

11  
DETERMINATION AND EFFECTS OF EXCHANGE

RATE CHANGES IN KENYA, 1966-1986: A

SIMULTANEOUS EQUATIONS' APPROACH *- multivariate*

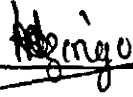
BY

MOHAMMED HAMISI MWAMADZINGO

Research Paper submitted to the Department of Economics,  
University of Nairobi in partial fulfillment of the  
Requirements for the Degree of Masters of Arts in  
Economics.

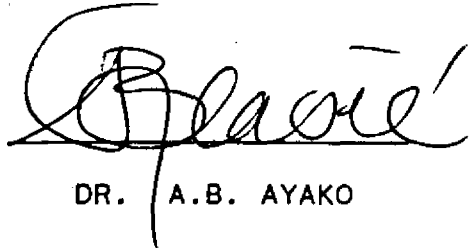
June, 1988

This Research Paper is my original work and has not been presented for a degree in any other University.



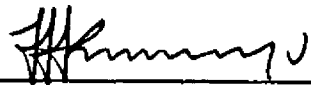
MWAMADZINGO, M.H.

This Research Paper has been submitted for examination with our approval as University Supervisors.



DR. A.B. AYAKO

UNIVERSITY OF NAIROBI  
LIBRARY



MR. P.K. KIMUYU

T A B L E   O F   C O N T E N T S

|                       | <u>Page</u> |
|-----------------------|-------------|
| LIST OF TABLES.....   | (iii)       |
| LIST OF FIGURES.....  | (iii)       |
| ACKNOWLEDGEMENTS..... | (iv)        |
| ABSTRACT.....         | (v)         |

#### CHAPTER 1: INTRODUCTION

|  |    |
|--|----|
| 1.1 Background.....                              | 1  |
| 1.1.1 Balance of Payments Position in Kenya..... | 1  |
| 1.1.2 The Exchange Rate Policy in Kenya.....     | 4  |
| 1.2 Statement of the Research Problem.....       | 8  |
| 1.3 Objectives of the Study.....                 | 10 |
| 1.4 Significance of the Study.....               | 10 |
| 1.5 Organization of the Paper.....               | 11 |
| Endnotes.....                                    | 13 |

#### CHAPTER 2: LITERATURE REVIEW

|  |    |
|--|----|
| 2.1 Theoretical Literature.....                      | 14 |
| 2.1.1 The Purchasing Power Parity Theory.....        | 15 |
| 2.1.2 The Balance of Payments Models.....            | 16 |
| 2.1.3 The Forward Exchange Theory.....               | 17 |
| 2.1.4 The Monetary Approach to Exchange-Rate Theory  | 18 |
| 2.1.5 Models of Exchange-Rate Dynamics.....          | 19 |
| 2.1.6 The Multi-Sector General-Equilibrium Models... | 21 |
| 2.2 Empirical Literature.....                        | 22 |
| 2.3 An Overview.....                                 | 36 |
| Endnotes.....  | 38 |

| CHAPTER 3: EMPIRICAL MODEL SPECIFICATION AND ESTIMATION<br>METHODOLOGY      | <u>Page</u> |
|---|-------------|
| 3.1 Empirical Model Specification.....                                      | 39          |
| 3.1.1 The Exchange-Rate Determination.....                                  | 40          |
| 3.1.2 The Effects of Exchange-Rate Changes.....                             | 41          |
| 3.1.2.1 Import and Export Equations.....                                    | 41          |
| 3.1.2.2 Price Equation.....   | 44          |
| 3.1.2.3 Agricultural Growth Equation.....                                   | 45          |
| 3.1.2.4 Economic Growth Equation.....                                       | 47          |
| 3.2 Estimation Methodology.....   | 47          |
| 3.2.1 The Order Condition of Identifiability.....                           | 48          |
| Endnotes.....   | 50          |
| <br>  |             |
| CHAPTER 4: DATA AND ANALYSIS OF EMPIRICAL RESULTS                           |             |
| 4.1 Data: Type and Source.....  | 51          |
| 4.1.1 Data Type.....  | 51          |
| 4.1.2 Data Sources and Data Limitations.....                                | 56          |
| 4.2 Analysis of Empirical Results.....                                      | 58          |
| 4.2.1 The Extent of Under- and Over-Valuation<br>of the Kenya shilling..... | 59          |
| 4.2.2 The Determination of Exchange Rate Changes.....                       | 62          |
| 4.2.3 Effects of Exchange Rate Changes.....                                 | 65          |
| 4.2.3.1 Effects on the Trade Balance.....                                   | 65          |
| 4.2.3.2 Effects on Inflation.....   | 70          |
| 4.2.3.3 Effects on Agricultural Growth.....                                 | 71          |
| 4.2.3.4 Effects on Economic Growth.....                                     | 73          |
| Endnotes.....   | 76          |

|  |             |
|--|-------------|
| CHAPTER 5: SUMMARY, POLICY IMPLICATIONS AND CONCLUSIONS            | <u>Page</u> |
| 5.1 Summary.....   | 77          |
| 5.2 Policy Implications.....                                       | 79          |
| 5.3 Conclusions.....   | 82          |
| 5.4 Limitations of the Study and Areas of<br>Further Research..... | 85          |
| BIBLIOGRAPHY.....  | 87          |
| APPENDIX: STUDY DATA.....  | 95          |

#### LIST OF TABLES

|   |    |
|---|----|
| 1.1 Summary of Kenya's Balance of Payments, 1966-1986.....  | 2  |
| 3.1 Summary of Identification Equations of Model by Order<br>Condition.....   | 49 |
| 4.1 Rate of Under- and Over-Valuation of Kenya Shilling...  | 60 |
| 4.2 Two Stage Least Squares Estimation Results on<br>the Determination of Exchange Rates.....   | 63 |
| 4.3 Two Stage Least Squares Estimation Results on<br>the Effects of Exchange Rates on Real Exports.....                               | 66 |
| 4.4 Two Stage Least Squares Estimations Results on<br>the Effects of Exchange Rates on Real Imports.....                              | 67 |
| 4.5 Two Stage Least Squares Estimations Results on<br>the Effects of Exchange Rates on Inflation.....                                 | 70 |
| 4.6 Two Stage Least Squares Estimations Results on<br>the Effects of Effective Exchange Rates on Real<br>Agricultural Production..... | 72 |
| 4.7 Two Stage Least Squares Estimations Results on the<br>Determination of Real Gross Domestic Product.....                           | 74 |
| 4.8 Effects of Exchange-Rate Changes on Economic Growth...  | 75 |

#### LIST OF FIGURES

|   |    |
|---|----|
| 1.1 Balance of Payments and Exchange Rate in Kenya, 1966-1986 | 7  |
| 3.1 The Linkages of Exchange Rate Movements in Kenya.....     | 42 |

ACKNOWLEDGEMENTS

My special thanks go to my first supervisor, Dr A.B. Ayako for his dedicated and invaluable guidance during preparation of this paper. I am also grateful to my second supervisor, Mr P.K. Kimuyu, for his useful suggestions and comments. I would like to thank Dr P.E. Coughlin for the introductory lessons on the computer.

This work would not have been written without the full scholarship generously awarded to me by the German Academic Exchange Programme (DAAD) through the University of Nairobi. I am therefore indebted to them.

My sincere gratitude go to my parents and uncle Mwamadzingo for the sacrifice they made to enable me get education. I am thankful to my wife, brothers and sisters for their patience and prayers which gave me confidence and encouragement during my University studies.

And finally, I appreciate the skills of Mary Victoria Dosio of the Ministry of Planning and National Development in the typing of this text.

However, the mistakes, views and interpretations in this paper are those of the author and should not be attributed to any of the above named persons nor the University of Nairobi.

ABSTRACT

The main objective of this research paper was to examine the relative performance of the main determinants of exchange-rate movements in Kenya, and to analyze the specific exchange-rate impacts on the target macroeconomic variables. The study also addressed itself to the issue of over- and under-valuation of the Kenya shilling.

The study used a simultaneous equation framework to analyze the causes and influences of exchange-rates changes. It was assumed that there is no one-way causation between the exchange rate and other variables. Annual time-series data covering the period 1966-1986 was used in the study.

The results of the study revealed that during the period of fixed exchange rate regime the Kenya shilling was undervalued, but immediately after the adoption of the managed flexible exchange-rate policy the domestic currency became increasingly overvalued.

The results also showed that there is no discernible relationship between the changes in the rate of exchange and the target macro-variables. The depreciation of the domestic currency was also not associated with any systematic bias in economic growth, as measured by the changes in real agricultural growth and real gross domestic product (GDP). However, there are some statistically significant influence of the movements in the exchange rate to the domestic rate of inflation. The findings of

the paper support other studies done in other Sub-Saharan African countries.

The paper also suggests some possible policy implications of the econometric results obtained from the two-stage least squares (2SLS) estimations. The paper emphasizes the need to understand the source of the exchange-rate changes, and the nature of other important policy instruments in the economy. The exchange-rate policy reform should only be pursued as a supplementary policy, and then be accompanied by other measures to ensure smooth adjustment of the country's production structure. Weaknesses of the study and avenues for further research are also suggested.



## CHAPTER 1

### INTRODUCTION

#### 1.1 BACKGROUND

##### 1.1.1 Balance of Payments Position in Kenya

Kenya is basically an open economy in which exports and imports account for about a quarter and more than one third of the gross domestic product (GDP), respectively. As a result, international conditions have been considered to have a significant influence on Kenya's economic development and policies adopted by the Government (Republic of Kenya, 1986: paragraph 2.41-2).

Since 1967, the country's external balances have shown large fluctuations caused mainly by external factors such as unstable world export demand and prices, severe external shocks, and adverse terms of trade. Table 1.1, below, gives the structure of Kenya's trade balance and balance of payments showing their major trends and developments over the last two decades. A closer look at this table enables us to understand the nature of and the causes underlying the unfavourable developments, and to appreciate Government policy responses to the external imbalance.

Kenya's economic and financial position began to deteriorate after the mid-1970s. In the period prior to the "oil shocks" of 1974 the economy was able to combine fairly high economic growth rates with a healthy balance of payments. In this period, the current account deficits were generally

TABLE 1.1 Summary of Kenya's balance of payments, 1966-1986  
(K£ millions)

| 1<br>YEAR | 2<br>EXPORTS<br>(f.o.b) | 3<br>IMPORTS<br>(c.i.f)<br>(a) | 4<br>BALANCE<br>OF TRADE<br>(1 - 2) | 5<br>NET<br>SERVICES<br>AND<br>TRANSFERS<br>(b) | 6<br>CURRENT<br>ACCOUNT<br>(4 + 5) | 7<br>NET INF-<br>LOWS OF<br>LONGTERM<br>CAPITAL<br>(b) | 8<br>BASIC<br>BALANCE<br>(6 + 7) | 9<br>MOVEMENT<br>OF SHORT-<br>TERM<br>CAPITAL<br>(c) | 10<br>OVERALL<br>BALANCE<br>(8 + 9) |
|-----------|-------------------------|--------------------------------|-------------------------------------|---|------------------------------------|--|----------------------------------|--|-------------------------------------|
| 1966      | 86.6                    | 113.5                          | -26.7                               | 16.9  | -9.8                               | 17.9   | 8.1                              | -8.6   | -0.5                                |
| 1967      | 79.0                    | 116.5                          | -37.5                               | 16.6  | -20.9                              | 17.8   | -3.1                             | 2.1  | -1.0                                |
| 1968      | 83.9                    | 120.8                          | -36.9                               | 13.4  | -23.5                              | 25.0   | 1.5                              | -2.0   | -0.5                                |
| 1969      | 90.2                    | 121.3                          | -31.1                               | 21.0  | -10.1                              | 27.4   | 17.3                             | -17.3  | 0.0                                 |
| 1970      | 102.0                   | 152.5                          | -50.5                               | 24.9  | -25.6                              | 37.9   | 12.3                             | -9.8   | 2.5                                 |
| 1971      | 104.9                   | 196.2                          | -91.3                               | 30.6  | -60.7                              | 36.1   | -24.6                            | -0.8   | -25.4                               |
| 1972      | 120.5                   | 186.0                          | -65.5                               | 28.0  | -37.5                              | 44.7   | 7.2                              | 2.7  | 9.9                                 |
| 1973      | 164.5                   | 215.8                          | -51.2                               | -6.4  | -57.6                              | 58.9   | 1.3                              | 6.2  | 7.5                                 |
| 1974      | 207.5                   | 366.4                          | -158.9                              | 32.9  | -126.1                             | 82.9   | 43.2                             | 11.6   | -31.5                               |
| 1975      | 232.4                   | 314.5                          | -82.2                               | -24.9   | -107.0                             | 80.5   | -26.5                            | 8.9  | -17.6                               |
| 1976      | 312.1                   | 389.4                          | -77.3                               | 13.0  | -64.3                              | 103.1  | 38.8                             | -3.2   | 35.6                                |
| 1977      | 488.0                   | 529.3                          | -61.3                               | 46.6  | -14.7                              | 111.0  | 96.3                             | 16.4   | 112.7                               |
| 1978      | 369.5                   | 724.9                          | -355.5                              | 71.3  | -284.2                             | 196.9  | -87.3                            | 9.7  | -77.6                               |
| 1979      | 385.5                   | 684.9                          | -299.4                              | 83.0  | -216.4                             | 219.6  | 3.2                              | 67.4   | 70.6                                |
| 1980      | 488.0                   | 994.6                          | -526.6                              | 153.3   | -373.3                             | 247.7  | -125.6                           | 53.4   | -72.2                               |
| 1981      | 474.8                   | 971.8                          | -497.0                              | 125.9   | -371.1                             | 228.9  | -142.2                           | 43.1   | -99.1                               |
| 1982      | 509.9                   | 939.9                          | -430.0                              | 128.2   | -301.8                             | 177.9  | -123.9                           | 16.7   | -107.2                              |
| 1983      | 615.8                   | 929.1                          | -313.3                              | 144.1   | -169.2                             | 214.3  | 45.1                             | 24.6   | 69.7                                |
| 1984      | 745.6                   | 971.7                          | -226.1                              | 55.8  | -170.3                             | 179.9  | 9.6                              | 29.6   | 39.2                                |
| 1985      | 775.0                   | 1048.4                         | -273.5                              | 106.4   | -167.1                             | 48.3   | -118.8                           | 20.2   | -98.6                               |
| 1986      | 950.6                   | 1186.2                         | -235.6                              | 81.5  | -154.1                             | 85.6   | -68.5                            | 26.0   | -42.5                               |

SOURCE: 1. Republic of Kenya, Statistical Abstracts (various issues).  
2. \_\_\_\_\_, Economic Surveys (various issues).

## NOTES:

- (a) Imports are valued on a free on board (f.o.b) basis for the years 1983-1986.  
(b) Government transfers have been re-allocated from current account to long term capital.  
(c) Includes errors and omissions.

manageable as they were financed by inflows of long-term capital. From 1966 (when national records of foreign exchange were first kept) until 1973, the foreign reserves rose steadily, under a stable nominal exchange rate.

The first post-independence balance of payments problem was experienced in 1971, with an abnormally large current account deficit of K£61 million accounting for 9.4% of GDP. However, the first major crisis occurred in 1974 as a result of the first round of drastic increases in the petroleum prices. The current account deficit worsened to K£126.1 million. In response to the large deterioration the Government instituted measures to restrain import demand, and, in 1975 the current account improved substantially. Subsequently, due to an improvement in the terms of trade brought about by sharply rising prices of coffee and tea in the international markets, the balance of payments improved further in 1976 and 1977, registering an all-time record surplus of K£113 million in 1977.

The second major difficulty of Kenya's balance of payments emerged in 1978 when the world coffee and tea prices dwindled, coupled with a large increase in import demand resulting from the export "boom" of 1976/77. The massive deficit in the current account (K£284 million) was partly offset by a large increase in Government long-term borrowing and partly by a fall in import demand.

Other severe balance of payments crises surfaced in 1980 and 1982, due to the second oil price escalation, deterioration in the terms of trade and global recession. However, there was a marked improvement in the overall balance in 1986 from a deficit of K£107.2 million in 1982 to a surplus of K£730 million in 1986 as a result of higher export earnings from coffee and lower international oil prices.

To eliminate the external payments disequilibria the Government has adopted various interventionary policy measures including long-term borrowing from overseas (mainly in terms of credits from the International Monetary Fund, the World Bank, and other foreign Governments), revision of the export compensation scheme, slowing down the approvals of foreign exchange allocation, controlling government expenditure, stabilizing domestic prices, and maintaining realistic exchange rates (Central Bank of Kenya, 1986).

The following section provides an outline of Kenya's exchange-rate policy since 1966.

#### 1.1.2 The Exchange-rate Policy in Kenya, 1966-1986.

In the period from 1966 to early 1971, Kenya maintained a fixed exchange rate regime whose adjustment was based on fundamental factors such as export earnings, import payments, tourist incentives, and external public debt.

The external value of the Kenya shilling was measured in various standards at different points in time. When it was

issued on 14th September, 1966, it was measured in gold. At that time Ksh 250 was equal to one troy ounce of fine gold. This was equivalent to pegging the Kenya shilling to the British sterling pound at Ksh 20.00 per pound. When, in November 1967, Britain devalued her currency by 16.7%, the Kenya authorities opted not to follow suit. In effect the shilling was revalued against the sterling pound by 14.03% to Ksh 17.143 per sterling pound. In September 1971, the peg of the shilling was changed to that of the United States dollar and fixed at Ksh 7.143 per US dollar.

After 1971, many countries abandoned the gold link thereby ushering in a system of floating rates which resulted in unpredictable day-to-day movements of foreign currencies. In Kenya, this led the external value of the shilling to fluctuate daily according to the dictates of supply and demand forces, particularly of the developed countries.

In October 1971, the US dollar was devalued against gold by 7.9% but the shilling remained pegged to it, leading to an effective devaluation of 6.5%. In February 1973 the US dollar was again devalued by 10%. By remaining pegged to the dollar it meant that the shilling was devalued by 17.1% against gold since 1971. But taking into account Kenya's trade pattern, the effective devaluation was about 14%. To counteract the downward slide of the dollar a central rate<sup>2</sup> of Ksh 7.00 to the dollar was declared in March 1973, and in June the same year another central rate of Ksh 8.90 to the dollar was announced. These two decisions had the effect of revaluing the shilling by 3-4%

against the dollar. The remainder of 1973 and the most of 1974 was characterized by a relatively stable exchange rate.

