AN ECONOMIC ANALYSIS OF PRODUCER INCOME INSTABILITY IN MALAYSIA'S AGRICULTURAL SECTOR: THE CASE OF RUBBER, COCOA, AND RICE

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CHAPTER I

INTRODUCTION

Background

This chapter provides general background on the country that is being studied. The chapter is divided into different sections. The first section discusses the location of Malaysia and its geographical background. A general view of the country's economy is given next. The third section gives a brief look at the economy in the agricultural sector. A problematic situation is then offered with the objectives and the procedure following it. The chapter concludes with a brief overview on the organization of the rest of the study.

Geographical Background

Malaysia is located in Southeast Asia, a fact reflected in the country's membership in the Association of Southeast Asian Nations (ASEAN, including Indonesia, Malaysia, the Philippines, Singapore and Thailand) as shown in Figure 1. It is about 9500 miles from San Francisco, United States of America; 4250 miles from Canberra, Australia; 3600 miles from Tokyo, Japan; 2900 miles from Peking, China; 1600 miles from Hong Kong; and, 1500 miles from Manila, Philippines, when measured from its capital Kuala Lumpur. Malaysia consists of two main regions which are West Malaysia and East Malaysia (Figure 2). These two regions are separated by about 400 miles of open sea, the South China Sea.

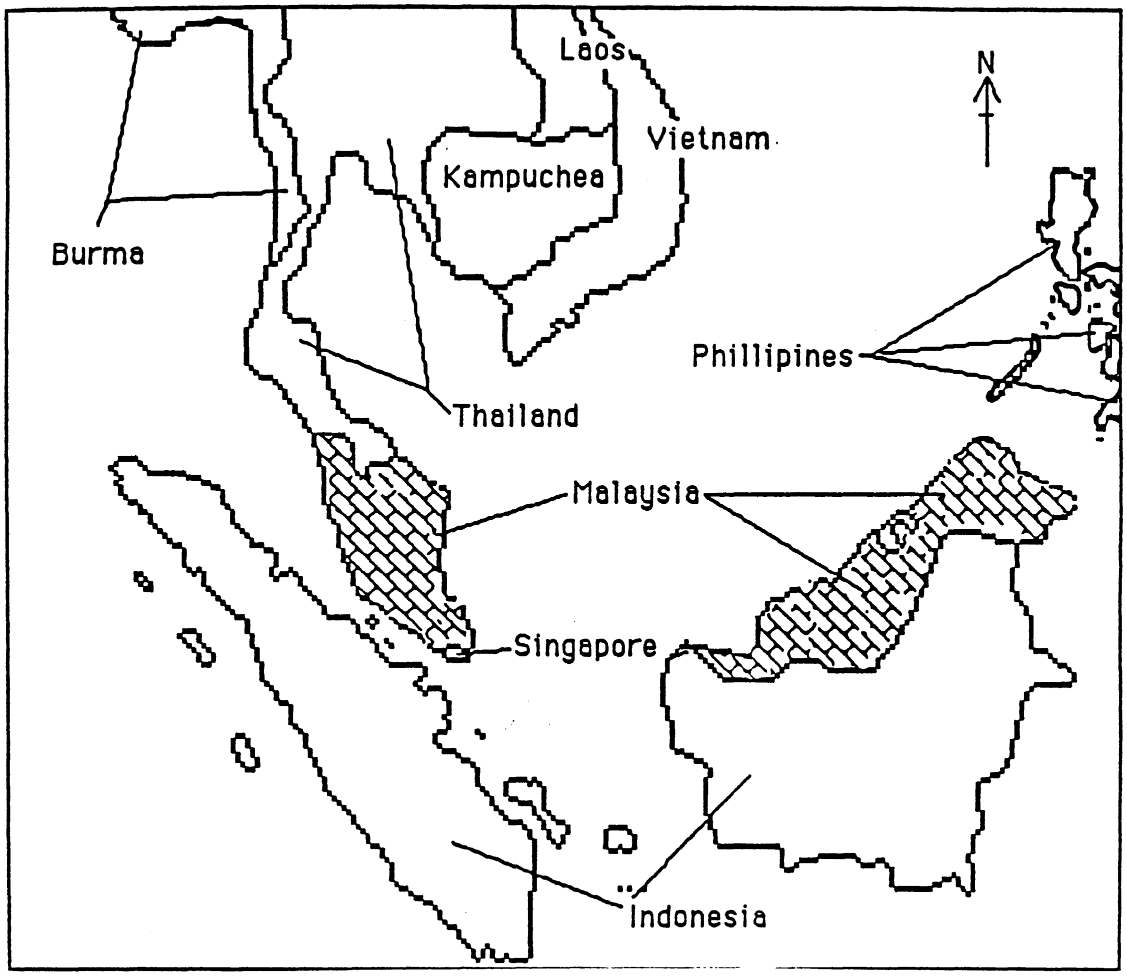

FIGURE 1. ASEAN : INDONESIA, MALAYSIA, PHILLIPINES, SINGAPORE AND THAILAND

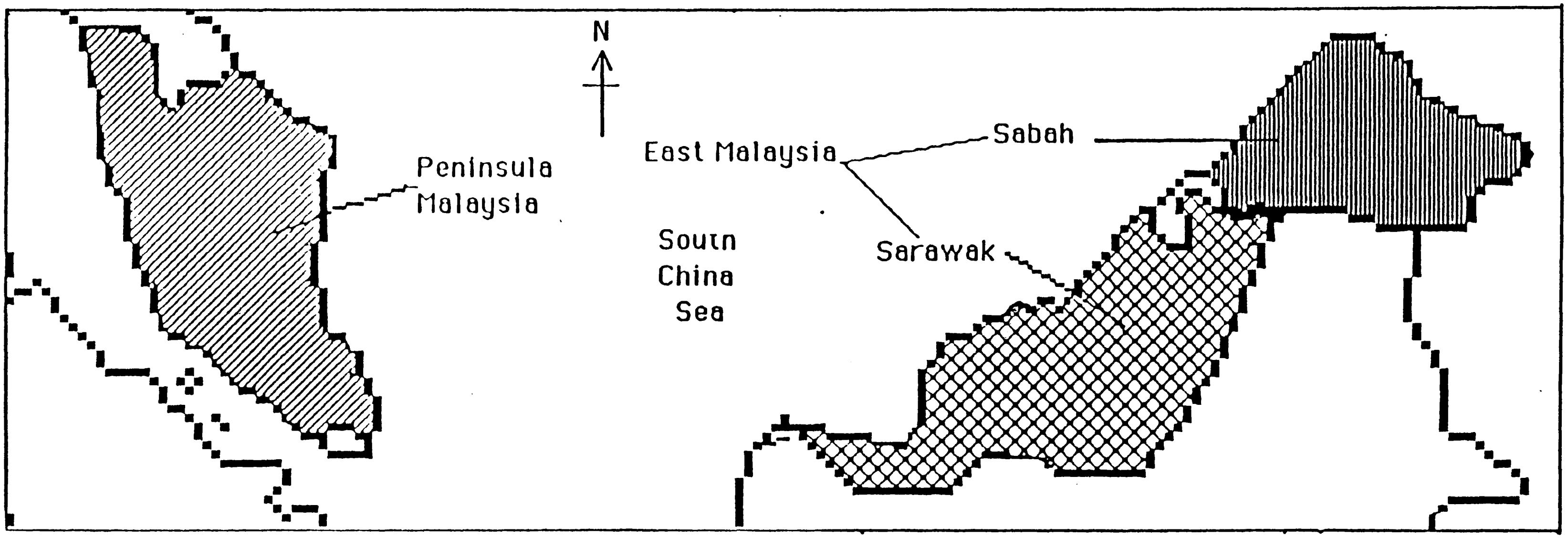

FIGURE 2. MALAYSIA (PENINSULA MALAYSIA AND EAST MALAYSIA)

West Malaysia is situated north of Thailand and to the south of West Malaysia lies Singapore. The west and the east coasts of West Malaysia are bordered by the Straits of Malacca and the South China Sea, respectively. The east-west distance reaches a maximum of about 200 miles. West Malaysia can be geographically divided into two regions : the east coast, and the west coast. The west coast is separated from the east coast by steep mountain ranges. This divide gives West Malaysia a regional structure somewhat similar to that of Italy (Kasper, 1974). The east coast region is sparsely populated due to monsoon winds which occur for half of the year causing heavy flooding throughout these regions (Bunge, 1984). Overall, Malaysia has a climate typical of the inner tropics and of a country near the open sea, with high humidity, copious rainfall (averaging about 100 inches a year), and very regular temperatures throughout the year (normally 75^{o} to 85^{o} F in the lowlands) (Kasper, 1974).

East Malaysia is separated from West Malaysia by the South China Sea. East Malaysia is situated on the northern and southwest regions of Borneo. The southeast region of the island is a part of Indonesia and is called Kalimantan. East Malaysia is divided into two regions, namely Sabah and Sarawak. Between Sabah and Sarawak lies the country of Brunei. East Malaysia is dominated by mountains, rain forest, long rivers, mangrove swamps, and a coastal fringe of alluvial plains (Young, et al, 1980). The agricultural sector of Sabah dominates the state economy in terms of foreign exchange and employment. In the Second Malaysia Plan, the agricultural sector provided 80 per cent of the foreign earnings in 1975 (Third Malaysia Plan: State of Sabah, 1977).

The total area of Malaysia is 127,315 square miles, about the same size as Vietnam or the Philippines (Bunge, 1984). Forty per cent of the total land area is located in West Malaysia, while East Malaysia accounts for the rest of the total land area which amounts to 70,037 square miles (Young, et al, 1980).

General Economy

During the period 1980 to 1985, the population annual growth rate was 2.6 per cent, with a population of 15.8 million in 1985. (Fifth Malaysia Plan, 1986). About 82 per cent of the population lives in West Malaysia with the majority of the population living in the west coast region. The population of Malaysia consists mostly of Malays and other Bumiputera, Chinese, and Indians. Malays and other Bumiputera makes up 60 per cent of the population, while there are 31 per cent Chinese, 8.4 per cent Indians, and the rest are from other races (Fifth Malaysia Plan, 1986). The majority of the Malays and other Bumiputera are located in small villages and rural areas. They are mostly smallholder farmers or fishermen. The Chinese, on the other hand, are situated in the major towns and are most likely to be traders or laborers working for a wage (Gullick, 1981). The Indians are mostly from the Tamil, Telufu and Malayali linguistic areas of south India (Gullick, 1981). Some are traders but most of the Indians work as laborers on the plantations, or in government organizations such as the railway or the public works department (Gullick, 1981). In 1985, 32 per cent of the population were in the work force. Sixty-nine per cent of the labor force were between 20 and 44 years old. The agricultural sector employed 35.7 per cent of the labor force. Although Malaysia is a third world country, the unemployment rate has been very stable and was estimated at 7.6 per cent of the work force in 1985 (Fifth Malaysia Plan, 1986).

Malaysia is one of the most prosperous countries in Southeast Asia. It is the world's leading exporter of tin, rubber, and palm oil. It is also a principal exporter of tropical hardwoods and exports a significant amount of oil and natural gas (Young, et al, 1980). Since its independence in 1963, Malaysia follows a parliamentary democracy system with a constitutional monarch, elected for a five year term from among and by hereditary rulers (Bunge, 1984). It has an open economy with few government restrictions (Kasper, 1974). Malaysia has a reasonably high gross national product growth rate (8 percent in the 1970s) and has exceptionally high internal price stability (retail prices went up by about 1 per cent per annum during the 1960s) (Kasper, 1974). However, Malaysia's Gross Domestic Product grew at an average rate of 5.8 per cent per annum during the period 1981-85 (Fifth Malaysia Plan, 1986). During the same period, the per capita income increased from M$3,719 (US$1499 @ M$2.481/US$1) in 1980 to M$4,609 (US$ 1858 @ M$2.481/US$1) in 1985. On the other hand, the gross national product growth rate slowed down from 7.9 per cent in 1980 to 5.6 per cent in 1985.

Malaysia has diversified into manufacturing, especially the value added industry for agricultural commodities. Thus, it is less dependent on the export of raw materials as the only foreign exchange earner. Infrastructure and social services have reached quality levels that are rarely attained elsewhere in the tropics (Kasper, 1974). Because it is the most advanced developing country among the rapidly growing economies in Southeast Asia, excluding Singapore and Hong Kong, Malaysia's experience can in many respects serve as a model for neighboring countries (Kasper, 1974). In 1985, it was estimated that 30.6 per cent of the Gross Domestic Product came from the primary sector (Fifth Malaysia Plan, 1986). In 1984, 20 per cent of Gross Domestic Product was from the agricultural sector and another 20 per cent was from the manufacturing sector, compared with 30.5 per cent and 14.7 per cent respectively in 1971 (Fourth Malaysia Plan, 1981). In 1985, 29 per cent of the foreign exchange revenue came from the agricultural sector (Fifth Malaysia Plan, 1986). In addition, the foreign exchange revenue from the agricultural sector increased by 8 percent in 1986 and the overall agricultural output increased by 3 percent due to an output gain of 10 percent from palm oil, 31 percent from cocoa, and 4 percent from rubber (Southeast Asia: Situation and Outlook Report, 1987).

The Agricultural Sector

The agricultural sector, which includes livestock, fisheries, and forestry, continues to play an important role in the economy through its contribution to Gross Domestic Product , foreign exchange earnings, and employment (Fifth Malaysia Plan, 1986). The National Agricultural Policy, enunciated in January, 1984, provided the broad direction of the strategy for the agricultural sector, as well as a long-term framework for its development to the year 2000 (Fifth Malaysia Plan, 1986). The value-added component of the agricultural sector grew by 3.4 per cent during the period 1981-85. Export earnings from the major agricultural commodities of palm oil, rubber, sawlogs and sawn timber, cocoa, and pepper accounted for 29 per cent of the total export value or M$11,300 million in 1985 (Fifth Malaysia Plan, 1986). In 1986, palm oil and rubber accounted for 53 percent of the agricultural output. If rice is included, the three commodities account for 70 percent of total output (Southeast Asia:Situation and Outlook, 1987). Although the agricultural sector employed 1.95 million or 35.7 per cent of the employment force, it generated about 42,300 jobs or 6.5 per cent of the total new employment during the period 1981-85 (Fifth Malaysia Plan, 1986). The sector also contributed indirectly to the overall economy through its linkages with other sectors, particularly manufacturing and services. Its growth also contributed to the general improvement of the rural areas, resulting in increased income and a decline in poverty (Fifth Malaysia Plan, 1986).

According to one source, the development of the agricultural sector--the main sector of employment in the economy--has been highly dualistic (Young et al, 1980) in that the agricultural economy has two different types of market: the estates and the smallholders. The estates are highly mechanized while the smallholders are basically labor intensive. The estate sector, or the commercial sector as it is normally called, contributed about 50 per cent of the total production in all agricultural products (Fifth Malaysia Plan, 1986). Although the output of the two sectors is about the same, the yield from the two sectors is different (Fifth Malaysia Plan, 1986). The main concern of the government for this dualistic nature is the sharp disparity in the level of efficiency, competitiveness, and hence income for the small farmers when compared to the estate sector. Some of the reasons for this phenomenon are diseconomy of size, low-return crops, traditional methods of production, low management resource base, inadequate access to assistance and support services, an aging rural labor force, a shortage of labor, and underutilization and abandonment of alienated arable land by the smallholders (Fifth Malaysia Plan, 1986). Another area of concern is that the growth of the sector is dominated by a few tree crops, namely oil palm, cocoa, and rubber, whose prices are determined by external factors. Therefore the smallholders, which produce about 50 per cent of total agricultural products, have a high incidence of poverty. In 1984, it was estimated that 37 per cent of the small holders in agriculture are below the poverty line (Fifth Malaysia Plan, 1986), compared to only 12.3 per cent for the rest of the country. Therefore smallholders continue to be the beneficiaries of government policies and programs to increase productivity (Southeast Asia: Situation and Outlook Report, 1987). In addition to the high incidence of poverty in the agricultural sector, the majority of farmers in the agricultural sector are Malays and this creates a total imbalance of income distribution among the races. In view of the underlying structural weakness, rigidities, and problems, as well as the required role of the agricultural sector in national development, a series of analyses of policies, strategies, performance, and prospects of the sector was conducted in early 1980 by the government (Fifth Malaysia Plan, 1986). This concerted effort culminated in the formulation of the comprehensive long-term National Agricultural Policy (NAP).

The Problem

The NAP main objective is to maximize income from agriculture through the efficient utilization of resources and the revitalization of the contribution of the sector to overall economic development (NAP, 1984). Income maximization refers to the maximization of both national and farm income, incorporating the distributive as well as growth aspects of economic development. The thrust of the NAP is to increase productivity, efficiency, and competitiveness in the development of new resources as well as the fuller utilization of existing resources (NAP, 1984). Development efforts are mainly geared toward the modernization and commercialization of the unorganized smallholders. The purpose of the programs is to increase production and efficiency (Fifth Malaysia Plan, 1986). Since the economy is open, there is no tendency to implement programs that would stabilize commodity prices that a producer would receive. In addition, commodity prices were erratic throughout the decade and contributed to farmers' income instability. With erratic commodity prices, producers have increased their income variability. Since the agricultural sector has a high incidence of poverty, an increase in variability in income would push the marginal farmer to the poverty line.

