that a real appreciation of the RER caused a deterioration in relative agricultural price incentives.But,the time profile of RER shows an upward trend between 1984 and 1990 while that one of P_A/P_H and P_A/P_N indicate downward trend.This implies that other factors influenced the price incentive structure during the period.

On the other hand, comparing the time profiles of the RER (Figure 1), P_{AX}/P_N, P_{AX}/P_H and P_{AX}/P_F (Figure 3), we find that all of them had an upward trend during 1970 - 90. This shows that during this period there was a positive relationship between the real exchange rate and the three price ratios. This has the implication that, a real depreciation of the real exchange rate precipitated an improvement in relative agricultural export prices. Between 1974 and 1975, 1977 - 81 the P_{AX}/P_N, P_{AX}/P_H and P_{AX}/P_F had a downward trend just as did the real exchange rate. This shows that there was a positive relationship between the real exchange rate and the three price ratios. Hence, a real appreciation was associated with a

deterioration of relative agricultural export prices.However, the time profile of RER indicate an upward trend between 1986 and 1987 while that one of P_{AX}/P_N, P_{AX}/P_F and P_{AX}/P_H shows a declining trend.As noted above other factors apart from RER influenced the relative price incentive structure.It should be noted that the poor performance of the agricultural exports observed earlier during the late 1980s cannot be explained by changes in the real exchange rate. This suggests that the poor performance can be attributed to deterioration of prices as a result of other unspecified factors.

So far, the analysis has been descriptive and to provide more concrete statistical evidence on the relationships between the relative agricultural prices and the real exchange rate, econometric models has been used. As indicated in Chapter 3, it is hypothesized that each of the relevant relative price ratios is a function of the real exchange rate, R and $(1 - T_{AX})$, where T_{AX} represents implicit agricultural export tax. In this study, the natural logarithms of a given dependent variable in (P_i/P_j) are regressed on the natural logarithms of the real exchange rate, R and $(1 - T_{AX})$ using Ordinary Least Squares (OLS) method.The expected signs of Ln R and $Ln(1 - T_{AX})$ are that, they are positive.The logical basis of these signs has been discussed in Chapter 3.The variables were expressed in natural logarithms hence the coefficients are elasticities.Note that an elasticity measures the effect of a percentage change in an explanatory variable on the dependant variable.

A number of diagnostic tests were done to determine the suitability of the data used in the study.The test for heteroscedasticity was done using the Arch tests.It was found that the Heteroscedastic Conditional Standard Errors (HCSE) were very close to the actual standard deviations ruling out the problem of heteroscedasticity.

This study also carried out the Jarque-Bera (JB) Normality tests. They were done to determine whether the error terms are normally distributed.From the literature, the error terms must be normally distributed for ordinary least squares

(OLS) to be efficient and consistent. The JB tests make use of the four moments of distribution, namely; means, standard deviation, skewness, and excess kurtosis along side the minimum and maximum values of the series to construct a distribution. A comparison is then made with the equivalent values produced by the standard normal distribution. The distribution is distributed as CHI^2 statistic.

The results indicate that all the variables have defined means, standard deviations, minimums and maximums. Therefore the variables satisfy the JB Normality tests.A conclusion can therefore be drawn to the effect that all the variables used in the estimation are normally distributed.The following is a representative test of some estimated equations(Table 13).

Table 13 : Analysis of Scaled Residuals (JB tests)

	$Ln(P_A/P_N)$	$Ln(P_A/P_H)$	$Ln(P_{AN}/P_H)$
Mean	.0000	.0000	.0000
Standard Deviation	.8819	.9129	.8498
Skewness	.4860	.8459	.5539
Excess Kurtosis	-.1905	.4702	-.2402
Minimum	-1.3713	-1.4652	-1.4457
Maximum	1.9765	2.3557	1.8620

CHI^2 (2) test for normality: .572   1.927   .696

The error terms are normally distributed given that CHI^2 (2) for normality should be less than the critical value of 6.0.