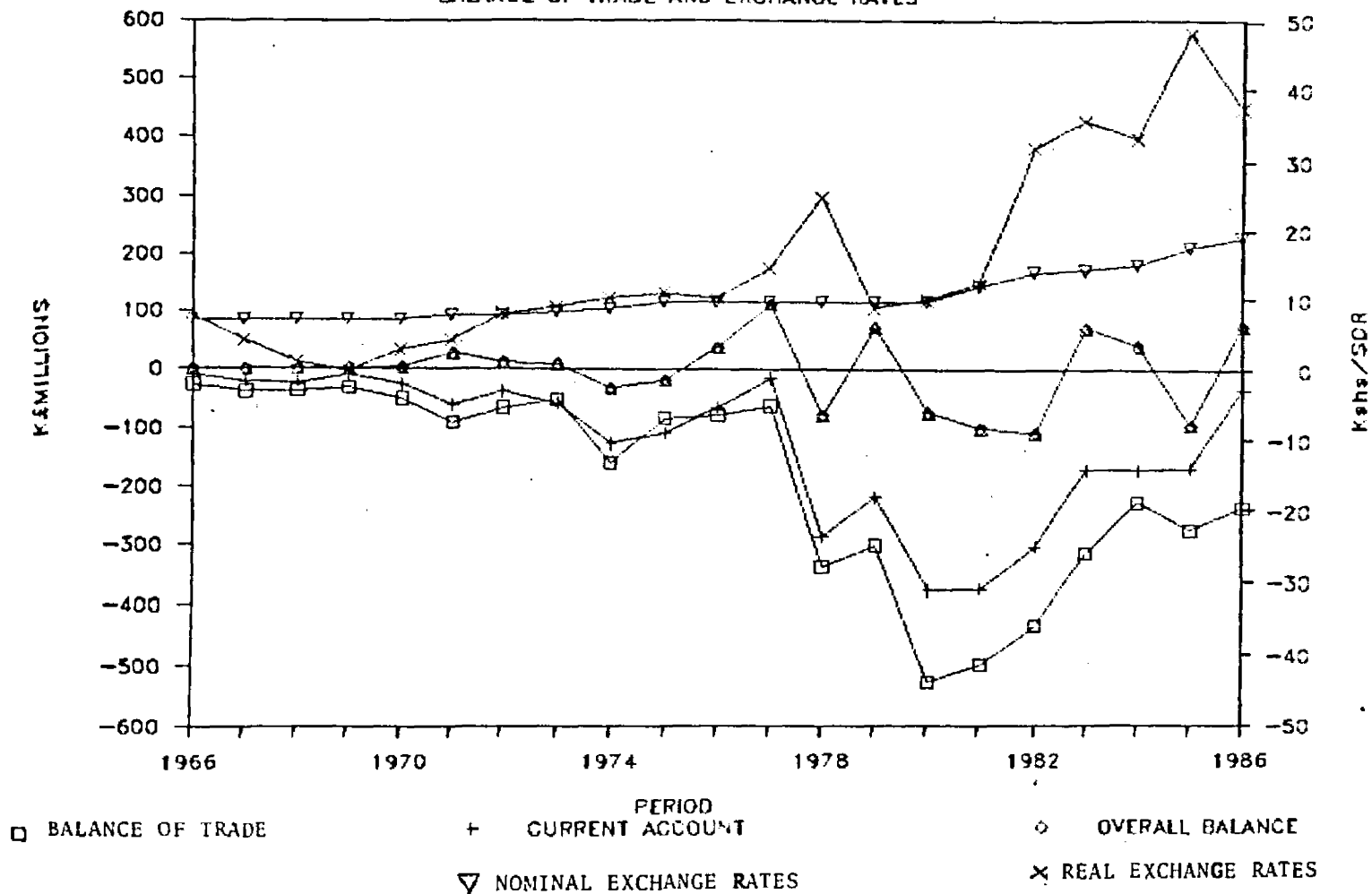
✓ With the United States not so dependent on imported fuel as other industrialized countries, the dollar strengthened against most key international currencies during the oil crisis of 1974. The shilling unduly appreciated with it. In an attempt to minimize these fluctuations the link between the shilling and the dollar was abandoned on 27th October, 1975, and Kenya established a central rate of Ksh 9.66 to the IMF accounting unit--the Special Drawing Rights<sup>3</sup>. The period between October 1975 and January 1981 was characterized by neither a currency devaluation nor a revaluation.

✓ The exchange rate of the shilling was again changed in 1981 when it was devalued twice, by 5% in February and by 15% in September being fixed at Ksh 11.95 per SDR. In December 1982, the shilling was further devalued to Ksh 14.06 per SDR. At the same time, the Authorities decided to adopt a managed flexible exchange-rate policy (a managed float) aimed at maintaining a competitive value of the shilling. ✓ The shilling was pegged to the same currencies as in the SDR basket. ✓

Figure 1.1 below presents a graphical exposition of the movements of the nominal and real exchange rates over the period 1966-1986, superimposed on the trends of the current account, and the trade and the overall balances to appreciate the efficacy of the adjustments in the exchange rate. ✓

# FIGURE 1.1

## BALANCE OF TRADE AND EXCHANGE RATES



SOURCE: Table 1.1, p2 Appendix, Table 34 and 8.

## 1.2 STATEMENT OF THE RESEARCH PROBLEM

One of the most persistent and difficult problems confronting the Kenyan policy makers over the past two decades has been the increasing balance of payments deficits. In many instances these deficits have been attributable to the foreign-exchange regime (Republic of Kenya, 1986, Loc cit p.11). In these circumstances, foreign exchange management and exchange-rate policies have assumed considerable importance in macroeconomic stabilization of the economy. ✓

The exchange rate is now widely used by developed and developing countries in their macroeconomic adjustments. According to Khan (1987) exchange rate is now the centre-piece of any adjustment effort because it is an efficient expenditure-switching and expenditure-reducing policy instrument. The exchange rate is a direct and powerful method of reducing real domestic expenditure and relative prices, thus diverting the scarce economic resources toward the external sector. This, in turn, has the effect of improving the balance of payments, reducing inflationary pressures over the longer run thereby sustaining economic progress. The exchange rate also affects all international transactions in an even-handed fashion, thus causing no distortions nor mis-allocations of the scarce resources in the economy.

The use of the exchange rate as an instrument of monetary policy is often a source of considerable controversy and debate over its determination and economic effects (CBK, 1986; Khan, 1987). Despite the controversies there has been no



attempt in Kenya to model the process of exchange-rate determination and the consequent effects. The purpose of the current study was to fill this information gap.

Although the exchange rate has been a target of manipulations by the Central Bank of Kenya (CBK), its role as a major policy instrument of economic management has received very little consideration in the policy documents of the Government, such as the Sessional Papers and the Development Plans. Moreover, despite the several autonomous and induced changes in the exchange rate there has been no attempt to study the process of its determination and its effects on the target macroeconomic variables in the country. The inability of the exchange-rate adjustments to improve the trade balance and balance of payment, (see figure 1.1 above), might be due to the lack of knowledge on the characteristics and extent of the determinants of exchange-rate changes to guide policy. This study makes an attempt to provide such missing empirical evidence.

The study will adopt the existing body of literature and the Kenya data fitted in a six-simultaneous equation model to focus on the exact behavioral responses (the directional change, magnitude and speed) of the exchange-rate movements on certain key macroeconomic variables in the Kenyan economy, viz, changes in real growth in exports and imports, rate of domestic inflation, real growth in GDP, and the rate of real agricultural growth.

### 1.3 OBJECTIVES OF THE STUDY

The broad objective of this study was to provide an analytical and empirical framework for analysing the causes, and evaluation of certain macroeconomic effects of the exchange-rate adjustments in Kenya.

① The specific objectives of the study were:-

- i) formulation and estimation of a model of exchange-rate determination for Kenya;
- ii) simulation of the effects of exchange-rate changes on such macroeconomic variables as exports, imports, GDP, and the rates of domestic inflation and agricultural output; and
- iii) from empirical findings, to make practical recommendations that could guide Kenya's future exchange-rate policy.

### 1.4 SIGNIFICANCE OF THE STUDY

This study hopes to generate information about the extent to which certain factors influence exchange rates. The exchange rate is an important factor affecting the volume and hence the stability of the flows of foreign exchange earnings and import payments between Kenya residents and foreigners. Hence, information generated in the study could guide policy makers in designing a rational exchange-rate policy for the country.

Furthermore, by generating information about the economic effects of exchange-rate changes on various economic variables the study should be helpful in forming a basis for revision or adoption of other policy measures, or strengthening the existing policies, to smooth the adjustment mechanism of the exchange rate. It is important for the policy makers to understand the efficacy of the past shilling devaluations and revaluations in order to improve the quality of their policy decisions and hence improve the functioning of the exchange-rate system. The information about the economic effects is also important because exchange-rate movements set off many macroeconomic effects, some of which are undesirable.

The findings of this study should also serve as reference material for further research in the area of foreign exchange and exchange-rate policies in Kenya. The findings should also be interesting to the academic and other researchers in the area.

#### 1.6 ORGANIZATION OF THE PAPER

The research paper has five chapters and an appendix. Chapter One gave background information on the position of the balance of payments and outlined the major changes of the exchange-rate policy since the inception of the Central Bank of Kenya in 1966. The Chapter also provided the statement of the research problem, objectives and the justification of the study. Chapter Two will provide a survey of theoretical and empirical literature on the determination and effects of exchange-rate movements in developed and developing countries. In the theoretical literature review six kinds of models of exchange-

rate determination are discussed, while the empirical literature review ascertain the practical implications of exchange-rate movements on a wide range of macro-variables such as exports, imports, interest rates, price levels, money supply, agricultural output, and rate of growth of gross national output.

In Chapter Three we specify a simultaneous equation empirical model and discuss its estimation methodology. Chapter Four has two sections. Section one discusses the type and source of data and defines the variables to be used for the model estimation. Section two presents estimation results or computer solutions of the model as applied on Kenyan data.

The final chapter (Chapter Five) assesses the extent to which the objectives of the research were achieved and presents major policy implications of the study. In the chapter we also highlight the limitations of the study, and suggests avenues of further research in the area of foreign exchange and exchange-rate policies. The appendix describes the data that provided the basis for the analysis.

ENDNOTES

1. This section is based on materials contained in Ayako and O'Connell (1987), and various issues of Central Bank of Kenya's Annual Reports and Quarterly Economic Reviews. See also Central Bank of Kenya (1976, 1986).

2. A central rate is a reference rate.

3. With effect from January 1981 the standard basket was reduced from sixteen to only five currencies, viz US dollar, the deutschemark, Japanese yen, French franc and pound sterling.

## CHAPTER 2

## LITERATURE REVIEW

This chapter outlines the main theoretical and empirical frameworks for analyzing the determination and economic impacts of the exchange-rate changes. It, therefore, acts as a starting point for the econometric model specified in Chapter Three to explain the trends and fluctuations of the exchange-rate movements in Kenya. The chapter also examines the weaknesses and strengths of past studies, thus placing the present study in perspective.

### 2.1 THEORETICAL LITERATURE

Various approaches to the exchange-rate determination were developed over the last few decades. Most of these can be classified under six broad headings:

- i) The purchasing-power-parity theory;
- ii) The balance-of-payments models;
- iii) The forward exchange theory;
- iv) The monetary approach;
- v) The models for exchange-rate dynamics; and
- vi) The general equilibrium approach.

### 2.1.1 The Purchasing-Power-Parity Theory

The purchasing-power-parity (PPP) theory measures the relationship between exchange rates and price levels among countries, and suggests how the prices would adjust to changes in the exchange rates, other things being equal. The concept of PPP has many variants (See Frenkel, 1978; Isard, 1978). In its absolute version, it states that the equilibrium exchange rate should equal the ratio of domestic and foreign general price levels. A more useful operational hypothesis<sup>1</sup> is the relative version, which states that the proportionate changes in the exchange rates should equal the proportionate changes in the ratio of domestic and foreign price indices.

Formally, the PPP hypothesis links the national price levels to exchange rates as follows (See Lindert, 1986: P 342):

$$P = ER \cdot P^* \text{ or } ER = P/P^* \quad \dots\dots 2.1$$

where, ER is the price of foreign currency in terms of the domestic currency, and P and P\* are the price levels in the home country and the rest of the world, respectively, each denominated in its own currency.<sup>2</sup>

The PPP theory implies that any disturbance of the exchange rate from the equilibrium ratio of price indices will have to be accompanied by exchange-rate adjustments to restore the equilibrium. However, since these adjustments have a time

lag in restoring the desired equilibrium the validity of the PPP concept depends on the time horizon under consideration<sup>3</sup>. Frenkel (1978) noted that PPP may have considerable validity only in the long run, long enough to change the ratio of national price indices. However, the assumption of short-run PPP has been widely used for the flexible price monetary models<sup>4</sup>.

### 2.1.2 The Balance-of-Payments Models

It has been argued that the most important indicator of the strength or weakness of an exchange rate will nearly always show up in the balance of payments position of a country (Coninx, 1978: p55). Persistent surplus in the balance of payments should lead to exchange-rate appreciation, if the surplus is caused by "positive" reasons, i.e, by trade and service earnings rather than by monetary flows.

During the Bretton Woods regime of adjustable pegs (1944-1970s) the official adjustment of the exchange rate was predicated with the occurrence of persistent current-account imbalances. Thus, the equilibrium exchange rate was determined mainly (if not entirely) by factors affecting the demands for and supplies of imports and exports in the goods market (Isard, 1978: p8; 1987: p11-14).



The balance-of-payments models can also be likened to the famous elasticity approach to exchange-rate determination, which treats capital flows as exogenous, and the trade account (exports and imports) as a function of the exchange rate, besides other exogenous variables (see Kindleberger and Lindert, 1978).

### 2.1.3 The Forward Exchange Theory

This theory was also referred by Isard (1978: p9) as the interest-rate-parity theory. The theory recognize that foreign exchange markets are also sensitive to interest-rate differentials. In essence, the concept of interest-rate parity asserts that bond (or asset) holders can choose either to hold domestic bonds which yield the own rate of interest  $r$ , or foreign bonds, yielding the own rate of interest  $r^*$ . The theory assumes that there is perfect capital mobility and that bonds are free of default risk, both domestically and abroad. This assumption implies that foreign bonds with forward cover are perfect substitutes for domestic bonds.

In simple terms the expectation of the exchange rate are influenced by the interest-rate-parity:

$$E[ER] = r^* - r \quad \dots\dots(2.2)$$

where ER measures the percentage forward premium<sup>5</sup> on domestic currency, and  $r$  and  $r^*$  are the domestic and foreign nominal interest rates, respectively<sup>6</sup>.

#### 2.1.4 The Monetary Approach to Exchange-Rate Determination

The monetary approach is a macro theory which isolates some of the exogenous determinants of equilibria in national markets and then explains exchange rates as the prices which generate simultaneous equilibrium among national money markets (See Frenkel, 1978; Hodrick, 1978; Hacche and Townend, 1981; Mussa, 1978). The approach stresses that since the exchange rate is a relative price of two national monies (rather than national outputs as in the PPP doctrine) the equilibrium exchange rate is determined by the equilibrium in the money markets (i.e between the demand for and supplies of the stocks of monies outstanding).

In its basic form, the monetary model can be set out as three structural equations (See Hacche and Townend, 1981: p206-8). The first equation is the domestic monetary equilibrium:

$$MS = kPY e^{Br} \quad \dots\dots(2.3)$$

where MS is the domestic money stock, P is the price level, Y is the real money income, r is the interest rate, and k is a constant.

$$\frac{Y}{T/E} = \frac{10,000 \text{ (at } 2, \text{ mn)}}{8,000 \text{ (at } 4, \text{ mn})} = 5/4$$

$$Y = C + I + G + (E - M)$$

The exchange rate (in local currency) follows the PPP doctrine:

$$ER = k^1 P/P^* \dots\dots(2.4)$$

where ER is the exchange rate, and  $k^1$  is a constant, not necessarily unity.

A log-linear version of the exchange-rate equation can then be estimated as follows:

$$\ln ER = K - \ln MS + \ln MS^* + \ln Y - \ln Y^* - r - r^* \dots\dots(2.5)$$

Where the asterisks " \* " shows foreign variables and parameters. Equation (2.5) predicts that a rise in domestic interest rates, by causing an excess supply of money, will lower the exchange rate.

#### 2.1.5 Models of Exchange-Rate Dynamics

Models of exchange-rate dynamics are formulated because long run effects of policy changes are nearly always different from the short run effects (Isard, 1978). The most notable framework of dynamic analysis are attributable to Dornbusch (1976, 1978).

Dornbusch (1976) develops a theory of exchange-rate changes under the assumptions of perfect capital mobility, a slow adjustment of goods market compared with money markets, and consistent expectations. He emphasized the association between expected exchange-rate changes and interest-rate differentials

and how a monetary expansion affects the time paths of the exchange rate, the domestic price level and the domestic interest rate.

The main features of the model are (i) in the short run, a monetary expansion induces an immediate depreciation of the exchange rate and the terms of trade; (ii) during the adjustment process, rising prices may be accompanied by an appreciating exchange rate, so that the trend behaviour of exchange rates stands potentially in strong contrast with the cyclical behaviour of exchange rates and prices; and (iii) the direct effect of exchange rate on domestic inflation. In this context, the exchange rate is identified as an important passage linking the effects of monetary policies to the aggregate demand for domestically produced goods and services.

A major limitation of the Dornbusch framework (See Isard, 1978: p29) is the assumption of only one asset, domestic money, whose demand is independent of wealth. Due to this assumption the model cannot adequately capture the effects of shifts in the international residence of wealth through trade imbalances.

### 2.1.6 The Multi-Sector General-Equilibrium Models

Under the present regime of widespread flexible exchange rates it has become imperative to estimate the exchange-rate changes empirically, bearing in mind that the exchange rate is one of several simultaneously determined endogenous variables. In this context, several methodological issues need to be addressed simultaneously, and single-equation (reduced-form) empirical models can have serious shortcomings. Thus to present a fairly general and eclectic view of the determinants of exchange rates, at least for empirical purposes, it has become important to use explicit separate equations, the "complete" or multiple equation models of open economies as postulated by Dervis, de Melo and Robinson (1978), Clements (1978), Mansur (1983), and Steinherr (1981).

The novel feature of this approach is the recognition that an economy has several sectors with different economic attributes. Since the economy is nothing but a totality of the sectors comprising it, the econometric models should have an explanation of the actions of the various sectors. The next step is to consider the equilibrium state for the economy, a condition which is fulfilled only if each sector is in equilibrium. This, of course, requires the specification of how sectors, and thus the economy, move, i.e., the dynamic structure of the model. Thus, general equilibrium framework considers

several conditions at different levels of disaggregation. The framework can also incorporate policy issues.

There are major limitations of the general equilibrium models, particularly in developing countries. It is an analysis which need to consider the available data first. It requires finely dis-aggregated data, which is often difficult to obtain, particularly as history recedes.

## 2.2 EMPIRICAL LITERATURE

Due to the importance of the knowledge of the determinants and the effects of the exchange-rate actions on various economic factors there has been an imperative need to undertake studies, both in the developed and the developing economies, to offer empirical understanding on the subject.

Frenkel (1978) developed a monetary view of the determinants of the exchange rate emphasizing considerations which relate to the demand for money and to the interest-parity theory. He examined the empirical relationships between money, prices, expectations and the exchange rate during the German hyperinflation of early 1920s. He estimated a log-linear function for monthly data over the entire period, February 1920 to November 1923. The empirical results were as follows (t-values in parentheses):

$$\log ER = - 5.133 + 0.975 \log MS + 0.591 \log CPI$$

$$\begin{array}{ccc} (-0.731) & (0.050) & (0.073) \end{array} \quad \dots\dots(2.6)$$

$$R^2 = 0.994 \quad DW = 1.91 \quad S.e.e = 0.241$$

where ER is the exchange rate, MS is the nominal money stock, and CPI is the rate of inflation.

The empirical results were consistent with the monetary (or the asset) approach to the exchange-rate determination. The elasticity of the exchange rate with respect to the money stock did not differ significantly from unity at the 95% level of confidence, and the elasticity of the spot exchange rate with respect to the forward premium was positive.

Frenkel's study had two major weaknesses. First, he considered the exchange rate as determined only in the money market and, then, only in terms of stock relationships. He ignored that the exchange rate, like any other price, is determined in general equilibrium by the interaction of flow and stock conditions. Second, Frenkel concentrated on the period of hyperinflation only, which cannot render insights into how exchange-rate actions cause real disturbances, such as structural changes.

Hodrick (1978) applied sophisticated econometric techniques of time series analysis to test the empirical implications of the monetary approach to exchange-rate

determination as applied to various series of exchange rates. He analyzed two types of monthly series models using data from the first few years of flexible exchange rates in the United States. He first presented estimates of the coefficients of the stock equilibrium model when the variables are in the level of natural logarithms, and then, examined the proportionate rates in a dynamic framework (by estimating the coefficients when the variables are in rates of growth or first differences of natural logarithms). The dynamic framework enabled Hodrick to test the functional form and whether the independent variables were really exogenous. Hodrick's results were broadly consistent with the predictions of the monetary theory.

① Clements (1978) analyzed the effects of devaluation on United States trade flows and domestic prices by simulating a unilateral devaluation of the US dollar with a fully specified multi-sector econometric model. He constructed a general-equilibrium model in a framework which distinguishes among three classes of commodities, viz, the exportables, the importables, and the non-traded goods. He assumed that these commodities were perfect substitutes in production. Clements' model had three fundamental building blocks consisting of (i) a system of demand equations representing the domestic consumer demands for the three commodities and investment demand; (ii) a system of three domestic supply equations obtained by solving a profit maximization problem; and (iii) the income identity and the



absorption equation as the link between the demand and the production parts of the model. The results of the time-series data for the period 1959-1971 showed that devaluation had substantial real effects, and that these effects tend to persist for a long period.