Objectives

The general objective of this study is to determine the sources, magnitude, and policy implications of producer income instability in the commercial and non-commercial agricultural sector of Malaysia. Specific objectives include:

1) to review appropriate statistics for measuring the stability of producer export earnings;
2) to quantify the stability of producer earnings from the export of selected commodities and import of selected commodities;
3) to evaluate the following domestic policy instruments under selected economic scenarios --
   a) no government intervention;
   b) limited government intervention;
   c) fixed price policy;
   d) guaranteed minimum income policy;
4) to develop policy recommendations which incorporate producer income stability as a goal.

Procedure

This study employs the coefficient of variation of income as a measure of instability. The measure has been used by many authors in empirical studies pertaining to instability. This section gives a general description of the procedure used in this study. Detailed methodology will be explained in a separate chapter. Objectives one and two will be achieved using a version of the Brodsky approach (Brodsky, 1983). The main exports are valued using major importer currencies and the Malaysian currency. Export earnings instability is calculated for each currency using the general approach of Cuddy and Della Valle (1978). The correlation coefficients between the various indices are calculated to determine if any different effects are caused by the currency. Objective three will be achieved through the use of an econometrics simulation model similar to that developed by Bigman (1985). Policy implication will be considered in Chapter VI for fulfillment of objective four.

Organization of Study

The rest of the thesis is organized as follows: Chapter II will consist of the literature review. Methodology will be the topic of Chapter III. Chapter IV will discuss the sources and measures of Malaysian income instability. The effects of the simulation program will be discussed in Chapter V and the summary and conclusion of the study are presented in Chapter VI. Future policy implications will be included in Chapter VI with suggestions for research.

CHAPTER II

REVIEW OF LITERATURE

Introduction

The increase in commodity price instability during the 1970s has caused an increase in the study of its effect on the welfare of less developed countries. The price instability concept was first discussed by Waugh who put forward the idea that price instability might be able to increase consumer welfare, thereby increasing net welfare gain (Waugh, 1944). Since the Waugh concept, research on price instability has taken many different directions (Schmitz, 1984). The purpose of this chapter is to give a brief literature review of the theoretical and methodological research on the subject. This review will concentrate on literature that has contributed to the analysis of income instability in the agricultural sector of a developing country. The literature review will be separated into two sections: (1) indices used in measuring instability and (2) different models that are used to analyze income instability.

Indices Used In Measuring Instability

Several types of indices are used to measure commodity price instability. Income instability is related to commodity price instability through income, which is defined as the commodity price multiplied by the volume of commodity sold. There are two ways of measuring income instability. One way of measuring instability is to calculate the instability caused by that single variable. Another method is to divide the variable into its elements and find each of the element's share of instability. Indices that are used for measuring income instability are diverse. They range from the simplistic, where the index is the standard deviation of the residuals from the trend (Massell,1970), to highly sophisticated indices, such as the Coppock log variance index (Coppock, 1962).

Single Variable Indices of Instability

At least 16 different indices of instability have been discussed in the literature (Gelb, 1978). The most commonly used and easily interpreted index has been the coefficient of variation (CV). Although this index is widely used, it can only be used on a trend corrected time series (Cuddy and Valle, 1978). However, some authors (World Bank (1975), Labys and Thomas (1975) or Labys and Perrin (1976)) have been inclined to report and utilize the simple trend corrected coefficient of variation as measured by I_a (2.1). The simple trend corrected coefficient of variation (I_a) is defined as :

$$I_a = \frac{100}{\overline{y}} \sqrt{\frac{\sum_{t=1}^{n} (y_t - \overline{y})^2}{N-1}} \qquad (2.1)$$

where y is the price variable being examined and $\overline{y}$ is its arithmetic mean.

According to Massell (1969), the type of trend fitted to the data influences the measure of instability obtained. In his study, the data suggested using an exponential trend instead Massell used a linear, trend-corrected, measurement of variation. He assumed that the trend could be approximated by a linear function. In addition, Brodsky used the Massell index as a measure of instability (Brodsky, 1983). Coppock, on the other hand, uses three types of instability indices; (1) the Coppock Index; (2) the method used in the United Nations Secretariat's 1952 study, Instability in Export Markets of Under-developed Countries; and (3) obtaining the average of percentage deviations from the least squares trend line through the actual annual values (Coppock, 1962). After computing the three indices, he concluded that the three methods used give identical results and he uses the correlation analysis to compare the results obtained by the three methods. Coppock, in his index, assumes a constant percentage increase or decrease of export proceeds and corrects annual changes for this. The Coppock index is defined as :

$$I_c = \text{antilog} \frac{1}{n-1} \sqrt{\sum_{t=1}^{n-1} \left[\log\left(\frac{X_{t+1}}{X_t} - M\right)\right]^2} \tag{2.2}$$

where

X_t = the logarithmic first difference of the variable.

t = time period

n = number of observations

$$M = \frac{1}{n-1} \sum_{t=1}^{n-1} \log\left(\frac{X_{t+1}}{X_t}\right) \tag{2.3}$$

Rangarajan and Sundararajan (1976) used the Coppock method to estimate their instability index. They indicated that an increase in the instability of exports leads to an increase in the instability of income for each country. They concluded that the usefulness of international schemes for stabilizing primary product prices or export earnings of less developed countries must be analyzed separately for each country.

Macbean in his study (1966), used the average percentage deviation of the dollar value of exports proceeds from their five-year moving average centered on the mid year. This has a disadvantage of losing two years in the beginning and the ending of the time series.

Cuddy and Valle point out that all the above indices have a fundamental defect from the analytical point of view: they are all ad hoc measures, reasonable but not derived from any clear theoretical foundations (Cuddy and Valle, 1978). They therefore proposed a general measure of instability that has theoretical foundations. Their instability index is as follows:

$$I_X = CV\sqrt{1 - \bar{R}^2} \tag{2.4}$$

where

$$\bar{R}^2 = 1 - \left[(1-R^2)*\left(\frac{N-1}{N-k}\right)\right] \tag{2.5}$$

It can thus be seen that the general measure of instability index is nothing more than a corrected coefficient of variation. Rop uses Cuddy and Valle's index in his study and he uses either the log-linearly or linearly trend corrected time series depending on which trend fits the data best (Rop, 1986). He found that the instability index is sensitive to the currency unit that was used in the valuation of the exports.

Glezakos proposed an index which uses the arithmetic mean of the absolute values of the yearly changes in a time series corrected for the trend and expressed as a percentage of the average of all observations. That is ,

$$I_X = \frac{100}{\overline{X}} \frac{\sum_{t=2}^{n} \left| X_t - X_{t-1} - b \right|}{N - 1} \tag{2.6}$$

where b is the slope of the linear trend $X_t = a + bt$ fitted by the ordinary least-squares (OLS) method.

Identity Function

Commonly used measures to reduce instability in a developing country are price and quantity control schemes. These measures stabilize the policy variable but cause other variables to be unstable. Therefore it is of interest to determine whether the major proportion of the instability comes from the quantity or the price or both quantity and price.

It has been shown that the supply fluctuations have been the source of export earnings instability for most developing countries (Murray, 1978). In his study, Murray calculates the price and quantity instability in an attempt to assess whether the price or the quantity fluctuations are the dominant causes of income instability. The export earnings from the commodities were divided into two components: price and quantity. Murray assumes that export earnings are defined as: export earnings = Price X quantity. To change the multiplicative function to an additive function, Murray uses the logarithm function. Thus the logarithm of the equation becomes:

$$\text{Log (E)} = \text{Log(P)} + \text{Log (Q)} \tag{2.7}$$

and the variance of Ln (E) around a fitted constant growth-rate trend line is given by the identity

$$\text{var (Log E)} = \text{var (Log P)} + \text{var (Log Q)} + 2 \text{ cov (Log P,Log Q)} \tag{2.8}$$

where the variances and the covariances are around trend lines. The terms on the right hand side are calculated from the price and quantity indices. The variance of price in the equation is then divided through by the sum and expressed as a percentage. The term becomes :

$$CP = 100 \frac{\text{var (Log P)}}{\text{var(Log P)} + \text{var (Log Q)} + 2\ \text{cov(Log P,Log Q)}} \quad (2.9)$$

which may be interpreted as the contribution of the variance of price to the variance of earnings. A similar interpretation is placed on CQ. The covariance term, positive or negative, reflects the extent to which price and quantity movements are reinforcing or offsetting. The sign in the covariance will indicate whether the dominant source of the variations is from the supply or the demand side.

Rop further adapts the above equation (2.9) substituting the identity from

export earnings = (price) X (quantity)

to

$$I = I_e + I_d \quad (2.10)$$

where I is the total income. I_e and I_d denote income from the exports and domestic marketings respectively. Using this method, he was able to determine whether the dominant source of the variation is from the export or the domestic market.

Burt and Finley (1968) conclude in their study that a variable that is an identity can be decomposed into its components. Two general types of identity are (1) Multiplicative identity , and (2) Additive identity. Multiplicative identity is of the functional form :

$$y = X_1 X_2 \quad (2.11)$$

The multiplicative identity can be rewritten as a Talyor's series expansion about the means of X_1 and X_2, and this expansion leads to a method of decomposing the variance of that variable, for example production, into each individual component. The only restriction is that the function can at least be approximated by a few terms of the Taylor's series expansion. The series expansion for (X) is :

$$y= \mu_1\mu_2 + (X_1 - \mu_1)\mu_2 + (X_2 - \mu_2)\mu_1 + (X_1 - \mu_1)(X_2 - \mu_2), \tag{2.12}$$

where μ_1 and μ_2 denote the means of X_1 and X_2. Taking the expectation of both sides of (2.12), we get

$$E(y) = \mu_1\mu_2 + \mathrm{Cov}\,(X_1,X_2), \tag{2.13}$$

where E is used to denote the expectation operator. Therefore the variance of y is

$$\begin{aligned} \mathrm{Var}\,(y) &= E[y - E(y)]^2 \\ &= E[(X_1 - \mu_1)\mu_2 + (X_2 - \mu_2)\mu_1 \\ &\quad + (X_1 - \mu_1)(X_2 - \mu_2) - \mathrm{Cov}\,(X_1,X_2)]^2, \end{aligned} \tag{2.14}$$

which can be reduced to

$$\begin{aligned} \mathrm{Var}\,(y) &= \mu_2^2\,\mathrm{Var}(X_1) + \mu_1^2\mathrm{Var}(X_2) + 2\mu_1\mu_2\,\mathrm{Cov}(X_1,X_2) \\ &\quad + E[(X_1 - \mu_1)(X_2 - \mu_2) - \mathrm{Cov}\,(X_1,X_2)]^2 \\ &\quad + 2\,\mu_1 E(X_1 - \mu_1)(X_2 - \mu_2)^2 \\ &\quad + 2\,\mu_2 E(X_1 - \mu_1)^2(X_2 - \mu_2). \end{aligned} \tag{2.15}$$

The first two terms of the above equation (2.15) are the direct effects of X_1 and X_2, and the third term is the first order interaction term. The fourth term is the variance of the covariance product about the covariance parameter. The last two terms are higher-order interactions. Since the last three terms are derived from the second-degree terms of Taylor's series, Burt and Finley assumed them to be insignificant. In addition, they are only interested in the relative contribution of X_1 and X_2 to the variance and propose that the interaction term will dominate the higher-order terms in most situations, causing the equation (2.15) to be rewritten as

$$\mathrm{Var}\,(y) = \mu_2^2\,\mathrm{Var}(X_1) + \mu_1^2\mathrm{Var}(X_2) + 2\mu_1\mu_2\,\mathrm{Cov}(X_1,X_2). \quad (2.16)$$

If the identity is an additive identity then the identity could be decomposed using the multiplicative method. Expansion of the linear function by Talyor's series yields the familiar formula for the variance of a sum. Thus for the identity

$$y = X_1 + X_2, \quad (2.17)$$

we have

$$\mathrm{Var}\,(y) = \mathrm{Var}\,(X_1) + \mathrm{Var}\,(X_2) + 2\mathrm{Cov}\,(X_1,X_2). \quad (2.18)$$

Dividing relation (2.18) by the sum of the variance of X_1 and X_2 would give a standardized form of interpretation.

Hazell (1985) uses his own procedure, developed in 1982, to analyze the means and variance of the components in world cereal production. He let Q denote production, A the area sown , and y the yields. He also let subscripts i and j denote crops and h and k denote regions; therefore total cereal production is $Q = \Sigma_h\Sigma_jA_{hj}Y_{hj}$. Average production is

$$E(Q) = \Sigma_h\,\Sigma_j\,E(A_{hj}Y_{hj}), \quad (2.19)$$

and the variance of production is

$$V(Q) = \Sigma_h\Sigma_k\Sigma_i\Sigma_j\,\mathrm{Cov}\,(A_{hj}y_{hi},A_{kj}y_{kj}). \quad (2.20)$$

The variance can be expanded as

$$V(Q) = \Sigma_h \Sigma_j V(A_{hj}y_{hj}) + \Sigma_h \Sigma_{i=j} \Sigma_j Cov(A_{hi}y_{hi}, A_{hj}y_{hj})$$

(Sum of individual crop variances within regions) (Sum of intercrop covariances within regions)

$$+ \Sigma_j \Sigma_{h=k} \Sigma_k Cov(A_{hj}y_{hj}, A_{kj}y_{kj}) + \Sigma_{h=k} \Sigma_k \Sigma_{i=j} \Sigma_j Cov(A_{hi}y_{hi}, A_{kj}y_{kj})$$

(Sum of interregional variances within crops) (Sum of covariances between different crops in different regions) (2.21)

Hazell further decomposed (2.21) into ten component parts where the first five terms are the "pure" effects, the next four are interactions effects which occur because of simultaneous changes in all the constituent parts, and the last term is a higher term which is typically small and of little importance.

Rourke (1970) uses the Feller's relationship of total variance to the variance of component parts as his method of measuring instability. The relationship can be specified as :

If $X_1, ..., X_n$ are random with finite variances $\sigma_2^1, ..., \sigma_2^n$;

and $S_n = X_1 + ... + X_n$;

then

$$Var(S_n) = \Sigma \sigma_k^2 + 2 \Sigma Cov(X_j, X_k), \qquad (2.22)$$

the last sum extending over each of the $\binom{n}{2}$ pairs (X_j, X_k) with $j < k$. The last statement can be written as :

$$1 = \frac{\Sigma \sigma_k^2}{Var(S_n)} + \frac{2\Sigma\, Cov(X_j, X_k)}{Var\,(S_n)} \qquad (2.23)$$

The first term is considered the direct contribution of individual components to total variability, and second term is considered as the contribution of the iteration of a pair of components to total variability.

Different Model Used in Analysis.

The theorem of price instability was first brought to light in Waugh's study in 1944. In that paper, Waugh proposed that price instability may be pareto superior to price stability for the consumers. Pareto superior is defined as the situation where a consumer can be made better off through a change in price. His theorem holds only if the consumers are given a specific sum of money to spend in a series of periods and are indifferent as to how this sum is distributed among the periods. Later Oi (1961), without knowing about the Waugh publication, proposed that instability in prices will always result in greater total returns compared to stability in prices. The requirement is that the firms maximize short run profits at each point in time. Another requirement is that the marginal cost curve of each firm be upward sloping throughout its relevant range.

Since both papers consider only one side of the picture, that is the consumer or the producer side respectively, Massell integrated the Waugh and Oi results (1969). His intention was to consider the welfare effects of price stabilization in a model containing both consumers and producers. Massell follows the definition that Waugh and Oi used as a measure of gain (a) for producers, the expected value of producer surplus and (b) for consumers, the expected value of consumer surplus. The expected value of producer surplus at price p is defined as the area of the curve below price p and above the supply curve. On the other hand, the expected value of the consumer surplus at price p is defined as the area of the curve above price p and below the demand curve. Additional information on the definitions and the controversies surrounding consumer surplus and producer surplus will be discussed in Appendix B. Waugh uses the Dupuit(1933)-Hicks(1939) interpretation of consumer surplus. Dupuit's interpretation of consumer surplus was restated by Hicks which states:

> The best way of looking at consumer's surplus is to regard it as a means of expressing, in terms of money income, the gain which accrues to the consumer as a result of a fall in price. Or better, it is the compensation variation in income, whose loss would just offset the fall in price, and leave the consumer no better off.