The models were re-estimated using OLS and both the dependant and explanatory variables were lagged by two periods where it is appropriate.The variables which were not significant were eliminated one by one and the results obtained are as follows:

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The empirical effects of the real exchange rate on the structure of the agricultural price incentives are reported in Table 14.

Table 14: Regression Showing the Effect of Real Exchange Rates on Agricultural Price Incentives.

Explanatory Variables	DEPENDENT VARIABLE				
	Ln(PA/PN)	Ln(PA/PH)	Ln(PAX/PN)	Ln(PAX/PH)	Ln(PAX/PF)
$Ln(PA/PN)_{t-1}$	0.5324a (1.6151)				
$Ln(PA/PH)_{t-1}$		0.5507* (2.8965)			
$Ln(PAX/PN)_{t-1}$			0.5771* (4.4548)		
$Ln(PAX/PH)_{t-1}$				0.7820* (5.9505)	
$Ln(PAX/PF)_{t-1}$					0.6484* (3.6625)
Ln R		0.2283a (1.5508)	1.0882* (1.5961)	0.2539 (0.4622)	
$Ln(R)_{t-2}$	0.3309* (1.9779)		0.5625 (0.8499)		0.3470 (0.6743)
$Ln(1-T_{AX})$	0.2088 (1.6945)		1.1498* (3.0699)	0.7589 (1.7474)	1.1650* (2.6550)
$Ln(1-T_{AX})_{t-1}$	-0.3045* (-2.6044)	-0.1826a (-1.5052)		-1.8798* (-3.6164)	-1.8727* (-3.422)
$Ln(1-T_{AX})_{t-2}$			0.2662 (0.6831)	0.8047 (1.953)	0.6897 (1.6593)
Constant	0.5351* (3.1877)	0.1233 (0.3671)	-0.9163 (-0.6542)	-0.1329 (-0.1246)	-0.8984 (-0.6470)
R^2	0.5656	0.3923	0.7429	0.7723	0.6427
$F(V_1, V_2)$	4.56* [3,15]	3.33* [3,15]	7.51* [5,13]	8.82* [5,13]	4.68* [5,13]
DW	2.02	2.29	1.91	1.99	2.09

NB: Figures in the parentheses are t-values.
* - Significant at 5 per cent level.
a - Significant at 10 per cent level.

From Table 14 it can be observed that the real exchange

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rate exerts an independent statistical influence on the
relative price ratios, P_A/P_H and P_{AX}/P_N at 10 per cent level.
This is indicated by their respective t - ratios. This implies
that changes in real exchange rate has an effect on these
relative price ratios. The positive signs of the effect
implies that an increase (decrease) in the RER stimulates a
increase (decrease) in the two relative price ratios.

For example, a 10 per cent increase (i.e depreciation) of
the RER precipitates a 10.88 per cent increase in the domestic
aggregate agricultural export to non-agricultural price ratio
(P_{AX}/P_N). This further implies that the domestic aggregate
agricultural export terms of trade will increase by 10.88 per
cent per year. On the other hand, a 10 per cent decline (i.e
appreciation) of the RER stimulates a 10.88 per cent decline
in the same price ratio. These results confirm the conclusions
drawn above, where a comparison of the time profiles of the
RER and the relevant price ratios was considered. It is worth
noting that, 10.88 per cent is an average figure for the
period under study. The magnitude of the response may vary
overtime and thus the most appropriate procedure would be to
vary the time parameter in the econometric models. When the
RER variable is lagged by two periods, P_A/P_N is signicant at
5 per cent level.The positive coefficients associated with RER
variable in the P_A/P_H and P_{AX}/P_N confirm the positive
relationship observed earlier from the geometric analyses
involving the time profiles of the relevant variable in
section 4.1.2.