2) Cooper (1971) carried out a review of twenty-four devaluations, involving nineteen different developing countries, to examine a "once-and-for-all" change in exchange rates. The study included most of the devaluations during the period 1959-66, excluding those involving countries in "unusual" circumstances. Cooper analyzed the effects of devaluation on the balance of payments, on the terms-of-trade, on the level of economic activity, on prices and wages, and on the political fate of the governments immediately responsible. The methodology of the study was limited to the period immediately after devaluation, usually one year. The following generalizations were made:

- i) currency devaluation seems to be successful in improving the balance on goods and services;
- ii) devaluation itself often initially tended to depress economic activity in the devaluing country;
- iii) devaluations, even large devaluations, did not seem to worsen the devaluing country's terms of trade. But this could be because the countries considered accounted for too small a portion of the world market for devaluation-induced

changes to the terms of trade to be a serious consideration;

- iv) currency devaluation stimulated increases in local prices of goods and services closely linked with foreign trade. It was also accompanied by larger than normal wage increases.
- v) a decision to devalue never typically spell political demise for governments undertaking it. However, there were high chances that the finance minister would lose his job.

The major weakness of Cooper's study is that he tried so much to avoid sophisticated adjustments which could delineate the effects of other economic changes other than the devaluation under examination. There was also no in-depth study of any of the 24 cases of devaluations. The assumption that the total effects of devaluation will occur within one year is also questionable.

~~Bautista~~  
Bautista (1980) examined the experience of a sample of 22 developing countries relating to exchange-rate changes under generalized currency floating. The investigations were based on inter-country data expressed in average monthly levels or rates of change over the period, 1973-1978. The LDCs in the sample were mostly in the middle-income category (based on the World Bank classifications) with substantial increasingly significant exports of manufactured products in the 1970s. Bautista found

out that major currency realignments had caused a general decline in the export competitiveness in most of the sample countries. The results also showed that the effects of macro-economic policy were not consistently reflected in the observed movements in the real exchange rates. The analysis also showed that effective exchange-rate changes and excess domestic demand could explain to a large extent the observed differences in inflation rates.

~~Donovan (1981)~~  
3) Donovan (1981) analyzed the specific effects associated with exchange rates in selected upper credit tranche stabilization programmes. He considered movements in exports, imports, trends in real GDP, and inflation of twelve developing countries that adopted IMF-supported stabilization programmes in the period 1970-76. The methodology used was one of comparing the relative performance of the programmes for the period immediately before and after the depreciations, and also comparing the programme performance with the average world performance during the same period. These comparisons were conducted on both short-run (one-year) and long-run (three-year) basis.

On average, the export growth rate of these countries rose from -1.3% in the year preceding the devaluation to 9.2% in the first post-depreciation year. While import growth rates also increased, a shift from -2.4% to 5.1% in the average difference

between export and import growth rates occurred (see Donovan, 1981: Tables 4 and 5).

Over a three-year period, only three countries experienced a deterioration in their export performance. The average difference between export and import growth rates rose from -2.1% to 2.5%. In half of the cases, high domestic rates of inflation were cited as suggesting an overall loss of competitiveness leading to a situation of currency overvaluation. There was no evidence that the programmes on average were associated with any systematic bias in economic growth as measured by changes in real GDP -- both in the short-run and also in longer-run perspective.

A major limitation in Donovan's study lies in the use of aggregate comparisons which may conceal important variations in the experiences of individual countries. Moreover, in some instances "special" factors (such as adverse weather) that had little to do with either the programmes design in general, or the impact of the exchange rate in particular, may have played an important role in determining the outcome for certain variables.

*Jx* Kincaid (1984) analyzed the effectiveness of the exchange-rate adjustment in promoting non-oil exports and restraining imports in Indonesia. To disentangle the impact of

other causes on the non-oil trade account the import-demand and export-supply functions were econometrically estimated (specified in log-linear forms) and employed to simulate imports and exports under alternative exchange-rate scenarios. The results obtained by quarterly, seasonally-adjusted data showed that the estimated equations were well specified.

The export-supply and import-demand functions were specified under the assumption that Indonesia is a price taker on the world markets. The estimated import-demand equation took the form (with t-values shown in parentheses):

$$\log M_t = -3.74 - 0.18 \log RP_t + 0.61 \text{RGDP}_t + 0.20 \log MS_t + 0.34 \log M_{t-1}$$

(2.60) (-2.31)                      (2.85)                      (1.47)                      (2.87)      (2.7)

$$R^2 = 0.98 \quad H\text{-statistic} = 0.15 \quad \text{SEE} = 0.06$$

where M is the demand for imports, RGDP is real domestic income, RP is the relative price of foreign to domestic goods, MS is the real money, and  $M_{t-1}$  is a lagged dependent variable. Equation (2.7) reveals that the coefficients for all the variables had the expected signs and are statistically different from zero at the 10% level of confidence.

The export supply function was specified as a function of profitability (measured by the relative price term, RP) and domestic capacity (proxied by the real gross domestic product, RGDP):

$$\log X_t = -5.51 + 0.61 \log RP + 0.53 \log RGDP + 0.90 \log X_{t-1}$$

(-2.38) (3.30)            (2.11)            (8.41)            .....(2.8)

$R^2 = 0.91$             H-statistic = -1.29            SEE = 0.18

\* Martin and Shaw (1986) assessed the effects of exchange-rate changes on the value of Australia's major agricultural exports. Because of the strong interdependence between the major agricultural export industries in production, and the diverse nature of the export markets for particular commodities, the analysis was undertaken using a large-scale econometric model incorporating the interactions between the major agricultural export industries. The model incorporated dynamic annual, industry-level determination of market supply, demand and price in the sheep, cattle, and crops sections of the Australian agriculture.

The results of Martin and Shaw's study suggested that there were significant lags in the response of agricultural exports to changes in the exchange rate. It appeared that, following a devaluation, the total value of Australia's major agricultural exports were likely to increase by slightly less than the magnitude of the devaluation, despite a substantial

increase in the volume of wool and wheat exports from stocks. Only in the second and subsequent years was the real value of export estimated to increase by more than the real amount of the depreciation.

Cleaver (1984) conducted a survey on the impact of price and exchange-rate policies on agriculture in thirty-one Sub-Saharan African countries. He estimated a linear regression model for two groups of countries: those with positive real rate of currency depreciation during 1970-81, and those having a real rate of currency appreciation over the same period. The results of the estimated linear model can be summarized as follows:

$$\text{AgrG} = -1.8 + 0.51 \text{ RD} + 0.11 \text{ G/GDP} + 1.0 \text{ PoP} - 1.5 \text{ PIIS}$$

$$\begin{array}{ccccccc} (-1.0) & (1.5) & (1.6) & (1.7) & (2.3) & \dots & (2.9) \end{array}$$

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

Where AgrG is the agricultural production, RD is the rate of depreciation (appreciation), G is the public expenditure, GDP is the gross domestic product, PoP is the population growth, and PIIS is the public investment in input supply.

The results showed that prices and exchange rates had positive impacts on agricultural growth, although they are not the most significant factors. From Equation (2.9), a 1% per annum increase in the rate of currency depreciation was associated with only 0.15% increase in agricultural growth. This

led Cleaver to conclude that "currency overvaluation does agriculture no good" (paragraph 42).

There exists very few studies on the field of exchange rates, in Africa, in general, and in Kenya, in particular. These studies, moreover, rarely employ any systematic econometric techniques as those reviewed above.

Kiggundu (1984) conducted a study to analyze the impact of short-term balance-of-payments policies on poverty and income distribution in Kenya. He hypothesized that (i) the devaluation of the shilling by about 45% between 1980 and 1984 raised import prices without favouring domestic import-substituting industries, and (ii) Kenya's currency devaluation does not raise her traditional exports share in the world markets. Unfortunately, Kiggundu never attempted any type of empirical estimations to adduce evidence for the hypotheses.

Degefe (1985) had the objective of finding the effect of the variability of the Ethiopian birr to the domestic economy. He examined the relationship between exchange rate (in real and nominal values) and exports and imports in both bilateral and global basis, and in simple linear and exponential regression specification. Degefe found that exchange rate (both in nominal and in real terms) did not influence exports, and as the birr appreciated the country imported less. However, the



association was not strong, suggesting that other factors such as export controls, quotas, etc, influenced merchandise imports much more than the exchange rate. He also found that global exports were very sensitive both to the nominal and the real exchange rates and that the coefficients were all statistically significant with no serial correlation at the 5% level of significance. The nominal rate was a more powerful explanatory variable than the real exchange rate.

Ndulo, Sakala and Siwale (1985) conducted a study to measure the impact and efficiency of devaluation in the Zambian economy on selected economic variables, namely balance of trade, domestic inflation, output diversification, profitability of the copper sector, and import volume.

The empirical analysis revealed no discernible relationship between the (1976 and 1978) devaluations and the trade balance. There was also no clear relationship between the devaluations and the inflation rate, particularly because of the tight fiscal and monetary policies (which were part of the devaluation packages) and the price control regime. Although the devaluations improved the profitability of the copper-mining companies there was no distinct evidence of the diversification of the productive sectors. This could be due to the institutional and structural rigidities in the Zambian economy, which the study never took into account.

Mwalwanda (1987) extended the agricultural supply response model to include the impact of the exchange-rate changes on the production of various crops in Malawi, over the period 1960-1986. The modification of the supply response model to allow for the effect of exchange rate resulted in the following basic equation in log-linear form:

$$\log q_{it} = \log a_t + b \log P_{it} + c \log R_x + d \log D_{it} + e \log q_{it} + w_{it} \quad ..(2.10)$$

where  $q_{it}$  = the quantity of sales of crop  $i$  to the Agricultural Development and Marketing Corporation (ADMARC) in time period  $t$ ;

$P_{it}$  = the price of commodity  $i$  paid by ADMARC to producers, divided by the price of the competitive alternative crop or the competitive alternative crop or the average price of other agricultural products;

$R_x$  = the exchange rate of the Malawi kwacha to the US dollar;

$D$  = dummy variable representing weather conditions.

In estimating equation (2.10) Mwalwanda separated (on the basis of the marketing arrangement) the small-holder crops from the estate sector.

Based on equation (2.10) several log-linear regressions were estimated to determine the impact of movements in relative producer prices and the exchange rate on output of estate agriculture and small-holder production. The regressions were intended to reveal substitution possibilities existing in the two agricultural sectors in response to the changes in relative producer prices and the exchange rate. The small-holder crops included tobacco, groundnut, maize, cotton and rice, while the estate agricultural crops are fire-cured tobacco and barley tobacco.

The regression results on small-holder crops showed that shifts in the exchange rate did not directly induce a shift in the production of agricultural crops, except through changes in relative producer prices or agricultural inputs. The significance of the variables was increased by lagging the response of agricultural output to changes in nominal relative prices and nominal exchange rate. But, the same was not the case when agricultural output was lagged against changes in "real" relative producer prices and "real" exchange rate.

On the estate crops there was a greater output response to changes in real exchange rate in estate tobacco crops, and the response was more pronounced when the relative producer prices and the real exchange rate were lagged one period.

A major weakness in Mwalwanda's analysis is that he, knowingly, never incorporated other important factors that influence agricultural production such as availability of credit, marketing arrangements, and research and extension services).

### 2.3 AN OVERVIEW

The reviewed empirical studies showed that econometric models and the use of aggregated data have been the main focus of exchange-rate modelling, especially in the developed world. Few studies conducted in developing countries have analyzed the exchange-rate issues by applying ordinary least squares to a single equation, either in linear or log-linear forms. Further, many studies, particularly in Sub-Saharan Africa, have never adopted even the simplest of the econometric techniques to support the hypothesized effects. These studies also ignored that other economic factors that had nothing to do with the effects of the exchange rate could be more significant in determining the outcome for certain target variables. Thus to delineate the impacts of other economic and "special" changes other than exchange-rate movements there is need to specify a systematic model rather than simply comparing the relative performances.

The analytic models discussed under the theoretical literature stressed that the exchange rate is one of the several simultaneously determined variables. In other words, the exchange-rate variable is not truly exogenous, that is, there is no one-way causation between exchange rates and other variables. In this context the exchange-rate function cannot be considered in isolation as a single equation model, otherwise serious econometric shortcomings and attendant policy errors will result. The theoretical studies also emphasized that the determination of exchange rate is a rather complex interactive process and thus cannot be explained by any single factor or by any simple set of explanatory variables.

This study will attempt to develop a simultaneous equation system for the nominal and real exchange-rate movements in Kenya. A simultaneous equation model is hoped, not only to remove the simultaneous equation bias, but also to estimate the economic impacts of the movements of exchange rates, having in mind its major determinants. Such a model is thus able to capture both the determinants and the effects of the changes in exchange rates on the macroeconomic variables. This approach seems realistic because whenever the policy makers change the exchange-rate level they should also have in mind the subsequent direct and indirect consequences.

ENDNOTES

1. The absolute PPP theory is difficult to test because price data are typically in index form.
2. Equation 2.1 may be written in logarithmic form as  $er = p - p^*$
3. PPP assumes an instantaneous adjustment of the exchange rates to changes in relative prices.
4. Examples of such models include Frenkel(1978), Bilson(1978), and Hodrick(1978). These studies are discussed in the empirical literature review in section 2.2.
5. The forward premiums are the discounts between the spot exchange rate and the forward(future) rates of the currency. The spot exchange rate (or simply the spot rate) is also the exchange rate of a currency and it is the one against which appreciations and depreciations are calculated.
6. A comprehensive discussion of the forward exchange theory can be found in Lindsay(1986: p216), Lindert(1986: p350-9), and Isard(1978 p9-16;1987: p6-11).

## CHAPTER 3

## EMPIRICAL MODEL SPECIFICATION AND ESTIMATION METHODOLOGY

3.1 EMPIRICAL MODEL SPECIFICATION

The literature reviewed in Chapter Two provided the theoretical models and the empirical findings on the impact and the determination of exchange-rate movements on various macroeconomic variables. In this chapter we specify the model and the estimation methodology. The estimation results will be presented in Chapter Four.

The model developed in this chapter is based on the assumption that the country is a price taker in the world markets. This is commonly referred to as the "small-country" assumption (see Dervis, 1982: p184; Taylor, 1982: p50-52). The assumption implies that, Kenya, taken as an individual country has no monopoly or monopsony powers to affect the terms at which it trades in the international markets.

Since Kenya's exchange-rate regime has been (up to 1982) that of fixed exchange rates the variability of the nominal exchange rate will appear to be too small ( as depicted in figure 1.1 above ) to have any significant effect on the aggregate variables. For the model to capture this special

feature of the Kenyan economy the study will adopt the variability of the nominal and real effective exchange rates.

However, the exact specification of the model as a whole (the simultaneous equation approach and the number of variables included in each equation) is an original attempt of the current study.

### 3.1.1 The Exchange-Rate Determination

The variables included in the exchange-rate equation are mainly based on the past studies reviewed in Chapter Two (both theoretical and empirical), and also on the determinants considered by the Central Bank of Kenya (1976: p12) when calculating the appropriate rate of adjustment in the exchange rate.

✱ The exchange-rate function relates exchange-rate fluctuations to the trade balance [export (X) and imports (M)], the rate of inflation (CPI), the purchasing power parity (PPP), money supply in the domestic economy (MS), tourist earnings (Tour), real interest rate (ir), foreign public debt (FPD), foreign reserves (FR), and capital movements (KMOVT). Thus, the exchange-rate function will take the following general functional form:

$$ER = f_1(\underbrace{X}_{(+)} \underbrace{M}_{(-)} \underbrace{CPI}_{(+)}, \underbrace{MS}_{(+)}, \underbrace{Tour}_{(+)}, \underbrace{ir}_{(+)}, \underbrace{FPD}_{(-)}, \underbrace{FR}_{(+)}, \underbrace{PPP}_{(-)}, \underbrace{KMOVT}_{(+)}) \dots (3.1)$$



where ER is the nominal or real effective exchange rates. The hypothesized relationships are given by the signs in parentheses below the variables.

### 3.1.2 The Effects of Exchange Rate Changes

The relationship between the exchange-rate movements and the target macroeconomic variables is quite complex and it is very difficult to identify all the possible linkages. Figure 3.1 below is a simplified schematic diagram attempting to identify most of the existing interlinkages in Kenya's exchange-rate system and economic growth. It is these interlinkages which have to be captured by the simultaneous equation model.

#### 3.1.2.1 The Import and Export Equations:

First, exchange-rate changes affects the economic growth directly through the trade balance. Theoretically, exchange-rate depreciation (or devaluation) is expected to increase the ability of the domestic country to export, and also act as a dis-incentive to imports. This will lead to an improvement in the trade balance, and eventually increase the rate of economic growth. The effects on the trade balance are induced by the changes in the relative prices between the traded and the non-traded goods and the elasticities of



Oda

demand for and supply of imports. However, these direct effects are likely not to be so strong in the Kenyan economy given the structural and institutional rigidities. The direct effects will also be affected by the fact that coffee and tea, which are the major exports accounting for more than half of total exports, are in the main exported by long-term agreements through the quota market. Furthermore, given the importance of imports of raw materials and intermediate inputs in the country's manufacturing process, coupled with the use of tariffs, quotas, and tight import-licensing procedures the role of exchange-rate fluctuations on the trade balance will be minimal.

The demand for total imports will be specified as a function of the level of economic activity (measured by the Gross Domestic Product, GDP), the nominal or real effective exchange rate, lagged export earnings (X-1), agricultural productivity (AGR) and availability of foreign exchange (proxied by foreign reserves, FR).

The import function is as specified below:

$$M = f_2(\text{GDP}, \text{ER}, \text{X-1}, \text{FR}, \text{AGR}) \quad \dots\dots(3.2)$$

(+ ) (- ) (+ ) (+ ) (- )

Factors influencing the country's export earnings will include the nominal or real effective exchange rate, world income (WY), domestic productive capacity (PRODC), lagged import

demand (M-1) and the country's export share in world export supply (X/WXS).

The export function can then be written as follows:

$$X = f_3 (ER, WY, PRODC, M-1, X/WXS) \dots\dots(3.3)$$

(+)(+) (+) (+) (-)

### 3.1.2.2 The Price Equation:

A second major link caused by exchange-rate depreciation is the increase (in terms of domestic prices) cost of imported inputs, capital goods and the cost of external borrowing. This will lead to high cost of production and eventually to the prices of locally produced goods. These high prices will be passed to the final consumers of goods creating inflationary pressures in the economy. Figure 3.1, above, also illustrates that the rising cost of living will lead to increased wage demands by trade unions, resulting to even more increases in the costs of production. This is called the popular "wage-price" spiral (see Ayako, Manundu and Mwau, 1987: p9; Cooper, 1971: p492; Boughton et al, 1986: p119).

From the figure, it can also be shown that there is a direct link between inflation and exchange-rate changes. A depreciation-caused inflation will create a need for further depreciation of the domestic currency through the relative prices. Inflation will raise the prices of the non-traded goods

y eroding the advantages of the depreciation (or  
ation).

The inflationary pressures could also call forth for  
ments in the country's fiscal and monetary policies which  
also have an effect in the process of economic growth.

The price equation for the economy will relate the  
s in domestic price level to the nominal or real effective  
ge rates, lagged price level (CPI-1), money supply (MS),  
productive capacity (PRODC):

$$PI = f_4(ER, CPI-1, MS, PRODC,) \quad \dots(3.4)$$

(+)   (?)   (+)   (-)

### 3 Agricultural Growth Equation:

d major channel of the exchange-rate fluctuations on  
ic growth is through agricultural growth. It has been  
that (World Bank, 1981: p42) trade and exchange-rate  
es have had far more profound impact on agricultural  
tion and incentives in much of Africa than any of the  
ltural pricing policies. Since agriculture plays an  
ant and distinct part in Kenya's economic growth<sup>1</sup> it is  
hile to examine the influence of exchange-rate movements  
icultural production.

The exchange-rate determines how much in Kenya shillings the Kenyan farmers are going to receive from the foreign currency earnings. Therefore, a depreciation of the shilling vis-a-vis the foreign currencies will induce the farmers to produce more because they will receive more in domestic currency for the exported tea and coffee. At the same time, a depreciation of the shilling increases the domestic currency cost of imported foodstuff. Domestic producers of food crops will thus be able to favourably compete with the expensive imported food supplies, thereby encouraging increased local production of food. Therefore, the overall effect of a depreciated currency is to augment agricultural growth.