Massell then concluded that price stabilization, brought about by a buffer stock, provides a net gain to producers and consumers taken together. Furthermore, the net gain would only be possible if the gain from the producers (consumers) are distributed to cover the losses from the consumers (producers). However, he assumed the storage cost to be zero, and if storage cost was positive than the net gain would decline. In addition, Massell ignored the effect of price stabilization on the variance of producers' and consumers' income. If price stabilization increased the expected value of producers' income and also increased the variance, then the producers might, on the average, suffer a welfare decline.

Hueth and Schmitz (1972) expanded Massell's framework to examine internationally traded goods. They considered trade in both intermediate and final goods and their effects of instability in both markets on the consumers and producers of final goods. To show that price stability is preferred to price instability, actual compensation by the producers or the consumers is necessary. In theory, if international compensation is made, the model shows that it is not the total world producers who must compensate world consumers or vice versa, in order for price stability to be desirable. Rather, it is only producers or consumers in one country who must make the compensation, and not the combined producers or consumers. But if the compensation cannot be made then price instability is pareto superior to price stability. Hueth and Schmitz also show that the desirability of price stability depends critically on the source of the instability.

Massell (1969) uses a linear demand and supply curves with the stochastic disturbance being additive. Turnovsky (1976) expanded on Massell's theory and used non-linear demand and supply curves. Instead of using an additive stochastic disturbance, Turnovsky used a multiplicative stochastic disturbance. He concluded that the desirability of stabilization is determined independently of the origin of the stochastic disturbance or any specific parameters characterizing their probability distributions such as their specific variances. Producers gain from having either demand and/or supply disturbances stabilized if demand is elastic and supply inelastic, or vice versa. On the other hand, consumers tend to gain if supply is elastic and demand is inelastic and be worse off otherwise. The supply or demand is considered elastic when the absolute value of the calculated elasticity is greater than 1. This conclusion cannot be generalized and might not work in particular cases.

Bale and Lutz (1979) demonstrated that different trade intervention policies have different effects in altering instability in one country and transmitting it to the rest of the world. For example, a specific tariff is shown to transfer the fluctuation so that a shock in one part of the system is absorbed by the world system. An ad valorem tariff will increase the price instability in the (importing) country which imposes the tariff. In addition the variances increases with an increasing tariff rate and with increasing slopes of the supply and demand function in the exporting country.

Another area that was significant in its effects on income instability is the risk that producers perceive in the market. Just (1975) explains why producers risk-averseness or risk-responsiveness should be included in the model used to show the effects of income instability. Using a similar model from Hueth and Schmitz (1972) that uses a buffer stock as a tool for price stabilization, Just (1975) was able to show that the expected change in buffer stock is not zero if producers are risk-responsive. He concluded that there were two reasons why risk considerations have been omitted in empirical policy analysis: (1) most policy analyses are usually considered in a deterministic framework; and, (2) appropriate models have not been developed.

Bigman (1985) developed a simulation model that analyzes the effects of instability in agriculture. With the knowledge that government intervention in support of agriculture is widely practiced in the developing countries, Bigman simulates models to analyze the economy-wide effects of several producer support policies. The main performance criteria are (1) the average level and variability of farmer prices, (2) the average and the variability of farmers' income, and (3) their income risk, which is defined as the probability that their income will fall by more than 15 percent below their normal income. These criteria are then measured against the government expenditures on the program. For a closed economy with risk neutral producers, Bigman found that the income risk was eliminated by all the programs considered. On the other hand, with an open economy, the fiscal costs of producer stabilization programs are considerably reduced. But if the producers are risk-averse and are in a closed economy, the results are (1) a decline in the mean price and (2) a rise in output as an effect of the greater stability secured by the policies. The magnitude of the results on producers' income would depend on the price elasticity of demand for the commodity.

In commodities that are traded, Bigman considered Newbery and Stiglitz's (1981) proposal that free trade may be inferior to no trade. He assumed that farmers are producing two crops. The production of one of the crops is assumed to be unstable while the other crop is considered to be completely stable. Two types of economies were used: an open economy and a closed economy. An open economy is described as an economy where free trade is available. A closed economy is defined as an economy where no trade is possible. Simulation results were obtained for log-linear demand and supply functions in closed and open economies, and for different price elasticities of demand. From the results Bigman concluded that

(1) For price elasticities of demand greater than or equal to -1, both consumers and producers are better off without trade than with trade.

(2) For price elasticities less than -1 and greater than -0.6, producers are better off with free trade but consumers are worse off.

(3) For price elasticities less than -0.6, consumers are better off with free trade. Producers are also likely to be worse off, given the very special assumptions on the stable and the unstable products.

Bigman thus shows that the Newbery and Stiglitz theory that trade can be Pareto-inferior to autarky applies only to higher demand elasticities (above -0.6). Whether or not free trade is Pareto-inferior or Pareto-superior is an empirical question and is very dependent on the specific parameters of the crops under consideration.

Chapter Summary

A partial examination of the literature has been reviewed. This chapter has been divided into two sections, namely the instability indices and the different models available for income instability analysis.

The complexity of finding a suitable index of measurement compounds the analysis of income instability. Although the indices are numerous, the analysis should be meaningful if the author(s) does not exceed its assumptions . Variables that could be divided into its components are able to show the effects of the component on that variable. Two identities are normally observed. Additive identity is easily split into its components. This enables the researcher to see the effects of the components on the variable. Multiplicative identity can also be split into its components by using Talyor's series.

The Waugh-Oi-Massell framework proposes that price instability might be better than price stability. This framework shows that a country might forego government programs that increase price stability but should instead promote price instability. Bigman shows that the benefit and losses that could exist in trade can be shown using theoretical methods. Simulation models could also be used to show the benefits and losses of alternative programs that are being considered.

CHAPTER III

METHODOLOGY

Introduction

This chapter is divided into three sections: methodology (1) to determine currency variability, (2) to determine the direction of the variability, and (3) to be used in the simulation model.

Currency Variability

Foreign exchange is one of the factors that affects producer income instability. To measure the effect of foreign exchange on producers' income instability, the Cuddy and Valle index will be used This index is used because it is able to correct for the trended data. The coefficient of variation index is given as follows:

$$I_{CV} = \frac{100}{\overline{P_{it}Q_{xt}}} \sqrt{\left[\frac{\sum_{t=1}^{N} \left(P_{it}Q_{xt} - \overline{P_{it}Q_{xt}} \right)}{N - 1} \right]} \qquad (3.1)$$

where P_{it} is the price in terms of currency of country i during period t, and t = 1,...,N. Q_{xt} represents the quantity traded of commodity x during period t. Hence $P_{it}Q_{xt}$ is the value of the marketed commodity in term of currency i. The CV index will overestimate the fluctuation in prices if a statistically significant trend exists (Cuddy and Valle, 1978).

According to Massell (1968), the trend could be eliminated using a linear form, although an exponential form would fit the data better. In this study, the data will be transformed into a linear form before the index Icv is calculated. The equation can be written as follows :

$$P_{it}Q_{xt} = \alpha_i + \beta T_i + X_{ti} \qquad (3.2)$$

where T = time (in years) and the Xti = deviations from the linear trend. The index could be written as :

$$I_{cv}^{adj} = \frac{100}{\widehat{P_{it}Q_{xt}}} \sqrt{\frac{\sum_{t=1}^{N}\left(P_{it}Q_{xt} - \widehat{P_{it}Q_{xt}}\right)^2}{N - 1}} \qquad (3.3)$$

where $\widehat{P_{it}Q_{xt}}$ is estimated from the linear equation.

On the other hand, Cuddy and Valle proposed an index, I_X (2.4), which is based on statistical theory. Rop (1986) also uses the identical procedure in his analysis on Kenya traded commodities. To determine the index, we first provides an expression for the coefficient of multiple determination :

$$R^2 = 1 - \frac{\sum_{t=1}^{N}\left(P_{it}Q_{xt} - \widehat{P_{it}Q_{xt}}\right)^2}{\sum_{t=1}^{N}\left(P_{it}Q_{xt} - \overline{P_{it}Q_{xt}}\right)^2} \qquad (3.4)$$

in which $\widehat{P_{it}Q_{xt}}$ is the estimated value of the $P_{it}Q_{xt}$ calculated from the regression. The definition can be written as

$$\sum_{t=1}^{N}\left(P_{it}Q_{xt} - \widehat{P_{it}Q_{xt}}\right)^2 = (1-R^2)\sum_{t=1}^{N}\left(P_{it}Q_{xt} - \overline{P_{it}Q_{xt}}\right)^2$$

$$= (N - K)\,(1 - R^2)\,\frac{(N-1)}{(N - K)}\;\frac{\sum_{t=1}^{N}\left(P_{it}Q_{xt} - \overline{P_{it}Q_{xt}}\right)^2}{N-1} \qquad (3.5)$$

The term on the LHS of the above equation (3.5) is R^2 which becomes the square of the standard error of regression estimates (SEE^2) when divided by the number of the degrees of freedom.

$$SEE^2 = \frac{\sum_{t=1}^{N}\left(P_{it}Q_{xt} - \widehat{P_{it}Q_{xt}}\right)^2}{N - K} \qquad (3.6)$$

where K is the number of independent variables in the regression including the constant. The last term of the RHS in equation (3.5) is the square of the standard deviation (SD) of $P_{it}Q_{xt}$. By implementing both of the above definitions in the equation (3.5) and dividing both sides by (N - K) the equation can be written as :

$$SEE = SD\sqrt{(1-R^2)\,\frac{(N - 1)}{(N - K)}} \qquad (3.7)$$

As the definition of I_{cv} is $\left(I_{cv}=100^*\frac{SD}{\overline{P_{it}Q_{xt}}}\right)$, this measure can be defined as $100^*\frac{SEE}{\overline{P_{it}Q_{xt}}}$ Hence the general measure of instability Ix is defined as :

$$I_x=\frac{100^*SEE}{\overline{P_{it}Q_{xt}}} = I_{cv}\sqrt{(1-R^2)\,\frac{(N - 1)}{(N - K)}} \qquad (3.8)$$

Using Cuddy's (1974) definition of corrected - $\overline{R}^2$:

$$\overline{R}^2 = 1 - \left[[(1-R^2)\,\frac{(N - 1)}{(N - K)}\right] \qquad (3.9)$$

the index can be rewritten as :

$$I_X = I_{CV}\sqrt{(1 - \bar{R}^2)} \quad (3.10)$$

Thus the index of instability is nothing more than a 'corrected' coefficient of variation. Two different types of trend corrected methods are used in this study : the linear and non-linear trend corrected method.

As a selection criterion, Rop and Cuddy and Valle use the following :

(1) Choose I_{CV}^{adj} if the trend corrected regression equations are not significant at the 1 percent level.

(2) Select I_X from the equation that has a significant R^2 at the 1 percent level if the alternative equation has a R^2 that is not significant at the 1 percent level.

(3) If the R^2 are significant at the 1 percent level in both equations then choose the I_X that has the higher R^2.

The index described above is then derived for the selected commodities and in the different currency values. The index selected is determined by the Cuddy and Valle criteria.

Direction of Currency Variability

Since producer gross incomes are determine by price and quantity, producers incomes from commodities can be divided into two sections and their effects on instability can be determined separately. This procedure could show which section is the major cause of income instability. Using Murray (1979) methodology, let the identity be

$$I_i = P_i Q_X \quad (3.11)$$

where i represents gross income from commodity X, where X = 1,...,3, P_i is its price in terms of the currency, and Q_X is the quantity marketed. Then the equation becomes:

$$Ln(I_i) = Ln\ (P_i) + Ln\ (Q_X) \qquad (3.12)$$

and the variance of Ln (I_i) is given by the identity :

$$Var(Ln\ I_i)=Var(Ln\ P_i)+Var(Ln\ Q_X)+ 2Cov(Ln\ P_i,LnQ_X) \qquad (3.13)$$

where the variance and the covariance are measured around the trend lines. The covariance term determines whether the instability is from the supply or the demand. If the covariance is positive (negative) then the source is demand (supply). The equations are then divided through by their sums and multiplied by 100 and expressed as percentages. Thus the term becomes:

$$CP = \frac{100 * Var(Ln\ P_i)}{[Var(Ln\ P_i) + Var(Ln\ Q_X) + 2\ Cov(Ln\ P_i,Ln\ Q_X)]} \qquad (3.14)$$

$$CQ = \frac{100 * Var(Ln\ Qx)}{[Var(Ln\ P_i) + Var(Ln\ Q_X) + 2\ Cov(Ln\ P_i,Ln\ Q_X)} \qquad (3.15)$$

where CP is the proportion of total instability from the price variable and CQ is the proportion of total instability from the quantity variable.

Model Specification

This section can be divided into three areas : 1) the demand and supply functional form for the selected commodities, 2) the government intervention, and 3) the simulation model.

The Demand and Supply of Commodities

Since this study is to analyze producer income instability due to the selected commodities, the consumer demand and the producer supply will be aggregated into a log- linear specification. This type of function takes into account the formation of expectations and the response to price and production risks. The functional form is written as follows :

$$\log S_t = \alpha_0 + \alpha_1 \log P_t^e - \alpha_2 \log R_t \qquad (3.16)$$

where S_t is planned output, P_t^e is the price expected at time (t - 1) and R_t is the risk factor which is represented by the variability of income and measured as

$$R_t = (1 - \frac{\sigma_I}{\bar{I}}) \qquad (3.17)$$

where

$$\sigma_2^I = \frac{1}{n} \sum_{i=1}^{n} (I_t - \bar{I}_t)^2 \qquad \text{and,} \qquad (3.18)$$

$$\bar{I}_t = \frac{1}{n + 1} \sum_{j=0}^{n} I_{t-j} \qquad (3.19)$$

where I_t is the farmers' income at time t. In this study, the random variable in the supply side is generated by the Gaussian distribution.

Government Intervention

All the commodities analyzed in this study except rice are major foreign exchange earners and are highly dependent on the world prices; a decline in prices could affect the producer income, as adjustment in production is difficult and involves a long time. Therefore government intervention is needed to prevent producer income from declining to the poverty level. In addition, the population of producers is very large and a decline in their income could be disastrous to the whole economy. Two aspects of government intervention are considered in this study : (1) to impose a commodity floor price and (2) to have free trade for the commodity. For rice, the aspects are (1) to have a fixed price and (2) to have a free market price with discount subtracted for domestic rice.

The Simulation Model

This study uses a modified version of Bigman's (1985) econometrics simulation model to evaluate the effects of alternative policies on producer income instability. Simulation creates an environment where various alternatives can be analyzed without having to implement the alternative. Although a simulation can not include all the variables that have an effect on the policy, the ability to incorporate almost all the essential variables helps to determine the effects of each different policy action and also gives insights to potential problems. The model consists of the following main components :

1) An econometrics model specifying the demand and supply functions for the selected commodities.
2) The stochastic process describing the random fluctuation in the country's agricultural production, in world price of these products, and in nonagricultural income.
3) A set of policy rules that define the government practices under different contingencies (in good and bad years, for high and low world prices, and so on).

This model is a representation of a dynamic process of an economic system. At the beginning of the time t, the state of the system can be represented by a vector Y_{t-1} which was determined by the previous period. This vector includes the total area harvested in each of the selected commodities and the supply and demand parameters for all the commodities. During the t period, random events which have known probabilities, denoted by the vector Z_t

occur. Policy actions denoted by vector X_t, are determined from the initial state of the system Y_{t-1}, and the current random events, with accordance to a set of decision rules D. Thus

$$X_t = D(Y_{t-1}, Z_t) \tag{3.20}$$

The initial state of the system, the random events, and the policy actions taken together determine the state of the system at time t. This can be expressed as :

$$Y_t = F_t(Y_{t-1}, Z_t, X_t) = F_t[Y_{t-1}, Z_t, D(Y_{t-1}, Z_t)] \tag{3.21}$$

Due to the recurrent nature of the equation, the state variables Y_t can be written as a function of the initial condition Y_0, the set of decision rules D, and the random events $Z_1, \ldots, Z_t$. The objective function can thus be written as a function of all the state variables :

$$H = H(Y_0, Y_1, \ldots, Y_T) \tag{3.22}$$

In a dynamic and stochastic model, the procedure is different from the ordinary comparative static analysis. In the partial or general equilibrium of a comparative static analysis, all the endogenous variables are solved simultaneously for the given exogenous and control variables. On the other hand, in a dynamic and stochastic model at partial equilibrium, production and resource allocation decisions in any given year are made in the beginning of the year on the basis of the expected prices, before the weather event and the actual prices for that year become known.

Therefore the model is recursive and sequential rather than simultaneous. The steps for each year are described below :

1) In any given year the initial conditions are specified by

   (a) a set of exogenous variables; demand and supply, elasticities, income, and weather,

and

(b) a set of endogenous variables that has been derived in the previous years such as past prices.

2) Given the initial conditions, the production decision is made at the beginning of that year. The supply function specifies planned production as a function of expected output prices and the price elasticity of supply. The expected price is itself a function of past price. This function is thus the cause of the model being recursive.

3) Actual supply in that year is determined by the actual weather conditions in that year.