The implicit agricultural export tax exerts an
independent statistical influence on P_{AX}/P_N and P_{AX}/P_F
regression equations at 5 per cent level. At the same time,
this variable has the expected positive sign, implying that it
has an effect in the relevant relative price ratios. The
implicit agricultural export tax variables are also
statistically significant in P_A/P_N and P_{AX}/P_H regression
equations at 10 per cent level.They also exhibit the expected
signs. The results imply that an increase (decrease) in the
magnitude of the implicit tax on agricultural exports which

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results in a 10 per cent reduction (rise) in $1 - T_{AX}$ induces a 11.5 per cent decline (rise) in the price ratio between agricultural exports and non-agricultural goods (P_{AX}/P_N). On similar terms, if the change in the impicit agricultural tax generates a 10% fall in $1 - T_{AX}$, then P_{AX}/P_F and P_{AX}/P_H will decrease (increase) by 11.65 and 7.59 per cent, repectively.Note that, when the implicit agricultural export tax variable is lagged,all the relevant regression equations are statistically significant.

The results for the individual agricultural export commodity prices with respect to non-agricultural prices, non-traded home goods and food prices are presented in Table 15.

Table 15: Regression Results Showing the effect of the RER on Domestic Prices of Coffee and Tea Relative to Food, Non- Agricultural Home Goods and Non-agricultural Goods

Explanatory Variables	DEPENDENT VARIABLES •					
	$Ln(P_{CC}/P_N)$	$Ln(P_{TT}/P_N)$	$Ln(P_{CC}/P_H)$	$Ln(P_{TT}/P_H)$	$Ln(P_{CC}/P_F)$	$Ln(P_{TT}/P_F)$
$Ln(P_{CC}/P_N)_{t-1}$	0.6503* (2.7466)					(
$Ln(P_{TT}/P_N)_{t-1}$		0.5667* (2.8616)				
$Ln(P_{CC}/P_H)_{t-1}$			0.7125* (3.222)			
$Ln(P_{TT}/P_H)_{t-1}$				0.4775ᵃ (1.8693)		
$Ln(P_{CC}/P_F)_{t-1}$					0.0117 (0.0443)	
$Ln(P_{CC}/P_F)_{t-1}$					-0.4076 (-1.8652)	
$Ln(P_{TT}/P_F)_{t-1}$						0.1271 (0.5234)
Ln R	0.7068 (0.7816)	1.9958* (2.3327)	1.0380ᵃ (1.6413)	2.1706* (2.1435)	0.3732 (0.8841)	2.1151* (2.5645)
Ln(R)	0.3743 (0.4404)	1.5792ᵃ (1.7975)		1.5506 (1.1085)		
Ln(R)$_{t-2}$			0.2469 (0.4025)	0.0638 (0.0669)		
$Ln(1-T_{AX})$	0.7671ᵃ (1.5742)	0.6412ᵃ (1.5134)			1.2840* (2.9962)	1.0119* (2.4173)
$Ln(1-T_{AX})_{t-1}$		1.4364* (2.8322)	0.6329 (1.4938)	0.9067ᵃ (1.7995)		
$Ln(1-T_{AX})_{t-2}$		0.4482 (1.0795)		0.3508 (0.6470)		
Constant	0.8359 (0.6423)	0.2838 (0.2220)	0.4788 (0.3509)	0.1195 (0.0730)	4.8689* (3.5435)	1.8520 (1.1799)
R^2	0.6093	0.6387	0.5332	0.4980	0.6389	0.5675
$F(V_1,V_2)$	4.37ᵃ [5,14]	3.54ᵃ [6,12]	4.00ᵃ [4,14]	3.98ᵃ [6,12]	6.19* [4,14]	3.41 [6,12]
D.W	1.800	2.108	1.950	2.064	1.75	1.797

Results from Table 15 indicate that real exchange rate and implicit agricultural export tax variables exhibit the expected signs, as indicated by the positive coefficients. The results also indicate the real exchange rate exerts an independent statistical influence on the domestic prices of the individual traditional export commodities except for P_{cc}/P_N and P_{cc}/P_F at 5 and 10 per cent levels. The results imply that a 10% real appreciation of the Shilling (i.e. fall in R) generates declines of 20, 10.4, 21.7 and 21.2 per cent, respectively in the tea to non-agricultural goods, coffee to home goods, tea to home goods and tea to food price ratios.