The agricultural growth equation can be stipulated as follows:

$$\text{AGR} = f_s (\text{ER}, \text{G}, \text{GDP}, \text{POP}, \text{AGR-1}, \text{AGRIS}, \text{D}) \quad \dots\dots\dots(3.5)$$

(+ ) (+ ) (+ ) (+ ) (+ ) (+ ) (?)

where AGR = agricultural production,

ER = nominal or real effective exchange rate,

G = amount of government expenditure in total agricultural production,

POP = Population,

AGR-1= lagged agricultural production,

AGRIS= agricultural input supply,

D= Dummy (special factors, such as adverse weather).

GDP= Gross Domestic Product.

### 3.1.2.4 Economic Growth Equation:

To measure the overall (indirect) effect of exchange-rate changes on the economic growth the following equation will be estimated:

$$\text{GDP} = f_6(X, M, \text{AGR}, \text{KFORM}, G, \text{GDP-1}, \text{POP}, D) \quad \dots\dots(3.6)$$

(+)(-) (+) (+) (+) (?) (-) (?)

where KFORM = Capital formation

G = government expenditure

and the other variables are as earlier defined.

## 3.2 ESTIMATION METHODOLOGY

For estimation purposes all the variables in the model will be specified in real terms at 1982 prices.

Equations (3.1)-(3.6) will be expressed in both linear and log-linear forms. To estimate the exact specification of the econometric model error terms ( $\mu_i$ ) will be introduced to capture all the omitted variables.

The model presented above is mathematically complete because it contains six equations in six endogenous variables (i.e., ER, X, M, CPI, AGR and GDP). However, since it is only equations (3.1) to (3.4) which are properly simultaneous, equations (3.5) and (3.6) can be considered as not part of the simultaneous equation system, and can thus be estimated separately, using ordinary least squares estimation technique.

Before a choice of econometric method of estimating the first four equations (3.1) to (3.4) is made the identification status of these individual equations and of the whole system is required.

### 3.2.1 The Order Condition for Identifiability

The order condition states that for an equation to be identified the number of predetermined variables excluded in the equation should be equal to or greater than the number of endogenous variables less one. If we let  $M$  be the total number of equations ( total number of endogenous variables),  $K$  be the number of all variables (both endogenous and exogenous ) in the model, and  $k$  be the number of variables, endogenous and exogenous, included in a particular equation, then the order condition for identification can be symbolically expressed as:

$$(K-k) \geq (M-1)$$

If  $(K-k) > (M-1)$  the equation is over identified and if  $(K-k) = (M-1)$  it is just identified.

Table 3.1 below shows that all the four equations (3.1-3.4) are over identified.



Although the order condition is necessary for a relation to be identified, it is not a sufficient condition (see Koutsoyiannis, 1977: p353; Pindyck and Rubinfeld, 1981: p327). However, for simplicity we can assume that the rank condition (the sufficient condition for identification) will also be satisfied.

TABLE 3.1 Summary of identification Equations of Model by Order Condition

| Equation | No. of<br>Predetermined<br>Variables<br>Excluded<br>(K-k) | No. of<br>Endogenous<br>Variables<br>Included Less<br>One (M-1) | Position        |
|----------|---|---|-----------------|
| 3.1      | 8   | 3   | Over identified |
| 3.2      | 11  | 1   | " "             |
| 3.3      | 11  | 1   | " "             |
| 3.4      | 12  | 1   | " "             |

The estimation of an over-identified equation calls for the use of two-stage least squares (2SLS) or maximum likelihood estimation (MLE) methods. The former has provided satisfactory results for the estimates of the structural parameters and has been accepted as the most important of the single equation techniques for the estimation of over-identified models (koutsoyiannis, 1977: p384). Therefore, the current study will adopt the 2SLS estimation method for the first four structural equations specified in Sections 3.1 above.

ENDNOTES

1. Agriculture is the most important sector of the Kenyan economy as it employs over 80% of the population and contributed over one-third of the country's GDP in 1986 at constant 1982 prices.

## CHAPTER 4

## DATA AND ANALYSIS OF EMPIRICAL RESULTS

## A. TYPE AND SOURCE

## 3.1.1 Type

Stochastic implementation of the model specified in Table 3.1 requires data on the following twenty three (23)

1.

1. Nominal Effective Exchange Rates

2. Real Effective Exchange Rates

3. Total Merchandise Imports

4. Total Merchandise Exports

5. Consumer Price Index

6. Gross Domestic Product

7. Agricultural Output

8. Purchasing Power Parity

9. Tourism Earnings

10. Money Supply

11. Real Interest Rate

12. Foreign Exchange Reserves

13. Net Capital Inflows

14. Government Foreign Debt

15. Import Price Index

16. Export Price Index

17. World Income

Government Expenditure

Kenyan Population

Capital Accumulation

Productive Capacity

World Export Supply

Funny Variable (Unusual economic situation)

ocial statistics do not furnish most variables used. Hence some of the variables were derived from published data.

Variables for the rest of the world were derived from the data from Kenya's six largest trading partners, Kingdom, United States of America, West Germany, and Italy. These countries were chosen because for about one-half of Kenya's exports and imports trade statistics are readily available. More countries are included in the rest of the world category, and can thus be considered as reference. To obtain the respective rest of the world's weight sum to unity.

To measure the 'actual' unemployment rate, the following formulae relating the nominal and real effective exchange rates were developed:



# The Australian National University

The Library

reference

GPO Box 4, Canberra, ACT 2601  
Telegrams & cables NATUNIV Canberra  
Telex AA 62694 NATUNI  
Telephone 062-49 5111

9 January 1986

## TO WHOM IT MAY CONCERN

Mr Joseph Nyamulu was employed at the Australian National University Library from 26 February 1985 to the end of January 1986, while he was completing the one year post graduate course in Information and Records Management at the Canberra College of Advanced Education, a course he successfully completed in December 1985.

Mr Nyamulu was employed as a Library Clerk and as a Librarian at ANU working in the Asian Studies and the Social Sciences and Humanities Divisions. Because of the nature of the work Mr Nyamulu was unable to undertake long term projects but he proved himself a most competent, hard working and cheerful member of staff. It is clear that we benefited from his general enthusiasm and wider perspective of issues in librarianship, while he clearly benefited from work in a largish University library system (currently \$A8.5 million budget covering 11 libraries) and from being exposed to the automated library procedures within the ANU Library. The Library has in place the integrated library system URICA with a bibliographic data base of 650,000 machine readable records. Familiarity with this system, which has much in common with other integrated systems e.g. GEAC and NOTIS, should be beneficial to Mr Nyamulu in those libraries in which he will work which are involved in automation.

(COLIN STEELE)  
University Librarian

20th December, 1984.

WHICH IT MAY CONCERN,

Mr. Joe Nyamulwa worked at the libraries of the three LaTrobe  
Complex colleges for 4 weeks, June-July 1983, as part of his  
experience program for his studies in librarianship at the R.M.I.T.

I found Joe to be reliable, mature, cheerful and totally  
professional in his approach to assigned tasks.

Joe's central task during his stay with us was the  
collation of a Union List of Periodicals for the Libraries of  
Burne College of Decoration, Flagstaff College of TAFE and the  
William Angliss College. Many of the titles held by the three  
libraries had, at that time, not been catalogued or validated in any  
manner hence Joe's task was in many ways quite complex. He also  
undertook the delicate task of reporting to three librarians, this he  
did so well that all gave fine reports on his professionalism and  
personal courtesy.

I recommend Joe Nyamulwa to any future employer,

Yours faithfully,



Donald B. Ruddick,  
B.A., Dip. Lib., Dip. Soc. Sci.  
Librarian,  
Hub Library Resource Centre,  
555 La Trobe Street,  
Melbourne.

MELBOURNE AND METROPOLITAN BOARD OF WORKS

228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000

EE039-1

TO WHOM IT MAY CONCERN

Mr Joseph Nyamulu has been employed by the Board as part of the vacation student intake for 12 weeks from 23 November 1984 to 25 January 1985.

As an Administrative Officer he was involved in work associated with the Equal Employment Opportunity Survey Project. This work involved collating and distributing publicity material for the survey and then the questionnaires and the major task of coding completed questionnaires.

The nature of the project necessitates that he adhere strictly to confidentiality requirements because of the sensitivity of the material being handled, and accuracy in the coding work he is undertaking. This is particularly important as this is the first occasion that Board staff (approximately 8,500) have been asked to present their views and experiences concerning their employment with the Board.

I have no hesitation in highly recommending Joseph for employment in an administrative capacity as his work was very satisfactory. Joseph's attendance was good, he worked longer hours when required, he was well presented and fitted in well with other staff.

*K. Spasojevic*

K SPASOJEVIC (MS)  
MANAGER  
EQUAL EMPLOYMENT OPPORTUNITY  
UNIT

The nominal effective exchange-rate index (NEER) was obtained as follows (See Mansur, 1983: p791-2):-

$$NEER_t = \sum_{j=1}^6 W_{jt} R_t E_{jt} \quad \dots\dots(4.1)$$

Where  $W_{jt}$  = relative weights (trade shares) of the six trading partner countries at time t,

$E_{jt}$  = value of one unit of currency of trading-partner j in terms of the Special Drawing Rights (as a numeraire currency),

$R_t$  = value of one unit of SDR in terms of the domestic currency.

The conventional measure of the real effective exchange rate (REER) was adopted. This is the trade weighted change of the NEER adjusted for the differences between the domestic inflation rate and the trade-weighted average inflation rate of the trading partners:

$$REER_t = \frac{NEER_t}{RP_t} \quad \dots\dots(4.2)$$

where RP is the relative prices, calculated as follows:-

$$RP_t = \sum_{j=1}^6 W_{jt} (CPI_t / CPI_{jt}) \quad \dots\dots(4.3)$$

with CPI being the consumer price index for the home country (Kenya) at period t, and  $CPI_{jt}$  is the consumer price index of country j at period t.



The inflation rate for Kenya will be represented by the consumer price index (CPI). The CPI is a measure of levels in the retail prices of goods and services, typically consumed by households in different income groups. It is therefore both a comprehensive and broadly comparable price index among countries. The CPI is also preferred because it involves both the traded and the non-traded goods <sup>2</sup>.

The purchasing power parity is measured as the relative per capita incomes of the domestic economy to the trading partners. The measure differs from the one used in past studies. The conventional measure of PPP is based on national price data. This can yield superfluous results because the purchasing power of a given domestic sum of money converted into foreign currency rarely permits the purchase of equal bundles of goods and services abroad and domestically (Grubel, 1977: p240-1). Therefore, to obtain the PPP variable we need data on Gross Domestic Product (GDP), Population, GDP deflators, and the convertible currency rates for Kenya and the six trading partners.

The world income level is the weighted average real GDP of the importing countries. The weights will be the quantity or value of exports to any particular trading partner in any given year. Similarly, the real interest rate is the domestic interest rate adjusted for movements in the trade-weighted

average of the central bank discount rates in the trading partners. The central bank discount rate is the rate at which the monetary authorities lend or discount eligible paper for commercial banks. A better proxy for the interest rates could be the lending rates by banks usually to meet the short- and medium-term financing needs to the private sector. Unfortunately there is no continuous series for the lending rates for Kenya, France, West Germany, Italy and the United Kingdom.

The value of real gross domestic product is obtained by adjusting the GDP at current market prices for the GDP deflator at constant 1982 (1982=100) prices. Similarly the values of real agricultural production, real imports and exports are calculated by adjusting the nominal values with the respective price indices, at 1982 prices.

The productive capacity of the economy was defined as the ratio of the proportionate change of real GDP to the average value of real GDP between 1966-1986, and calculated as follows:

$$PRODC = \frac{\hat{GDP}}{\overline{GDP}} \quad \dots\dots(4.4)$$

where  $\hat{GDP}$  is the change in real GDP,  
 $\overline{GDP}$  is the average real GDP.

The country's export share in the world export supply comprised of the ratio of Kenya's export of tea and coffee<sup>3</sup> to the world export supply of tea and coffee (rescaled to sum to unity):

$$X/WXS = \sum_{i=1}^2 W_{it}(X_{it}/WXS_{it}) \quad \dots\dots(4.5)$$

where  $W_{it}$  is the relative weights of Kenya tea and coffee exports,

$X_{it}$  is Kenya export supply of commodity  $i$ (tea and coffee) at period  $t$ ,

$WXS_{it}$  is the total world export supply of commodity  $i$  at period  $t$ .

#### 4.1.2 Data Sources and Data Limitations

All the data used in this study are highly aggregated and obtained wholly from secondary sources. The data covered the period 1966 to 1986, and was mainly extracted from various publications of the Central Bank of Kenya such as the Quarterly Economic Reviews and the Annual Reports, the Kenya Government's Statistical Abstracts and Economic Surveys, and the International Monetary Fund's International Financial Statistics. Other sources include the United Nations' Food and Agricultural Organizations (FAO) Trade Yearbooks, and International Trade Statistics Yearbooks.

A major difficulty encountered in the data collection was the non-availability of some of the data at the required frequency (on monthly or quarterly basis). The data for variables such as GDP, agricultural output, public foreign debt, population, government expenditure and capital formation are published only on annual basis. Therefore the study used the annual aggregative data for the period 1966 to 1986, giving only twenty-one (21) observations.

A further problem in data collection concerns the form in which the data was available, that is whether at current or constant prices. Given the long time-span covered by the study it was important that we isolate the inflationary effects from the real effects. Thus, real values of the variables were needed for the estimation. However, not all variables have values already expressed at constant prices. For instance, the values of tourism earnings, money supply, and government expenditure were reported only at current prices without a corresponding price index which can be used to deflate them. For this matter the study used the GDP deflator to obtain the constant values for the variables without an appropriate price index. The implicit GDP deflator was preferred to the consumer price index because the latter is based on data from Nairobi only and is an average of three income groups for which separate index series are constructed. However, the movements in the two price series are very similar (See, Republic of Kenya, 1983: p12-13).

#### 4.2 ANALYSIS OF EMPIRICAL RESULTS

This section presents a summary of the empirical results of the computer solution of the model specified in Chapter Three as applied on the Kenyan data. The computations were done on an Epson PC AX Computer with the aid of a programme known as LIMDEP (version of January, 1986).

Three sets of results will be presented and analyzed:-

- i) the appropriateness of the external value of the Kenya shilling for the past two decades,
- ii) the determination of the main causes of exchange-rate movements in Kenya and,
- iii) the economic effects of the exchange-rate movements on trade balance (imports and exports), domestic inflation, agricultural production and economic growth.

Preliminary investigations showed that the linear equation specification appeared to give better fit as compared with non-linear specification. Therefore, the empirical results of (ii) and (iii) will be based only on the linear specification of the equations of the empirical model.

#### 4.2.1 The Extent of Under- and Over-Valuation of the Kenya Shilling

The past several years have been characterized by many large swings in the nominal effective exchange rate values of the Kenya shilling (see Appendix, Table 3). Furthermore, the real effective exchange rates have also undergone very large changes, implying that nominal values have not been closely correlated with the relative inflation differentials.

To show the extent of overvaluation or undervaluation<sup>4</sup> of the Kenya shilling Table 4.1, below, used the nominal and real effective exchange rates, weighted by the distribution of Kenya's multilateral trade. The table shows that both indices produces similar results in determining the overvaluation or undervaluation of the currency.

For the entire period when the Kenyan authorities maintained a fixed exchange-rate regime the shilling seems to have been undervalued in the foreign markets, both in nominal and real effective terms. This implies that the domestic currency was supposed to buy many more dollars and pounds under the demand and supply conditions than it did under the pegged regime. However, no sooner had the authorities decided to adopt the "managed" float in 1982 than the overvaluation of the shilling became a reality. In 1982, the nominal and real

TABLE 4.1: Percentage rate of under- and over-valuation of the shilling \*

| YEAR | NEER  | REER  |
|------|-------|-------|
| 1966 | -0.9  | -17.0 |
| 1967 | +52.0 | +24.1 |
| 1968 | +58.2 | +38.5 |
| 1969 | +46.0 | +24.8 |
| 1970 | +66.7 | +55.6 |
| 1971 | +45.8 | +35.5 |
| 1972 | +46.3 | +48.5 |
| 1973 | +27.2 | +41.0 |
| 1974 | +66.0 | +73.3 |
| 1975 | +27.4 | +29.7 |
| 1976 | +47.0 | +47.7 |
| 1977 | +24.7 | +19.2 |
| 1978 | +52.6 | +49.2 |
| 1979 | +40.6 | +41.8 |
| 1980 | +74.4 | +78.6 |
| 1981 | +2.5  | +14.6 |
| 1982 | -27.3 | -27.3 |
| 1983 | -41.0 | -44.3 |
| 1984 | -26.6 | -34.2 |
| 1985 | -53.8 | -61.9 |
| 1986 | -65.3 | -71.3 |

SOURCE: APPENDIX A, Table 3

REER Real Effective Exchange Rates

NEER - Nominal Effective Exchange Rates

\* A positive sign (+) means the undervaluation of the Kenya shilling, and a negative sign (-) the overvaluation from the nominal (official) exchange rate.

effective rates were overvalued by more than 27% of the nominal (SDR) exchange rates. By 1986 the rate of overvaluation was 65% and 72% in nominal and real effective terms, respectively.

It should however be noted that the exchange rate under- or over-valuation was not intended by the Government. It mainly depended on the economic conditions prevailing in the trading partners. The exchange-rate overvaluation could also be due to the expansionary and monetary policies adopted by the Government aimed at maximizing economic growth. A side effect of these expansionary monetary and fiscal policies is inflation which when more rapid than the inflation rate of the principal trading partners (see Appendix, Table 8) causes the real effective exchange rate to appreciate. The exchange-rate overvaluation for the last few years could also be due to the imposition of high duties and quotas aimed at protecting local manufacturers of industrial goods. This has the effect of increasing the local prices of the industrial goods relative to world prices. Consequently, the official exchange rate will typically overvalue the domestic currency relative to the foreign currencies, compared to the real purchasing power of the domestic currency.



#### 4.2.2 Determination of Exchange-Rate Changes

To analyze the factors determining exchange-rate movements in Kenya the exchange-rate equation formulated in Chapter Three (equation 3.1) was estimated using both the nominal and real effective rates.

The estimation results for the exchange-rate equation are presented in Table 4.2, below. The results of the nominal and real effective exchange rates are almost the same in terms of the signs and the statistical significance (as shown by the t-ratios). However the equation using REER as the dependent variable is statistically better than the former as shown by the coefficient of determination ( $R^2$ ) and the adjusted R-squared. This implies that real effective exchange rate is a more powerful indicator of exchange-rate movements in Kenya than the nominal rate. Put differently, the real rate tend to explain the movements better than the nominal rate.

The results of the exchange-rate equation suggests that the variables included in the model explain 84.8% and 88.1% of the total variation in NEER and REER, respectively. We can therefore conclude that the specified model was satisfactory. From the F-statistic test we can conclude that the joint effect of the regressors on the exchange rates was statistically significant from zero at one percent level of significance.