4) Given the actual supply, the market price of the product is then determined through the corresponding demand function. The price and quantity are then referred to as the reference solution.

5) The reference price is then equated with the CIF import price and the FOB export price. If the reference price is higher than CIF import price then the product is imported or vice versa. The market price is then determined by the import price and the quantity imported by the difference between the quantity consumed at that price and the quantity produced in the country. This set of prices and quantities is then referred to as the free-market solution.

6) The free-market prices and quantities are equated with trigger prices that determine the government intervention rules. The intervention rules are :

(a) if the free-market price is lower than the trigger price, the government will intervene by buying up the surplus and storing it.

(b) if the free-market price is higher than a certain ceiling price than the government will sell the stored commodities in the world market.

A diagram showing the steps taken is given in figure 3.

Chapter Summary

In this chapter, the methodology was discussed . This was followed by a covariance analysis methodology which showed whether the commodity currency had an effect on the instability of producer income. This analysis would be able to determine the currency used in commodity pricing that would decrease producers' instability. The effects of producers' income instability could also be determined through the demand or supply function of the commodity. This effect will be measured by dividing the revenue into its components: price and quantity. The components are then analyzed for their effects on instability. A simulation model, a model similar to Bigman's model, is then presented which would show whether government intervention is relevant to creating instability in producer income.

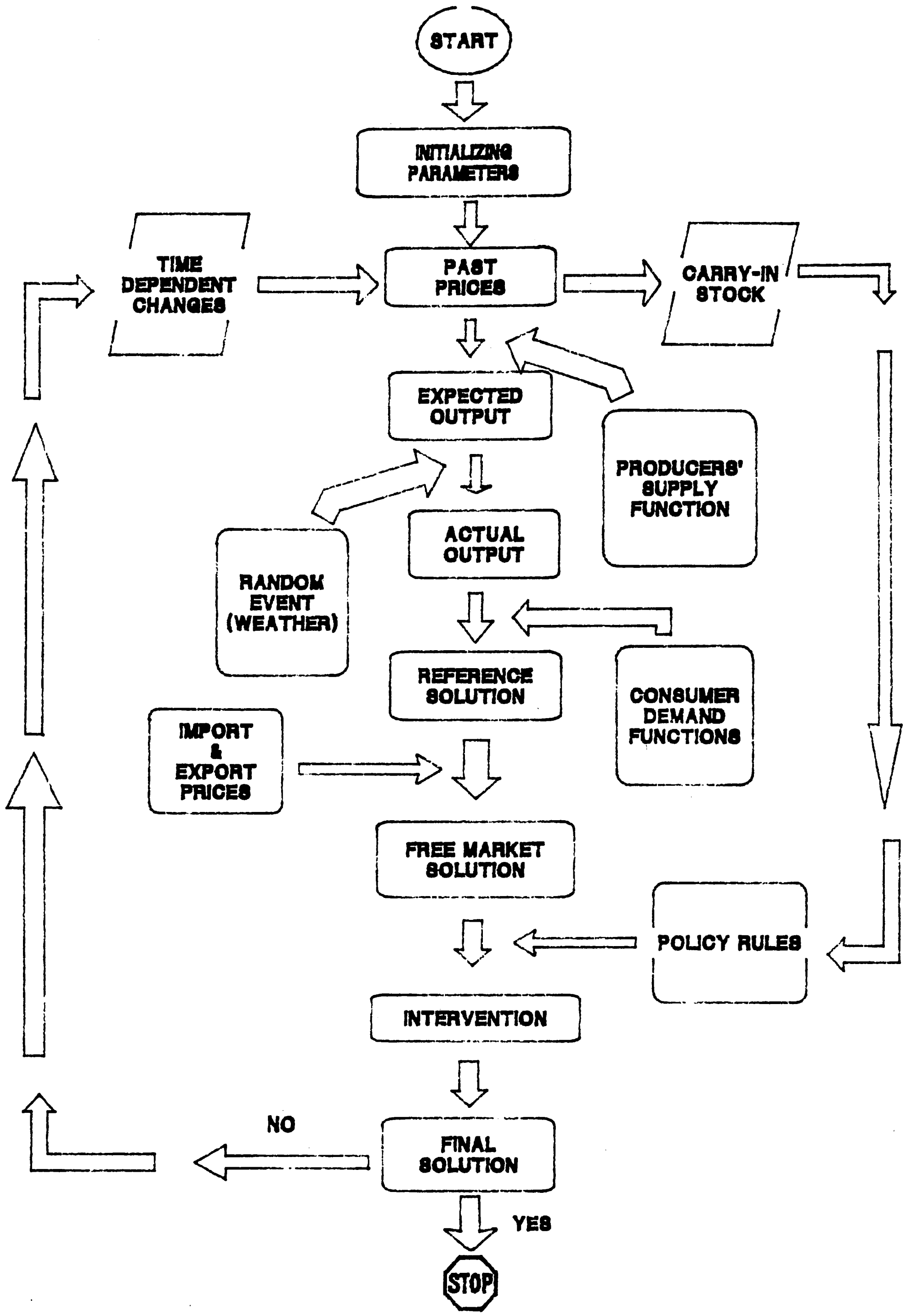

FIGURE 3. DIAGRAM SHOWING THE SIMULATION MODEL USED IN THE STUDY

CHAPTER IV

DATA REQUIREMENTS AND EMPIRICAL RESULTS

Introduction

Although many different methodologies are available in the literature for measuring producer income instability, the methodology discussed in Chapter III was used. This chapter will present the empirical results obtained from using the methodology addressed in Chapter III. The first section gives a brief description of the commodities and the price trend of the commodities. The data requirement that is needed to estimate the demand and supply function for the selected crops will be reviewed. The second section examines the empirical results obtained for fulfillment of objective two of this thesis. Objective two is to determine whether producer income instability could be reduced by using different currency to value the exported commodities. Empirical results of selecting a currency that will be the major vehicle of exchange rate for the exporting commodities will also be discussed. Section three will display the empirical results which will show the sources of producer income instability, while section four will discuss the policy implications that resulted from the previous sections. The chapter concludes with a summary of the effects of the different currencies on the producer income instability and the sources of producer income instability.

Background and Data Requirements on Selected Commodities in the Study

Background on Selected Commodities

The commodities considered in the study are rice, cocoa, rubber, and timber. All these commodities are grown largely for export and are major foreign exchange earners except rice which is grown for the domestic market. Rice is a seasonal crop while rubber, cocoa, and timber are perennial crops. Rice and cocoa are harvested at a certain time of the year while rubber and timber are harvested all year round. Although rice is grown in Malaysia, it is still imported into the country and is a major foreign exchange drain. As all the commodities are primary products, their prices fluctuate drastically. The demand for the exported commodities is derived demand from industrial countries and developed countries. Rice is considered in this study due to its importance to the government and the public. A brief history of the price trend for the above crops is presented below.

Rice.

Although world trade in rice increased from 6.4 to 10.3 million metric tons (mmt) between 1961 to 1978, it has never exceeded 4 percent of total production (Falcon et al, 1980). According to Falcon, the dominant importers were the Asian countries during 1961-78. In 1978, the market share of the Asian countries declined while the market share of Middle Eastern and African countries increased. In the early 1960's, the international price was stable while world production increased gradually. The political unrest and the severe weather in Asia in 1966-68 caused the international price to increase

(FAO:Commodity and Outlook, 1971). After 1968, production of rice increased due to the increased use of the new rice varieties and normal weather, causing the price to trend downward. Poor rice and wheat harvests in 1972-73 created a large increase in the international price for both cereals causing production to increase and the rice price started to decline in 1975. By 1977 production shortfalls among producers in Asian countries caused the price to increase and it has thus fluctuated throughout this decade.

Natural Rubber.

On the other hand, Natural rubber prices were on the decline from the early 1960's to the early 1970's (FAO:Commodity Review and Outlook,1982). This decline in natural rubber prices was due to the perfection of the manufacturing process of making synthetic rubber and to the low oil price that prevailed at that period. During the first oil boom in 1973, a drastic jump in natural rubber prices was observed as the synthetic rubber price was relatively more expensive. World production of natural rubber increased by 11 percent for 1973 for the first time since 1969 (FAO:Commodity Review and Outlook,1974). The higher synthetic rubber prices caused the demand for the cheaper natural rubber to increase, thereby increasing the natural rubber prices. The increase in natural rubber prices stabilized until the second oil boom occurred in 1979, which caused natural rubber prices to increase by about 20 percent between 1979 and 1980 (FAO:Commodity Review and Outlook,1981). After the second oil boom, natural rubber prices start to decline because high oil prices were perceived to be prevailing and because of the ability of synthetic rubber production to adjust to changes in short run prices.

Cocoa.

World cocoa production since world War II shows a cyclical behavior which consists of 7 to 11 years of increasing production and declining real prices followed by stagnant production and increasing real prices (Akiyama & Duncan, 1982). Akiyama & Duncan propose to separate the production cycle into different sub-periods of (1) 1946-57, (2) 1957-64, (3) 1964-76, and (4) 1976- 82 .

1) Between 1946-1957, the moderate increase in world output of 2.6 percent per annum was contributed by a large increase in Brazil and Cameroon, while production in the two largest producers, Ghana and Nigeria stagnated. Demand was also increasing from the low levels of the World War II era.

2) Between 1957-1964, due to the high real prices observed in the late 1950's, world production increased at a high rate of 7.8 percent per annum. The Ivory Coast, Ghana, and Nigeria increased their production at a rate of 13-15 percent per annum.

3) Then in 1964-76, production from Ghana and Nigeria declined at an average rate of 2 percent and 1.8 percent, respectively, whereas production in Brazil and the Ivory Coast rose but was not enough to compensate for the decline in world production. During this period real prices were increasing and Malaysia was increasing its new planting in anticipation of higher prices in the future.

4) During the period 1976-1982, production in Nigeria declined, but Brazil and the Ivory Coast were able to increase

production to compensate for Nigeria's reduced production. The world production growth rate of 4.9 percent per annum was reached due to new plantings that took place in Brazil, the Ivory Coast and Malaysia in the early and mid '70's.

In 1982-1984, cocoa prices increased 38 percent in response to a decrease in production in West Africa, Brazil, and Ecuador due to weather (FAO: Commodity Review and Outlook, 1985). Political and economic instability in Ghana, a major cocoa producer, also helped fuel the rapid price increases.

Tropical Logs:

World production of non-coniferous logs during the 1961 to 1973 period increased from 163,373,000 m^3 to 215,457,000 m^3, a growth rate of 3 percent per annum during that period. During this period, the nominal price of tropical logs was increasing only at a growth rate of 2.6 percent per annum. In 1972, production of tropical logs declined from 215,457,000 m^3 to 201,748,000 m^3, a decrease of 6.4 percent, causing prices to increase by 30 percent per annum in the 1972 to 1973 period. Nominal prices decreased in 1975 but started an upward climb, reaching a high in 1979. An increase of 94 percent in nominal price was observed between 1978 and 1979. This dramatic increase was a function of production trying to keep up with demand and the increase in demand by the booming world economy. In 1980-1981, prices started to fall due to reduction in imports of Japan, South Korea, and other Asian importing countries (FAO:Commodity Review and Outlook, 1982). Prices fell during 1980 to 60 percent of the 1979 peck and remained low during 1981. These declines caused severe consequences for economies heavily dependent on wood products as a source of income, particularly for the states of Sabah and

Sarawak in Malaysia. The downward trend in exports of tropical logs continued in 1982. Imports into France and Italy were sharply reduced, reflecting the depressing economy in their furniture industry (FAO: Commodity Review and Outlook, 1984).

Data Requirements

The secondary time series was obtained from several sources, primarily the from FAO Trade Yearbook, the FAO Production Yearbook, and Appendix A of "The Study of West Malaysian Natural Rubber Exports" by Nailul Morad Mohd Nor. Revenue and quantity data were obtained from the FAO Trade Yearbook for all the selected crops. The production figures are from the FAO Production Yearbook while the exchange rates for Malaysia's major trading partners are collected from the International Financial Statistics (IFS) published by the International Monetary Fund (IMF). The data for the rubber crop was obtained from the appendix of the "The Study of West Malaysian Natural Rubber Exports " whose author is Nailul Morad Mohd Nor.

Empirical Results

Four agricultural crops were used to derive an index of instability. The crops are rice, cocoa, rubber, and timber. Annual earnings for the crops were obtained from the FAO Trade Yearbook. Empirical results were obtained using the methodology discussed in Chapter III. Coefficient of variation for the trend corrected , linear trend, and log linear trend were calculated for the rubber export revenue, rice import revenue, cocoa export revenue, and timber export revenue in selected currencies, namely the Singapore Dollar, Japanese Yen, Holland Guilder, South Korea Won, Thailand Baht, Malaysia Dollar, and

American (U.S.A.) Dollar (Table I). In general, the log-linear index was selected the most often. A total of 21 out of 28 of the selected indices are log-linear and 7 are trend corrected index and one is of the linear index. One peculiar occurrence was observed in the rice import category where all the indices selected for the different currencies were the trended coefficient of variation except the South Korean currency whose index was a log-linear index. For rubber, the indices selected for all currencies were log-linear, except for United States currency which is a linear index, and the indices range from 19.662 to 31.671. The currencies that have the lowest indices is Holland Guilder, followed by the South Korea Won, Japanese Yen, Thailand Baht, Singaporean Dollar, Malaysia Ringgit, and finally the U.S.A. Dollar. This ranking confirms the direction of the rubber export trade. The most important importer of rubber were the European Economic Council (EEC) and within the EEC the largest importer was the Netherlands.

For rice, the index that was selected more frequently was the trend corrected coefficient of variation (Table I). The only index that was not the trend corrected index was the South Korean currency. The South Korean Won has a log-linear index. The range for the selected rice import indices was less than that for the rubber export revenue. It ranges between 40.072 and 52.938 and the lowest index was found in Japanese Yen with the South Korean Won, Singaporean Dollar, Malaysian Ringgit, Holland Guilder, U.S.A. Dollar, and Thailand Baht following respectively. The indices for rice import revenue shows that when imports are valued at Japanese Yen, the earnings of the importer are more stable, followed by South Korean Won, then followed by Singaporean Dollar, Malaysian Ringgit , Holland Guilder, U.S.A. Dollar, and Thailand Baht.

TABLE I

VALUES OF COEFFICIENT OF VARIATION IN DIFFERENT CURRENCIES FOR RICE, COCOA, RUBBER, AND TIMBER

		Rice	Cocoa	Rubber	Timber
Malaysia	Coefficient of Variation	44.698	25.961	30.221	19.171
	Index used	CV	LL	LL	LL
Singapore	Coefficient of Variation	40.500	25.827	25.873	19.573
	Index used	CV	LL	LL	LL
Japan	Coefficient of Variation	40.072	26.123	23.737	19.146
	Index used	CV	LL	LL	LL
Holland	Coefficient of Variation	45.085	457.11	19.663	20.954
	Index used	CV	CV	LL	LL
South Korea	Coefficient of Variation	40.324	24.174	22.129	15.333
	Index used	LL	LL	LL	LL
Thailand	Coefficient of Variation	52.938	24.282	24.886	18.804
	Index used	CV	LL	LL	LL
U.S.A.	Coefficient of Variation	50.226	25.403	31.672	18.788
	Index used	CV	L	LL	LL

Where: LL -- log-linear trend corrected index
L -- linear trend corrected index
CV -- trend corrected index

On the other hand, the indices selected by cocoa export earnings were all log-linear form except for the Holland Guilder, which has a trend corrected coefficient of variation index (Table I). The highest value is 457.111 and the lowest value is 24.174. The highest value is attained by Holland currency and the lowest values is by South Korea. The highest index is obtained from the trend corrected index. The ranking of the currency from lowest index value to highest index value is as follows: South Korean Won, Thailand Baht, U.S.A. Dollar, Singaporean Dollar, Malaysian Ringgit, Japanese Yen, and Holland Guilder. This ranking shows the reverse of the rubber export revenue index. Cocoa seems to have the lowest coefficient of variation when the export revenue is measured by the South Korea currency. In theory, we would expect the currency which has the most trade in that commodity to have the most stable revenue. Basically, this shows that a cocoa producer's income is more stable if he uses South Korean currency as his currency for trade.

Table I shows that all the indices chosen by the methodology specified in Chapter III are log-linear for the Timber export revenue. The difference between the high and low currency indices was only 5.621026 unit. This shows that the instability of the currency does not differ too much between currencies. The lowest index (15.33297) is found in South Korean currency and the highest index (20.953996) is found in Holland currency. The currencies when ranked from the lowest index value to the highest value are as follows: South Korea, U.S.A., Thailand, Japan, Malaysia, Singapore, and Holland. This differs from the value of imports of major trading partners in timber, which, when ranked from the biggest trader to the smallest trader according to total imports, are Japan, Taiwan, and South Korea (Bank Negara Malaysia: 1983).