The implicit agricultural export tax $(1-T_{ax})$ variables are statisticlly significant at 5 and 10 per cent levels in all the relevant price ratios. A 100 per cent rise (fall) in $(1-T_{ax})$ as a result of a fall (rise) in the implicit agricultural tax stimulates increases (declines) in the coffee to non-agricultural foods, tea to non-agricultural goods, coffee to food, and tea to food price ratios of 76.7, 64.1, 128.4 and 101.2 per cent, respectively. These results imply in general that a reduction in implicit tax on agricultural exports turns the terms of trade in favour of agricultural export producers and against those who produce food, non-agricultural goods and non-traded home goods.

Results in Table 14 and 15 indicate that the DWs are within the accepted range and thus rule out the problem of serial correlation. The results further indicate that the coefficients are statistically significant as shown by the F statistic. Most of the regression equations suggest that other unspecified variables influence the relative price ratios as indicated by the low respective coefficients of determination (R^2). However, this study does not go into details of establishing other factors affecting the relevant price ratios. This work is left out as an area for further research.

4.3: <u>The Effects of the Real Exchange Rate on Agricultural Exports</u>

In section 4.2, it was observed that the real exchange rate exerts an influence on the agricultural price incentive structure and particularly in relation to agricultural export prices. As noted in Chapter 3, price incentive structure is an important determinant of intersectoral (and inter-commodity) resource flows, which in turn determines the levels of sectoral and commodity output. Hence, RER is likely to be one of the main factors that determine the output of agricultural exports.

Comparing the time profile of the real exchange rate (Figure 1) with time profiles of total real agricultural exports, X_A (Figure 4), coffee (X_{cc}) and tea (X_{TT}) exports (Figure 5), it can be observed that during 1970 and 1990, increases in RER were associated with increases in the volumes of real total agricultural exports, tea and coffee. However, between 1985 and 1990 the RER had an upward trend while real agricultural exports had a downward trend. From this analysis, it can be implied that the real depreciation of the Shilling (ie increase in RER) was associated with an increase in volumes of real agricultural exports (X_A), coffee (X_{cc}) and tea (X_{tt}) in 1970s. However, the decline in real exports in the late 1980s cannot be explained by the real exchange rate. During this period, the RER exhibited an upward trend indicating a depreciation of the real exchange rate. This observation contradicts the conventional wisdom. Recall that in Chapter 1, depreciation of the real exchange rate was observed to turn out in favour of tradeable goods which include the agricultural exports.

These issues are explored further by employing econometric models. It is worth noting that in chapter 3, the real exchange rate was modelled to influence exports indirectly through its effects on prices, which in turn influence the volumes of agricultural exports. The OLS regression results are presented in Table 16.

Table 16:Regression Results For Agricultural Exports

Explanatory Variables	DEPENDENT VARIABLES		
	$Ln(X_A)$	$Ln(X_{cc})$	$Ln(X_{--})$
$Ln(X_{A,t-1})$	0.5145* (3.5371)		
$Ln(X_{cc,t-1})$		0.42598* (2.0953)	
$Ln(X_{TT,t-1})$			-0.1488 (-0.7187)
$Ln(P_{AX}/P_F)$	0.2083 (0.8022)		
$Ln(P_{AX}/P_N)$	-0.2587 (-1.1906)		
$Ln(P_{AX}/P_{N,t-1})$	0.08612 (1.1906)		
$Ln(P_{CC}/P_F)$		0.1749* (2.2620)	
$Ln(P_{TT}/P_{F,t-1})$			0.1596* (2.6470)
$Ln(Y)$		1.2972* (4.1920)	2.4926* (5.0584)
$Ln(Y_{t-2})$	0.3047[a] (1.4977)		
$Ln(W)$	0.0400 (0.3951)	-0.1382 (-1.2546)	0.1217 (1.2930)
$Ln(W_{T,t-1})$			0.2066* (2.1023)
Constant	5.0687* (2.2780)	1.6865 (1.0307)	-12.5820* (-4.2911)
R^2	0.6573	0.8366	0.9805
$F(v_1,v_2)$	13.84*	13.31*	100.37*

