Commodity Markets: A Case Study

of

Coffee and Tea in the United States

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ABSTRACT

Historical evidence has shown that increases in coffee prices, though generating a short term gain in export earnings for producers, also lead to increased plantings of the coffee crop. This in turn leads to overproduction and a subsequent drop in coffee prices. The establishment of the International Coffee Agreements was meant to stabilize this fluctuating behaviour in coffee prices.

The purpose of this paper is to present an overall analysis of coffee prices in order to predict the future course of prices under two circumstances. First, when the international coffee market is governed by the mandates of the International Coffee Agreements and secondly, when the market operates under free market conditions. The paper also attempts to draw parallels between the structure and mechanisms of the markets of coffee and tea. The first part of this paper provides a background study of the markets of coffee and tea including a discussion of the commodity cartels which have been signed to date in both markets. Part two provides a historical analysis of prices in both markets, followed by an econometric analysis of the demand for coffee in the largest consuming country in the world, the United States.

RÉSUMÉ

L'évidence historique a démontré que des hausses dans le prix du café, tout en générant un gain de court terme dans les revenus d'exploitation des producteurs, conduit également à une augmentation du volume de production. Cela provoque une surproduction et une baisse subséquente du prix du café. L'établissement de l'Accord International sur le Café (AIC) se voulait stabiliser ce comportement fluctuant du prix du café.

L'objectif principal de ce texte est de présenter une analyse globale des prix du café dans l'optique de prédire l'évolution future des prix sous deux scénarios: premièrement, lorsque le marché international du café est gouverné par les mandats de l'AIC et deuxièmement, lorsque le marché opère sous les conditions du marché libre. Ce texte tente aussi de mettre en parallèle les structures et les mécanismes les marchés du café et du thé. La première partie du texte donne un arrière-plan des marchés du café et du thé, incluant une discussion sur les cartels, ce type d'entente existant dans les deux marchés étudiés. La seconde partie présente une analyse économétrique de la demande de café aux États-Unis, le plus grand pays consommateur de café.

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INTRODUCTION

In 1989, Brazil was pressed by the United States to reduce its export quota for coffee from thirty percent of world production, in favour of a larger quota for Colombia. The refusal by Brazil brought about the breakup of the International Coffee Agreement in July, 1989, leading to speculation in the international coffee market and causing coffee producers' prices to fall. Then in March, 1991, Brazil suspended all export quotas (expecting to bolster falling coffee prices) but instead its share of the world market decreased from thirty percent to twenty-five percent.

Brazil's dethronement by Colombia (in terms of income earned) in 1990 was due to several factors.[1] A freeze in 1975, followed by a drought in 1985 and internal government mismanagement in Brazil, has been countered by aggressive marketing techniques from Colombia, leading the International Coffee Exporters' Federation to predict that international buyers will do more business with Colombia and other countries like Kenya. Given the stagnating world demand and a collapse of coffee prices worldwide, Colombia has done extraordinarily well because of the quality of its beans and because of the reliability of its supply. Added to these elements is the growing preference for the milder Colombian blends, as reported by Consumer Reports in its January 1991 issue. The magazine ranked twenty-nine ground coffees sold in the US by flavour and aroma and found that the top five used Colombian beans.

The objective of this paper is to present an overall analysis of the behaviour of coffee prices under two circumstances. First, when the market operates under free market conditions and secondly, when it is regulated by the mandates of the International Coffee

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[1] In 1990, Colombia earned $1.4 billion US from the sale of 13.9 million 60 kg. (132 lb.) bags of coffee, as compared to Brazil's $1.3 billion US from the sale of 16.9 million bags. Source: The Ottawa Citizen, June 2, 1991, B5.

Agreements. Past studies have shown that when there is a large increase in coffee prices, it leads to increased acreage of the coffee plant while generating short-term earnings for producers. Increased acreage, in turn, leads to overproduction and an overall decrease in producer prices. This cyclical behaviour of coffee prices is one of the elements of the coffee market that this paper investigates in order to assess the effectiveness of the International Coffee Agreements, and, to be able to predict the future trend of world coffee prices. Another question of interest is the effect on coffee prices of the changing preference for Mild Arabicas, which itself implies a shift in the established hierarchy of coffee producers. Thus, whereas past studies have typically concentrated on a particular country case or have dealt exclusively with only one aspect of the coffee market, this paper looks at a cross-section of producers which include both traditional powers as well as newcomers to the market. The study also attempts to draw parallels and contrasts between the structure and mechanisms of the markets of coffee and tea, in order to ascertain the degree of inter-relationship between the two commodity markets. Historical price movements in both markets are examined, and, using econometric analysis we attempt to isolate the factors that determine the demand for coffee in the United States -- the largest consuming country in the world. Thus, the data cover the countries of Brazil, Colombia, Kenya, United States, India and Sri Lanka from the years of 1960 to 1989.

Following the introduction, chapter one traces the structure of the coffee industry from the agricultural stage to the point where it appears for individual consumption. The chapter describes the coffee plant, discusses the different types of coffee traded and produced, explores the nature of production, and offers a brief description of the international coffee market.

Chapter two reviews the historical developments, from the 1920s, that led to the first international coffee agreement, and provides an assessment of the principal technical aspects of the three subsequent international agreements.

Chapters three and four follow the same pattern as chapters one and two in dealing

with the tea industry in that these chapters discuss the agricultural aspect of the market, provide a history of the tea agreements, and appraise recent changes in the international tea market

Chapter five reviews a selection of the large literature dealing with the two markets The studies are organized by similarities in study design and are collected from eleven major journals

Chapter six is an analysis of the two markets using data from the period of 1960 to 1989 The chapter provides a table of the variables used as relevant indicators, together with a selection of graphs to aid in the discussion of prices and export performance of the countries under study

Chapter seven attempts to determine a meaningful relationship among the variables that govern the coffee market using a five-stage empirical process, which looks at the different factors that affect the quantity of coffee imported into the United States The chapter addresses such questions as what is the effect of the export volumes of coffee on the average prices of coffee sold on the international market, and, how does the four main types of coffee affect the value of the total import of coffee into the US

CHAPTER 1

Coffee, known by the Arabic name 'qahwah', is a drink believed to have been first inaugurated into Sufi mystic circles to replace the traditional wine that was drunk during religious festivals. Originally, 'qahwah' was a poetic name for wine but towards the end of the thirteenth century, when Yemen started its coffee production, 'qahwah' was transferred to mean a drink made from the berries of the coffee tree. Deriving its roots from the Arabic 'qahwah' and the Turkish 'kahweh', it became 'cafe' in French, 'kaffee' in German and 'coffee' in English.

The 'Coffea Arabica' species is believed to have been the first to be cultivated, in 575 A.D., in the Arabian colony of Harrar, in Ethiopia, and by the end of the fifteenth century had spread to the rest of the Islamic world. The rapid growth of the first coffee plantations was also associated with the beginning of a jealously guarded trade, which the Arabians dominated for the next hundred years or so. Visitors were prohibited from plantations and the berries from the coffee tree were not allowed out of the country without first being steeped in boiling water to destroy their power of germination. Then in 1616, the first coffee tree was brought to Europe by Dutch merchants, and by the end of the century, the Dutch East India Company had already set up plantations in the colonies of Ceylon, Java and Bali, and elsewhere. The French followed in 1714 by setting up plantations in their own colonies while Brazil acquired its first coffee tree in 1727, and coffee production soon spread to other parts of South America. The British though were latecomers, they began cultivation in Jamaica in 1730 and later expanded to India in 1840, where they had, till then, concentrated on tea[1]. In the middle of the nineteenth century, a leaf

[1]Roden, 1987, p.45

rust disease in Asia virtually decimated production so that by the end of the century, Brazil had acquired a supremacy in world coffee production

By the time of the establishment of the coffee plantations in the Dutch, French and British colonies of the eighteenth and nineteenth centuries, coffee drinking had become a way of life and an integral part of European culture Today, in more than 60 countries, lying in a belt between the Tropic of Cancer and the Tropic of Capricorn (that embraces the Americas, spreads through the islands of the Caribbean, the East Indies, the Pacific islands and areas of Africa and Arabia), coffee growing provides a living for approximately 25 million people [2]

There are few developing countries in the world today that do not grow coffee What is especially significant about this particular agricultural product is that over 80% of the world's coffee production enters into international trade The economies of the major exporters depend precariously on the foreign exchange earnings generated by this product [3] However, the coffee plant is subject to the vagaries of weather, disease and natural disaster, so the history of coffee production in the last few decades has been one of recurring cycles of over-production and under-production, neither of which is conducive to stable socio-economic growth

This chapter traces the structure of the coffee industry from the agricultural stage in two of the largest coffee-growing areas of the world, namely parts of Africa and Latin America, to the point when it appears for individual consumption in the largest importing country in the world, the United States of America

The six sections of this chapter begin with Section 1 1 which contains a brief description of the coffee plant Section 1.2 deals with the different types of coffee produced and

[2]Ibid., p.46

[3]In Colombia, the ratio of export earnings for coffee to total export earnings in 1985 was 50%. In Brazil, the ratio was only 9% in 1985, while Kenya's ratio was 28%. Source: World Bank Data Tables, 1989-1990 Edition.

description of the coffee plant. Section 1.2 deals with the different types of coffee produced and traded, while Section 1.3 describes the nature of production. Sections 1.4 and 1.5 follow the path of the coffee to markets in the producing countries and abroad, respectively. The final stage in Section 1.6 outlines the intermediate market, where the coffee is bought, namely, the international market in the United States. Appendix 1.1 is a diagrammatic representation of how the coffee moves from the producers to the consumers, in both the producing and importing countries.