TABLE 4.2: Two stage least squares estimation results on determination of exchange rates

| Nominal Effective Exchange Rate |             |           | Real Effective Exchange Rate |             |          |
|---------------------------------|-------------|-----------|------------------------------|-------------|----------|
| Variable                        | Coefficient | t-ratio   | Variable                     | Coefficient | t-ratio  |
| Constant                        | 50.244      | 2.583 **  | Constant                     | 43.701      | 2.177 *  |
| CPI                             | 0.186       | 1.216     | CPI                          | 0.112       | 0.714    |
| IMP                             | 0.014       | 2.859 **  | IMP                          | 0.010       | 1.915 *  |
| EXP                             | -0.017      | -1.403    | EXP                          | -0.002      | -0.197   |
| PPP                             | -8.043      | -1.837 *  | PPP                          | -7.513      | -1.677   |
| TOUR                            | 0.051       | 2.696 **  | TOUR                         | 0.046       | 2.365 ** |
| MS                              | -0.023      | 2.256 *   | MS                           | -0.024      | -2.244 * |
| IR                              | -0.490      | -2.302 ** | IR                           | -0.284      | -1.292   |
| FR                              | 0.034       | 3.295 *** | FR                           | 0.030       | 2.825 ** |
| KMOV                            | 0.022       | 1.805     | KMOV                         | 0.035       | 2.754 ** |
| FPD                             | -0.014      | -2.299 ** | FPD                          | -0.014      | 2.226 *  |
| R-Squared.....                  | 0.848       |           | R-Squared.....               | 0.881       |          |
| Adjusted R-Squared..            | 0.696       |           | Adjusted R-squared...        | 0.762       |          |
| Std. Error of Regr..            | 1.026       |           | Std. Error of Regr...        | 1.059       |          |
| F-Statistic(10,10)..            | 5.581       |           | F-Statistic(10,10)...        | 7.392       |          |
| Sig. of F-Test.....             | 0.006       |           | Sig. of F-Test.....          | 0.002       |          |
| D-W Statistic.....              | 2.342       |           | D-W Statistic.....           | 2.249       |          |

## Notes:

|      |  |
|------|--|
| CPI  | Consumer Price Index                   |
| IMP  | Real Merchandise Imports (K£ millions) |
| EXP  | Real Merchandise Exports (k£ millions) |
| PPP  | Purchasing Power Parity                |
| TOUR | Tourism Earnings (K£ millions)         |
| MS   | Money Supply (K£ millions)             |
| FR   | Foreign Reserves (k£ millions)         |
| IR   | Real Interest Rate                     |
| KMOV | Net Capital Movements (K£ millions)    |
| FPD  | Foreign Public Debt (K£ millions)      |

\* Statistically Significant at 10% level.

\*\* Statistically Significant at 5% level.

\*\*\* Statistically Significant at 1% level

Alternatively, the F-statistic test shows that  $R^2$  was statistically significant from zero. As a formal test of serial correlation the Durbin-Watson (D-W) statistic shows no problem of association between adjacent residuals. Therefore the results of the regression equation are valid and reliable with minimal specification error.

The positive and significant constant value implies that, hypothetically, if there were no changes in any of the variables (except those excluded from the model), Kenya will still have a significant positive effective rate of exchange. Most coefficients have the expected signs and are statistically different from zero at 10% level of significant. These results appear consistent with the theory of exchange rate determination. The purchasing power parity, real imports, tourism earnings, foreign reserves, net capital inflows and foreign public debt had statistically significant influence on exchange rate variations. However, although money supply and real interest rate had statistically significant effects they did not have the expected signs. On the other hand, the coefficients of the domestic inflation, and real exports have statistically insignificant effects at any of the accepted levels of significance. This suggests that the rate of domestic inflation and real exports do not make any significant contribution to the explanation of the variations in the exchange rate.

It is not surprising that there is no clear pattern to the relationship between the exchange-rate changes and important variables such as domestic inflation and real exports. This finding does not necessarily imply that the causal relationships are weak, but rather that they are probably complex and depends crucially on the origin of the exchange-rate changes (Boughton et al, 1986).

#### 4.2.3 Effects of Exchange-rate Changes

##### 4.2.3.1 Effects on the Balance of Trade

The econometric results presented in Tables 4.3 and 4.4, below, indicate that despite the absence of either positive or negative first order auto-correlation the estimated equations for import demand and export supply are very much mis-specified as depicted by the  $R^2$ , the adjusted  $R^2$ , the significance of F-test and of the constant term.

TABLE 4.3: Two stage least squares estimation results  
on the effects of exchange rates on real exports

| Nominal Effective Exchange Rate |             |           | Real Effective Exchange Rate |             |           |
|---------------------------------|-------------|-----------|------------------------------|-------------|-----------|
| Variable                        | Coefficient | t-ratio   | Variable                     | Coefficient | t-ratio   |
| Constant                        | 417.780     | 4.455 *** | Constant                     | 355.197     | 4.456 *** |
| NEER                            | -11.009     | -1.026    | REER                         | -0.841      | -0.070    |
| WY                              | -0.327      | -1.131    | WY                           | -0.136      | -0.409    |
| PRODC                           | 3.896       | 2.151 **  | PRODC                        | -2.635      | 1.104     |
| IMP-1                           | 0.076       | 0.873     | IMP-1                        | 0.058       | 0.632     |
| X/WXS                           | -7.812      | -0.659    | X/WXS                        | -6.747      | -0.526    |
| R-Squared.....                  | 0.329       |           | R-Squared.....               | 0.310       |           |
| Adjusted R-Squared..            | 0.106       |           | Adjusted R-Squared...        | 0.080       |           |
| Std. Error of Regr..            | 63.095      |           | Std. Error of Regr....       | 63.987      |           |
| F-Statistic(5,15)...            | 1.423       |           | F-Statistic(5,15)....        | 1.349       |           |
| Sig. of F-Test.....             | 0.256       |           | Sig. of F-Test.....          | 0.297       |           |
| D-W Statistic .....             | 1.433       |           | D-W Statistic .....          | 1.200       |           |

Notes:

|       |   |
|-------|---|
| NEER  | Nominal Effective Exchange Rates              |
| REER  | Real Effective Exchange Rates                 |
| WY    | World Income (K£ billions)                    |
| IMP-1 | Lagged Real Merchandise Imports (K£ millions) |
| X/WXS | Kenya Export Share in World Export Supply     |

\*\*\* Statistically Significant at 1% level.

\*\* Statistically Significant at 5% level.

TABLE 4.4: Two stage least squares estimation results on the effects of exchange rates on real imports

| Nominal Effective Exchange rate |                    |                | Real Effective Exchange Rate |                    |                |
|---------------------------------|--------------------|----------------|------------------------------|--------------------|----------------|
| <u>Variable</u>                 | <u>Coefficient</u> | <u>t-ratio</u> | <u>Variable</u>              | <u>Coefficient</u> | <u>t-ratio</u> |
| Constant                        | 646.044            | 5.087 ***      | Constant                     | 636.027            | 5.818 ***      |
| NEER                            | -1.131             | -0.123         | REER                         | 0.030              | 0.004          |
| GDP-1                           | 0.009              | 0.071          | GDP-1                        | 0.011              | 0.092          |
| EXP-1                           | -0.109             | -0.465         | EXP-1                        | -0.120             | -0.483         |
| FR                              | -0.003             | -0.007         | FR                           | -0.006             | -0.017         |
| AGR-1                           | 0.245              | 0.532          | AGR-1                        | 0.242              | 0.525          |
| R-Squared.....                  |                    | 0.209          | R-Squared.....               |                    | 0.214          |
| Adjusted R-Squared.....         |                    | -0.054         | Adjusted R-Squared.....      |                    | -0.048         |
| Std. Error of Regr.....         |                    | 86.606         | Std. Error of Regr.....      |                    | 86.326         |
| F-Statistic(5,15).....          |                    | 0.794          | F-Statistic(5,15).....       |                    | 0.818          |
| Sig. of F-Test.....             |                    | 0.571          | Sig. of F-Test.....          |                    | 0.555          |
| D-W Statistic.....              |                    | 2.362          | D-W Statistic.....           |                    | 2.320          |

Notes:

|       |   |
|-------|---|
| NEER  | Nominal Effective Exchange Rates            |
| REER  | Real Effective Exchange Rates               |
| GDP-1 | Lagged Gross Domestic Product (K£ millions) |
| EXP-1 | Lagged Merchandise Exports (K£ millions)    |
| FR    | Foreign Exchange Reserves (K£ millions)     |
| AGR-1 | Lagged Agricultural Output (K£ millions)    |

\*\*\* Statistically significant at 1% level

On the face of it, the above evidence seems to scotch the view that, in general, devaluation has an effect on imports and exports. The findings presented in Table 4.3, strongly suggests that real exports are not influenced by the exchange rates whether in nominal or real terms. Table 4.4 also shows that the relationship between real imports and all the variables included in the import-demand equation is also not statistically different from zero even at 10% level of significance.

The estimation results suggests that trade flows were not strongly influenced by any of the variables included in the respective equations. We can, therefore, conclude that the increase in real export earnings were not accredited to the shilling depreciations nor did they reflect the growth in world demand (proxied by the growth in world income). On the other hand, it will be equally in-appropriate to hypothesize that the increase in real imports are associated with a rise in real GDP, real agricultural output or the overvalued rate of the Kenya shilling.

It should, however, be noted that although the exchange-rate adjustments did not have any significant observed effect on the real trade flows it does not necessarily mean that the adjustments were unsuccessful. The exchange-rate changes can still be judged highly successful if they permit many controls and subsidies required before the adjustments to prevent a much

worse balance than actually observed to be eliminated. Moreover, a successful adjustment might worsen the trade balance but still eliminate balance of payments deficits if it induces a larger net capital inflows from abroad (Cooper, 1971).

The lack of clear relationship between the exchange-rate changes and the trade flows could also be because of to the weighting procedure, choice of the base year, the currency numeraire used, the number and characteristics of the trading partners chosen for the study, etc. Furthermore, for a variety of reasons, Kenya, like many developing countries, does not apply a single, well-defined exchange rate to all current account transactions with foreigners. Rather the country maintains a systems of multiple rates, the rates used for particular transaction depending on the type of transactions and even sometimes on the foreign country involved in the transaction. Examples of such multiple rates include the indicative Preferential Trade Area (PTA) rates, the tourist rates, the buying and selling rates, etc. The use of import duties, export taxes and direct controls could also have influenced the behaviour of the real exports and imports as they have the same effects as the multiple rates.



## 4.2.3.2 Effects on Inflation

Nominal and real effective rates of exchange significantly affect the increases in the domestic prices (see Table 4.5, below).

The inflation equation is statistically significant at more than 95% level of confidence, with the values of the D-W statistic and the coefficient of determination suggesting no specification bias of the equation.

TABLE 4.5: Two stage least squares estimation results on the effects of exchange rates on inflation

| Nominal Effective Exchange Rate |             |         | Real Effective Exchange Rate |             |          |
|---------------------------------|-------------|---------|------------------------------|-------------|----------|
| Variable                        | Coefficient | t-ratio | Variable                     | Coefficient | t-ratio  |
| Constant                        | -10.419     | -1.341  | Constant                     | -10.383     | -1.545   |
| NEER                            | 0.889       | 1.949 * | REER                         | 0.888       | 2.359 ** |
| CPI-1                           | 0.410       | 1.825 * | CPI-1                        | 0.373       | 1.713    |
| MS                              | -0.004      | -0.306  | MS                           | -0.008      | -0.571   |
| PRODC                           | 0.093       | 0.707   | PRODC                        | 0.127       | 0.979    |
| R-Squared.....                  |             | 0.513   | R-Squared.....               |             | 0.552    |
| Adjusted R-Squared.....         |             | 0.392   | Adjusted R-Squared.....      |             | 0.440    |
| Std. Error of Regr.....         |             | 4.323   | Std. Error of Regr.....      |             | 4.148    |
| F-Statistic(4,16).....          |             | 4.219   | F-Statistic(4,16).....       |             | 4.930    |
| Sig. of F-Test.....             |             | 0.016   | Sig. of F-Test.....          |             | 0.009    |
| D-W Statistic.....              |             | 1.893   | D-W Statistic.....           |             | 2.047    |

## Notes:

|        |                                  |
|--------|----------------------------------|
| NEER   | Nominal Effective Exchange Rates |
| REER   | Real Effective Exchange Rates    |
| CPI -1 | Lagged Consumer Price Index      |
| MS     | Money Supply (K£ millions)       |
| PRODC  | Productive Capacity (%)          |

- \* Statistically Significant at 10% level  
 \*\* Statistically Significant at 5% level

The expected positive sign of the exchange rate variable supports the classical view that a devaluation of a currency is likely to increase cost of domestic production and hence the prices of locally manufactured goods, creating inflationary pressures in the country. This has the effect of undermining the improved competitiveness that the devaluation is designed to accomplish.

This result probably support the notion that many policy makers in developing countries are reluctant to undertake serious exchange rate adjustments despite their knowledge of overvalued domestic currency (see Cooper, 1971:p492).

#### 4.2.3.3 Effects on Agricultural Growth

The regression results displayed in Table 4.6, below, refutes the general assertion that an exchange-rate depreciation is always associated with an increase in agricultural output. To the contrary, the negative coefficients of the nominal and real effective exchange rates imply that it is the appreciation (negative devaluation) of the Kenya shilling against the Special Drawing Rights that leads to real agricultural growth. However, the exchange-rate variations (like government involvement in agriculture and the amount of input supply in the sector) explains very little ( using the statistical significance) of the observed movements in real agricultural output.

The major determinant of Kenya's agricultural production is the growth of the country's real gross domestic product with the growth in population being a major hindrance. This finding supports the Government's concern over population growth rate and lack of arable land.

TABLE 4.6: Ordinary least squares estimation results on the effects of exchange rates on real agricultural output

| Nominal Effective Exchange Rate |             |           | Real Effective Exchange Rate |             |           |
|---------------------------------|-------------|-----------|------------------------------|-------------|-----------|
| Variable                        | Coefficient | t-ratio   | Variable                     | Coefficient | t-ratio   |
| Constant                        | 247.030     | 2.734 **  | Constant                     | 297.470     | 3.920 *** |
| NEER                            | -3.330      | -0.726    | REER                         | -5.849      | -1.716    |
| G.AGR                           | -0.413      | -0.672    | G.AGR                        | -0.190      | -0.331    |
| GDP                             | 0.465       | 4.518 *** | GDP                          | 0.493       | 5.116 *** |
| POP                             | -44.178     | -2.164 *  | POP                          | -56.583     | -2.834 ** |
| AGR-1                           | 0.197       | 1.488     | AGR-1                        | 0.257       | 2.211 **  |
| AGRIS                           | -0.141      | -0.156    | AGRIS                        | 0.364       | 0.435     |
| DUMMY                           | -6.949      | -0.380    | DUMMY                        | -0.158      | -0.010    |
| R-Squared.....                  |             | 0.982     | R-Squared.....               |             | 0.985     |
| Adjusted R-Squared....          |             | 0.972     | Adjusted R-Squared....       |             | 0.976     |
| Std.Error of regr.....          |             | 29.128    | Std.Error of Regr.....       |             | 26.828    |
| F-Statistic(7,13).....          |             | 100.258   | F-Statistic(7,13) ....       |             | 118.521   |
| Sig. of F-Test.....             |             | 0.000     | Sig. of F-Test.....          |             | 0.000     |
| D-W Statistic.....              |             | 1.251     | D-W Statistic.....           |             | 1.413     |

Notes:

NEER Nominal Effective Exchange Rates  
 REER Real Effective Exchange Rates  
 G.AGR Government Expenditure in Agriculture (K£ millions)  
 GDP Gross Domestic Product (K£ millions)  
 POP Kenya Population (millions)  
 AGRIS Agricultural Input Supply (K£ millions)  
 DUMMY A Dummy variable (1968, 1974, 1978, 1979, 1983, 1984)

\* Statistically significant at 10 % level  
 \*\* Statistically significant at 5 % level  
 \*\*\* Statistically significant at 1 % level

#### 4.2.3.4 Effects on Economic Growth

While direct empirical analysis of the effects of exchange-rate adjustments on real GDP is difficult to undertake, it is important to examine the actual outcome for growth rates in GDP to determine any existing effects. Since the effects of the exchange-rate action on real economic growth depends on the speed and extent of the effects on the balance of trade positions and agricultural production, it will also have an indirect effect on GDP growth rates.

If we assume that the variations in real GDP are attributable mainly to the changes in real imports and exports and real agricultural output we can compute indirect coefficients to represent the indirect linkages of exchange rates on real GDP. Table 4.7, below suggests that although exports and imports have the correct sign they are not important at all in the determination of Kenya's economic growth. Since the relationship between exchange rates and exports and imports was also weak it appears correct to say that exchange-rate adjustment does not have any useful linkage to the overall economic growth. On the other hand, agriculture appears to contribute positively to the country's real GDP. But, again, the interlinkage with exchange-rate movements seems to be too weak to have any significant indirect effects through agriculture to overall growth.

TABLE 4.7: Ordinary least squares estimation results on the determination of real gross domestic product

| <u>Variable</u>         | <u>Coefficient</u> | <u>t-ratio</u> |
|-------------------------|--------------------|----------------|
| Constant                | -272.670           | -1.892 *       |
| EXP                     | 0.201              | 0.871          |
| IMP                     | -0.035             | -0.255         |
| AGR                     | 0.873              | 2.527 **       |
| GEXP                    | -0.023             | -0.368         |
| KFORM                   | 0.127              | 0.925          |
| GDP-1                   | 0.434              | 2.352 **       |
| POP                     | 57.905             | 1.858 *        |
| DUMMY                   | -13.947            | -0.533         |
| R-Squared.....          |                    | 0.997          |
| Adjusted R-squared..... |                    | 0.994          |
| Std. Error of Regr..... |                    | 48.860         |
| F-Statistic(8,12).....  |                    | 430.996        |
| Sig. of F-Test.....     |                    | 0.000          |
| D-W Statistic.....      |                    | 2.280          |

NOTES:

|       |   |
|-------|---|
| EXP   | Merchandise Exports (K£ millions)                     |
| IMP   | Merchandise Imports (K£ millions)                     |
| AGR   | Agricultural Output (K£ millions)                     |
| KFORM | Capital Formation (K£ millions)                       |
| GEXP  | Government Expenditure (K£ millions)                  |
| POP   | Kenya Population (millions)                           |
| DUMMY | A Dummy Variable (1968, 1974, 1978, 1979, 1983, 1984) |

\* Statistically significant at 10% level

\*\* Statistically significant at 5% level

Table 4.8, below is an attempt to calculate the extent of the effects of exchange-rate movements on real GDP. The analysis is one of comparing the effects on exports, imports and agriculture, and then the effects of the latter factors on GDP. Evidently as in agricultural growth, it is currency appreciation which is associated with positive rates of economic growth. But since this is a partial-equilibrium calculation, it should be regarded as indicative of the minimum range of the effects. However, as noted earlier, the extent of the effects is likely to be very small.

TABLE 4.8: Effects of exchange rate changes on economic growth

|             | Direct Effects        |           | 3<br>GDP | Indirect Effects On GDP |                  |
|-------------|-----------------------|-----------|----------|-------------------------|------------------|
|             | 1<br>NEER             | 2<br>REER |          | 4<br>NEER<br>1X3        | 5<br>REER<br>2X3 |
| Exports     | -7.465                | -1.955    | 0.201    | -1.500                  | -0.393           |
| Imports     | -1.131                | 0.030     | -0.035   | 0.040                   | 0.001            |
| Agriculture | -3.330                | -5.847    | 0.873    | -2.907                  | -5.106           |
|             | Total Indirect Effect |           |          | -3.827                  | -5.498           |

ENDNOTES

1. For different implications of various exchange-rate indices see Maciejewski, 1983; Rhomberg, 1976.
2. The CPI is a measure of imported and domestically produced goods and services. It can, therefore, reflect both the direct and indirect effects of a depreciation on prices. But, the GDP deflator on the other hand reflects only indirect effects. See Boughton et al.
3. Tea and coffee comprise more than 60% of Kenya's exports, and their data are easily obtained as are classified in the ISTC codes
4. While the need to estimate the extent of over- and under-valuation of a currency is obvious, the actual measurement has and is fraught with the danger of under- or over-valuation. See Mwalwanda et al. (1985).

## CHAPTER 5

## SUMMARY, POLICY IMPLICATIONS AND CONCLUSIONS

5.1 SUMMARY

The prime objective of this study was to provide an empirical framework to examine the relative importance of the main determinants of exchange-rate movements, and evaluate certain macroeconomic effects of the exchange-rate policy in Kenya. The study had three specific objectives. First, to formulate and estimate a simultaneous equation model for exchange-rate determination in the country. Second, to analyze the specific impacts of the exchange-rate changes on certain target macroeconomic variables, namely, real imports and exports, rates of domestic inflation, real GDP, and real agricultural production. The third objective, which will be accomplished in the present chapter, was to discuss the policy implications of the empirical results.

The motivation for the study could be attributed partly to lack of any empirical evidence to guide public policy, and partly to the limitations of past studies on exchange rates. A further motivation was the controversy and debate surrounding the success of the exchange-rate adjustments to improve the trade balances and balance of payments, particularly in Sub-Saharan African countries.



Chapter Two discussed the theoretical and empirical literature on the determination and effects of exchange-rate movements, focussing attention on the relationship between exchange-rate adjustments and exports, imports, interest rates, inflation rates, money supply, expectations, agricultural growth, and rate of economic growth. The shortcomings of past studies and improvements thereof were also discussed.