Figures in Parentheses are t-values

* - Significant at 5 per cent level

a - Significant at 10 per cent level

As far as the aggregate agricultural exports (X_A) equation is concerned, the lagged agricultural exports ($X_{A,t-1}$) is the only significant variable at 5 per cent level. Lagged foreign income is also significant at 10 per cent level. The results also shows that in the coffee exports equation, only the lagged coffee exports ($X_{cc,t-1}$), coffee to food price ratio (P_{cc}/P_F), and foreign income (Y) variables are significant at 5 per cent level. On the tea exports equation, the only significant variables at 5 per cent level are the foreign income (Y), and lagged weather variable. Table 13 further shows that in the real agricultural exports equation the relevant relative price ratios are not significant and therefore do not affect the volumes of aggregate agricultural exports.However, results in Tables 14 and 15 indicate that most of the relevant relative price ratios are statistically significant and therefore affect the volumes of both tea and coffee.It can therefore be argued that RER affects aggregate agricultural exports through individual export commodities.

As expected the real agricultural exports respond to changes in foreign income. However, the response of real agricultural exports to foreign income is inelastic as its regression coefficient is less than unity. This imply that, if lagged foreign income increases by 10 per cent, then the real agricultural exports will increase by less than 10 per cent. Contrary to expectation, the weather variable is not significant in all the equations estimated. The only exception is the lagged weather variable in the tea exports equation which is significant at 5 % level. However, the response is inelastic given that the coefficient is less than unity. Note that the DW statistic is not binding here because of the lagged dependent variables.

From this econometric analysis, it can be concluded that the estimated coefficients of the parameters are unbiased estimators given that the F-Statistic shows their significance at 5 and 10 per cent levels.

CHAPTER 5

5.0: SUMMARY. POLICY IMPLICATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

5.1: Summary, Conclusions and Policy Implications

This study set out to explore the effects of the real exchange rate of the Shilling on Kenya's agricultural exports. The analysis traced the effects of the RER through the price incentive structure. It is hypothesised that RER affects the structure of price incentives which in turn, influence the volume of agricultural exports.

To quantify the effects of the RER on the structure of agricultural price incentives and exports, the study employed econometric models. In addition, to quantify the effects of RER on the agricultural exports, the study specified export functions, which depended inter alia on the relative prices. These export functions were combined with relative price functions to generate the effects of the RER. All the regression equations specified in this study were estimated using the Ordinary Least Square (OLS) method. The study used secondary, annual time series data, obtained from World Bank and IMF publications together with local publications from Central Bank of Kenya, Tea and Coffee Board of Kenya.

During the study period (1970-1990), the Shilling depreciated in real terms and the real exchange rate of the Shilling registered a growth rate of 35.6 per cent during the same period.

The study shows that, over the entire period (1970-1990), it was more profitable to produce agricultural export commodities than to produce non-agricultural products, non-traded home goods and the local food. During this period, P_{AX}/P_N rose by 3.82 per cent while PAX/PF and PAX/PH rose by 2.75 and 3.59 per cent per annum respectively. The results also indicate that the terms of trade favoured the agricultural exports in the 1970s than in 1980s. In 1970s, the compound growth rates for PAX/PN, PAX/PH and PAX/PF were 7.47, 5.98 and 4.65 per cent respectively. In 1980s, these rates declined to 1.10, 1.14 and 0.55 per cent per annum,

respectively. Thus, the poor performance of agricultural exports observed in 1980s can be attributed to decline in their prices.However,in 1980s the RER exhibited an upward trend indicating that the Shilling depreciated in real terms.The changes in RER during this period cannot therefore explain the decline in export prices and the poor performance of agricultural exports.