SECTION 1.1: The Coffee Plant

The coffee tree is an evergreen shrub which can grow in tropical and sub-tropical lands, in widely differing soils, altitudes, climates and with various amounts of rainfall. These different environments produce the distinctive characteristics of the variety of coffee beans that are sold to consumers.

Depending on the specie, coffee trees grow in the highlands at elevations of 2,000 to 5,000 feet or in low hot country at 2,000 feet down to sea level.[4] Coffee is a perennial crop that reaches its first harvest in three to four years after planting, with increasing yield in the fifth and sixth years. Because of this lag in production, supply in the short run cannot be adjusted to demand in the case of crop failure, leading to volatility in prices. Between its seventh and tenth years the coffee plant reaches peak production. This level of output is maintained up to the fifteenth year after planting, after which yields start to decline. However, with good management, the drop in production is not rapid and the tree has an economic life of up to fifty years. Where management of coffee holdings is poor, trees have to be replaced after twenty to thirty years.[5] The coffee plant itself is highly susceptible to leaf rust disease and frost, which causes fluctuating

[4]For details see Wickizer, 1943, ch.2

[5]For details on tree management, see Singh, 1977, ch. 2.

supplies, affecting, especially in the case of Brazil, the world market price

No two beans are the same, even when picked from the same branch Factors such as differences in tree species, environmental conditions, differing agricultural practices, bean processing and storage create the distinctions among green coffee beans Coffee can be stockpiled but stockpiled coffee deteriorates in taste so it is virtually unusable after three years The only exceptions to this deterioration are the Venezuelan and Colombian coffees, which, because they retain their taste, are at a premium when aged Aged coffee is, however, not common in the world market and most Venezuelan and Colombian coffees are sold before the designated three years.

SECTION 1 2: Types Of Coffee

The four main species of coffee -- Arabica, Robusta (a native of the Congo), Liberica (indigenous to Liberia), and Excelsa -- differ not only in appearance and place of growth but most significantly in flavour Of these four, only Arabica and Robusta will be considered here, since they are the only two of economic importance.[6]

The Arabica tree produces the best quality beans and is the most widely grown specie, representing about three-quarters of world-wide coffee production Arabicas are usually propagated by seed and require lower temperatures, and are thus, grown at higher altitudes In Africa, they can be found in Ethiopia and Kenya, while in Latin America, the Arabica grows in Brazil, Colombia, Guatemala and Mexico. Since the fruit of the coffee tree ripens several times in the year, the pickers of quality coffees, like the Arabicas, return to the same tree time and again to pick only the ripe cherries It is estimated that the average yearly yield for a single tree is two

[6]Liberica and Excelsa, both of which are grown in Western Africa, account for less than half of one percent of world production and exports.

pounds of clear green beans

A new and high yielding Arabica specie that was developed at experimental farms, and introduced on a commercial basis in 1975, is the Caturra, which could prove to be an alternative to the extremely delicate Arabica The Caturra has a higher yield than the traditional Arabica and can be cultivated on land other than mountain highlands In addition, it only takes three years to reach fruit bearing maturity. The Caturra, however, has yet to make a major impact on the international market.

The Arabica coffees are divided into three types: washed (or high-grown mild) Arabicas, other (or low-grown mild) Arabicas, and unwashed Arabicas.[7] If the coffee cherries are dried and then depulped to free the coffee beans, the coffee is classified as unwashed. Unwashed Arabicas are also known as Brazils since the Brazilian crop constitutes this category. Trees that eventually produce unwashed Arabicas are grown without shade at relatively low altitudes. Their coffee has a neutral flavour lacking the desirable aroma and flavour of the high altitude, shade-grown Arabica If the cherries are depulped immediately and the beans then placed in water to facilitate later removal of mucilage, the coffee is called "washed". Since the International Coffee Agreement in 1967, the washed coffees have been further subdivided into "Colombian Milds" and "Other Milds".[8] Mild coffees vary in quality among themselves with Colombian Milds commanding premium prices because of methods of production and processing. Coffee connoisseurs in general are said to prefer Arabica coffees for their mild flavour, and because they contain less caffeine than Robustas.

Robustas, as the name implies, is a hardy tree less prone to disease and with a higher yield than the Arabicas. It can be grown in hot and humid climates where Arabicas cannot

[7]For details on Arabica coffee grades see Singh, 1977, ch.2.

[8]See Chapter 2 for further details on the ICA (International Coffee Agreement).

grow, and requires less cultivation and maintenance The Robusta specie is found mostly in Africa, in the countries of Angola, Uganda and the Ivory Coast Because of its coarser fruit, it has less appeal for consumers and fetches a lower price on the market

However, unlike Arabicas, the Robusta coffee gives a higher yield of instant coffee per pound of beans Whereas traditionally, the flat neutral taste had led to Robustas being used primarily as a filler in cheaper coffees, the steady increase in consumption of instant coffees has helped in improving the position of Robustas in the world market by creating additional demand. The rising importance of Robustas may in part explain the decline of the price premium of Arabicas

SECTION 1.3. The Nature of Production

There are two major institutional forms of organization in the production of coffee; namely, the small-scale independently-owned producing units, and the large-scale plantations.

In Latin America, the largest of the coffee farms are operated on a commercial basis with many of their owners being absentee landlords The farms are usually run under administrators who are mainly salaried, though they generally receive a small bonus that is based on crop receipts or profits. On these estates which cover large tracts of land, the percentage of total land given to coffee production is generally less than on the small-holdings -- for the larger the farm, the more varied the soils and greater the proportion of land unsuitable for coffee The smaller holdings are worked by peasant proprietors and their families, with some hired labour employed. For these farms, coffee is virtually their only cash crop Thus, coffee provides over 50% of cash receipts on the large fazendas, and well over 80% on the smaller plantations

In Africa, the core of the industry consists of a few large commercial estates, with

the bulk being formed of small independent small-scale producers. The large commercial enterprises are operated in a similar manner to those in Latin America, while the small holdings are either organized by landowners or share-croppers

The small coffee farms owe their success to the fact that coffee is not a capital-intensive product The 'capital invested' usually takes the forms of (1) accumulation of seeds, (2) the care of the coffee plant as it grows and consequently, becomes more valuable, and (3) draining, terracing, and levelling of land, all of which can be readily generated by the peasant-farmer. Furthermore, in most African and some Latin American countries (in particular, Colombia), the additional expense of finance for research, transportation, and port facilities is made available to the farmer at no additional cost by the state.[9]

SECTION 1.4: Coming to Market

In both Latin America and Africa, different systems of marketing exist by which the coffee reaches the consuming centres of the world. Following the formation of the International Coffee Agreement in 1967 and its consequent amendments, state intervention in the coffee market has increased in varying degrees in different countries. It is the role of the state to see that decisions made at the international meetings are adhered to. Broadly speaking, there are three types of government coffee-marketing agencies. They are the marketing board, the Caisse de Stabilisation, and quasi-governmental coffee producers' associations or institutes.[10]

The marketing board is commonly found in British ex-colonial countries like Uganda and Kenya It is the legal responsibility of the boards to purchase the whole of the coffee

[9]For further information on the structure of coffee farms in various African and Latin American countries, see Rowe, 1963, ch.5.