Based on the review of the literature, the empirical model for this study was specified in Chapter Three. The model consisted of a six simultaneous equation system. The estimation methodology for the specified model was discussed in detail in Chapter Three.

Discussion of the data type and sources used for the estimation of the empirical model was accomplished in the first section of Chapter Four. All the data used in the study were highly aggregative and obtained wholly from secondary sources, and covered the period from 1966 to 1986. The specified model was estimated using two-stage least squares estimation procedure. Discussion of the limitations of the data for the estimation purposes was also made in Chapter Four.

## 5.2 POLICY IMPLICATIONS

The analyses and findings of this study can be used to provide some guidance for policy making concerning the exchange-rate management in Kenya.

The use of the exchange rate as an instrument of policy raises many social, political and economic problems. One most important issue is about its appropriate level. Is the current rate of US dollar at Ksh 17.03 correctly valued? This study has shown that using trade weights of six trading partners in the calculation of nominal and real effective exchange-rate indices (which are normally used to evaluate the international competitiveness of a currency) the same results are attained -- the Kenya shilling became increasingly overvalued when the country floated her currency. This implies that the floating exchange-rate policy might not be appropriate for the country! However, it would be wrong to attach great importance to the changes in nominal and real effective rates because the usefulness of these indices is limited unless considered along with additional information.

The divergence in the values of the nominal and real effective exchange rates imply that the nominal rates have not been closely correlated with the relative prices. This, together with the finding that real rates is a better indicator of the exchange rate movements than the nominal rate, calls for more

consideration on the relative inflation differentials between Kenya and her trading partners whenever the policy makers realign the exchange rate.

While it appears true that the movements of import payments, tourism earnings and foreign public debt, determine the exchange rate adjustments, the other CBK's principle determinant, the export earnings, did not show any systematic influence. It is foreign exchange reserves which seem to explain the changes much better than export earnings. Therefore, there is need to review more closely what really causes the exchange-rate changes in Kenya.

Regarding the conduct of policy the inconsistent relationship between the exchange rate and money supply and real interest rate infers that the monetary approach does not appear to have any systematic implications for the exchange-rate or its management in Kenya. This implies that the exchange rate manipulations could probably not be pursued through domestic monetary policy.

The validity and reliability of the results on the determination of exchange-rate changes using two stage least squares estimation technique can be interpreted as supporting the notion that the exchange rate is really an endogenous variable that responds to several factors simultaneously.

Therefore, to determine the "correct" exchange rate, particularly in the long run, detailed information on other variables and other policies, is required, otherwise the adjustments would not be predicted correctly.

Regarding the role of exchange rates on the specific macroeconomic variables, no clear cut recommendations emerge from the findings except that there is always a need to critically consider the prevailing economic conditions before a decision to manipulate the exchange rate is made. This is because the evaluation of the policy reactions to the economic changes associated with shilling movements should not be considered in a vacuum; rather, it depends crucially on the conditions under which the exchange-rate changes occurred. The question of appropriate policy reactions also hinges on whether the exchange-rate movement itself resulted from a policy shift or from a shift in the competitive market behaviour. The source and the timing of the changes may also be important.

The poor impact of the exchange rates on the target variables also calls for the policy makers to try to understand the nature of the other policy instruments in the economy and address themselves to the institutional and structural rigidities. For instance, in the case of agricultural growth other instruments such as improved research, extension, input supply, marketing and/or credit systems need to be established

first. Exchange-rate policy reforms might then be pursued as a second step. This is because there could be many possible reasons for the distortions in the economy, such as tariff and other trade policies, wage and price controls, etc. which calls for many other ways of dealing with them, apart from using the exchange rate.

Finally, it is also important to ensure that any exchange-rate adjustment is accompanied by other policy measures, for example to contain domestic inflation, or to promote exports. Perhaps the main measures to consider include the monetary and fiscal policies and other policies to ensure smooth adjustment of the production structure of the economy.

### 5.3: CONCLUSIONS:

The following are main findings of the study:

(i) Measuring the external value of the Kenya shilling using the Special Drawing Rights as a numeraire currency, it was found that the domestic currency was, on average, depreciated by 168% over the period under review, with most changes occurring in the 1980s. However, the nominal and real effective exchange rates show that the external value of the shilling had appreciated on average by 6.2% and 8.9%, respectively, between 1966 and 1986.

(ii) Comparing the official exchange rate to the "equilibrium" rates (the nominal and real effective exchange rates, NEER and REER) the shilling was valued at lower rates than it could actually fetch in the international markets. However, this was only the case during the fixed exchange-rate regime (up to 1982). The shilling became overvalued immediately Kenya adopted the "managed" flexible exchange-rate policy.

(iii) REER was a more powerful indicator of the exchange-rate movements in Kenya than NEER. This means that the REER is a better proxy for the changes in the external value of the Kenya shilling.

(iv) The exchange-rate variations were, to a large extent, consistent with the theory of exchange-rate determination. The purchasing power parity, real imports, tourism earnings, foreign reserves, net capital inflows and foreign public debt were statistically significant and consistent determinants of the movements in the real effective rates. Money supply and real interest rate were also statistically significant but did not have the expected signs. Although real exports and domestic inflation affected the changes in exchange rates, the effects were not as great as expected. The effects of PPP were relatively more statistically

significant from zero on nominal effective rates than on the real rates.

(v) Domestic inflation was influenced more by money supply and productivity of the economy than by the movements in the exchange rate.

(vi) The results refuted the general assertion that an exchange-rate depreciation is always associated with an increase in agricultural output. Besides, the exchange-rate variations explained very little of the observed movements in real agricultural output.

(vii) Finally, the study showed that if it were not for the rather weak linkage between the exchange-rate movements and the main determinants of the overall growth of the economy, the depreciation of the domestic currency could depress economic activity.

#### 5.4: LIMITATIONS OF THE STUDY AND AREAS OF FURTHER RESEARCH

There is need to recognize the limitations of the nominal and real effective exchange-rate indices constructed which can be used as indicators of over- or under-valuation of the domestic currency. Different approaches with different weighting procedures (bi-lateral, multi-lateral, etc.) should be found to determine the appropriate indices suited to Kenya, which can be implemented.

The analysis should be done in quarterly or monthly data not only to gain more degrees of freedom (and thus more reliable results) but because decisions on exchange-rate policy may be taken at intervals short than what is implied in the annual data.

Although single-equation and partial-equilibrium analyses are useful in measuring and evaluating specific connections that are important in the transmission of exchange-rate effects they cannot be used to measure the overall effects very clearly. Thus our study might have ignored numerous indirect channels that interact in complex ways. A full general-equilibrium model for Kenya is perhaps overdue, to quantify the role of various channels in the overall effect of exchange-rate adjustments. Such a model should also include policy issues.



Other equally relevant issues to be addressed when changes in the exchange rate are under consideration includes the effects on the wages and employment, savings and investment, income and distribution of income, increased production capacity, international reserves, foreign public debt, price of imported inputs, government budget, etc. The consequences on other social factors such as income distribution between consumers and producers, rural and urban communities, etc. should also be studied.

Other areas of research should include case studies for investigating the influence of exchange-rate policy on the volume and composition of various exports and imports, pricing policy of various manufacturing firms, the agricultural marketing boards, and the general operation of some selected enterprises.

Since the existence of black market exchange rates of developing countries is common knowledge, and the Kenyan shilling has been alleged to be traded in an unofficial market an attempt to study the black market exchange rate in Kenya could also be important.

## BIBLIOGRAPHY

- Artus, Jacques, R. (1981) "Toward a More Orderly Exchange Rate System." Finance and Development, Vol. 20. No. 1. pp. 10-13
- Ayako, Aloys B. and Stephen A. O'Connell (1987) "A Model of Exchange Rate Realignment for Kenya." Department of Economics, University of Nairobi, (mimeo). This is a revised version of a paper presented at IDRC Conference in Harare, December 1986.
- Ayako, A.B, M. Manundu and G.N. Mwaui (1987) "Devaluation and Inflation in Kenya: A Theoretical Framework." Department of Economics, University of Nairobi, (mimeo). This is a revised version of a paper presented at IDRC Conference in Harare, December 1986.
- Balassa, Bela (1984) "External Shocks and Policy Responses in Sub-Saharan Africa, 1973-78." Finance and Development, Vol. 21, No. 1. pp. 10-12.
- \_\_\_\_\_ (1987) "Effects of Exchange Rate Changes in Developing Countries." World Bank: DRD Discussion Paper Report, No. DRD 291.
- \_\_\_\_\_ (1987) "The International Monetary System and Exchange Rate Policies in the Developing Countries." World Bank: DRD Discussion Paper Report, No. DRD 294.
- Bautista, Romeo M. (1980) "Exchange Rate Changes and LDC Export Performance under Generalized Currency Floating." Weltwirtschaftliches Archiv, Vol. 117. pp. 443-468.
- \_\_\_\_\_ (1980) "Exchange Rate Adjustment under Generalized Currency Floating: Comparative Analysis among Developing Countries." World Bank Staff Working Papers, No. 436.
- Belanger, Gerald (1976) "An Indicator of Effective Exchange Rates for Primary Countries." International Monetary Fund Staff Papers, Vol. 23. pp. 113-136.
- Bhagwat, Avinash and Yusuke Onitsuka (1974) "Export-Import Responses to Devaluation: Experience of the Non-Industrial Countries in the 1960s." International Monetary fund Staff Papers, Vol. 21. pp. 414-462.
- Bhandari, Jagdeep S. (1982) Exchange Rate Determination and Adjustment. (New York: Praeger Publishers).

- Boughton, James M, Richard D. Haas, Paul R. Masson, and Charles Adams (1986) "Effects of Exchange Rate changes in Industrial Countries." International Monetary Fund: World Economic and Financial Surveys, July. pp. 115-149.
- Brodsky, David A. and Gary S. Sampson (1983) "Exchange Rate Variations Facing Individual Industries in Developing Countries." Journal of Development Studies, Vol. 19. pp. 349-367.
- \_\_\_\_\_ (1984) "The Sources of Exchange Rate Instability in Developing countries: Dollar, French Franc and SDR Pegging Countries." Weltwirtschaftliches Archiv, Vol. 120, No. 1. pp. 133-154.
- Central Bank of Kenya (1976) The First Ten Years. (Nairobi: Central Bank of Kenya).
- \_\_\_\_\_ (1981) Sources and Uses of Foreign Exchange in Kenya, 1974-1979. (Nairobi: Central Bank of Kenya).
- \_\_\_\_\_ (1986) Its Evolution, Responsibilities and Organization. (Nairobi: Central Bank of Kenya).
- \_\_\_\_\_ (1987) Annual Reports. (Nairobi: Central Bank of Kenya).
- \_\_\_\_\_ Quarterly Economic Reviews. (various issues) (Nairobi: Central Bank of Kenya).
- Cleaver, Kevin (1984) "The Impact of Price and Exchange Rate Policies on Agriculture in Sub-Saharan Africa." Institute for Development Studies, University of Nairobi. Discussion Paper No. 279.
- Clements, Kenneth W. (1978) "Devaluations in an Empirical General Equilibrium Model." In: Frenkel Jacob A. and Harry G. Johnson (eds.), The Economics of Exchange Rates: Selected Studies. (Reading: Addison-Wesley Publishing Company). pp. 193-211.
- Coninx Raymond G. F. (1978) Foreign Exchange Today. (Cambridge: Woodhead-Faulkner).
- Cooper, Richard N. (1971) "An Assessment of Currency Devaluation in Developing Countries." In: Ranis, Gustav (ed), Government and Economic Development. (New Haven and London: Yale University Press). pp. 472-515.
- Corden, W. Max (1985) "Protection, the Exchange Rate and Macroeconomic Policy." Finance and Development, Vol. 22, No. 2. pp. 17-19.

- Crockett Andrew D. and Saleh M. Nsouli (1977). "Exchange Rate Policies for Developing Countries." The Journal of Development Studies, Vol. 13, No. 2. pp. 125-143.
- \_\_\_\_\_ (1981) "Determinants of Exchange Rate Movements: A Review." Finance and Development, Vol. 18, No. 1. pp. 33-37.
- \_\_\_\_\_ (1987) "Strengthening the International Monetary System: Exchange Rates, Surveillance and Objective Indicators." International Monetary Fund Occasional Papers, No. 50.
- Cutler, D. and Dhruba Gupta (1974). "SDRs: Valuation and Interest Rate." Finance and Development, Vol. 11, No. 4. pp. 18-21.
- Degefe, Befekadu (1985) "Exchange Rate Policy and Economic Distortions: The Ethiopian Experience, 1976-1983." A paper presented at IDRC Workshop in Nairobi.
- Dervis, Kemal, Jaime de Melo and Sherman Robinson (1981) General Equilibrium Model for Development Policy. (Cambridge: Cambridge University Press).
- \_\_\_\_\_ (1981) "A General Equilibrium Analysis of Foreign Exchange Shortages in a Developing Country." World Bank Staff Working Papers, No. 443.
- Dervis, Kemal, and Sherman Robinson (1978) "The Foreign Exchange Gap, Growth and Industrial Strategy in Turkey: 1973-1983." World Bank Staff Working Papers, No. 306.
- Devarajan, Shantayanan and Jaime de Melo (1987) "Adjustment with a Fixed Exchange Rate: Cameroon, Cote d'Ivoire, and Senegal." The World Bank Economic Reviews, Vol. 1, No. 3. pp. 447-487.
- Diaz-Alejandro, Carlos F. (1963) "A Note on the Impact of Devaluation and the Redistribution Effect." The Journal of Political Economy, Vol. 71. pp. 577-580.
- Donovan, Donal, J. (1981) "Real Responses Associated with Exchange Rate Action in Selected Upper Credit Tranche Stabilization Programmes." International Monetary Fund Staff Papers, Vol. 28. pp. 698-727.
- \_\_\_\_\_ (1982) "Macroeconomic Performance and Adjustment under Fund-Supported Programs: The Experience of the Seventies." International Monetary Fund Staff Papers, Vol. 29. pp. 171-203.

- Dornbusch, Rudiger (1976) "Expectation and Exchange Rate Dynamics." Journal of Political Economy, Vol. 84. pp. 1161-1176.
- \_\_\_\_\_ (1978) "The Theory of Flexible Exchange Rate Regimes and Macroeconomic Policy." In: Frenkel, J.A. and H.G. Johnson (eds.), op. cit. pp. 27-46.
- Fenswick, A.C. and M.L. Lesiit (1986) "Kenya's Balance of Payments: Performance, Perspectives and Policies." Central Bank of Kenya Staff papers, Vol. 1, No. 2.
- Frenkel, Jacob A. (1978) "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence." In: Frenkel and Johnson (eds.), op. cit. pp. 1-25.
- Genberg, Hans (1982) "Effects of Central Bank Intervention in Foreign Exchange Market." International Monetary Staff Papers, Vol. 28. pp. 451-476.
- Gerlach, Stefan (1987) "Exchange Rates: A Review Essay." Journal of Monetary Economics, Vol. 19. pp. 137-142.
- Goldstein, Morris (1984) "Whither the Exchange Rate System?" Finance and Development, Vol. 21, No. 2. pp. 2-6.
- Grubel, Herbert G. (1977) International Economics. (Illinois: Richard D. Irwin Inc).
- Gulhati, Ravi, Swadesh Bose and Vimal Atukorale (1985) "Exchange Rate Policies in Eastern and Southern Africa, 1965-1983." World Bank Staff Working Papers, No. 720.
- International Monetary Fund, International Financial Statistics Yearbooks. (various issues) Washington D.C.
- Hacche, Graham and John Townend (1981) "Exchange Rates and Monetary Policy: Modelling Sterling Effective Exchange Rate, 1972-80." The Oxford Economic Papers, Vol. 23. Supplement. pp. 201-247.
- Hirschman, Albert O. (1949) "Devaluation and the Trade Balance: A Note." Review of Economics and Statistics, Vol. 31. pp. 50-53.
- Hodrick, Robert J. (1978). "An Empirical Analysis of the Monetary Approach to Determination of the Exchange Rate." In: Frenkel and Johnson(eds.), op. cit. pp. 97-116.
- Isard, Peter (1978) "Exchange-Rate Determination: A Survey of Popular Views and Recent Models." Princeton Studies in International Finance, No. 42.

- \_\_\_\_\_ (1987) "Lessons from Empirical Models of Exchange Rates." International Monetary Fund Staff Papers, Vol. 34, No. 1. pp. 1-28.
- ✓ Kaldor, Nicholas (1983) "Devaluation and Adjustment in Developing Countries." Finance and Development, Vol. 20, No. 2. pp. 35-37.
- ✓ Khan, Mohsin S. (1987) "Macroeconomic Adjustment in Developing Countries: A Policy Perspective." World Bank Research Observer, Vol. 2, No. 1. pp. 23-43.
- ✓ Kiggundu, S.I. (1984) "The Consequences of Macroeconomic Stabilization for Poverty and Income Distribution: A Case of Kenya." A Paper prepared for a Mid-Term ODI-IDRC Workshop, Nairobi.
- Kincaid, Russel G. (1984) "A Test of the Efficacy of Exchange Rate Adjustment in Indonesia." International Monetary Fund Staff Papers, Vol. 31. pp. 62-92.
- Kindleberger, Charles and Peter H. Lindert (1978) International Economics. 6th edition. (Illinois: Richard D. Irwin Inc).
- ✓ Koutsoyiannis, A. (1977) Theory of Econometrics. 2nd edition. (London and Basingtoke: Macmillan).
- ✓ Lindert, Peter H. (1987) International Economics. 8th edition. (Delhi: All India Traveller Bookseller).
- Lindsay, Hogan I. (1986) "A Comparison of Alternative Exchange Rate Forecasting Models." The Economic Record, Vol. 62, No. 117. pp. 215-223.
- Maciejewski, Edward. B. (1983) "Real Effective Exchange Rate Indices: A Re-Examination of the Major Conceptual and Methodological Issues." International Monetary Fund Staff Papers, Vol. 30, No. 3. pp. 491-541.
- Maddala, G. S. (1977) Econometrics. (Singapore: McGrawHill Book Company).
- Mansur, Ahsan Habib (1983) "Determining the Appropriate Levels of Exchange Rates for Developing Economies: Some Methods and Issues." International Monetary Fund Staff Papers, Vol. 30, No. 4. pp. 786-816.
- \_\_\_\_\_ (1984) "Determining the Appropriate Exchange Rate in LDCs." Finance and Development, Vol. 21, No. 4. pp. 18-21.

- Martin, W. and I. Shaw (1986) "The Effect of Exchange Rate Changes on the Value of Australia's Major Agricultural Exports." In: Ngugen, D.T. and R.G. Gregory (eds), Exchange Rates and the Economy: A Supplement to the Economic Record, pp. 101-110
- Marwah, Kanta (1969) "An Econometric Model of Colombia: A Prototype Devaluation View." Econometrica, Vol. 37. pp. 228-251.
- McKenzie Ian M. (1986) "Australia's Real Exchange Rate During the Twentieth Century." In: Nguyen and Gregory (eds), op. cit. pp. 69-81.
- Morgan, Theodore and Albert Davis (1982) "The Concomittants of Exchange Rate Depreciation: Less Developed Countries." Economic Development and Cultural Change, Vol. 31. No. 1.
- Mussa, Michael (1987) "The Exchange rate, the Balance of Payments, and Monetary and Fiscal Policy under a Regime of Controlled Floating." In: Frenkel and Johnson (eds.), op. cit. pp. 47-65.
- Mwalwanda, C.T, H.P. Bandawe and C. Chipeta (1985) "Foreign Exchange and Exchange Rate Policy Issues in Eastern and Southern Africa: The Experience of Malawi." A paper presented at IDRC Conference in Nairobi.
- Mwalwanda, C. T. (1987) "The Effects of Exchange Rate Policy on Agricultural Incentives and Output with Particular Reference to Malawi." A paper presented at IDRC Workshop in Nairobi.
- Nashashibi, Karim (1983) "Devaluation in Developing countries: the Difficulty Choices." Finance and Development, Vol. 20. No. 1. pp. 14-17.
- Ndegwa, D. N. (1977) The Kenya Shilling Within and Across the Frontiers. (Nairobi: Central Bank of Kenya).
- Ndulo, Manenga, Martin Sakala and Winston Siwale (1985) "The Impact and Efficiency of Currency Devaluations in Zambia." A paper presented at IDRC Workshop in Nairobi.
- Ochieng, E.O, G. Ssemogerere, S. Obura, S. Bachou and J. Nkera (1985) "The Impact of Foreign Exchange and Exchange Rate Policies on the Economy of Uganda, 1981-1984." A paper presented at IDRC Workshop in Nairobi.