The study started with the hypothesis that RER exert profound effects on the structure of price incentives which in turn, influence the volume of agricultural exports. This hypothesis is confirmed by the regression results obtained in this study. The econometric results indicate that the RER exerts independent statistical effects on PA/PH and PAX/PN at 10 per cent level. This implies that changes in RER has an effect on these relative price ratios. Results indicate that an increase (decrease) in the RER generates an increase (decrease) in the various relative price ratios. A 10 per cent increase (i.e depreciation) of the RER of the Shilling precipitates a 2.28 and 10.9 per cent increase on the aggregate agricultural food price ratio (PA/PH) and aggregate agricultural exports to non-agricultural price ratio (PAX/PN). These results further imply that the domestic aggregate agricultural export terms of trade will increase by 10.9 per cent per year.

The study further found out that the implicit agricultural export tax exerts an independent statistical influence on P_A/P_N, P_{AX}/P_N, P_{AX}/P_H,and P_{AX}/P_F at 5 and 10 per cent levels.The only exception was agricultural to non traded home goods price ratio (PA/PH) which was not significant at both 5 and 10 per cent levels. The implicit agricultural export tax variable exhibited the expected positive sign. The results indicated that an increase in the magnitude of the implicit tax on agricultural exports which results in a 10 per cent reduction in $1-T_{AX}$ induces a 11.5 per cent decline (rise) in the price ratio between agricultural exports and non-agricultural products (PAX/PN). Among the following relatives price ratios, PAX/PN, PAX/PH and PAX/PF, it is the agricultural export to food price ratio (PAX/PF) that responds most to a change in the implicit agricultural export tax.

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On the individual agricultural export commodities (coffee and tea), RER variable exhibit the expected positive sign.The results indicate that the RER exerts an independent statistical influence on the domestic prices of individual traditional export commodities except for PCC/PN and PCC/PF at 5 and 10 per cent levels. The results further indicate that the implicit agricultural export tax variable exerts a statistical influence on all the relative price ratios of tea and coffee with respect to food, non-traded home goods and non-agricultural goods.The results imply that a 10 per cent rise (fall) in $(1-T_{Ax})$ as a result of a fall (rise) in the agricultural export tax stimulates increases (declines) in the coffee to non-agricultural goods and tea to non-agricultural goods price ratios of 7.67 and 6.41 per cent, respectively.

The study indicates that real agricultural exports increased by 19.97 per cent per annum during 1970-90.However, the real agricultural exports declined by 28.70 per cent in 1980s. On the other hand, the volume of coffee and tea increased respectively by 9.67 and 18.06 per cent per annum during 1970-90. In 1970s and 1980s, the growth rates in the volumes of tea were higher than those of coffee.The growth rate of tea volumes was 10.93 per cent while it was 6.97 per cent in 1980s. During the same decades, coffee registered growth rates of 4.96 and 2.98 per cent, respectively.

The volumes of both tea and coffee declined during the 1980s. The study demonstrates that the depreciation of the real exchange rate of the Shilling during 1970-90, was associated with increases in volumes of tea and coffee, which constitute the largest share of agricultural exports.

As observed above, a conclusion can be drawn to the effect that agricultural exports in general are responsive to changes in the RER. It can also be concluded that the RER, influences the agricultural exports and in particular tea and coffee, through its effect on their prices. For example, between 1970 and 1990, the study established that there was a positive relationship between the RER and the relative agricultural export price ratios. Real depreciation of the RER precipitated an improvement in the

relative agricultural export prices. On the other hand, a real appreciation was associated with a deterioration of the relative agricultural export prices. Thus, the effects of the RER on the relative prices have substantial impact on the structure of the incentives.