Summarizing, the empirical results show that producer income instability due to different currency varies by commodities. The empirical results also indicate that to reduce producer income instability, the currency used should be the Holland Guilder for rubber, the Japanese Yen for rice, the South Korean Won for cocoa and timber. These results show that there is no single currency which would be able to minimize producer's income instability for all selected commodities thus the inability to use a currency for all transactions of traded goods. The next section will try to determine whether a single currency could reduce producer instability for all traded commodities.

In order to determine whether a single currency is available which could stabilize export commodities revenue, a Pearson correlation coefficients matrix of the selected currencies was calculated. The empirical results are presented in Table II. The hypothesis used in evaluating the Pearson correlation matrix is that the higher the correlation coefficient towards one , the less it deviates between the producer income measured in Malaysian Ringgit and other currencies. In Table II, the empirical results show that Malaysian Ringgit was highly related to the Singaporean dollar and the Japanese Yen. The Malaysian Ringgit was observed to have a highly negative correlation with the Thailand Baht, and the South Korean Won. Holland currency was found to be uncorrelated with Malaysian currency and the correlation coefficient was found to be insignificant at $\alpha = 0.01$. The results conclude that the most likely vehicle would be the Singaporean currency. The use of Singaporean currency as a vehicle for the exchange rate for exported commodities correlates with the trade statistic which shows that Malaysian trade with Singapore (the most trade is with Malaysia) from 1980 to 1985 increased from M$5,385 million or 19.1 percent of total exports to M$6,772 million or 19.4 percent in 1985 (Fifth Malaysian Plan: 1986). But according to each individual commodity, Singaporean currency was selected as the third or highest in its instability index compared to other countries' currencies.

TABLE II

CORRELATION MATRIX FOR SELECTED CURRENCIES

	Malaysia	Singapore	Japan	Holland	Thailand	S. Korea
Malaysia	1.000 (0.000)					
Singapore	0.80842 (.0001)	1.000 (0.000)				
Japan	0.75029 (0.0001)	0.96296 (0.0001)	1.000 (0.000)			
Holland	0.43704 (.0.0476)	0.86677 (0.0001)	0.88179 (0.0001)	1.000 (0.000)		
Thailand	-0.80373 (.0001)	-0.37412 (0.0948)	-0.30821 (0.1741)	0.11068 (0.6329)	1.000 (0.000)	
S. Korea	-0.93503 (0.0001)	-0.89640 (0.0001)	-0.84001 (0.0001)	-0.59868 (0.0041)	0.70357 (0.0004)	1.000 (0.000)

Parentheses are probabilities greater than |R| under Ho : RHO = 0. N=21

Sources of Instability by Components

Producer income instability could be due to high quantity variability or high price variability or both high quantity and price variability. A breakdown of the producer income into its components was done and each component's effect was studied using the Murray Methodology described in Chapter III. Table III contains the empirical results. Rubber, cocoa, and timber instabilities arise from the demand while rice instability is due to the supply. The percentage of instability due to quantity is high in all commodities. It range from a low of 44.805 percent to 128 percent. In rice, all the instability is caused by quantity while in rubber, 62 percent of the instability are due to quantity and the rest is distributed between price (9%) and the effect of both price and quantity (29%). Rice has a negative contribution in its covariance effect (4%) from price. Cocoa, on the other hand, has 40 percent of its instability from quantity, but 37 percent from the joint effect of quantity and price and 18 percent from price. In timber, the contribution of quantity is 55 percent and price, 38 percent, while the joint effect contributes only 7 percent. The small contribution of the joint effect may be the result of either supply or demand shifts (Murray, 1978). In conclusion, the empirical results show that all the exported commodities in the studies derive their instability from the demand side while rice, which is an import, has supply-derived instability. Quantity instability has a bigger impact than price instability.

TABLE III

DETERMINING PRODUCER INCOME INSTABILITY DUE TO PRICE AND QUANTITY COMPONENTS FOR RUBBER, RICE, COCOA, AND TIMBER.

	Rubber	Rice	Cocoa	Timber
Var(ln P)	1.2656	0.2347	3.5583	1.2669
Var(ln Q)	8.5467	7.6221	8.7771	1.8271
CoV(ln P, ln Q)	1.9872	-0.9683	3.6205	0.1125
Var(ln PQ)	0.2627	0.2038	4.7557	0.8268
CP %	9.1800	3.9640	18.1760	38.1730
CQ %	62.000	128.7480	44.8050	55.0490

Policy Implications

The empirical results obtained suggest that (1) there is no single currency that could minimize producer income instability for rubber, cocoa, and rice, (2) the currency obtained that minimize producer's income instability is not the currency selected by all the selected commodities using the Cuddy Vella methods, and (3) producer income instability in Malaysia is mainly due to quantity rather than price fluctuations. In addition, the income variation is due primarily to the demand rather than the supply except for rice, which is imported into the country. These results have policy implications which will be briefly discussed.

In order to minimize producer income instability, the government should export all commodities in currency other than the Malaysian Ringgit. Two alternatives for government intervention to stabilize producer income instability are to use different currency to value each individual export commodity or to use one individual currency to value all export commodities. The first alternative could be accomplished by using Holland Guilder for rubber exports and the South Korean Won for cocoa and timber. On the other hand, the second alternative could be implemented, using the Singaporean dollar as the main currency to value all export commodities.

It has been argued that producer income instability is mainly derived from demand rather than supply. Therefore, policies that increase alternative uses of the primary commodities should be encouraged. A policy of market expansion should also be implemented to increase the demand for primarily commodities. In addition, policies that reduce quantity fluctuations should be encouraged as empirical results have shown that quantity is less stable than price.

Chapter Summary

The empirical results obtained have shown that different currencies could be used to value different export commodities. That is, rubber exports should be valued at the Holland Guilder, rice at the Japanese Yen, and cocoa and timber at the South Korean Won. The currency that reduces variability for all commodities was found to be different from the currencies selected individually for each commodity. This chapter also concludes that the variability for the exported commodities is supply dependent and for the imported commodities, is demand dependent. Lastly, all the commodities were observed to have more variability in the quantity component than the price component.

CHAPTER V

SIMULATION RESULTS

Introduction

This chapter discusses a model which simulates several policies to determine their effect on producer income instability. The chapter is divided into three sections. The first section will briefly discuss the data requirements. The next section will touch on the inputs and outputs needed to run the simulation model. A brief description of the model will also be discussed. The third section will include the results of the simulation model while the fourth section will summarize the chapter.

Data Requirements

The main data requirements are generated by the demand and supply functions for the selected commodities, rubber, rice, and cocoa. Timber demand and supply functions were not estimated due to insufficient data. The required data for estimation were taken from the same sources as described in Chapter III.

The rubber demand and supply functions were taken from Nailul Morad Mohd. Nor (1985) and C. Suan Tan(1984) respectively. Using Nailul Morad Mohd. Nor's data, an estimation was done and the following model was selected.

$$Rubexp = -103.87 + .005\, wpdrb + 1.8715\, R1 + 0.8099 RM -$$

(-1.28)* (2.45)* (0.67)* (8.22)*

$.03496Rs + 0.1969RR$ (5.1)

(-3.14)* (4.54)*

$R^2 = 0.9927$

where

Rubexp	--	Rubber exports from West Malaysia
Wpdrb	--	World price for natural rubber (RSSI), IRSG.
RI	--	Rubber variable for importing countries' income per capita growth
RM	--	Rubber production in West Malaysia, IRSG various issues
Rs	--	World synthetic rubber production , IRSG various issues
RR	--	World Natural rubber Production, IRSG various issues

* Numbers in parentheses are t-values.

The variable RI was kept in the model even though it is insignificant because it is important in estimating the demand for rubber. The rubber demand model uses a linear function. A linear demand function assumes that the demand for the commodity is increasing and will never reach a maximum. It also assumes that the function is homogeneous of degree one. The limitation of a linear demand function is its inability to have a maximum point of demand. The own price elasticity of demand is estimated at 0.008 while the own price of elasticity of demand for the world was estimated at 0.77 (UNCTAD, 1974).

On the supply side, C. Suan Tan's (1984) supply function was used because her model was the only model found in the literature. She estimates her supply function using an almon model specified for the distributed lags. Her estimation results were divided into estates and smallholders for West Malaysia. Since this study only looks at rubber in the aggregate, the coefficients that C.

Suan Tan estimated were used by applying a ratio of 68.58 percent smallholder and 31.42 percent for estates to her two supply functions. The following is the weighted model used in this study adapted from C. Suan Tan's model.

$$QSRB = 0.0558Q1 + 0.5044Q2 + 0.1795\ PPRR + 0.0568\ PRRB(1) + 0.0813\ PRRB(2) + 0.0729\ PRRB(3) + 0.0458\ PRRB(4) + 0.0285\ PRRB(5) + 0.0279\ PRRB(6) + 0.0161PRRB(7) - 0.0062\ PRRB(8) - 0.0356\ PRRB(9) - 0.0658\ PRRB(10) - 0.0881\ PRRB(11) - 0.0904\ PRRB(12) - 0.0586\ PRRB(13) + 0.0247\ PRRB(14) \quad (5.2)$$

Where

QSRB -- Production of Rubber

Q1 -- Production of Rubber lagged one.year

Q2 -- Production of Rubber lagged two years.

PRRB(1)....(n) -- Price of Natural Rubber lagged n times where n is between 1 and 14.

Rice supply and demand functions were estimated using secondary data collected for the Chapter III analysis. After numerous estimations using different regression methods, the demand and supply functions were estimated using the linear model. The linear models were found to have a better R^2 than the logarithm model. The sign of the coefficients are the correct sign that theory suggested. The demand and supply functions are :

Demand Function :

$$QDRPD = \underset{(14.940)}{1296945} - \underset{(-2.068)}{1994.487}\ WDPR - \underset{(-2.433)}{0.0107}\ RG + \underset{(3.040)}{8399.218}\ RWPP + \underset{(3.544)}{42451.38}\ RCT \quad (5.3)$$

$R^2 = 0.8424 \qquad N = 23 \qquad DW = 1.888$

Supply Function :

$$QSPRD = -1709.71 + 830.2249\,EXC + 0.7112\,PRPR$$
$$(-1.515) \quad (2.388) \quad (1.328)$$
$$+ 58.3250RT \qquad (5.4)$$
$$(5.102)$$
$$R^2 = 0.8212 \qquad N = 23 \qquad DW = 1.5668$$

where

QDPRD	-- Rice produced + rice imported - rice exported. (assuming no storage)
WDPR	-- Price of Rice Malaysia bought from World Market
RG	-- Malaysia Gross National Product.
RWPP	-- World wheat price, FAO data, US$/MT.
RC	-- Trend line for demand
QSPRD	-- Rice produced in Malaysia
EXC	-- Exchange rate M$/US$
RT	-- Rice trend line for supply function

The demand elasticity for rice was estimated at -0.235, when calculated at the mean, which is comparable to the UNCTAD (1974) estimation of -0.1 during the period 1964-66 for the South East Asia Region. The supply elasticity for rice was calculated at the mean to be 0.10116.

Cocoa demand and supply functions were estimated. The data period is 1970-1983. This small period was due to data collection. Because of the small data period, the possibility of the model being biased is minimal as the data period exceeded at least one behaviour cycle of 7-11 years. A linear function for the export demand was estimated while a log linear supply was estimated. The demand and supply functions are written below :

Demand function

$$QDC = -57748 - 186.74\ WDPC - 381.82\ CS + 5719.18\ CT \qquad (5.5)$$

$$(-13.44) \quad (6.71) \quad (-2.22) \quad (17.14)$$

$$R^2 = 0.974018 \qquad N = 14 \qquad DW = 1.754$$

Supply function

$$Ln\ QSC = -0.4631 + 0.1897\ Ln\ CPD - 0.2503\ Ln\ CA \qquad (5.6)$$

$$(-3.33) \quad (1.41) \quad (-5.15)$$

$$+ 0.1676 Ln\ CST + 0.1762\ Ln\ PC3P$$

$$(6.84) \quad (3.18)$$

where

QDC	-- Quantity of cocoa exported.
WDPC	-- World cocoa price
CS	-- World sugar price
CT	-- Cocoa trend
QSC	-- Cocoa produced in Malaysia
CP	-- Cocoa production with a lag of 1 .
CA	-- Cocoa area with a lag of 1.
CST	-- Cocoa trend for supply.
PC3	-- Cocoa price with a laggof 3.

The long run own price elasticity of supply is estimated at 0.1762 and the long run price elasticity of demand is estimated at -0.76979. According to Erh-Cheng Hwa (1981), the own price elasticity of demand is -0.391 for the long run and -0.083 for the short run. However, UNCTAD (1974) estimated the own price elasticity of demand at -1.947 for the long run for developing countries while estimating the own price elasticity of demand for the world model at -0.407. Akiyama & Duncan (1982) estimated the world demand of price elasticity at -.16 for the short term and -0.30 for the long term.

Input and Output Needs and Description of Model

The requirement for the simulation model is small and consists of coefficients from the demand and supply functions in the previous sections and current values for all variables in the demand and supply function for rubber, rice, and cocoa. The 1983 data for all endogenous variables were used as the initial values for the simulation model. The values of the exogenous variables are given in Appendix A. Weather factors were assumed to be the only source of stochastic events and were assumed to be equally represented by the residual of the estimated equations. Furthermore, the residuals are assumed to followed a normal probability distribution.

Uniformly distributed random numbers on the interval (0,1) were generated using RanF(NARG) function, a function written in Fortran programming language that generates random numbers between one and zero. These random numbers were then translated into a Gaussian distribution with mean of zero and standard deviation of one. The translations were done through the Gauss function in the simulation program. To illustrate, a random number from a Gaussian distribution with mean $\overline{m}$ and standard deviation $\overline{s}$, can thus be obtained using the relationship

$$\text{Temp} = \bar{m} + \bar{s} * \text{Guasf} \qquad (5.7)$$

Where

Temp -- is the random variate

Guasf -- is the Gaussain distribution

Since the residuals of the demand and supply functions are different, there will be a different random variate for each function. The changes between variates in the equation are the mean $\overline{m}$ and the standard deviation $\overline{s}$. The

Guasf value generated for each year will be the same for all demand and supply functions used in this study. The demand and supply functions that will be used in the simulation model are given below :

Rubber

Demand

$$\text{Rubexp} = -103.87 + .005\,\text{wpdrb} + 1.8715\,\text{R1} + 0.8099\text{RM} - .03496\text{Rs} + 0.1969\text{RR} + \text{TMPDRB} \quad (5.8)$$

Supply

$$\text{QSRB} = 0.0558\text{Q1} + 0.5044\text{Q2} + 0.1795\,\text{PPRR} + 0.0568\,\text{PRRB}(1) + 0.0813\,\text{PRRB}(2) + 0.0729\,\text{PRRB}(3) + 0.0458\,\text{PRRB}(4) + 0.0285\,\text{PRRB}(5) + 0.0279\,\text{PRRB}(6) + 0.0161\text{PRRB}(7) - 0.0062\,\text{PRRB}(8) - 0.0356\,\text{PRRB}(9) - 0.0658\,\text{PRRB}(10) - 0.0881\,\text{PRRB}(11) - 0.0904\,\text{PRRB}(12) - 0.0586\,\text{PRRB}(13) + 0.0247\,\text{PRRB}(14) + \text{TEMPRB} \quad (5.9)$$

Rice

Demand

$$\text{QDRPD} = 1296945 - 1994.487\,\text{WDPR} - 0.0107\,\text{RG} + 8399.218\,\text{RWPP} + 42451.38\,\text{RCT TEMPDR} \quad (5.10)$$

Supply

$$\text{QSPRD} = -1709.71 + 830.2249\,\text{EXC} + 0.7112\,\text{PRPR} + 58.3250\text{RT} + \text{TEMPR} \quad (5.11)$$

Cocoa

Demand

$$\text{QDC} = -57748 - 186.74\,\text{WDPC} - 381.82\,\text{CS} + 5719.18\,\text{CT} + \text{TEMPDC} \quad (5.12)$$

Supply

$$\ln QSC = -0.4631 + 0.1897 \ln CPD - 0.2503 \ln CA + 0.1676 \ln CST + 0.1762 \ln PC3P. + TEMPC \quad (5.13)$$

Where

Rubexp	-- Rubber exports from West Malaysia
Wpdrb	-- World price for natural rubber(RSSI), IRSG.
RI	-- Rubber variable for importing countries' income per capital growth
RM	-- Rubber production in West Malaysia, IRSG various issues
Rs	-- World synthetic rubber production , IRSG various issues
RR	-- World Natural rubber production, IRSG various issues
QSRB	-- Production of rubber
Q1	-- Production of rubber which has been lagged once.
Q2	-- Production of rubber which has been lagged twice.
PRRB(1)....(n)	-- Price of natural rubber lagged n times where n is between 1 to 14.
QDPRD	-- Rice produced + rice imported - rice exported. (assuming no storage)
WDPR	-- Price of rice Malaysia bought from World Market
RG	-- Malaysia Gross National Product.
RWPP	-- World wheat price, FAO data, US$/MT.
RCT	-- Trend line for demand
QSPRD	-- Rice produced in Malaysia
EXC	-- Exchange rate M$/US$
RT	-- Rice trend line for supply function
QDC	-- Quantity of cocoa exported.
WDPC	-- World cocoa price

CS	-- World sugar price
CT	-- Cocoa trend
QSC	-- Cocoa produced in Malaysia
CPD	-- Cocoa production with a lag of 1 .
CA	-- Cocoa area with a lag of 1.
CST	-- Cocoa trend for supply.
PC3P	-- Cocoa price with a lag of 3.
TEMPDRB	-- Random variate for rubber demand.
TEMPRB	-- Random variate for rubber supply.
TEMPDR	-- Random variate for rice demand.
TEMPR	-- Random variate for rice supply.
TEMPC	-- Random variate for cocoa demand.
TEMPDC	-- Random variate for cocoa supply.