[10]Wrigley, 1988, p.551.

crop, which they then sell on the world market at the ongoing price. In some countries, there are intermediate traders who buy from the farmer and then sell to the marketing boards. The amount that the coffee growers receive is determined by the boards and is often a fixed price that prevails throughout the crop year. The proportion of export revenues returned to growers also varies from country to country. In Kenya, there is pressure to return the maximum amount to the grower, while in Uganda, returns are as little as 14%.[11]

The Caisse de Stabilisation is found in countries with traditional French connections, as in the Ivory Coast. Unlike the marketing boards, the caisses do not purchase the coffee themselves. They first set a price which licensed traders and co-operatives, who collect the coffee on a commission basis, must pay the coffee-growers. The coffee is then sold by the private buyers, with the difference between the growers' price and the export price going to the agencies. Theoretically, this difference could either be a profit or a loss, but in reality the price set by the caisses are considerably less than the world market price.

The quasi-governmental agencies are typical of the Latin American countries. For example, note the IBC (Instituto Brasileiro do Cafe) in Brazil and the FNC (Federacafe) in Colombia. Though these agencies vary in their institutional dealings with the coffee growers, they all have certain similar features. Through the manipulation of buying prices and taxes, they virtually control the entire coffee communities of their respective countries. They not only establish the minimum guarantee price paid to growers and define domestic delivery requirements, but also play a vigorous role in establishing minimum export prices. In Colombia, the FNC also owns and manages shipping and processing facilities. Because of the foreign revenues generated by this produce, reinvestment in the infrastructure of the coffee industry is very heavy in Brazil and Colombia, the two largest coffee-exporting countries of the world.

[11]Ibid., p.552.

SECTION 1.5 Coffee Predominantly for Export

The enactment by Britain of the Tea Act in 1773, which subsequently led to the Boston Tea Party, was the beginning of the 'love affair' between coffee and its largest national consumer, the United States. When the citizens of Boston boarded British ships waiting in the harbour and threw overboard all the tea cargoes of the British East India, it was coffee that was then crowned 'King of the Breakfast Table'.

Therefore, it is no surprise that New York is the world's dominant coffee market and the price quotations of the New York Coffee and Sugar Exchange are regarded as world market prices. The exchange itself is divided into a 'spot' market and a 'futures' market. The widely accepted coffee prices are those quoted on the New York spot market, and all export quotas are based on this price. In the 1968 ICO (International Coffee Organization) Agreement, a separate indicator price was set for each of the four groups.[12] Any adjustment of the quota based on rising or falling prices, is confined to the group where the price change occurred. Under the subsequent 1983 agreement however, changes in quota are on a pro rata basis, the quota for each group being increased by an equal percentage.

After arrival from the producing countries, spot coffee is sold while lying in a warehouse, and is traded among importers, brokers, jobbers and roasters. The terms of sale, including responsibility for storage and movement of the coffee, vary from one international market to another. The day-to-day and month-to-month price fluctuations observed on the spot market are primarily caused by crop failures, bumper crops and declining supply rather than any supply restrictions imposed by the producing countries.

Trading on the futures market consists of contracting to buy or sell a specific

[12]The four groups are Colombian Milds, Other Milds, Unwashed Arabicas and Robustas as per the 1983 International Coffee Agreement.

amount of a specified variety of coffee for delivery at a certain date in the future. The contract price is arrived at by open bidding or offering, and while the contract specifies delivery, the trading is normally a paper transaction for the obligation to deliver or receive offset by another contract.

The New York market quotes its prices in U.S. cents per pound. Subtraction of transport costs to New York, which include insurance, customs entry and other charges, from the New York spot prices gives the f.o.b. (free on board) prices of the different brands of coffee. Thus this f.o.b. price received by the exporters from the various coffee producing countries is a weighted average over the four major varieties of coffee as designated by the ICO. Costs of transportation range from 4.5 cents a pound from the Latin American countries to 5-5.5 cents from Africa.[13] To eliminate fluctuations in prices due to changes in the value of the US dollar, prices are discounted by the U.S. wholesale price index (1982=100).

When considering public quotations for the Brazilian and Colombian coffee prices, it must be borne in mind that these are entirely artificial. They are gross prices, with discounts to roasters not taken into account. Almost all coffee from these countries is sold under contracts to roasters in the consuming countries. These contracts entitle the roaster to a refund equal to the difference between the price actually paid and the price of certain predetermined other varieties of coffee in the N.Y. market. In return, the roaster is under obligation to purchase a certain quantity of coffee. An example of this form of agreement is the Brazilian contracts of supply. They grant the roaster a refund equal to that figure achieved by subtracting the ICO indicator price for unwashed Arabicas on the day of purchase from a 60-40 weighted average of the ICO price for Other Milds and Robustas. In addition, there also exists a "fidelity bonus", the amount of which depends on the percentage of Brazils used in the roaster's blend. Often included in this

[13]Singh, 1977, p. 39.

bonus is a refund given to roasters who stress the country of origin in their advertising. In this way, the contracts reduce the actual price paid by the roasters, not only in Brazil but also in Colombia

SECTION 1.6 Intermediate Purchases

The buyers in the consuming countries are either brokers or roasters. It is the roasters who blend and roast various types of green beans, arriving at a coffee most suited to the tastes of consumers There has been a growing tendency in recent years for roasters to include large amounts of Robusta in their blends, since the law does not specify that there be any indication of the types of coffee used in a certain blend This has the double effect of keeping prices down while increasing the market share for Robustas

When the coffee leaves the industrial roaster, it is either sold as whole beans or ground by the manufacturer after roasting and 'vacuum packed' for sale. Through the use of various blend technologies, manufacturers differentiate their products and thereby carve oligopolistic niches within the market

Soluble, or instant, coffee follows the same path as roasting and blending, except that it can then be either freeze-dried or spray-dried. The first method is the more successful way of extracting the drinking properties from ground-roasted coffee but it is more capital-intensive when compared to the latter. Freeze-drying uses the best quality beans in the cheaper range, brewing and then freezing the liquor into slabs, which are later ground into particles. These particles are passed through a tunnel with a high vacuum and a small amount of heat, the ice and water being further removed by sublimation, so that the particles are dry and chunky.

The more common and cheaper method, spray-drying, evaporates the water from the concentrated liquid, leaving only coffee powder or hollow spherical particles. Requiring high

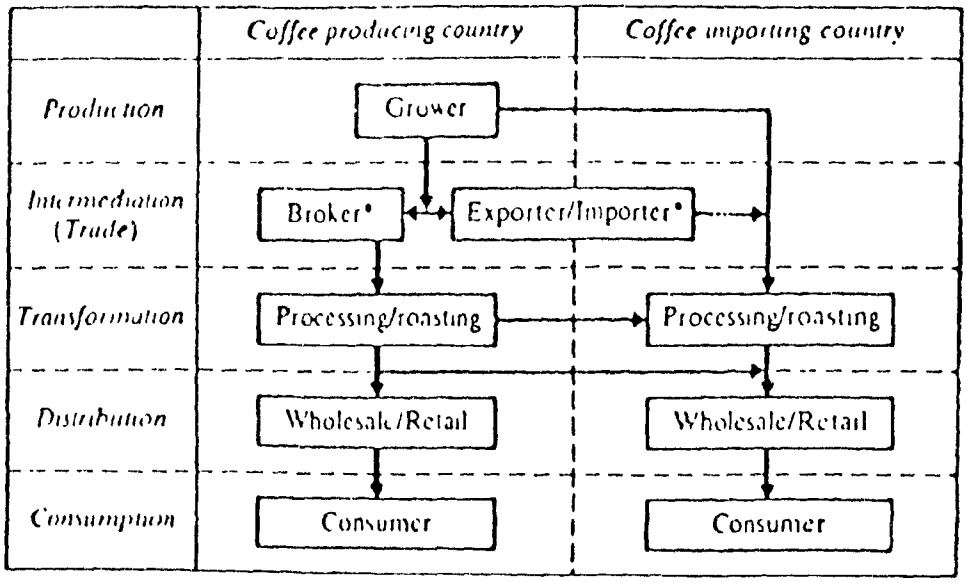
heat, this process not only changes the character of the soluble material but also destroys those constituents that give coffee its natural flavour. Though the procedure of making soluble coffee is more capital-intensive than more traditional methods, the use of lower quality African beans and the expanding market for instant coffee has made this a highly viable product for the large coffee firms.