- Omotunde, Johnson E.G. (1976) "The Exchange Rate as an Instrument of Policy in Developing countries." International Monetary Fund Staff Papers, Vol. 23. pp. 334-345.
- \_\_\_\_\_ (1987) "Currency Devaluation and Export Expansion." Finance and Development, Vol. 24, No. 1. pp. 23-26.
- Pakkiri, Logan and Nelson Moyo (1987) "Foreign Exchange and Exchange Rate Policies in Zimbabwe." A paper presented at IDRC Workshop in Nairobi.
- Parades, Carols E. (1987) "The Real Exchange Rate and the Performance of Manufactured Exports in Peru." A paper Submitted for the Seventh Annual Meeting of the Latin American Chapter of the Econometric Society in Sao Paulo.
- Pfefferman, Guy (1985) "Overvalued Exchange Rates and Development." Finance and Development, Vol. 22, No. 1. pp. 17-19.
- Pindyck, Robert S. and Daniel L. Rubinfeld (1981) Econometric Models and Economic Forecasts. 2nd edition. (Singapore: McGrawHill Book Company).
- Republic of Kenya (1983) Development Plan, 1984-1988. (Nairobi: Government Printers)
- Republic of Kenya (1986) "Economic Management for Renewed Growth", Sessional Paper No. 1 of 1986. (Nairobi: Government Printers).
- \_\_\_\_\_ Economic Surveys. (Nairobi: Government Printers) (various issues).
- \_\_\_\_\_ Statistical Abstracts. (Nairobi: Government Printers) (various issues).
- Schader, Susan (1984) "Interest Rates and Exchange Rates." Finance and Development. Vol. 21, No. 2. pp. 7-11.
- Sohmen, Egon (1958) "The Effect of Devaluation in Price Level." Quarterly Journal of Economics, Vol. 72. pp. 273-283
- Ssemogerere, G. and E.O. Ochieng (1987) "The Effects of the IMF Supported Exchange Rate Adjustment Policy Package of June 1981 on Uganda's Economic Performance 1981/84." A paper presented at IDRC Workshop in Nairobi.
- Steinherr, Alfred (1981) "Effectiveness of Exchange Rate Policies for Trade Account Adjustment." International Monetary Fund Staff Papers, Vol. 28. pp. 199-224.



- Takagi, Shinji (1986) "Pegging to a Currency Basket." Finance and Development, Vol. 23, No. 3. pp. 41-44
- Taylor, Lance (1979) Macro Models for Developing Countries. (New York: McGrawHill Book Company).
- Thomas, J.J. (1967) "The Reporting of Empirical Work in Economics." Applied Economics, pp. 172-176.
- Tsikata, T.M, W. Masenya, M. Kibuka and M.A. Mabe (1985) "Aspects of Foreign Exchange and Exchange Rate Policy Issues in Botswana." A paper presented at IDRC Workshop in Nairobi.
- United Nations International Trade Statistics Yearbooks. (various issues) (New York: United Nations).
- de Vries, Margaret G. (1968) "The Magnitudes of Exchange Rate Devaluation." Finance and Development, Vol. 5, No. 2. pp. 8-12.
- \_\_\_\_\_ (1969) "Fluctuating Exchange Rates: The Fund's Approach." Finance and Development, Vol. 6, No. 2. pp. 44-48.
- World Bank (1981) Accelerated Development in Sub-Saharan Africa: An Agenda for Action. (Washington D.C: World Bank).
- Zulu, Justin B. and Saleh M. Nsouli (1984) "Adjustment Programmes in Africa." Finance and Development, Vol. 21, No. 1. pp. 5-9.

## APPENDIX

## STUDY DATA

TABLE 1 Analysis of foreign trade-exports: Main countries of destination  
(K\$ millions)

| YEAR | UNITED<br>KINGDOM | UNITED<br>STATES | WEST<br>GERMANY | JAPAN | FRANCE | ITALY | OTHER<br>COUNTRIES | TOTAL  |
|------|-------------------|------------------|-----------------|-------|--------|-------|--------------------|--------|
| 1966 | 12.29             | 5.28             | 8.10            | 1.79  | 0.75   | 1.64  | 61.36              | 91.21  |
| 1967 | 13.09             | 3.61             | 4.91            | 1.22  | 0.55   | 1.44  | 60.95              | 85.77  |
| 1968 | 14.86             | 4.04             | 5.79            | 1.69  | 1.25   | 1.28  | 60.36              | 89.27  |
| 1969 | 14.80             | 5.01             | 7.85            | 1.29  | 0.69   | 1.42  | 66.25              | 97.31  |
| 1970 | 14.85             | 6.06             | 6.82            | 1.23  | 0.56   | 1.54  | 77.64              | 108.90 |
| 1971 | 14.76             | 4.93             | 7.03            | 2.63  | 0.53   | 1.51  | 80.85              | 112.24 |
| 1972 | 19.86             | 5.29             | 9.48            | 2.09  | 0.70   | 2.85  | 92.44              | 132.71 |
| 1973 | 20.18             | 7.26             | 13.49           | 5.01  | 1.43   | 3.41  | 129.93             | 180.71 |
| 1974 | 18.39             | 7.92             | 17.84           | 5.36  | 1.86   | 4.42  | 180.08             | 235.89 |
| 1975 | 22.41             | 8.27             | 19.20           | 4.54  | 1.45   | 5.77  | 243.85             | 238.08 |
| 1976 | 35.50             | 18.31            | 42.11           | 6.34  | 3.02   | 13.61 | 226.17             | 345.06 |
| 1977 | 63.58             | 27.59            | 85.95           | 5.23  | 6.07   | 13.44 | 292.78             | 494.64 |
| 1978 | 57.27             | 18.47            | 56.94           | 3.81  | 5.62   | 18.89 | 234.74             | 395.74 |
| 1979 | 58.79             | 16.74            | 60.83           | 5.10  | 4.93   | 23.80 | 243.29             | 413.45 |
| 1980 | 64.94             | 17.34            | 58.29           | 4.03  | 6.32   | 23.92 | 340.86             | 515.70 |
| 1981 | 59.91             | 15.55            | 58.63           | 4.00  | 5.85   | 20.19 | 368.22             | 532.35 |
| 1982 | 72.25             | 35.18            | 60.83           | 3.46  | 5.97   | 15.20 | 375.70             | 568.59 |
| 1983 | 96.25             | 39.10            | 82.01           | 4.63  | 11.30  | 14.76 | 417.02             | 655.07 |
| 1984 | 142.26            | 38.82            | 98.05           | 6.14  | 11.13  | 21.28 | 459.49             | 775.67 |
| 1985 | 135.45            | 54.03            | 93.45           | 6.23  | 27.17  | 17.78 | 468.23             | 802.34 |
| 1986 | 138.71            | 85.79            | 136.38          | 8.56  | 14.13  | 20.46 | 577.67             | 981.70 |

SOURCE: Central Bank of Kenya(1987), Annual Report, Nairobi.

TABLE 2 Analysis of foreign trade--imports: Main countries of origin  
(K£ millions)

| YEAR   | UNITED<br>KINGDOM | UNITED<br>STATES | WEST<br>GERMANY | JAPAN  | FRANCE | ITALY  | OTHER<br>COUNTRIES | TOTAL    |
|--------|-------------------|------------------|-----------------|--------|--------|--------|--------------------|----------|
| 1966   | 37.75             | 11.28            | 8.06            | 2.70   | 3.56   | 3.61   | 70.10              | 137.02   |
| 1967   | 34.99             | 7.76             | 10.56           | 5.83   | 3.65   | 3.88   | 53.18              | 120.95   |
| 1968   | 23.78             | 7.32             | 8.69            | 6.59   | 4.05   | 4.63   | 72.05              | 127.11   |
| 1969   | 36.45             | 8.74             | 9.57            | 9.34   | 3.88   | 4.90   | 55.89              | 128.77   |
| 1970   | 41.46             | 11.91            | 11.20           | 15.20  | 5.14   | 6.19   | 55.00              | 158.01   |
| X 1971 | 56.25             | 16.32            | 16.10           | 19.33  | 6.77   | X 6.95 | 78.34              | 200.06   |
| X 1972 | 50.56             | 11.95            | 16.87           | 17.87  | 7.12   | 7.85   | 85.63              | 197.85   |
| X 1973 | 50.74             | 16.76            | 20.31           | 25.00  | 6.58   | 8.16   | 100.00             | 228.55   |
| X 1974 | 63.95             | 20.79            | 36.19           | 40.44  | 12.71  | 12.40  | 197.45             | ✓ 383.93 |
| 1975   | 69.46             | 24.88            | 27.03           | 30.01  | 9.62   | 12.68  | 189.17             | 362.85   |
| 1976   | 77.04             | 23.67            | 40.97           | 45.03  | 10.92  | 12.91  | 196.56             | 407.00   |
| 1977   | 95.22             | 30.48            | 57.85           | 65.60  | 26.32  | 22.01  | 233.81             | 531.29   |
| 1978   | 110.38            | 41.11            | 87.77           | 67.91  | 30.83  | 33.49  | 289.07             | 661.16   |
| 1979   | 141.19            | 34.89            | 68.74           | 49.93  | 17.55  | 23.75  | 283.25             | 619.30   |
| 1980   | 165.42            | 61.17            | 78.80           | 89.51  | 32.83  | 37.77  | 494.53             | 959.03   |
| X 1981 | 156.58            | 63.64            | 75.02           | 73.26  | 31.01  | 25.05  | 500.80             | 925.36   |
| X 1982 | 135.36            | 54.36            | 75.46           | 69.87  | 28.04  | 22.91  | 522.89             | 905.89   |
| X 1983 | 121.56            | 56.64            | 70.32           | 85.84  | 38.63  | 15.68  | 516.95             | ✓ 905.62 |
| 1984   | 152.34            | 51.05            | 98.06           | 111.76 | 56.00  | 34.10  | 611.54             | 1114.85  |
| 1985   | 164.25            | 66.19            | 95.66           | 120.01 | 42.04  | 33.30  | 679.69             | 1201.13  |
| 1986   | 210.63            | 64.47            | 146.23          | 146.67 | 154.47 | 46.65  | 564.25             | 1335.67  |

SOURCE: Central Bank of Kenya (1987), Annual Reports.

TABLE 3 Nominal and real effective exchange rates, 1966-1986

| 1    | 2                            | 3        | 4            | 5                 | 6            |
|------|------------------------------|----------|--------------|-------------------|--------------|
| YEAR | Foreign Currencies Per SDR * | Kshs/SDR | NEER (1 x 2) | Relative Prices * | REER (4 ÷ 5) |
| 1966 | 50.575                       | 0.1400   | 7.080        | 1.194             | 5.930        |
| 1967 | 77.510                       | 0.1400   | 10.860       | 1.226             | 8.858        |
| 1968 | 80.725                       | 0.1400   | 11.301       | 1.142             | 9.896        |
| 1969 | 74.498                       | 0.1400   | 10.429       | 1.170             | 8.914        |
| 1970 | 85.040                       | 0.1400   | 11.905       | 1.071             | 11.116       |
| 1971 | 87.707                       | 0.1289   | 11.310       | 1.076             | 10.511       |
| 1972 | 87.972                       | 0.1289   | 11.344       | 0.985             | 11.517       |
| 1973 | 88.163                       | 0.1201   | 10.588       | 0.902             | 11.739       |
| 1974 | 126.967                      | 0.1143   | 14.518       | 0.958             | 15.154       |
| 1975 | 118.861                      | 0.1035   | 12.304       | 0.982             | 12.530       |
| 1976 | 137.057                      | 0.1035   | 14.198       | 0.995             | 14.269       |
| 1977 | 116.356                      | 0.1035   | 12.045       | 1.046             | 11.515       |
| 1978 | 142.429                      | 0.1035   | 14.744       | 1.023             | 14.413       |
| 1979 | 131.229                      | 0.1035   | 13.585       | 0.992             | 13.695       |
| 1980 | 162.782                      | 0.1035   | 16.851       | 0.997             | 17.248       |
| 1981 | 146.400                      | 0.0837   | 12.251       | 0.899             | 13.627       |
| 1982 | 143.689                      | 0.0711   | 10.220       | 1.000             | 10.220       |
| 1983 | 122.690                      | 0.0694   | 8.510        | 1.059             | 8.036        |
| 1984 | 169.196                      | 0.0658   | 11.141       | 1.115             | 9.992        |
| 1985 | 145.336                      | 0.0564   | 8.193        | 1.213             | 6.754        |
| 1986 | 127.060                      | 0.0523   | 6.640        | 1.229             | 5.403        |

SOURCE: Own Computations from Tables 1,2,4,and 8.

\* Trade Weighted.

TABLE 4 Kenya and world sdr rates, 1966-1986

| YEAR | KENYA    | UNITED KINGDOM | UNITED STATES | WEST GERMANY | JAPAN   | FRANCE         | ITALY        |
|------|----------|----------------|---------------|--------------|---------|----------------|--------------|
|      | Kshs/SDR | UK/SDR         | US\$/SDR      | DM/SDR       | Yen/SDR | Francs/<br>SDR | Lire/<br>SDR |
| 1966 | 7.1430   | 0.3584         | 1.00000       | 3.9773       | 362.47  | 4.9518         | 624.50       |
| 1967 | 7.1430   | 0.4156         | 1.00000       | 3.9990       | 361.91  | 4.9085         | 623.90       |
| 1968 | 7.1430   | 0.4194         | 1.00000       | 9.9995       | 357.70  | 4.9481         | 623.50       |
| 1969 | 7.1430   | 0.4165         | 1.00000       | 3.6899       | 357.80  | 5.5583         | 625.50       |
| 1970 | 7.1430   | 0.4178         | 1.00000       | 3.6480       | 357.65  | 5.5200         | 623.00       |
| 1971 | 7.7551   | 0.4258         | 1.08571       | 3.5481       | 341.78  | 5.6718         | 644.91       |
| 1972 | 7.7551   | 0.4624         | 1.08571       | 3.4764       | 327.88  | 5.5643         | 632.43       |
| 1973 | 8.3238   | 0.5193         | 1.20635       | 3.2608       | 337.78  | 5.6795         | 733.36       |
| 1974 | 8.7454   | 0.5213         | 1.22435       | 2.9501       | 368.47  | 5.4416         | 795.12       |
| 1975 | 9.6600   | 0.5785         | 1.17066       | 3.0698       | 351.23  | 5.2510         | 800.20       |
| 1976 | 9.6600   | 0.6825         | 1.16183       | 2.7448       | 340.18  | 5.7740         | 1016.60      |
| 1977 | 9.6600   | 0.6373         | 1.21471       | 2.5570       | 291.53  | 5.7152         | 1058.68      |
| 1978 | 9.6600   | 0.6403         | 1.30279       | 2.3815       | 253.52  | 5.4457         | 1080.99      |
| 1979 | 9.6600   | 0.5923         | 1.31733       | 2.2810       | 315.76  | 5.2957         | 1059.13      |
| 1980 | 9.6600   | 0.5348         | 1.27541       | 2.4985       | 258.91  | 5.7598         | 1186.80      |
| 1981 | 11.9500  | 0.6101         | 1.16396       | 2.6245       | 255.95  | 6.6904         | 1396.80      |
| 1982 | 14.0600  | 0.6832         | 1.10311       | 2.6215       | 259.23  | 7.4184         | 1511.30      |
| 1983 | 14.4170  | 0.7218         | 1.04695       | 2.8517       | 243.10  | 8.7394         | 1737.40      |
| 1984 | 15.1870  | 0.8476         | 0.98021       | 3.0857       | 246.13  | 9.4022         | 1897.60      |
| 1985 | 17.7380  | 0.7604         | 1.09842       | 2.7035       | 220.23  | 8.3052         | 1843.70      |
| 1986 | 19.1350  | 0.8295         | 1.22319       | 3.3740       | 194.61  | 7.8957         | 1661.30      |

SOURCE: International Monetary Fund, International Financial Statistics Yearbooks, (various issues)

TABLE 5 Kenya and world incomes, 1966-1986 \*

| YEAR | KENYA  | UNITED KINGDOM | UNITED STATES | WEST GERMANY | JAPAN  | FRANCE    | ITALY   |
|------|--------|----------------|---------------|--------------|--------|-----------|---------|
|      | Ksh m. | UK£B.          | US\$B.        | DM B.        | YEN B. | Francs B. | Lire B. |
| 1966 | 414.8  | 38.25          | 766.4         | 488.2        | 38086  | 523.5     | 42577   |
| 1967 | 439.7  | 40.47          | 810.5         | 494.4        | 44631  | 565.4     | 46860   |
| 1968 | 479.7  | 43.95          | 885.9         | 533.3        | 52923  | 614.8     | 50818   |
| 1969 | 519.2  | 46.96          | 957.1         | 597.0        | 62262  | 700.7     | 56136   |
| 1970 | 577.8  | 51.50          | 1008.3        | 675.3        | 73345  | 782.5     | 63127   |
| 1971 | 643.0  | 57.84          | 1093.3        | 750.6        | 80699  | 872.5     | 68773   |
| 1972 | 739.2  | 64.05          | 1201.6        | 823.7        | 92395  | 981.1     | 75367   |
| 1973 | 872.2  | 74.00          | 1343.1        | 917.3        | 112498 | 1114.2    | 89943   |
| 1974 | 1005.2 | 84.10          | 1453.4        | 984.6        | 134245 | 1278.3    | 110719  |
| 1975 | 1192.3 | 106.26         | 1580.9        | 1026.9       | 148328 | 1452.3    | 125378  |
| 1976 | 1471.6 | 126.44         | 1761.7        | 1121.7       | 166575 | 1678.0    | 156657  |
| 1977 | 1899.8 | 145.57         | 1965.1        | 1197.8       | 185623 | 1884.6    | 190083  |
| 1978 | 2049.8 | 167.84         | 2219.2        | 1285.3       | 204403 | 2141.1    | 222254  |
| 1979 | 2271.9 | 196.38         | 2464.4        | 1392.3       | 221547 | 2442.3    | 270198  |
| 1980 | 2632.5 | 230.01         | 2684.4        | 1478.9       | 240176 | 2769.3    | 338743  |
| 1981 | 3038.6 | 253.47         | 3000.5        | 1540.9       | 257363 | 3110.6    | 401579  |
| 1982 | 3399.5 | 276.04         | 3114.9        | 1597.9       | 269629 | 3567.0    | 470484  |
| 1983 | 3873.3 | 300.02         | 3350.9        | 1669.6       | 280257 | 3935.0    | 538998  |
| 1984 | 4046.1 | 318.05         | 3726.8        | 1748.1       | 298084 | 4283.0    | 612112  |
| 1985 | 4763.3 | 348.86         | 3947.7        | 1830.4       | 316115 | 4595.4    | 805754  |
| 1986 | 5034.8 | 373.38         | 4194.5        | 1944.0       | 330752 | 5015.9    | 894362  |

SOURCE: 1. IMF, International Financial StatisticsYearbook (various issues)2. Republic of Kenya), Statistical Abstracts (various issues)

\* Gross Domestic Product at current prices.