It can be concluded therefore that the good performance of real agricultural exports in 1970s was associated with depreciation of the real exchange rate of the Shilling.Changes in real exchange rate cannot therefore explain the poor performance of agricultural exports in the 1980s.However,since RER explains less than fifty per cent of the export performance during this period (1970-90), other unspecified factors contributed to the poor performance.

The study has also confirmed the basic postulate of the analysis that RER influence the structure of the relative prices facing different sectors of the economy and that this determines the allocation of the resources within and among sectors. For example, the study established that during 1970-90, the relative price of agricultural goods had a general upward trend. This shows that over the period, the agricultural exports fetched higher prices than the non-agricultural products. This might signal the transfer of resources out of the non-agricultural sector to the agricultural exports sector.

The coefficient of determination (R^2) for real agricultural exports is low suggesting that apart from the specified factors in the study affecting agricultural production, other non-price factors account for the difference. Like other developing countries, other non-price factors include the poor state of roads, lack of credit facilities and the high cost of inputs, among others.All these factors have an influence on the incentive structure and therefore affect the performance of agricultural products and in particular agricultural exports.A study should be done to establish their effects on agricultural exports.

Finally, the study has established that agricultural export taxes have an influence on the performance of agricultural exports.This is borne out by the significant relationships between the implicit agricultural export tax (1-TAX) and the various

relative agricultural price ratios. For example, the results indicate that an increase in the magnitude of the implicit tax on agricultural exports which results in a 10 per cent fall in 1-TAX induces a 11.5 per cent fall in the price ratio between agricultural exports and non-agricultural goods (PAX/PN). This has the implication that an increase of tax on agricultural exports favours non-agricultural goods and goes against agricultural exports. It is therefore advisable for the government to impose lower taxes on agricultural exports. This will go along way to induce the farmers to put more effort on agricultural exports where they are likely to fetch higher prices.

5.2: LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FURTHER RESEARCH

The analysis on this study was done on the implicit assumption that the response of the price relative to a real appreciation is equal in magnitude to the similar response to a real depreciation. But in reality, the two types of responses are not necessarily equal and this may give rise to an asymmetric response. This study did not introduce an explanatory variable to capture the effect of an asymmetric response. This means that this study cannot establish whether depreciation of the RER tends to exert the same effect on the various relevant price ratios as the real exchange appreciation.

However, to gauge the operation of asymmetric relationships between the relative prices considered in the present study and the RER, a suggestion is made to introduce a variable to capture the effects of an asymmetric response. In this regard, research should be done on how to define the asymmetric variable to be introduced.

Another limitation of this study is that, real exchange rate is held to be exogenous. However, in real life situation the real exchange rate may be related to factors such as the overall trade deficit, external terms of trade, implicit export and import tax and monetary and fiscal policies. Hence, there is a need to endogenize the real exchange rate, a task this study was not able to accomplish. As an area for further research, attempts should be

made to endogenize the RER, such that it will be related to factors already mentioned to reflect the real situation.

The results of this study show that RER is a partial indicator of the competitiveness of the agricultural exports sector. This is indicated by the low coefficients of determination (R^2) of the real agricultural exports equation, which suggest that other unspecified factors accounted for the difference. This study did not go into details of establishing which these factors are and an attempt should be made towards this end.

Finally, in estimating the variables used in this study, some of the data required were not readily available. For example, the data to help compute non-traded home goods price index (P_H) and domestic price index of local food (P_F) were not readily available. This necessitated the use of proxies which may not capture the actual effect.