After processing, the majority of the coffee moves through wholesale and retail outlets under the manufacturer's brand labels to households. A small portion is acquired by restaurants and hotels. An even smaller percentage is sold to institutions.

The oligopolistic nature of the coffee industry is clear since the bulk of the world market for ground and soluble coffee is dominated by two corporate groups and their subsidiaries.[14] They control, to a large extent, the manufacturing, marketing and distribution of coffee in the international market. The two corporate groups are General Foods and Nestle Alimentana, both of which are major producers in the United States. The third largest producer is Folger Coffee Company, a unit of Proctor and Gamble. These large corporations, whose roasters benefit from contracts like the Brazilian contracts of supply, ensure adequate supply and provide a continuing market for the producing countries. They owe their continued success to the ownership of recognized brand names and to the erection of barriers to entry which take the following forms: market dominance through product differentiation and advertising, and firm control over marketing and distribution.

[14]Streeten, 1970, p.76.

Appendix 1.1



* Private or governmental agencies

Source: Wrigley, 1988, p.551.

CHAPTER 2

Before the International Coffee Agreement, coffee had been subject to recurring cycles of long periods of oversupply and low prices, followed by periods of short supply and soaring prices. The International Coffee Agreement grew out of years of deliberation and was designed to achieve market stability.

Section 2.1 is a condensed history from the 1920s onwards of the events leading up to, in 1962, to the first of the four International Coffee Agreements which has been signed to date. A brief description of the four agreements in section 2.2 is followed by an account of the technical aspects of these agreements in section 2.3. Section 2.4 concludes with an assessment of the four agreements.

Section 2.1: History of the International Coffee Agreement

Brazilian attempts to control the coffee market in the 1920s led to surpluses in the 1930s, when supply exceeded demand and prices plummeted. In order to maintain the same level of return to growers, the Brazilian government destroyed large quantities of coffee beans. The results of this 'retention' policy were a decrease in Brazil's output and an increase in production in other Arabica-growing countries. By the late 1930s, Brazil's output had declined while African production had trebled.[1]

In November of 1940, the United States and fourteen Latin American countries signed the Inter-American Coffee Agreement, to become effective in April of 1941. Thus, while prices had increased due to stockpiling between 1940 and 1941, the new Agreement kept the price

[1]Mwandha, 1985, p.73.

of coffee fixed for the duration of the war Overall, world production continued to fall until 1945, with new producers capturing larger shares of the market For example, in the thirty years between 1920 and 1950, Brazil's market share declined from 70 to 42 percent, while other Latin American countries raised their share from 22 to 32 percent and the African countries from less than 3 to 21 percent[2] The lowering of trade barriers in 1945 was also accompanied by the death of the Inter-American Coffee Agreement

The post-war years were a period in which increasing demand far outstripped supply Prices rose to unprecedented levels, pushed further by a drought in 1949, a frost in 1953 and the Korean War This excess demand, in turn, led to new plantings and, consequently, overproduction and a fall in prices by the end of the 1950s and early 1960s By 1957, concern over falling prices led to a revival of interest in the Inter-American Coffee Agreement Seven Latin American countries met in Mexico City to draw up a new Agreement whose objective was to stabilize prices and set new export quotas The main burden of containing excess supply fell on the shoulders of Colombia and Brazil However, in the face of fast developing production, the Mexican Agreement was not successful in halting the spiralling effect of declining prices.

In 1958, the United States formed the Coffee Study Group, resulting in the ICO, (International Coffee Organisation), in the same year However the market had anticipated an organization that limited world supplies and the ICO was ineffective in maintaining prices. Meanwhile differences between African and Latin American countries were starting to widen while the downward trend in prices continued By the end of 1958, it became apparent that any kind of international agreement would have to take the interests of the African producers into account Consequently, the 1960 and 1961 Agreements included 90 percent of the world's coffee producers, many of whom represented African countries, but there were still several major African

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[2]Ibid , p 72

producers who stayed outside of the agreements. Thus negotiations continued through the early 1960s and reached a crisis in 1962, when the pressure of falling prices induced all major African producers to join the negotiations, and led to the first five-year ICA, (International Coffee Agreement), in 1962.[3]

Section 2.2: The International Coffee Agreements

The ICA became effective in 1963 and was renewed for another five years in 1968. The 1962 and 1968 Agreements both included a quota system, by which excess supplies were withheld from the market, and established a range within which prices could move. It was the responsibility of the consuming countries to implement the provisions of the Agreements by denying access to their markets for non-member producers as well as "policing" quota regulations. Diversification schemes were set up by the Agreement to limit supply and promotional programmes started to encourage the consumption of coffee. According to some sources, the ICA raised the prices in the 1963 to 1972 period, while others argue that the Agreement helped in keeping prices stable for the same period.[4,5] Despite this controversy, what is apparent is that production and consumption came into balance, and there were no major price upheavals during this period.

In 1972, at a meeting in London on December 12, producers and consumers failed to arrive at new quota regulations for the last nine months of the 1972/73 crop. Thus the International Coffee Organization suspended producers' quota regulations and prices followed free

[3]For a detailed history leading to the International Coffee Agreement of 1962, see Ibid., ch.5.

[4]See Report by the Comptroller General of the United States, 1973, ch.1.

[5]Wrigley, 1988, p 560

market conditions from 1973 until 1980.[6]

In order to maintain prices for these years, four of the major coffee growing countries (namely, Angola, Brazil, Colombia and Ivory Coast) acted through a London-based sales organization in limiting supplies and buying on the market. Instead of joining this quasi-cartel, twenty-two Latin American and Caribbean countries formed, in 1974, a separate group called GEPLACEA, (Group of Latin American And Caribbean Coffee Exporting Countries). Despite these attempts to stabilize prices, both groups failed because of the unpredictable nature of the coffee market. Firstly, not all the producing countries could withhold inventories indefinitely and this led to supply in excess of demand, at the 1974-75 price. Secondly, the smaller producing countries (whose economies were solely dependent on coffee) had to forego earnings by suspending sales. In addition, a severe frost in 1975 affected Brazilian supplies causing a further increase in prices. These factors together with a growing fear that high prices would drive consumers away from coffee to other beverages led to the third ICA, effective in 1976.

The 1976 Coffee Agreement was similar to the 1962 pact in that it regulated quotas to maintain an agreed price floor. Due to an already high market price, which was well above the ICA's ceiling, pricing provisions were suspended so that free market conditions still prevailed. It was during this period of 1978 to 1980 that a group of Latin American countries, including Brazil and Colombia, decided to maintain stability by forming an organization known as Pancafe. This organization was financed to buy and sell coffee on the New York and London markets, and though successful for a time, it could not eventually sell back all it had bought. Pancafe became highly controversial in the coffee community since all the constituent members were also part of the ICA. Mounting pressure from the United States and other importers saw the eventual liquidation of Pancafe in September 1980.

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[6]Wrigley, 1988, p.561.

The 1983 Agreement maintained the provisions of the 1976 Agreement, especially with regard to production policy. That is, it did not regulate production to any degree at the global level. However, the ICA urged its members to "use their best endeavours", leaving the responsibility of bringing supply into balance with demand in their hands. The Agreement differed from the earlier agreements in only one respect. The Council now required a two-thirds majority vote for establishing procedures in co-ordinating production policies, making it even more difficult for the Council to arrive at any given policy.

The 1983 ICA was set to expire in September 1989, and in spite of intense negotiations, disagreements among ICO members over economic clauses, that were to be introduced into the ICA in October 1989, caused the export quota system to be suspended in July 1989. The economic clauses dealt with two issues. First, was the allocation of quotas (among mild Arabica-, unwashed Arabica-, and Robusta-producing countries) in the face of changing world demand in the favour of mild Arabicas. The second issue was that of large discount sales made by exporting countries to nonmember importing countries, (as in the case of the Eastern Bloc countries). Therefore, at the moment, the ICA is operating without economic clauses, and is scheduled to do so until September 1991, while negotiations on the economic quota clauses continue.

Section 2.3: Technical Aspects of the Agreements

When the United Nations Coffee Conference (UNCC) convened in July 1962 to draw up the first of the International Coffee Agreements, it faced pressures from both producers and major importers, for each wanted their importance in the world market to be translated into influence in the ICA. The exporters wanted to stabilize and raise coffee prices while the importers wished for stable, but not higher, prices, with a minimum of administrative 'policing' obligations.