M. millions

B. billions

TABLE 6 Kenya and world ~~gdp~~ deflators (1982=100)

| YEAR | KENYA | UNITED KINGDOM | UNITED STATES | WEST GERMANY | JAPAN | FRANCE | ITALY |
|------|-------|----------------|---------------|--------------|-------|--------|-------|
| 1966 | 28.8  | 18.6           | 35.0          | 47.2         | 36.2  | 26.4   | 15.6  |
| 1967 | 30.3  | 19.2           | 35.9          | 47.9         | 38.4  | 27.3   | 16.0  |
| 1968 | 30.7  | 19.9           | 37.7          | 48.9         | 40.4  | 28.5   | 16.3  |
| 1969 | 31.6  | 21.0           | 39.8          | 51.0         | 42.4  | 30.3   | 16.9  |
| 1970 | 32.4  | 22.6           | 42.0          | 54.9         | 45.7  | 32.1   | 18.1  |
| 1971 | 33.9  | 24.7           | 44.4          | 59.3         | 48.2  | 33.9   | 19.4  |
| 1972 | 32.8  | 26.8           | 46.4          | 62.4         | 51.0  | 36.0   | 20.7  |
| 1973 | 36.0  | 28.6           | 49.5          | 66.4         | 57.6  | 38.8   | 23.0  |
| 1974 | 42.7  | 32.9           | 54.0          | 71.1         | 69.6  | 43.1   | 27.3  |
| 1975 | 49.7  | 41.8           | 59.3          | 75.3         | 74.9  | 48.9   | 32.1  |
| 1976 | 58.3  | 48.0           | 63.1          | 78.1         | 80.2  | 53.7   | 37.8  |
| 1977 | 68.2  | 54.7           | 67.3          | 81.0         | 84.9  | 58.5   | 45.1  |
| 1978 | 70.4  | 60.8           | 72.2          | 84.4         | 89.0  | 64.1   | 51.3  |
| 1979 | 74.9  | 69.5           | 78.6          | 87.8         | 91.6  | 70.7   | 59.5  |
| 1980 | 82.6  | 83.3           | 85.7          | 92.1         | 95.1  | 79.4   | 71.7  |
| 1981 | 91.2  | 97.2           | 93.9          | 95.8         | 98.2  | 88.8   | 84.9  |
| 1982 | 100.0 | 100.0          | 100.0         | 100.0        | 100.0 | 100.0  | 100.0 |
| 1983 | 110.9 | 104.9          | 103.8         | 103.2        | 100.8 | 109.5  | 115.0 |
| 1984 | 122.8 | 109.0          | 108.1         | 105.2        | 102.1 | 117.5  | 127.3 |
| 1985 | 138.8 | 116.1          | 111.7         | 107.4        | 103.8 | 124.4  | 136.6 |
| 1986 | 144.3 | 120.4          | 114.4         | 110.9        | 105.4 | 129.0  | 147.6 |

SOURCE: IMF, International Financial Statistics  
Yearbooks (various issues)

TABLE 7 Kenya and world population, 1966-1986  
(millions)

| YEAR | KENYA | UNITED<br>KINGDOM | UNITED<br>STATES | WEST<br>GERMANY | JAPAN  | FRANCE | ITALY |
|------|-------|-------------------|------------------|-----------------|--------|--------|-------|
| 1966 | 9.6   | 54.50             | 196.56           | 59.50           | 99.79  | 49.16  | 52.33 |
| 1967 | 10.1  | 54.80             | 198.71           | 59.87           | 100.83 | 49.55  | 52.67 |
| 1968 | 10.5  | 55.05             | 200.71           | 60.17           | 101.96 | 49.91  | 52.99 |
| 1969 | 10.9  | 55.27             | 202.68           | 60.44           | 103.17 | 50.32  | 53.32 |
| 1970 | 11.5  | 55.42             | 205.05           | 60.71           | 104.34 | 50.77  | 53.66 |
| 1971 | 11.9  | 55.61             | 207.66           | 61.29           | 105.70 | 51.25  | 54.01 |
| 1972 | 12.4  | 55.78             | 209.90           | 61.67           | 107.19 | 51.70  | 54.41 |
| 1973 | 12.9  | 55.91             | 211.91           | 61.97           | 108.71 | 52.13  | 54.80 |
| 1974 | 13.4  | 55.92             | 213.85           | 62.04           | 110.16 | 52.79  | 55.10 |
| 1975 | 13.9  | 55.90             | 215.97           | 61.83           | 111.57 | 52.79  | 55.40 |
| 1976 | 14.4  | 55.89             | 218.04           | 61.51           | 112.77 | 52.19  | 55.70 |
| 1977 | 14.9  | 55.85             | 220.24           | 61.40           | 113.86 | 53.15  | 55.93 |
| 1978 | 15.5  | 55.84             | 222.59           | 61.31           | 114.90 | 53.38  | 56.13 |
| 1979 | 16.1  | 55.88             | 225.06           | 61.44           | 115.87 | 53.61  | 56.29 |
| 1980 | 16.7  | 88.95             | 227.74           | 61.56           | 116.78 | 53.88  | 56.42 |
| 1981 | 17.3  | 56.35             | 230.04           | 61.67           | 117.65 | 54.18  | 56.50 |
| 1982 | 18.0  | 56.34             | 232.35           | 61.64           | 118.45 | 54.48  | 56.64 |
| 1983 | 18.8  | 56.38             | 234.54           | 61.42           | 119.26 | 54.73  | 56.84 |
| 1984 | 19.5  | 56.49             | 236.68           | 61.18           | 120.02 | 54.85  | 56.98 |
| 1985 | 20.2  | 56.62             | 239.28           | 61.02           | 120.75 | 55.17  | 57.13 |
| 1986 | 21.0  | 56.76             | 241.60           | 61.05           | 121.49 | 55.39  | 57.22 |

SOURCE: IMF, International Financial Statistics  
Yearbooks (various issues)



TABLE 8 Kenya and world annual rates of inflation, 1966-1986

| YEAR | KENYA | UNITED KINGDOM | UNITED STATES | WEST GERMANY | JAPAN | FRANCE | ITALY |
|------|-------|----------------|---------------|--------------|-------|--------|-------|
| 1966 | 4.0   | 3.1            | 4.9           | 2.7          | 3.5   | 2.4    | 3.9   |
| 1967 | 1.6   | 2.6            | 4.1           | 2.8          | 1.6   | 3.7    | 2.7   |
| 1968 | 0.5   | 4.2            | 5.3           | 4.5          | 1.7   | 1.5    | 4.8   |
| 1969 | -0.2  | 5.4            | 5.3           | 6.2          | 1.8   | 2.6    | 5.4   |
| 1970 | 2.1   | 5.9            | 7.6           | 5.8          | 3.3   | 4.8    | 6.3   |
| 1971 | 3.7   | 4.3            | 6.1           | 5.5          | 5.2   | 5.0    | 9.5   |
| 1972 | 6.1   | 3.3            | 4.5           | 6.2          | 5.5   | 6.7    | 7.1   |
| 1973 | 9.3   | 6.2            | 11.7          | 7.4          | 7.0   | 10.8   | 9.2   |
| 1974 | 17.7  | 11.0           | 22.7          | 13.6         | 7.0   | 19.1   | 15.9  |
| 1975 | 19.1  | 9.2            | 12.2          | 11.8         | 5.9   | 17.2   | 24.2  |
| 1976 | 11.4  | 5.7            | 9.7           | 9.6          | 4.6   | 15.7   | 16.8  |
| 1977 | 14.9  | 6.5            | 8.1           | 9.4          | 3.6   | 17.0   | 15.9  |
| 1978 | 16.9  | 7.5            | 3.8           | 9.1          | 2.8   | 12.1   | 8.3   |
| 1979 | 8.0   | 11.3           | 3.6           | 10.7         | 4.1   | 14.7   | 13.4  |
| 1980 | 13.8  | 13.5           | 8.0           | 13.8         | 5.4   | 21.2   | 18.0  |
| 1981 | 11.8  | 10.4           | 4.9           | 13.4         | 6.3   | 17.8   | 11.9  |
| 1982 | 20.4  | 6.2            | 2.6           | 11.8         | 5.3   | 16.5   | 8.6   |
| 1983 | 11.5  | 3.2            | 1.9           | 9.6          | 3.3   | 14.6   | 4.6   |
| 1984 | 10.2  | 4.3            | 2.3           | 7.4          | 2.4   | 10.8   | 5.0   |
| 1985 | 13.0  | 3.6            | 2.0           | 5.8          | 2.2   | 9.2    | 6.1   |
| 1986 | 4.0   | 1.9            | 0.6           | 2.5          | -0.2  | 5.9    | 3.5   |

SOURCE: IMF, International Financial Statistics Yearbooks (various issues)

TABLE 9 Kenya and world export supply of coffee and tea  
(US\$ millions)

|      | <u>COFFEE</u> |          | <u>TEA</u> |          |
|------|---------------|----------|------------|----------|
|      | KENYA         | WORLD    | KENYA      | WORLD    |
| 1966 | 52.690        | 2399.100 | 30.432     | 635.892  |
| 1967 | 43.970        | 2263.790 | 25.520     | 670.856  |
| 1968 | 35.876        | 2511.273 | 28.119     | 636.311  |
| 1969 | 47.384        | 2568.312 | 31.559     | 518.750  |
| 1970 | 62.343        | 3190.469 | 35.573     | 586.690  |
| 1971 | 54.709        | 2879.114 | 33.252     | 616.731  |
| 1972 | 69.373        | 3416.208 | 45.967     | 672.989  |
| 1973 | 101.887       | 4607.965 | 48.303     | 669.230  |
| 1974 | 107.590       | 4666.212 | 54.254     | 781.296  |
| 1975 | 95.163        | 4581.462 | 61.934     | 932.503  |
| 1976 | 223.108       | 8827.097 | 75.902     | 959.337  |
| 1977 | 494.087       | 13203.93 | 173.528    | 1778.800 |
| 1978 | 338.423       | 11754.85 | 176.052    | 1562.738 |
| 1979 | 301.581       | 12875.68 | 183.995    | 1451.035 |
| 1980 | 291.384       | 12979.15 | 156.227    | 1630.882 |
| 1981 | 244.279       | 9128.821 | 136.384    | 1487.398 |
| 1982 | 248.511       | 9792.042 | 133.324    | 1299.100 |
| 1983 | 240.556       | 10942.35 | 185.433    | 1477.005 |
| 1984 | 363.004       | 11615.07 | 379.236    | 2260.174 |

SOURCES: 1. United Nations, International Trade Statistics Yearbooks New York (various issues)

2. Food Agriculture Organizations(1971), Trade Yearbooks Vol. 25.

TABLE 10 Kenya and world: central bank discount rates \*

| YEAR | KENYA | UNITED KINGDOM | UNITED STATES | WEST GERMANY | JAPAN | FRANCE | ITALY |
|------|-------|----------------|---------------|--------------|-------|--------|-------|
| 1966 | .. .. | 7.00           | 4.50          | 5.00         | 4.50  | 3.50   | 3.50  |
| 1967 | 6.50  | 8.00           | 4.50          | 3.00         | 4.50  | 3.50   | 3.50  |
| 1968 | 6.50  | 7.00           | 5.50          | 3.00         | 5.50  | 6.00   | 3.50  |
| 1969 | 6.50  | 8.00           | 6.50          | 6.00         | 6.50  | 8.00   | 4.00  |
| 1970 | 6.50  | 7.00           | 5.50          | 6.00         | 5.50  | 7.00   | 5.50  |
| 1971 | 8.50  | 5.00           | 4.50          | 4.00         | 4.50  | 6.50   | 4.50  |
| 1972 | 6.50  | 9.00           | 4.50          | 4.50         | 4.50  | 7.50   | 4.00  |
| 1973 | 6.50  | 13.00          | 7.50          | 7.00         | 7.50  | 11.00  | 6.50  |
| 1974 | 6.50  | 11.50          | 7.75          | 6.00         | 7.75  | 13.00  | 8.00  |
| 1975 | 7.00  | 11.25          | 6.00          | 3.50         | 6.00  | 8.00   | 6.00  |
| 1976 | 7.00  | 14.25          | 5.25          | 3.50         | 5.25  | 10.50  | 15.00 |
| 1977 | 7.50  | 7.00           | 6.00          | 3.00         | 6.00  | 9.50   | 11.50 |
| 1978 | 7.50  | 12.50          | 9.50          | 3.00         | 9.50  | 9.50   | 11.50 |
| 1979 | 8.00  | 17.00          | 12.00         | 6.00         | 12.00 | 9.50   | 16.00 |
| 1980 | 12.50 | 14.00          | 13.00         | 7.50         | 13.00 | 9.50   | 16.50 |
| 1981 | 15.00 | .. ..          | 12.00         | 7.50         | 12.00 | 9.50   | 19.00 |
| 1982 | 15.00 | .. ..          | 8.50          | 5.00         | 8.50  | 9.50   | 18.00 |
| 1983 | 12.50 | .. ..          | 8.50          | 4.00         | 8.50  | 9.50   | 17.00 |
| 1984 | 12.50 | .. ..          | 8.00          | 4.50         | 8.00  | 9.50   | 16.50 |
| 1985 | 12.50 | .. ..          | 7.50          | 4.00         | 7.50  | 9.50   | 15.00 |
| 1986 | 12.50 | .. ..          | 5.50          | 4.50         | 5.50  | 9.50   | 12.00 |

SOURCE: IMF, International Financial Statistics Yearbooks. (various issues).

\* End of period in per cent per annum.

TABLE 11 Kenya: agriculture \*  
(K£ millions)

| YEAR | AGRICULTURAL<br>PRODUCTION ** | AGRICULTURAL<br>INPUT SUPPLY | GOVERNMENT<br>EXPENDITURE<br>ON AGRICULTURE |
|------|-------------------------------|------------------------------|---|
| 1966 | 56.34                         | 13.851                       | 12.273                                      |
| 1967 | 56.21                         | 12.864                       | 12.254                                      |
| 1968 | 60.83                         | 12.827                       | 13.327                                      |
| 1969 | 64.31                         | 14.655                       | 14.989                                      |
| 1970 | 72.29                         | 16.471                       | 12.615                                      |
| 1971 | 72.81                         | 17.438                       | 13.106                                      |
| 1972 | 94.36                         | 21.950                       | 16.648                                      |
| 1973 | 107.43                        | 25.540                       | 16.567                                      |
| 1974 | 123.08                        | 38.535                       | 21.962                                      |
| 1975 | 135.39                        | 39.225                       | 31.534                                      |
| 1976 | 640.50                        | 43.349                       | 56.039                                      |
| 1977 | 668.01                        | 60.552                       | 41.931                                      |
| 1978 | 631.73                        | 70.649                       | 49.529                                      |
| 1979 | 648.78                        | 65.301                       | 58.159                                      |
| 1980 | 688.13                        | 72.791                       | 59.259                                      |
| 1981 | 791.74                        | 85.469                       | 97.257                                      |
| 1982 | 907.20                        | 84.282                       | 92.861                                      |
| 1983 | 1030.61                       | 88.171                       | 96.672                                      |
| 1984 | 1083.89                       | 116.342                      | 72.993                                      |
| 1985 | 1198.98                       | 147.619                      | 129.412                                     |
| 1986 | 1352.13                       | 165.400                      | 139.854                                     |

SOURCE: 1. Republic of Kenya, Statistical Abstracts,  
(various issues).  
2. \_\_\_\_\_, Economic Surveys,  
(various issues).

NOTES:

\* Current Market prices

\*\* Includes agriculture, veterinary and forestry.

TABLE 12 Kenya: various price indices (1982=100)

| YEAR | IMPORT<br>PRICE<br>INDEX | EXPORT<br>PRICE<br>INDEX | AGRICU-<br>LTURAL<br>DEFLATOR * | CAPITAL<br>FORMATION<br>DEFLATOR * |
|------|--------------------------|--------------------------|---------------------------------|------------------------------------|
| 1966 | 19                       | 20                       | 29                              | 19                                 |
| 1967 | 19                       | 20                       | 30                              | 19                                 |
| 1968 | 20                       | 20                       | 29                              | 19                                 |
| 1969 | 20                       | 21                       | 28                              | 20                                 |
| 1970 | 21                       | 22                       | 29                              | 20                                 |
| 1971 | 23                       | 22                       | 30                              | 21                                 |
| 1972 | 25                       | 23                       | 34                              | 24                                 |
| 1973 | 30                       | 26                       | 36                              | 26                                 |
| 1974 | 44                       | 34                       | 41                              | 34                                 |
| 1975 | 56                       | 40                       | 50                              | 41                                 |
| 1976 | 65                       | 54                       | 64                              | 49                                 |
| 1977 | 70                       | 76                       | 83                              | 54                                 |
| 1978 | 74                       | 65                       | 75                              | 61                                 |
| 1979 | 86                       | 69                       | 80                              | 69                                 |
| 1980 | 112                      | 83                       | 84                              | 77                                 |
| 1981 | 143                      | 91                       | 91                              | 87                                 |
| 1982 | 100                      | 100                      | 100                             | 100                                |
| 1983 | 128                      | 120                      | 109                             | 125                                |
| 1984 | 131                      | 144                      | 119                             | 136                                |
| 1985 | 155                      | 142                      | 127                             | 147                                |
| 1986 | 147                      | 152                      | 137                             | 173                                |

SOURCES: 1. Republic of Kenya, Development Plan 1984-1988.  
 2. \_\_\_\_\_, Statistical Abstracts, (various issues).  
 3. \_\_\_\_\_, Economic Surveys, (various issues).

NOTE: \* Calculated from the data on current and constant value

UNIVERSITY OF NAIROBI  
LIBRARY

TABLE 13 Other data used in the study  
(K£ millions at Current Prices)

| YEAR | TOURISM<br>EARNINGS | MONEY<br>SUPPLY | FOREIGN<br>RESERVES | NET<br>CAPITAL<br>INFLOW | FOREIGN<br>PUBLIC<br>DEBT | CAPITAL<br>FORMATION | GOVERNMENT<br>EXPENDITURE |
|------|---------------------|-----------------|---------------------|--------------------------|---------------------------|----------------------|---------------------------|
| 1966 | 14.3                | 90.3            | 17.1                | 12.7                     | 86.10                     | 61.22                | 84.9                      |
| 1967 | 16.0                | 102.4           | 28.9                | 11.4                     | 91.11                     | 82.21                | 94.7                      |
| 1968 | 17.3                | 115.1           | 33.7                | 17.9                     | 85.49                     | 89.53                | 105.0                     |
| 1969 | 16.7                | 137.4           | 58.3                | 20.5                     | 93.28                     | 93.73                | 121.5                     |
| 1970 | 18.5                | 175.3           | 73.5                | 31.7                     | 102.04                    | 112.71               | 156.8                     |
| 1971 | 24.1                | 188.5           | 55.2                | 15.3                     | 94.87                     | 144.20               | 180.5                     |
| 1972 | 27.3                | 214.8           | 66.1                | 32.8                     | 105.76                    | 160.37               | 201.4                     |
| 1973 | 24.3                | 267.8           | 76.6                | 53.4                     | 126.49                    | 175.19               | 230.2                     |
| 1974 | 26.5                | 291.0           | 68.5                | 85.8                     | 136.33                    | 202.80               | 301.6                     |
| 1975 | 33.4                | 340.7           | 70.6                | 68.9                     | 167.51                    | 241.89               | 373.6                     |
| 1976 | 41.1                | 422.8           | 114.0               | 88.6                     | 209.86                    | 290.43               | 409.8                     |
| 1977 | 48.3                | 620.7           | 208.6               | 102.4                    | 228.94                    | 390.01               | 590.8                     |
| 1978 | 60.0                | 705.9           | 133.3               | 174.8                    | 242.62                    | 514.01               | 697.6                     |
| 1979 | 62.0                | 819.8           | 234.5               | 253.8                    | 287.93                    | 540.45               | 781.3                     |
| 1980 | 82.5                | 810.4           | 187.0               | 261.7                    | 497.34                    | 622.53               | 972.0                     |
| 1981 | 90.0                | 918.2           | 126.4               | 236.3                    | 644.23                    | 725.41               | 1123.0                    |
| 1982 | 118.0               | 1066.2          | 137.8               | 153.0                    | 858.34                    | 668.33               | 1308.2                    |
| 1983 | 122.0               | 1118.3          | 269.6               | 158.6                    | 1167.72                   | 720.89               | 1296.8                    |
| 1984 | 152.0               | 1262.1          | 307.7               | 183.9                    | 1531.58                   | 836.12               | 1267.9                    |
| 1985 | 197.0               | 1346.5          | 321.4               | 85.9                     | 1542.58                   | 910.38               | 1674.6                    |
| 1986 | 247.0               | 1784.3          | 339.3               | 110.9                    | 2029.00                   | 1212.30              | 1136.8.                   |

SOURCES: 1. Republic of Kenya, Statistical Abstracts. (various issues)  
 2. \_\_\_\_\_, Economic Surveys. (various issues)  
 3. CBK (1987), Annual Report.