NOTES

The real exchange rate can be distinguished from the nominal rate in the sense that, the latter is an undeflated factor used for converting one currency into another. It is the exchange rate a government can announce or attempt to fix. On the other hand, governments don't control RER directly. An exchange rate policy focussed on maintaining a target real exchange rate would use nominal exchange rate changes 'as well as complementary monetary and fiscal policy measures. In Kenya, nominal exchange rate, for example, is the Shilling price of the US dollar.

A country's foreign exchange rate is overvalued when too high a value is placed on the domestic currency and the corresponding price of the foreign currency is too low. The consequence of this has direct and indirect impact on exports.

Tradable goods are those whose prices are determined by World prices, nominal exchange rates and taxes. This is especially true in an open economy. On the other hand, non-tradable goods are those whose prices are determined by domestic supply and demand and are influenced by the actions and policies of the government. It is important to distinguish between tradable and non-tradable goods because the performance of the former is directly related to the exchange rate while the latter is indirectly related. It is also important because the prices of non-tradable goods are not directly deduced from world prices and tariffs and these goods are to some extent sheltered from trade exports. Non-tradable goods are also called home goods. However, Mundlak, Cavallo and Domenech (1990) have noted that there are no products which can be classified as purely tradables or non-tradables. To prove their case, they gave an example of a television set which is a tradable product. But the price quoted in a departmental store reflects inputs, such as location, which are not tradable.

4. Home goods (non-traded) are goods whose prices are not
    directly deduced from world prices plus tariffs. The prices
    of home goods are determined from the domestic economy.
    These prices have become a reference point, since home goods
    are to some extent sheltered from trade. This domestic
    sector is a residual sector absorbing resources from and
    spilling them to the traded sectors as relative prices
    change. In most developing countries it is a large sector
    that includes subsistence agriculture and services (Valdes,
    1989).

5. Getting home goods price is not an easy exercise (FOSU,1989).
    This is because, the traditional domestic price indices
    available do not cover non-traded goods as a whole. The
    aggregate domestic price indices or their components, usually
    cover a combination of non-traded goods, import competing and
    export goods. Although Tshikala (1986) recommended the use
    of housing component of the consumer price index as a proxy
    for home goods, the present study does not follow this
    suggestion as the corresponding index for Kenya constitutes
    housing and other prices, believed to have large tradable
    components. As a result, local food component of consumer
    price index is used as a proxy for home goods. This is due
    to the fact that, local food prices in Kenya have been
    observed to be a major component of (and therefore
    influences) the national domestic consumer price index (see
    also, FOSU, 1992).

6. Data for non-agricultural home goods prices is not
    readily available. The use of the wage rate as a proxy
    has been suggested by Oyejide (1986), Valdes (1989) and
    Fosu (1992), who provide justification for its use.
    They argued that labor is the single most important
    market determining the relationship between nominal and
    real devaluation, given that wages are the principal
    determinant of changes in the prices of home goods.
    Wage rate is also the primary input to services which
    constitute the bulk of non-tradable (home goods) and as
    such wage levels are closely related to price of home

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goods.

7. This assumption was necessitated by the fact that complex and reliable data on transportation, handling and other transactions for Kenya, for the period under study are not readily available. However, the use of this assumption does not imply that these costs are irrelevant. Where these data are available, it would be useful to relax this assumption. According to FOSU (1992), transaction costs are important in RER discussions as they determine to a large extent what is tradable and non-tradable. High transaction or transfer costs tend to create a large gap between import and export parity prices.

8. The word 'Profitable' as used here should be understood from its relative and not absolute sense. For example, the growth in the relative price, P_{AX}/P_N of 7.47 per cent per year in the 1970s, should be taken to imply that the terms of trade turned in favour of producing agricultural export commodities in 1970s.

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Figure 3: **Time Profiles of P_{AX}/P_N, P_{AX}/P_F and P_{AX}/P_H**

Time in years

☐ PAX/PN   + PAX/PF   ◊ PAX/PH

Figure 5: **Time Profiles of volumes of Coffee and Tea**

Time in years

□ Coffee   + Tea