Brazil and Colombia hoped to 1) maximize foreign exchange earnings, 2) stabilize export proceeds, and 3) retain their share of the world market vis-a-vis the African producers. With these objectives in mind, Brazil opted for a price defence strategy, against the Africans, as opposed to a volume strategy. Given the low price elasticity of demand for coffee, Brazil was fully aware that if it had chosen to follow the latter, it might have suffered a loss in foreign-exchange earnings.

On the other hand, African producers wanted to continue to expand their market share but the knowledge of large Brazilian stocks and the fear that Robusta prices would dip even further led the Africans to agree to an export quota system. They knew, in turn, that Brazil could selectively dump its stocks on the world market, pushing prices below the low-cost production level for producers in Africa. Thus the Africans hoped that the 1962 ICA would be flexible in its application for the expanding Robusta submarket through waivers and a porous enforcement system.[7]

The interest of the largest importing country, the United States, was defined by the changing climate of its domestic market. African producers had been gaining steadily over imports from Brazil and Colombia for a number of reasons; Increased demand for soluble coffee in the late 1950s and early 1960s saw the rise in importance of Robustas, mainly from Africa. Further, the Brazilian policy of price defence held up a 'price umbrella' for African entry. The result was a close working relationship between major roasters in the U.S. and African Robusta-producing countries.

Given these demands by the member countries, the main objective of the ICA was to stabilize prices in the short and medium term and to ensure that "the general level of coffee

[7] Waivers is a pricing system based on differentiated quota expansions by submarket (selectivity).

prices does not decline below the level of such prices in 1962".[8] To achieve this, the ICA relied on a system of administered quotas which would limit the amount of coffee on the international market. The export quota mechanism was simple to administer and dealt directly with the oversupply issue, but the problem lay in calculating quotas

The method by which individual quota shares were to be derived evolved into two options -- the historical share approach, which would favour the oligopolies of Brazil and Colombia, and the flexible approach. The latter, which is basically a selectivity pricing system, was looked on with approval by the Africans, who were confident that Robustas would continue to be demanded by the world coffee community.

To solve this allocative problem, the UNCC devised a formula which had three basic elements: 1) each country's quota share was based on its average exportable production in its choice of either the two coffee years 1961/62 and 1962/63, or the four coffee years 1959/60-1962/63, the output for the last year in each case requiring an estimate, 2) The base average was then reduced by ascending percentages of retention;[9] 3) actual quotas were then adjusted to reflect the special problems of particular exporters.[10] The result was a three-tiered system of administered export quotas.

The first tier was the basic export quota which represented each member's percentage share of the world market. The second tier was the annual export quota, set by the ICC (International Coffee Council) at the beginning of each coffee year This was based on the Council's estimate of total world imports and probable nonmember exports for that year. Lastly,

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[8]UN, E/Conf., 1962, ch.1, general objectives.

[9]The figures were 6% up to 500,000 bags, 8% up to 1 million bags, 10% up to 2 million bags, and 12% up to 10 million bags.

[10]UN E/Conf., 1962, p.49.

the quarterly export quota was aimed at maintaining orderly marketing throughout the coffee year.

To enforce the quota system, the ICA designed 'certificates of origin'. All member exporting countries were under obligation to send certificates of origin along with all coffee shipments, and copies of these certificates were to be sent to the ICO office in London. The extent of importer enforcement was very important to the ICA and, as a backup to the policing actions of the importer countries, the ICA stated that the ICC could intervene to verify certificates of origin In addition, if an exporting country exceeded its quota for a given quarter, the Council had the authority to retrench an equal amount from future quotas.

The dispute over importer commitment with regard to imports from non-member countries had two facets. Most of the member producer countries reasoned that, without control over non-member imports, the effectiveness of the ICA would be diminished and, that it was unfair to the member countries that non-member producers gain a market share at the expense of the ICA members. They also hoped that regulation of non-member imports would eventually force the remaining producing countries to join the ICA Those opposed to regulation of non-member imports debated that the ICA should not interfere with the movement of free trade since it might inhibit the growth of world demand They proposed that members should defer regulation and wait to see what percentage of non-member producing countries joined the ICA.

Given this debate, the ICA decided: it could limit total annual imports from non-member countries to a quantity not in excess of the average annual imports from non-member countries as a group during the three-year period prior to the date that the ICA went into force.

The main aim of the 1962 ICA was to check declining prices but here again it faced conflicting opinion. Clearly, the exporters wanted to see coffee prices back at their 1950s high levels while importers, more interested in stabilization, opted for coffee prices at 'reasonable' levels. The United States urged the ICC to rely on market conditions to determine prices under

the quota system, This led the ICA to state that annual and quarterly export quota changes would be applied "pro-rata" by the ICC, according to a distributed two-thirds majority vote.[11] Therefore, at the time, the delegates did not make any concrete headway in agreeing on a price floor for coffee.

In setting production goals, the ICC was again reminded against interference in the domestic policies of producers, especially in the case of small countries, who felt they could not diversify as easily as the larger producers. Therefore the ICA called on producers to adjust their stocks relative to the ICA's policy on stocks, leaving the producing countries accountable for policies and procedures.

When the 1962 Agreement was renegotiated in 1968, the major producing countries wanted their influence in the market to continue to be reflected in a strong voice in the Executive Board. On the other hand, the smaller exporting countries, displeased with their quota shares, were also interested in a larger voice in shaping ICA policy. Thus, in order to readjust market shares to reflect the changing patterns of consumer demand, the 1968 ICA advocated the following changes. Basic quotas underwent drastic modifications, though the three-tiered quota system remained virtually unchanged. The shares of the quota market were reduced for thirteen countries, with a cut of 42.8 percent for Venezuela at the upper limit and 1.5 percent for Togo at the lower. The two largest producing countries, Brazil and Colombia accepted cuts of 2.7 and 2.6 percent, with the rest being split among the smaller countries. Fifteen countries, mainly in Africa and Latin America, received quota increases. They were led by Kenya and Tanzania, which had their quota shares increased by 39 percent and 34 percent, respectively.[12]

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[11]'Distributed two-thirds majority vote' means a two-thirds majority of the votes cast by exporting members present and voting and a two-thirds majority of the votes cast by importing members present and voting, counted separately. Source: UN 76/845/EEC, 1976, ch 2, Article 3

[12]Fisher, 1972, p.126.

The smaller exporting countries (that is, those exporting less than 25,000 bags),[13] which had so far been free from the basic quota system under the 1962 ICA, were allotted basic quotas in the 1968 agreement with the understanding that their quotas would be adjusted upwards if they could demonstrate that their production capabilities were greater than their 1968/69 quotas. In order to reduce the number of waiver requests that came before the ICC, the 1968 ICA prohibited waivers based on overproduction or noncompliance with the production control aspects of the 1962 ICA

The inability of the members to decide on prices in 1962 was eventually resolved and a price floor was agreed upon Together with this, a price selectivity system was also initiated which gave special export authorizations and waivers to be distributed on a sub-market basis, and, established a selectivity system for the "principal types of coffee".[14] The agreement asserted that if prices dropped under the limit set for the submarket under selectivity, then the ICC had the power to revise quotas downwards pro rata.

In the 1968 ICA, stricter enforcement by importers was called for with regard to the certificates of origin The certificates could no longer be based on a 'model' but must be valid under certain rules set by the ICC. This in effect, was the beginning of the stamp plan. Adhesive stamps, issued by the ICO, were distributed to member countries in accordance with their export quota shares. The stamps were issued quarterly and could be used up to the end of the trading year. The exporters attached the stamps to the certificates of origin so that eventual exhaustion of the stamps would also mean an exhaustion of the quota amount.

The penalties for overshipment of quarterly quotas in the 1968 Agreement were

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[13]"Bag" means 60 kg or 132 276 lbs of green coffee, where green coffee means all coffee in the naked bean before roasting. Source: UN 76/845/EEC, 1976, p.1416.