In addition to the random variates for each equation, the prices for each equation were assumed to be stochastic. Prices for the commodities are calculated using the individual commodity mean and standard deviation of the data in the period collected (1963-1983) and using the relationship in equation 5.7

The procedure outlined in Snedocar and Cochran (1967), used by Rop (1986), is used to calculate the required sample size. The sample size n is given by :

$$n = \frac{4\sigma^2}{L^2} \qquad (5.14)$$

Where σ^2 is the estimated population variance and L^2 is the square of the allowable error. The σ^2 for rubber demand and supply are 72440.65 and 62032.54942. For rice demand, rice supply, cocoa demand, and cocoa supply the σ^2 are 8.805×10^{10}, 8.058×10^{10}, 3.34×10^8, and 2.237×10^8

respectively. On the other hand, the allowable error for rubber is 100 MT; for rice, 10,000 MT; and cocoa, 1000MT, thus causing n to range from 8.96 to 35. Due to the wide range for the sample size, a sample size of 20 was used. This sample size is also used by Bigman while Rob (1986) use a sample size of 15. The simulation results represented long run performance measures.

The following section will offer a brief discussion of the simulation model.

The Simulation Model

The simulation model uses the 1983 value for the exogenous variables and estimates demand and supply for the selected commodities. Since the producer uses the previous year's price to estimate production, a lag in the price was used in the supply functions for all commodities. On the other hand, the prices used in the demand functions are current prices which were made stochastic through the use of Figure 3. After estimating the supply and demand, the model goes through and tests for the rule for policy intervention and if necessary will intervene and adjust the commodity prices. The model then calculates how much of the commodities will go into storage. After the first year of simulation, the year end prices are used to estimate the succeeding years' supply causing the model to be recursive. In the next section, the simulation results will be discussed under four different scenarios.

Simulation Results

Four scenarios were used to determine the effectiveness of current government policies and other alternatives. The four scenarios are (1) free trade, (2) limited government intervention, (3) a fixed price policy, and (4) a guaranteed minimum income policy. In free trade, producers receive world prices, while in limited government intervention, producers receive 80% of world prices. In a fixed price policy, producers receive a fixed price which is equivalent to the mean price of the sampling period. Finally, in the guaranteed minimum income policy, producers receive world prices but the government would subsidizes the producers if their income falls below 75% of the past two years revenue. In each case, the performance measures are the variability of farmers output and revenue which is measured by the coefficient of variation methods. In Figure 4, Figure 6, and Figure 8 actual quantities produced are plotted from 1961-1983, while the simulated values are plotted for 1984-2008 for the four scenarios in each commodity. Simulation values were not plotted for the period 1961-1983, as the main objective was to study the effects of the alternative policies and their impact on producer income instability in the future rather than the past. As the figure shows, each commodity begins to differ only in the fourth year after starting the simulation. From Figure 4, the quantity supplied of rubber was observed to bottom out in 1996 and then start to improve until 2003. The information in Figure 4 also shows that limited government intervention produces the lowest decline in quantity supplied but the revenue was the lowest because prices that producers received were only 80% of world price. Fixed price policy was observed to have the medium range in production of rubber and was observed to have the least variation in rubber revenue. Free trade and guaranteed minimum income policies produce identical production and revenue curves until year 14 when the free trade curve is higher than the guaranteed minimum income policy curve. This phenomena was observed because the policy which guaranteed minimum income was activated. The policy was only activated in year 11 but has a two year delay effect in the revenue curve. Generally the rubber production curve for the four scenarios has the same trend except that different scenarios cause different

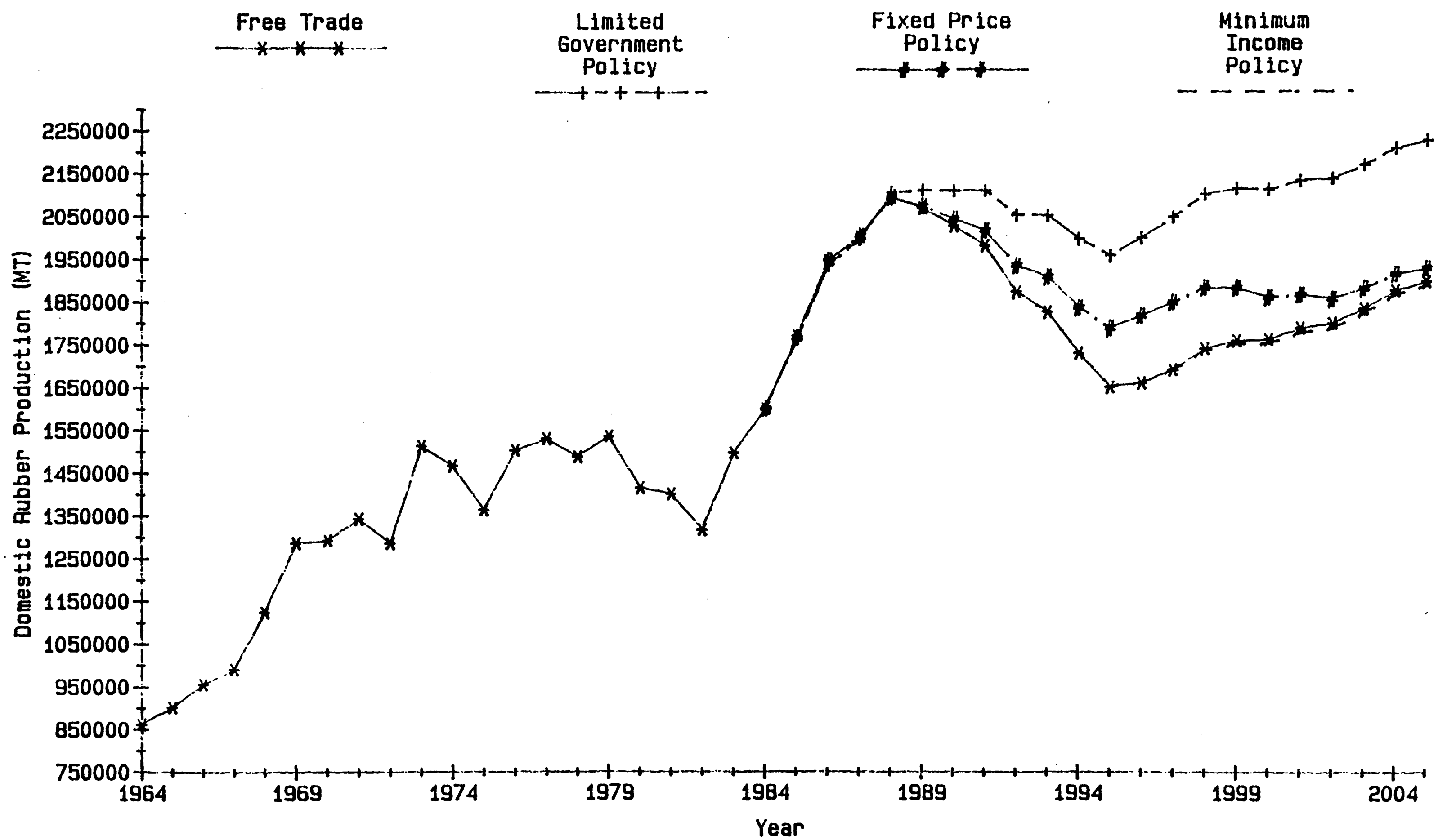

FIGURE 4 . DOMESTIC RUBBER PRODUCTION FROM 1964-2005; FOR THE PERIOD 1984-2005 THE FIGURES ARE PROJECTED UNDER THE FOUR SCENARIOS.

shortfalls/increases. In Figure 5, the revenue for the four scenarios in rubber was presented. The figure shows that the variation of free trade, limited government intervention, and guaranteed minimum income policy move in the same direction and have a greater variation than fixed price policy.

The information in Figure 6, and Figure 7 shows rice production and rice revenue for the four scenarios. The rice production curve shows that a low in production will be achieved in the fourth year of the simulation. The movements of the four scenarios are in the same direction and production changes between the scenarios are small. Overall, free trade shows a higher production curve than all the other scenarios. To further enhance the interpretation, Figure 7 shows that the rice revenue for free trade is much higher than for the other scenarios. This implies that free trade would be a better choice for rice.

Cocoa production and cocoa revenue curves are presented in Figures 8, and 9, respectively. From Figure 8, limited government intervention yields the lowest production and hence the lowest revenue (Figure 9). In general the production trends of the four scenarios are similar except from year 13 to year 17 where the fixed price policy shows a peak in production while the other three scenarios projected a low at the same period. Referring to Figure 9, cocoa revenue shows that the variation year by year is the lowest in fixed price policy, followed by limited government intervention, free trade and guaranteed minimum income policy respectively. The main choice would be fixed price policy which reduces variation and produces more revenue on the average.

Table IV presents the results of the simulation model. In the simulation period, the minimum price support was found to be inactive and thus the results obtained were identical to the current policy (free trade) except for one or two years in the simulation period. The minimum price policy will not be selected since the best alternative between the free trade and the minimum price support

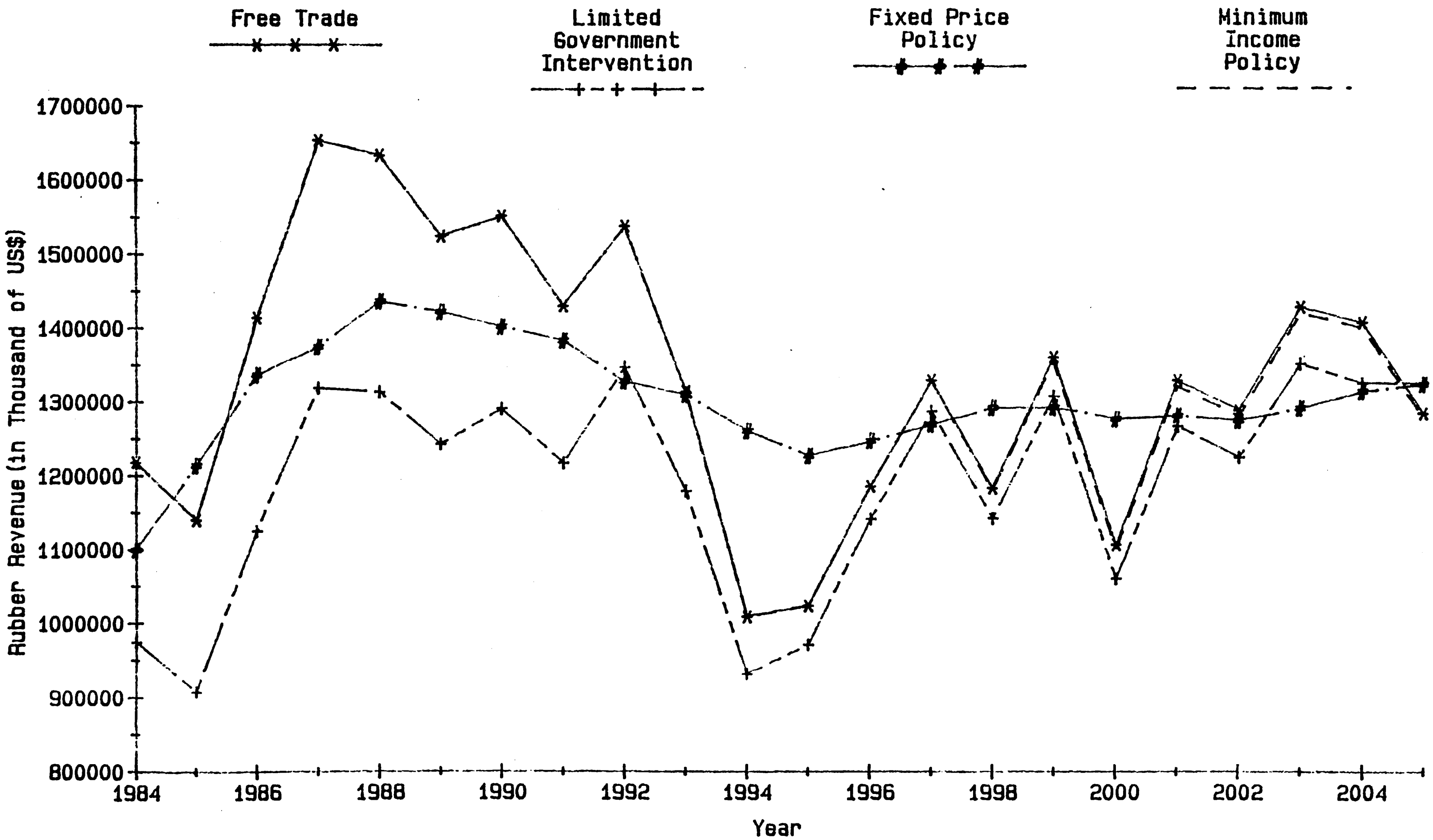

FIGURE 5. RUBBER REVENUE FROM DOMESTIC PRODUCTION FOR THE PERIOD 1984-2005 UNDER THE FOUR SCENARIOS.

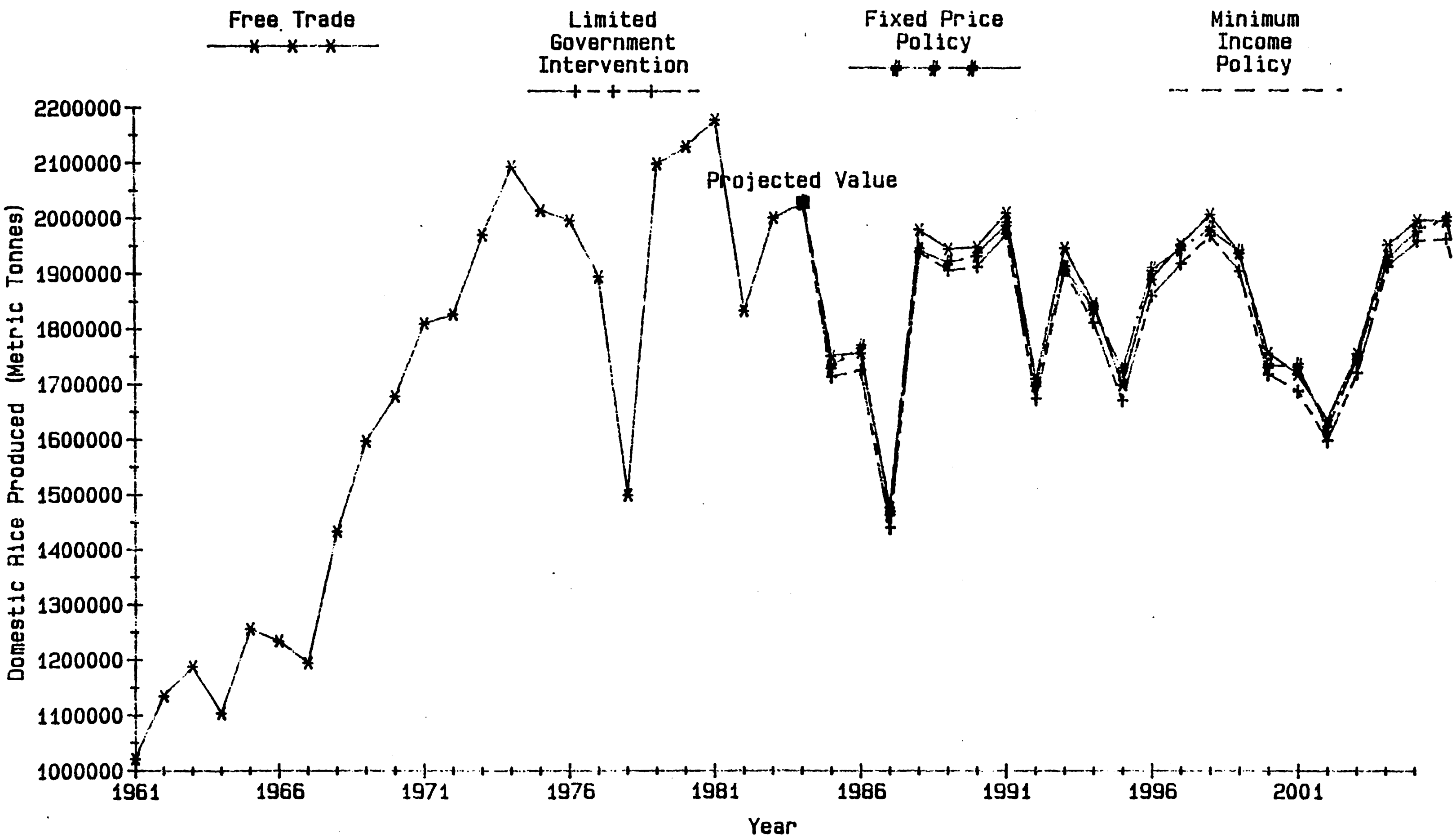

FIGURE 6. DOMESTIC RICE PRODUCTION FROM 1961-2005. FOR THE PERIOD1984-2005 THE FIGURES ARE PROJECTED UNDER FOUR DIFFERENT SCENARIOS.