[14]Fisher, 1972, p.237.

also tightened Whereas in the past, the ICC deducted an equal amount from future quotas, the penalty for the first overshipment was now a deduction of 110 percent of the excess If the offence was repeated, the ICC deducted twice the excess, and with a third transgression, the ICC was empowered to make a double deduction and suspend the member's voting rights while it decided whether the member should be asked to withdraw

Production goals in the 1968 ICA underwent minor changes Exporters could still retain their own policies and procedures as before, but if the Council determined that those steps were inadequate, then the member countries were liable to lose a certain portion of their export quotas. This policy forced members to define national production goals and attempted to solve the problem of autonomous and perhaps incompatible national coffee policies

The one major change initiated in the 1968 Agreement was the Diversification Fund. As the name suggests, this Fund was introduced to help wean away countries dependent on coffee, as a major earner of foreign exchange earnings, to diversify into other cash crops Participation in the Fund was compulsory for those member countries who exported over 100,000 bags each year to the quota market, with contributions of sixty cents per bag for all bags actually exported. Twenty percent of the total contributions were to be in convertible currency for use in territories of any exporting member, while eighty percent of the contributions were to go towards projects in the contributing countries and administrative expenses

The 1976 Agreement was negotiated in a climate of high prices and world-wide shortages of coffee. For this reason, price selectivity was continued but cuts were limited to the annual quota levels. No price ceiling was agreed upon because of the already high prices of coffee, but the ICA established a system of indicator prices which provided a daily composite indicator price.

A fifteen-day moving average of prices was calculated, the levels of which

determine intervention procedures That is, when the indicator fell to an agreed amount, quotas were also cut by an agreed amount, and when it rose towards the upper limit, quotas were increased to release more supplies to the market.

The production goals of the 1976 Agreement revert back to those of the 1962 Agreement with no specific machinery for the regulation of production. This choice was due to the prevailing shortages of coffee in the world market at the time when reduction in production would not have been to anyone's advantage Thus the ICC was reduced to the function of co-ordinating production policies and supervising contributions for the diversification fund.

Enforcement by importing countries and penalties for overshipment of quarterly quotas remained the same in the 1976 ICA, with the only major addition being the creation of a Promotion Fund All exporting members were to pay a compulsory levy at the rate of 25 cents per bag for members subject to basic quotas, 10 cents per bag for those exempt from the basic quota but with an annual quota of more than 100,000 bags, and 5 cents per bag for those with an annual quota of less than 100,000 bags

The objectives of this new Fund were to promote consumption in importing countries without regard to origin, type or brand of coffee. In addition, the Promotion Committee also supported scientific and technical research relating to the health aspects of coffee drinking and monitored the shifting patterns of consumption of this commodity.

As in 1976, the 1983 Agreement differed little from the 1968 Agreement, except in the areas of price selectivity, production policy and the implementation of the Promotion Fund. Selectivity was continued with the slight addition that 4.2 percent of the global quota share be redistributed among the smaller exporters, subject to three conditions. Any member who fell into this latter category could request the Council to establish a basic quota for it. Secondly, whenever the member was given a basic quota, the percentage with respect to that country was deducted

from the global quota for that category, and finally, the quota for the category was increased accordingly. This ensured that the smaller exporting countries would compete among themselves rather than against the established exporters for quota allocation. The ICA also gave the smaller exporters additional votes in order to increase their influence on ICA policy with hope that these new provisions would breed solidarity among the smaller exporters.

The Agreement contrasts with the production policies of earlier Agreements in that it now required a two-thirds majority vote to decide on all procedures governing the co-ordination of production policies. This implied, that the Council did not wish to control production at the global level, but nevertheless considered it a major dilemma which the major producers would do well to consider.

The Promotion Fund in the 1983 Agreement maintained the provisions of the 1976 Agreement but added strict penalties for non-payment of the levies. These penalties could include loss of voting rights in the Promotion Committee or the Executive Board of the ICC, and withdrawal of export stamps corresponding to the amount of coffee on which the levy was unpaid.

Section 2.4: Assessment of the International Agreements

The objectives of all four Agreements can be summarized as follows.[15]

1. to achieve a reasonable balance between world supply and demand on a basis which will assure adequate supplies of coffee at fair prices to consumers and markets for coffee at remunerative prices to producers, and which will be conducive to long-term equilibrium between production and consumption;

2. to avoid excessive fluctuations in the levels of world supplies, stocks and prices which

[15]For the actual objectives of the four Agreements of 1962, 1968, 1972 and 1983, see UN, E/Conf., ch.1, general objectives.

are harmful to both producers and consumers,[16]

3 to contribute to the development of productive resources and to the promotion and maintenance of employment and income in member countries, thereby helping to bring about fair wages, higher living standards and better working conditions;

4 to increase the purchasing power of coffee-exporting countries by keeping prices in accordance with the provisions of paragraph one (above) and by increasing consumption;

5. to promote and increase the consumption of coffee by every possible means; and

6. to further increase international cooperation with regard to world coffee problems and to recognize, the relationship of trade in coffee to the economic stability of markets for industrial products

For analytical purposes, the four ICA Agreements will be treated as a unit, for the fundamental problem faced by each was the reconciliation of the interests of various groups of producing countries. Conflicts arose because of the differing scales of production, shares of the world market and the nonhomogeneity of coffee as a commodity. The situation was further complicated by political affiliations within the two largest groups.

They were the Latin Americans and the Africans; on one hand were the Latin Americans, with their traditional power over the world coffee market mainly producing Arabicas and on the other, the more recent power in the market, the Africans, who produce mainly Robustas. Furthermore, the Latin American countries enjoy a close proximity to the largest consuming country, namely the United States, while the African countries benefit from close association with the EEC under the Lome Convention.

Accommodation of the ICA's own objectives with those of its members is

[16]That is, the ICA wanted stability, where stability is taken to mean raising prices to an acceptable level rather than the more conventional definition of reducing undue fluctuations. Under the ICA, prices can fluctuate at relatively high or low levels.

reflected in various forms in the Agreements. For the purposes of this chapter, these objectives are subdivided into discussions on the subsequent topics prices and stabilization, export quotas and the debate over the diversification and the Promotion Funds

Due to the conflict over selectivity price systems, prices in the first Agreement were allowed to follow market conditions aided by the quota restrictions, which meant frequent adjustments to the quotas in response to prices This cumbersome and inefficient method was rectified with the creation of the indicator prices, which set a floor price and ceiling price for coffee. Though an improvement, this change still treated coffee as a homogenous product, discounting the various price movements among the different submarkets for coffee Selectivity which was later introduced by the ICA through pressure from the African producers also had its advantages and disadvantages

The advantages of the selectivity system were (1) stabilization in the submarkets of the various grades and types of coffee, (2) expanded demand, and (3) higher prices The selectivity pricing scheme acted as an incentive for producers, who found it to their advantage to support the pricing policies of the ICO and regulate supply, in order to stabilize prices in a particular submarket. Selectivity also ensured a higher quality of coffee which meant maintaining higher prices.

The disadvantages can be summarized as follows Firstly, was the devaluation of the American dollar in December 1971, which adversely affected the purchasing power of exporters' dollar earnings, secondly, was the manipulation of prices by certain groups to their own advantage. This was achieved by maintaining two prices, one was the price at which producers sold coffee on the market, and, the other was for ICO registration The latter is important because it is this registration price that the ICO uses to define quotas.

A further result of the selectivity system was the prices paid to producers, which made it highly profitable for them to continue to expand their production of coffee. This meant excess production and, since these countries do not have the financial resources to stockpile, it consequently led to a strong incentive to ship coffee in excess of the country's quotas. Overshipment of quotas is achieved by using loopholes in the certificate scheme, either by obtaining waivers from the ICC or through the usage of "tourist" coffee The latter is a procedure by which quantities of coffee meant for low consumption markets suddenly change direction in mid-ocean and are re-exported to higher priced markets Thus, not only does the pricing scheme encourage excess supply but it also fails in reducing the productive capacity of countries with high costs of production

In summary, there are two viewpoints on the question of price stabilization. Many authors on the subject regard stabilization as a discrete form of aid in an era of declining foreign aid. If this is the case, then no-one can deny that the ICA has indeed improved the foreign-exchange earnings of the developing member countries. The difficulty arises in assessing by what percentage these earnings have actually increased.

The opposing view is to ask -- to what degree, have prices been moderated and maintained at an 'equitable' level. Here the problem lies in the objectives of the Agreement, where the question of equitable prices is open to interpretation. However, despite these shortcomings, and in the face of huge surpluses, the Agreements have achieved the purpose of maintaining prices above the 1962 levels, with a smaller price range than before the first ICA agreement in 1962

The shortfall of the quota system is related to the pricing scheme for it is the indicator prices, which trigger the adjustment of quotas, that are at fault. Though the idea is

conceptually simple, it is a crude measure which does not take into account the many different types and qualities of coffee. In addition, it is not a true indicator of the world prices in every market. Introduction of the 'two category fixed and variable' approach was the breakthrough that solved the quota allocation problem in the 1976 Agreement and was subsequently maintained in the 1983 ICA.