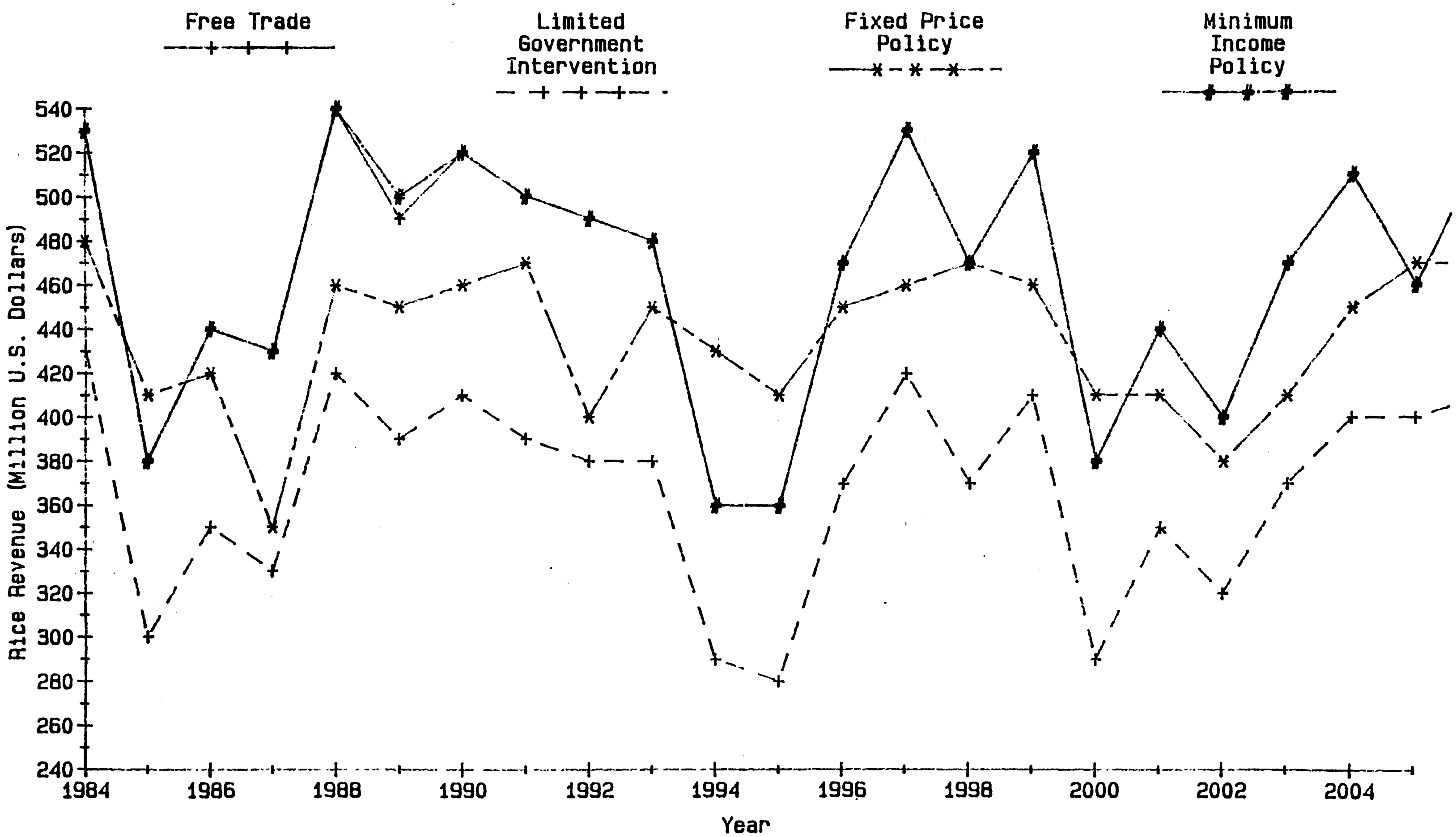

FIGURE 7. RICE REVENUE FOR DOMESTIC PRODUCTION FOR THE PERIOD 1984 - 2005 UNDER THE FOUR SCENARIOS.

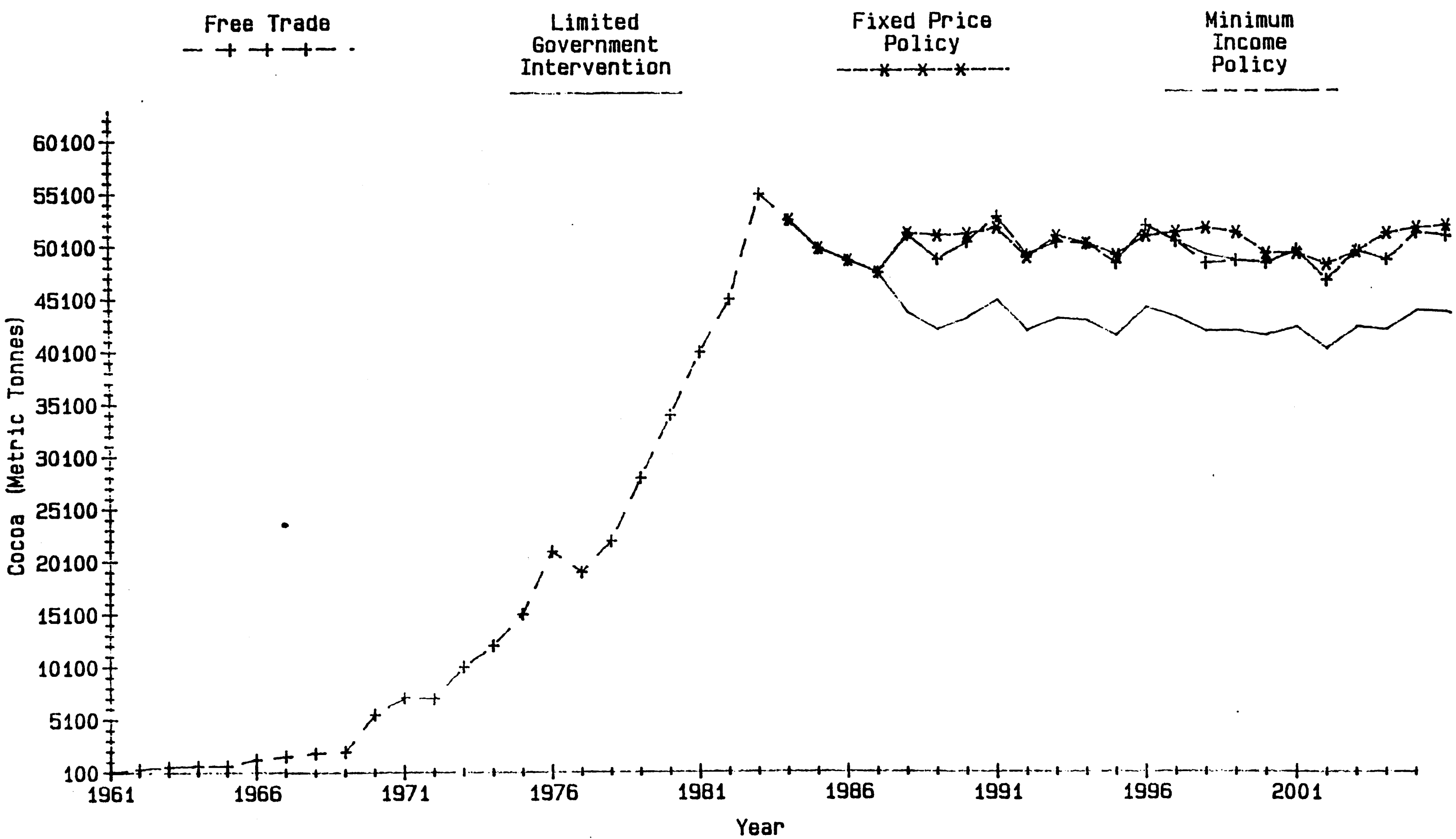

FIGURE 8. DOMESTIC COCOA PRODUCTION FROM 1961-2005; FOR THE PERIOD 1984-2005 THE FIGURES ARE PROJECTED UNDER THE FOUR SCENARIOS.

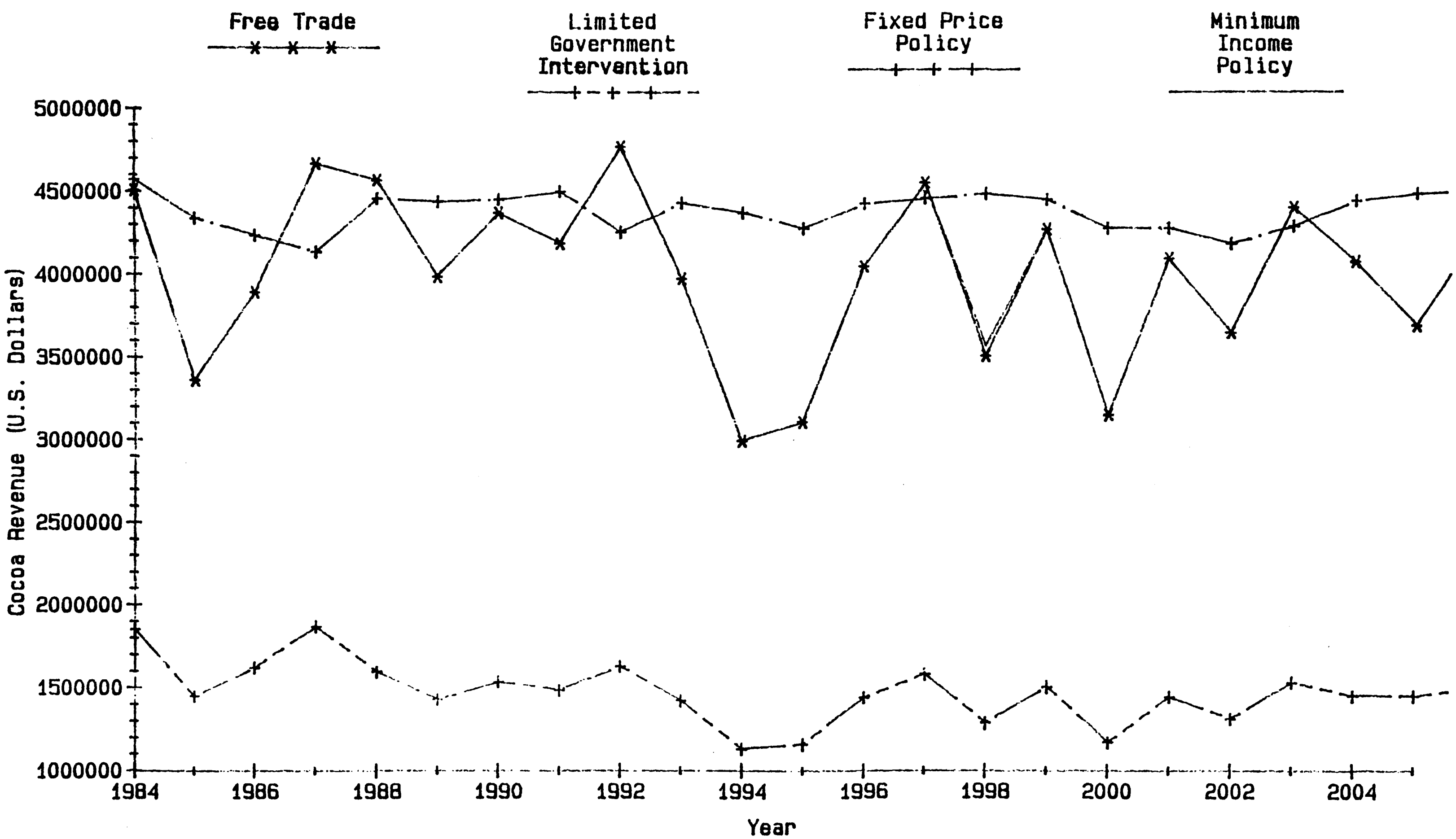

FIGURE 9. COCOA REVENUE IN U.S. DOLLARS FOR THE PROJECTED PERIOD 1984 - 2005 UNDER THE FOUR SCENARIOS.

TABLE IV

SIMULATION RESULTS FOR RUBBER, COCOA, AND RICE IN FOUR POLICY ALTERNATIVES.

	Free Trade	Limited Government Intervention	Fixed Price Policy	Minimum Income Policy
a) Rubber				
Supply*	100	112	103	100
CV %	7.72	6.57	5.93	7.78
Revenue*	100	89	98	100
CV %	13.98	11.85	5.93	14.02
Stock*	100	160	116	99
CV %	37.22	22.54	25.12	37.65
b) Cocoa				
Supply*	100	88	101	100
CV %	3.2	7.19	2.65	3.15
Revenue*	100	37	111	100
CV %	13.3	13.22	2.65	13.26
Stock*	100	100	100	100
CV %	435.89	435.89	435.89	435.89
c) Rice				
Supply*	100	98	100	100
CV %	7.96	8.19	7.76	7.96
Revenue*	100	79	95	100
CV %	12.45	12.63	7.76	12.45
Imports*	100	106	101	100
CV %	1453.96	1435.7	1405.43	1453.93

* Percentages of free trade compared to other alternatives around the means

CV % --Coefficient of variation (percent) policies, would be the free trade policy. The table shows that the fixed price policy is the best alternative since it has the lowest coefficient of variation in supply and revenue. In addition, the fixed price policy has the second lowest coefficient in storage. This policy creates an increase in production of 3% (on the average) above the current policy, while a decrease in revenue of 2 % will be observed. Stocks of rubber will increase by 16%. Although revenue and production decline, the year by year variations are minimal, therefore producers have more stable incomes. The next best policy will be to have a limited government intervention policy. This policy will produce on the average a higher production of rubber and will also create an additional 60 % in stock accumulation above the current policy.

On the other hand, cocoa shows that the policy that would produce the least variation in supply and revenue is the fixed price policy. The production of cocoa in the four alternative did not change significantly. The fixed price policy shows an increase of 1%, on the average, while the limited government intervention policy shows a decrease of 12% compared to the current (free trade) policy. A sharp drop of 63%, on the average, in revenue was observed in the limited government intervention policy, while there was an increase of 11%, on the average, for the fixed price policy compared to the free trade policy.

Rice shows that the fixed price policy is the best alternative to reduces producer variation in production, revenue, and imports. Production of rice from the fixed price policy, on the average, is the same as the production of rice from the free trade policy. The limited government intervention policy reduces, on the average, the production of rice by 2% and revenue by 21% in comparison to the current policy. Imports will increase an average of 6% compared to the current policy.

Chapter Summary

To summarize, the simulation shows that for rubber, rice, and cocoa, the fixed price policy is the best alternative to reduce the variation of supply and revenue. From the results, the coefficient of variation of fixed price policy is 7.76 for rice revenue compared to 12.63 or 12.45 for limited government intervention, or free trade and minimum income policies. In addition, the coefficient of variation of the fixed price policy for cocoa revenue was 2.65 while the coefficients of variation for free trade policy, the minimum income policy, and limited government intervention were 13.3, 13.22, and 13.26. Identical results were obtained for rice revenue, where the coefficients of variation for the fixed price policy was 5.93, the free trade policy was 13.98, the limited government intervention was 11.85 and the minimum income policy was 14.02. Furthermore, the percentage changes in the decline/increase of the unit value, on the average for all commodities, is the lowest for the fixed price policy compare to the other policy alternatives. These results indicate that the implementation of a fixed price policy would decrease the variability of producer income. The Figures and Tables presented indicate that the fixed price policy overall reduces the variation of supply and income.

CHAPTER VI

SUMMARY AND CONCLUSION

Summary

This study was undertaken to identify and quantify the important sources of farm income instability. This study was also used to evaluate the performance of different stabilization policies and their effect on farm income instability with the intention of providing the government with policy recommendations. Several commodities were selected to evaluate the objectives of this study.

The selected commodities were rubber, cocoa, and rice. Timber was included in the research to identify and quantify the source of producer income instability but was not included in the simulation model due to insufficient data. Time series data were taken from secondary sources: the FAO Production Yearbook, the FAO Trade Yearbook, Appendix A of "The Study of West Malaysia Natural Rubber Exports," and the International Monetary Fund Revenue and quantity data were obtained from the FAO Trade Yearbook while production data was obtained from the FAO Production Yearbook. The exchange rates for the major trading partners were collected from the International Financial Statistics book published by the International Monetary Fund. Rubber export data was obtained from Appendix A of "The Study of West Malaysia Natural Rubber Exports."

Different methods of measuring instability were discussed and the Cuddy Vella index was used because it is based on statistical theory. The other indices discussed in Chapter II are ad hoc measures which are not derived from any clear theoretical foundations (Cuddy and Vella, 1978). This study concludes that no single currency could reduce producer income instability for all the commodities. However, this study was able to determine that certain currencies would minimize producer income instability in the selected commodities. The currencies selected are the Holland Guilder for rubber, the Japanese Yen for rice, and the South Korean Won for cocoa and timber. A correlation coefficient matrix for the different currencies was calculated and the results showed that the Singaporean Dollar was the preferred currency to use as a vehicle for exchange rate.

A breakdown of producer income into its components, quantity and price was studied. By studying these components, the effect of price, quantity, or both price and quantity could be determined and evaluated to see which had the larger effect. In addition, the breakdown of producer income could also determine whether the effect was mainly caused by demand or supply. Results from this study showed that instability was derived from demand for rubber, cocoa, and timber while rice instability was derived from supply. Quantity was the major cause of instability for all commodities. In rice, the majority of the instability is from the quantity component. Rubber derived 60 percent of its instability from quantity, cocoa derived 40 percent of its instability from quantity and 39 percent from the joint effects of price and quantity, and timber instability was evenly spread between quantity and price.

A simulation model evaluated the effects of several alternative government stabilizing policies on producer income instability. Four scenarios were used to determine their effects on producer income instability. The four scenarios were (1) free trade, (2) limited government intervention (3) fixed price policy, and (4) guaranteed minimum income. Free trade assumes no intervention by the government, while limited government intervention assumes that the government keeps the domestic price at 80% of the world price. The fixed price policy, on the other hand, assumes that the government fixes prices at the mean of the data period, and guaranteed minimum income assumes that the government supports the income of producers if it falls below 70% of the average of the two previous years. Since Malaysia has an open economy, this study assumes that the commodities selected in this study trade freely without any government intervention. Using a modified version of Bigman's model, the results indicate that the current policy would not be the best alternative. The best alternative derived from the simulation results for rubber, cocoa, and rice is the fixed price policy.

Conclusion

Although this study did not go into depth in each of its objectives, some conclusions were reached. These conclusions are as follows:

1) Results show that no single currency could minimize producer income for all commodities. However, for each commodity a currency was obtained that could minimize producer income instability. In addition, Singaporean currency was observed to be highly correlated to Malaysian currency. Assuming that the Singapore currency would be highly correlated to Malaysian currency and that the Singapore currency is stable in the future, two alternatives are available for policy implementation.

a) Use a different currency to value each traded commodity. This alternative should be implemented after further studies have been taken. This conclusion was obtained because the currency selected does not correspond to the currency that has the most trade in that commodity

b) Use Singaporean currency as the currency to value all traded commodities.

2) Since the majority of the exported commodities have instability caused by demand, the ability of the government to reduce the instability is limited. An alternative is to promote the commodities in the demand market, and create demand in new markets. This could be accomplished through the creation of a marketing agency in consumer countries.

3) Policies to stabilized the production of the commodities should be implemented. This study shows that the major instability factor is quantity. Policies that would stabilize the production of these commodities should be encouraged.

4) The simulation model shows that a fixed price policy would reduce producer income instability. This means that government policy for the selected commodities should be geared towards a fixed price policy.

Limitations and Need for Further Study

This study has several limitations. Foremost, the data used were collected from secondary sources, data from primary sources may have improved the results. In addition, the data collected were limited in the time series period and data for other equally important commodities were not available. Malaysia as a country is a major producer of other commodities apart from the commodities selected in this study, such as coconut products, palm oil, and pineapples. Another assumption that was taken into account was the ability to measure consumer surplus and producer surplus.

Another drawback is the currencies selected for this study. The currencies selected should encompass the major trading partners of the selected commodities. Ranking the results obtained for different currencies should also be considered as a point of reference to compare the effects of different currencies. This would create a more detailed research. At the same time, the simulation model only shows the effects of the supply of the commodities. A more detailed model should consider the demand, supply and stocks of the commodities. It should also consider all aspects that have an impact on producer income instability. Furthermore, a sensitivity analysis should be done to determine which policy would be able to withstand the different shock applied to the policy.

Additional research should be done to study the effects of producer income instability from the perspective of the estates and the smallholders. The impact on the individual and the general economy due to the alternative policies should also be investigated. A policy issue that should be included is the effect of government policy on smallholders income instability. Finally, there is a need to determine what effect producer income instability has on the whole economy which is heavily dependent on primary commodities as a means of foreign exchange.

BIBLIOGRAPHY

Akiyama,Takamasa and Duncan, Ronald C. Analysis of the World Cocoa Market. Washington D.C.: World Bank, Staff Working Paper No: 8, June 1982.

Bale, Malcolm D. and Lutz, Ernst. "The Effects of Trade Intervention on International Price Instability," American Journal of Agricultural Economics, 61(1979), 512-516.

Bank Negara Malaysia:.Annual Report. Kuala Lumpur: Bank Negara Malaysia,1983.

Bieri, Jurg and Schmitz, Andrew. "Export Instability, Monopoly Power, and Welfare," Journal of International Economics. 3(1973), 389-396.

Bigman, David. Food Policies and Food Security Under Instability: Modeling and Analysis. Lexington, MA: D. C. Heath and Co., 1985.

Brodsky, David A. "Exchange Rate Changes and the Measurement of Export Instability," Bulletin of Oxford University Institute of Economics and Statistics, 1983, 289-296.

Bunge, Frederica M, Malaysia: A Country Study, Washington D.C.: Foreign Area Studies, The American University, 1984. 74-75.

Burt, Oscar R. and Finley, Robert M. "Statistical Analysis of Identities in Random Variables," American Journal of Agricultural Economics 50(1968), 734-744.

Coppock, Joseph D. International Economic Instability. New York: McGraw-Hill Book Company Inc., 1962, 16-26.

Cuddy, J. D. A. and P. A. Della Valle. "Measuring the Instability of Time Series Data." Oxford Bulletin of Economics and Statistics 40 (1978), 79-85.

Duncan, Ronald. The Outlook for Primary Commodities: 1984 to 1995. Washington D.C.: World Bank, Staff Working Paper No: 11, 1984.

Dupuit, Jules, De l'Utilite et de sa Mesure, reprinted in 1933 by La Riforma Soziale, Torino, Italy. (Originally published in 1844 and 1849)

Hicks, J. R. Value and Capital, London: 1939. Note to Chapter II, 38-41.

Hwa, Erh-Cheng. A Simultaneous Equation Model of Price and Quantity Adjustment in World Primary Commodity Markets. Washington D. C.: World Bank, Staff Working Paper No: 499, October, 1981.

Falcon, Walter P. and Eric A. Monke. "International Trade in Rice." Food Research Institute Studies. XVII, No. 3 (1980).

Fifth Malaysian Plan. 1986-1990. Kuala Lumpur : National Printing Department, 1986.

Food and Agriculture Organization of the United Nations: Commodity Review and Outlook, No:22, 29,36, and 40.

Food and Agriculture Organization of the United Nations: Production Yearbook, Various Issues.

Food and Agriculture Organization of the United Nations: Trade Yearbook, Various Issues.

Fourth Malaysian Plan 1981-1985. Kuala Lumpur: National Printing Department, 1981.

Gelb,A.H. "On The Definition and Measurement of Instability and Costs of Buffering Export Fluctuations," Review of Economic Studies, 1978, 149-162.

Glezakos, Constantine. "Export Instability and Economic Growth: A Statistical Verification," Economic Development and Cultural Change, 1970, 670 - 678.

Gotur, Padma. "Effects of Exchange Rate Volatility on Trade: Some Further Evidence." Staff Papers, International Monetary Fund, 32 (1985), pp 475-512.

Gullick, John. Malaysia: Economic Expansion and National Unity. Colorado: Ernest Benn Limited, London and Westview Press,1981, 1-10.

Hueth, Darrell and Schmitz, Andrew. "International Trade in Intermediate and Final Goods: Some Welfare Implications of Destabilized Prices," The Quarterly Journal of Economics, XXXVI, No: 3(August 1972), 351-365.

Just, Richard. "Risk Response Models and Their Use in Agricultural Policy Evaluation," American Journal of Agricultural Economics,57(1975), 836-843.

----------, E. Lutz, A. Schmitz, and S. Turnovsky. "The Distribution of Welfare Gains from Price Stabilization: An International Perspective," Journal of International Economics, 8 (1978), 551-563.

----------, D. L. Hueth, and A. Schmitz, Applied Welfare Economics and Public Policy, Englewood Cliffs: Prentice Hall, 1982.

Kasper, Wolfgang. Malaysia: A study in Sucessful Economic Development. Washington D.C.: American Enterprise Institute for Policy Research, 1974, 1-17.

Konandreas, Panos A. and Schmitz, Andrew. "Welfare Implications of Grain Price Stabilization: Some Empirical Evidence for the United States." American Journal of Agricultural Economics, 60 (1978), 74-84.

Labys, W., and Y. Perrin. "Multivariate Analysis of Price Aspects of Commodity Stabilization." Weltwirtchaftliches Archiv, 112 (1976), 556-564.

---------- and Harmon C. Thomas "Speculation, Hedging, and Commodity Price Behavior: An International Comparison." Applied Economics, 7 (1975), 288-301.

Leith, Clark J. "The Decline in World Instability: A Comment," Bulletin of the Oxford University Institute of Economics and Statistics, 32, No: 3 (1970), 267-272.

Lipschitz, Leslie. "Exchange Rate Policies for Developing Countries: Some Simple Arguments For Intervention," International Monetary Fund:Staff Papers, 1978, 650-675.

Macbean, Alasdair I. Export Instability and Economic Development. Cambridge: Harvard Press, 1966.

Marshall, Alfred. Principles of Economics, London: 1930, Book III, Chapter 7.

Massell, Benton F. "Export Instability and Economic Structure," The American Economic Review, 60(1970), 618-630.

----------. "Price Stabilization and Welfare," The Quarterly Journal of Economics, 83(1969), 284-298.

McCalla, Alex F. "Impact of Macroeconomic Policies upon Agricultural Trade and International Agricultural Development." American Journal of Agricultural Ecnomics , 64(1982), 861-868.

McKinnon, Ronald I. "Currency Substitution and Instability in the World Dollar Standard," The American Review , 72, No:3(June 1982), 320-333.

Mohd. Nor., Nailul Morad. "The Study of the West Malaysian Natural Rubber Exports." Informal Report. Oklahoma State University.(Unpublished paper.) May 1985.

Murray, David. "Export Earnings Instability: Price, Quantity, Supply, Demand?," Economic Development and Cultural Change., 1978, 61-73.

National Agricultural Policy (NAP). Kuala Lumpur: National Printing Department, 1984.

Natural Rubber., Washington D.C.: World Bank,Sectoral Paper, 1982.

Newbery, David M. G., and Joseph E. Stiglitz. The Theory of Commodity Price Stabilization: A Study in the Economics of Risk. Oxford: Clarendon Press, 1981.

Oi, Walter Y. "The Desirability of Price Instability Under Perfect Competition," Econometrica , 29, No:1 (January 1961), 58-64.

Rangarajan, C. and Sundararajan, V. "Impact of Export Fluctuations on Income--A Cross Country Analysis," The Review of Economics and Statistics, 58 (1976), 368-372.

Rop, Isaac Kipruto A.. An Economic Analysis of Producers' Income Instability in Kenya's Selected Agricultural Sector: The Case of Selected Marketed Commodity. Diss. Oklahoma State University 1986.

Rourke, B.E. "Short Range Forecasting of Coffee Production." Food Research Institute Studies in Agricultural Economics, Trade, and Development , 9(1970), 197-214.

Schmitz, Andrew. "Commodity Price Stabilization: The Theory and Its Application." Washington D.C.: World Bank, Staff Working Paper No:668, 1984, 1-27.

Snedocar, George W. and William G. Cochran Statistical Methods. Ames, IA: Iowa State University Press, 1967.

Southeast Asia: Situation and Outlook Report. Economic Research Services. Washington, D.C.,Dept. of Agriculture, June 1987.

Tan, Suan C. World Rubber Market Structure and Stabilization: An Econometrics Study. Washington, D.C., The World Bank, 1984

Third Malaysia Plan :State of Sabah 1976-1980. Kota Kinabalu: Chief Minister's Department, 1977.

Turnovsky, Stephen J. "Price Expectation and the Welfare Gains from Price Stabilization," American Journal of Agricultural Economics 56 (1974), 706-716.

---------- "The Distribution of Welfare Gains from Price Stabilization: The Case of Multiplicative Disturbance," International Economic Review, 17, No: 1 (February 1976), 133-148.

United Nations on Trade and Development: "Survey of Commodity Demand and Supply Elasticities," Research Memorandum No : 48, 19 March 1974.

Waugh, Frederick V. " Does the Consumer Benefit From Price Stability?," The Quarterly Journal of Economics, 58(1944), 602-614.

World Bank. World Bank and Commodity Stabilization Policy Planning Division and Commodities Division, Aug. 1975.

Young, Kevin, Bussink, C.F. Willem, and Hasan Parez. Malaysia: Growth and Equity in a Multiracial Society. Baltimore: John Hopkins University Press, 1980, 1- 32.

APPENDICES

APPENDIX A

DATA APPENDIX

Initial Value of All Variables in the Simulation Model

Variable Name	Value
CPD1	4.0073
CA1	4.7185
TPC3P(1)	4.5453
TPC3P(2)	4.3696
TPC3P(3)	4.5654
WPDRB(1)	2469
TPRPR(1)	5.8291
TPRPR(2)	5.8770
TPRPR(3)	5.8729
PRRB(1)	1064.17
PRRB(2)	857.60
PRRB(3)	1122.81
PRRB(4)	1424.63
PRRB(5)	985.69
PRRB(6)	814.61
PRRB(7)	773.82
PRRB(8)	560.86

Variable Name	Value
PRRB(9)	751.56
PRRB(10)	677.92
PRRB(11)	331.80
PRRB(12)	332.46
PRRB(13)	407.19
PRRB(14)	502.21
PRRBCO(1)	0.56838
PRRBCO(2)	0.0813140
PRRBCO(3)	0.072925
PRRBCO(4)	0.045778
PRRBCO(5)	0.028470
PRRBCO(6)	0.027880
PRRBCO(7)	0.016148
PRRBCO(8)	-0.00620
PRRBCO(9)	-0.03558
PRRBCO(10)	-0.06587
PRRBCO(11)	-0.08809
PRRBCO(12)	-0.09044
PRRBCO(13)	-0.05857
PRRBCO(14)	0.024746

Where

CPD1 -- Cocoa production with one year lag.
CA1 -- Cocoa area with one year lag.

TPC3P(n) -- World cocoa price with the number in parentheses being lag of n.

WPDRB -- World price for rubber.

TPRPR(n) -- Price of rice with the number in parentheses being lag of n.

PRRB(n) -- Price of rubber with the number in parentheses being lag of n.

PRRBCO(n) -- Coefficient for the price of rubber with the number in parentheses being lag of n.

Appendix B

CONSUMER SURPLUS AND PRODUCER SURPLUS CONTROVERSY

There has been much controversy about the meaning of consumer surplus, and many objections have been raised to using it as a measure of welfare. Dupuit (1933) postulated using the willingness-to-pay approach as a means of defining consumer surplus. Another method of definition is to considered the income loss(gain) when a price is increased(decreased) while the quantity purchased remains the same (Just, Hueth, and Schmitz, 1982). Both these approaches, according to Just, Hueth, and Schmitz, have only an ordinal significance since they do not measure utility directly. Another problem that arise from using consumer surplus as a measure of welfare is called the path-dependency problem. This problem exist as because the direction of consumer surplus changes is not well defined in the case where several prices change simultaneous or where income changes together with price. On the other hand, Waugh believe the path-dependency problem was fully answered in the works of Dupuit and Marshall (1930).

On the producer side, controversy arises from the approaches used to calculated producer surplus. The most common method is to determine the area above the short-run curve and below the price. Another method is to calculated the quasi-rent or, equivalently, producer surplus as the difference between the total revenue and total variable cost (Just, Hueth, and Schmitz, 1982). A third possibility is to determine producer surplus as the difference between selling price P and the average variable cost multiply by the quantity purchased.

As discussed above, the use of consumer surplus and producer surplus as a measurement of welfare is fully controversial to this day.

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