This meant that quotas were no longer governed solely by the past performance of the member country. Seventy percent of the member's basic quota is now determined by past export records, which comprises the fixed part. The remaining thirty percent, the variable part, of the global annual quota is distributed among exporting members in proportion to the stocks of coffee which they hold The variable portion itself is based on three conditions 1) The stocks are subject to aggregation by the ICO, 2) The share of the variable quota is determined by the ratio of existing global stocks to those of the individual member, and 3) no single member can be assigned a variable quota of more than 40 percent of total members' stocks, unless the Council decides otherwise.

This provision resolved the conflict between producers of long standing and recent entrants to the world market. The seventy percent limit reassures producers of historical standing of the security of their market share while, the variable category pacifies producers with large productive capabilities, who had till now been dissatisfied with their quota shares Since it also provides an incentive to hold stocks, the ICC hopes that this type of regulation will also dissolve the chronic problem of excess supply, benefitting both exporters and importers

The Diversification Fund was started to divert resources away from the production of coffee to the cultivation of other crops, thereby reducing storage costs, government subsidies and over-dependence on a primary commodity. Though the objectives were laudable, there were

several practical difficulties that beset the Fund. The first problem was with the two basic inputs, land and labour, both of which are abundant in most coffee growing countries, making alternative enterprises undesirable as well as unprofitable. Implementation, in terms of financial resources was the other bone of contention

The nature of the coffee plant permits it to be grown in a wide variety of altitudes and climates in regions where little else would survive. Coffee production does not need sophisticated machines or constant attention and has the added attraction of being a labour-intensive crop In addition, coffee's value, in relation to weight handled, is relatively high when compared to other agricultural products. All factors that make it an ideal crop for small farmers. Thus, to diversify away from coffee, for most countries, would lead to unemployment and inefficient land usage Furthermore, diversification costs to farmers is high and alternative markets do not often exist. When they do, these alternative markets do not hold the same attractiveness of coffee. In terms of foreign-exchange earnings for the respective national governments, gains from expanding production far outweigh those from participation in the Fund, since loan conditions are too strict and no other exportable commodity has the ability to earn such high rates of return.

The Fund was raised from compulsory levies of 60 cents per bag on exports in excess of 100,000 bags. This meant that the smaller exporting countries were not asked to contribute and neither were the consuming countries, resulting in a fund, in 1976, of $100 million which proved inadequate in dealing with the sweeping structural changes which were necessary. Of the total amount, only 20 percent was available for projects outside the contributing countries. This left many producers feeling that the social and economic costs of their contributions far outweighed the gains. What made the problem more acute was that the Promotion Fund also transferred resources to non-contributing member countries. In addition, the Fund made it

necessary for producers to relinquish control of a proportion of their coffee revenues in the hands of an external organization.

Long term promotion of coffee is highly advantageous to both consuming and producing countries for both derive economic benefits vital to their national economies. Thus one would be correct in assuming that these countries will continue, through the Promotion Fund, to increase the world consumption of coffee. As with the Diversification Fund, the problem is in assessing what the actual benefits of the Promotion Fund has been. It would be safe to argue that without such a Fund, the consumption of coffee would have been driven down even further than it has already.[17] This can be attributed to the intense competition that coffee faces from other beverages, as well as the anti-coffee campaign which has swept through the world in recent years.

An interesting point to note is that the Promotion Fund and the quota system are perhaps the only two issues on which the ICA has truly succeeded in reconciling the interests of both producers and importers alike. The Diversification Fund, in retrospect, was perhaps 'lip service' by its very nature, and the selectivity pricing scheme has still not succeeded in maintaining price stability, acceptable to both producers and importers alike.

[17]The import of coffee into the US dropped from 3,872 million US dollars in 1980 to 2,032 million US dollars in 1988. Source: Statistical Abstract of the US, 1990, US Dept. of Commerce, Bureau of the Census.

CHAPTER 3

Tea is a plant that has long been grown in Japan and China, and though its origins are lost in the mists of antiquity, its discovery is sometimes ascribed to the Chinese Emperor Shennung in the second millennium BC. It is known that when travellers from the East began to make mention of the drink in the early sixteenth century, tea-drinking was an established social habit all over China, and had been for at least two thousand years. As with the advent of the coffee trade, tea-trading with its beginning in the seventeenth century was also a monopoly, which lasted till a hundred and fifty years ago It was a monopoly on both sides with the Chinese implementing strict producer control, while the English East India Company quickly rose to be the single most important buyer and distributor.

By the late eighteenth century, political pressures in China and at home forced the English East India Company to think of alternatives to reduce their dependence on Chinese tea. In 1788, in a report to the Company, the botanist Sir Joseph Banks had identified North-east India as an ideal region for growing the tea plant. When in 1834, the East India Company's charter was revoked, the British decided to set up their own tea industry within their colonial territories, the first of which was to be in the northeastern province of Assam in India. What was unknown to Sir Joseph Banks, but later discovered, was that a variety of the tea plant had already been growing wild in the Upper Assamese forests. This Indian variety differed from the Chinese in that it was better suited to the 'black tea' markets of today. By the end of the eighteenth century, "China or Indian" was a phrase often repeated by tea lovers.

As the nineteenth century drew to a close, India emerged as the largest tea producer in the world, displacing 'green-tea' producing China and almost ousted it from world

trade. When in the mid-nineteenth century, Ceylon (now Sri Lanka) had its entire coffee crop destroyed by a fungus, the country had switched to the production of tea. By the end of the century, it was second only to India in its exports of tea. Java, Sumatra and the rest of the East Indies were not far behind in starting their own tea estates, followed by the British owned African colonies of Kenya and Tanganyika. Originally a luxury which only the rich could afford, the popularity of tea today can be attributed to many factors, two of which are the variety of prices and the presence of a bewildering array of brands, blends and sizes (of packets of tea).

Though ranking much below coffee in terms of total trade value, tea, not unlike coffee, is an extremely valuable source of foreign exchange as well as employment for the developing countries in which it is produced. For example, in Sri Lanka, it is the most important agricultural product produced and contributes about two-thirds of the foreign-exchange earnings and approximately one-seventh of the total employment of the working force.[1] Tea is also a source of government revenue, being subject to export and excise duties and sales tax in a number of producing and consuming countries.

This chapter begins with a brief description of the tea plant in section 3.1. The production of tea under the plantation system versus small estates is discussed in section 3.2, followed by section 3.3 which describes the methods used, both modern and traditional, in the processing of tea. The transportation of tea to marketing centres in the producing country and its financing for export are covered in sections 3.4 and 3.5 respectively. Section 3.6 concentrates on the status of tea in the United States and follows the path of tea as it travels from packers to the shelves in supermarkets. Lastly, appendix 3.1 gives a list of the gradings of black tea in the two main grades of Orthodox and CTC, (crush, tear and curl).

[1]Sarkar, 1972, p.4.

Section 3.1: The Tea Plant

Camellia sinensis or Thea sinensis, as tea is botanically known, is a broad-leaved evergreen tree crop. This single species has two varieties, as earlier mentioned. They are the Chinese and the Assamese varieties, their main difference being that the Chinese variety is characterised by a divided stem and small frost-resistant leaves.

Though often referred to as a tea bush, the tea plant is actually a forest tree, which when developed from seed has a deep tap-root. This tree can grow to a height of thirty feet but on the tea estates, it is generally pruned to three to five feet. Its original habitat was the sub-tropical forest floor, subject to heavy monsoon rains. Given these conditions, tea bushes lie dormant in the relatively cool, dry winters, and then produce a 'flush' of shoots and leaves. The young flushes are thus plucked during the active growing seasons. In regions with little variation of temperature, plucking goes on throughout the year. Tea bushes are known for their longevity and it is not unusual for them to exceed a hundred years, an uncommon property implying that the tea planter is assured of a long term investment.

Plucking of the tea bushes is carried out every seven days or so in climates with little variability, and at longer intervals in cooler regions, where growth is slow. This is known as "variable picking". Since hand-plucking is unavoidable, the pluckers can represent up to seventy percent of the total labour force on the estates, while the attendant irreducible cost, in the form of wages, amounts to about forty percent of estate expenses as a whole.

The art of pruning tea bushes is perhaps the most important and controversial element in the cultivation of tea. In general, pruning has three main objectives: 1) to keep the bush in a vegetative form, that is, as distinct from a reproductive phase with no flowers or seeds, 2) to form a frame on which the flush will rapidly regenerate, and 3) to maintain the 'plucking table' at a convenient level Pruning is still more an art than a science for the physiology of the

tea bush is imperfectly understood, and agriculturists differ in their opinions about which is the best method by which production can be kept at a high level for any prolonged period

The tea bush reaches maturity in nine to ten years although it begins to produce leaves that can be processed in three to four years. The two primary ways of processing yield the commercially sold black and green teas. If after plucking, the leaves are withered, rolled and heated (fired), black tea is produced, while for green tea, the leaves have to be rolled and fired immediately so as to prevent any fermentation. In the changing marketplace of today, black tea has far outstripped green tea in its economic importance as well as in its relative share of the world market. Among black teas themselves, there are differing forms of manufacture which result in the Orthodox and CTC grades.

Section 3.2: Production under the Plantation System

Tea production throughout the world is primarily carried out in plantations or estates whose main features are (i) they are centrally owned, (ii) have large scales of operation, and (iii) they are in essence, monocultures They are generally owned by public companies, though chain ownerships by big stock companies and agency houses are not uncommon These estates employ salaried managers and skilled technical personnel together with a small army of hired labourers who constitute the pluckers They are monocultures in the sense that all available land is given to tea bushes. Though uncommon, there do exist some estates on which rice and other food grains are grown for supply to estate workers at subsidized prices

The dominance of the estate system can be explained partly by the economies of scale enjoyed by the large corporate organizations and by the peculiar character of tea production. Firstly, the limited liability and highly credit-worthy tea companies are assured of an elastic supply of funds from the capital markets of the world for meeting the large initial overheads, as well as

being able to supply a uniform crop which meets the needs of the market. Some authors feel that the availability of land at very low prices to the original planters might have placed an elastic limit on the size of the estates.[2] Since most tea estates can trace their beginnings to about fifty or hundred years ago, there might be some truth in this statement.

Secondly, tea is a crop, unlike coffee, which requires immediate and considerable processing because the newly harvested wet leaf is liable to loss of weight, and therefore there must be processing factories and storehouses on or near the estates. This vertical integration of production units results in a substantial saving of cost, implying that ownership of land holdings and processing plants must lie in one hand.

Experts differ on how large an estate has to be to justify the construction and operation of a tea factory, and according to one such estimate, they cannot be less than five hundred acres.[3] This debate however, varies from country to country. For example, in India, the Indian Tea Board considers estates below a hundred and fifty acres, if owned by an individual, and estates below three hundred acres, if owned by a company, as uneconomical.[4] Studies show that there exists a positive correlation between the size of estates and their yield per acre. On the other hand, the FAO rightly points out neither acreage nor yield per unit is a valid yardstick to determine whether an estate of a given size is able to achieve an economic return. However, they do concede that, in the absence of a better criteria, these measures are generally used.

Where there are small holdings, there can be little control over the quality and quantity of the leaves that are sold to the processing plant, but in places where they do exist, groups of estates often function as one unit with a single factory. This factory is usually located

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[2]Ibid., p.8.

[3]Ibid , p.18.

[4]Ibid., p.17.

close to the largest of the small holdings, the rationale being that the greater the amount of tea grown, the higher is the cost of transporting it to the processing plant.

In addition, tea is a commodity sold at auction centres away from the production estates and thus calls for special marketing and transportation arrangements for keeping marketing costs at a minimum, an objective best provided for by the large estates. These estates not only possess the capital essential for marketing tea in the form of specialized equipment and storage facilities, but they also have a wide knowledge of the international market and its requirements.

Section 3.3: Methods of Tea Production

Since black tea constitutes the bulk of the international tea market, we will only outline the process by which orthodox and CTC grades are produced. The orthodox grade, as the name implies, is the more traditional method for processing tea in the factories, whereas CTCs are the result of a mechanized procedure.

From earliest times, tea manufacture has consisted of five processing steps. The green leaf, after being weighed and brought into the factory, was spread by hand on hessian shelves or 'tats' and left to wither for up to twenty hours. It was then gathered into baskets and given a series of rolls on circular, flat-bed machines, designed to rupture the leaf-cells and reproduce mechanically the 'twist' imparted by hand-rolling in the Far East. Next, the leaves were spread by hand in rooms with the appropriate humidity and temperature so that they could ferment. Now they were ready to be fired. That is, the leaves were gathered up for insertion into the drier, where trays mounted on an endless chain carried them over hot air from a furnace. From here the processed leaves emerged as the crisp, black aromatic substance that consumers know as tea, to be sifted and graded into sizes.

The aim of the modern mechanized method was to convert the old batch process

into a continuous or conveyor-belt one. The hessian tats have been replaced by a variety of alternatives, of which the 'trough' is the most popular. In this, air is blown through the leaves from a fan at one end, reducing the withering stage from twenty hours to as little as sixteen and, in some cases, twelve hours. This acceleration accounts for a lessening of the traditional loss of quality.

It is at this next stage, where the leaves are rolled, that the influence of the market is most felt. Throughout the Western world, there has been a growing tendency towards quicker-brewing, small leaf blends, brought on by the increasing popularity of the teabag. Here, appearance does not count and the smaller the leaf the better, as long as it does not seep through the perforations of the teabag paper.

Thus, the rolling objective has been a small leaf and an accelerated process, both of which are satisfied adequately by the creation of the McKercher CTC (crush, tear, curl) machine. This is operated in conjunction with the Rotorvane, which is best described as a 'pre-conditioner' with a mincing-machine action. With the advent of the CTCs, there has been a severe restriction on grading for it produces a limited range, in which Pekoe Fannings and Pekoe dust dominate.

The continuous tray drier has also been largely replaced by the fluid bed drier, in which the fermented leaf particles are desiccated in a suspension of hot air. This is reported to have more than doubled the output of tea Due to the summary treatment to which the leaf is now subjected, care has to be taken to keep it free from fibrous and other extraneous material which clog the high-speed teabag machinery of the present day. Here the invention of the stalk-extractor plays a very important role for it sorts through the dried leaves and discards all foreign substances.

Section 3.4: Coming to Market

Traditionally, tea has been transported in individually handled three-ply chests but as the demand for tea increased, there was a move towards block consignments and 'palletisation' On a pallet or wooden platform, a neat cube of chests can be secured by straps, and the code of palletisation ensures that chests be shipped in perfect cubes of tens or twenties Of course, a pallet on which the chests remain exposed does not provide complete protection but, nevertheless, it has distinct advantages over individual chests. Not only are pallets easily transported by fork lifts but experience has shown that they do much to stem the rising in-transit damage to chests Thus latter damage arose partly from a deterioration in the construction of chests and, partly, from decreasing standards of discipline in handling. Whereas the chest may have been handled a dozen times or more before it even got on board ship in the country of origin, palletisation reduces this handling with specialized equipment designed to manipulate unitised consignments

Since 1978, there has been a growing world-wide movement towards shipping tea in containers. The motivation behind containerisation is not only simple but highly economical. Furthermore, the logic of palletisation combined with the use of containers is easily demonstrable It has been calculated that before these two innovations, it took a week to clear a cargo of fifty thousand loose chests. The same number, palletised and packed in two hundred and fifty containers, can now be handled in a single day [5] The larger forty feet containers take twice that number of chests, though they create transportational difficulties at both the sending and receiving end. Once the containers are 'stuffed', no serious harm can reach the chests, the container can be swung ashore straight on to trucks and delivered in a single operation either to the warehouse or direct to the packing factory

In recent years, accelerating costs of plywood and a growing environmental

[5]Forrest, 1985, p.111.

consciousness has forced tea producers to think of alternatives to packaging tea in ply-wood chests. The production of up to sixteen million chests per annum for exports alone, plus about the same number for internal trade, is certainly a heavy burden on timber resources. The situation is acute, especially for India, whose forests not only carry the burden of indigenous demand, but are also a main source for the tea-chest industry of Sri Lanka.

The problem has been to find a material which is in plentiful supply, yet cheaper and more ecologically acceptable than plywood. It has to be capable of rough treatment and be able to protect the tea from damp and contamination. In addition, it must also be able to accommodate palletised transportation. One such alternative was the jute hessian sack, but since hessian imparts a taint to the tea, producers are wary of this innovation. The corrugated fibreboard carton was another but it shows only a marginal reduction in cost over the ply-wood chest. Cartons are also unwieldy to transport and present difficulties to the packing factory at the receiving end The multi-walled paper sack, which is one-third of the price of a ply-wood chest, is the most feasible alternative to date, but a problem still exists in the selection of a suitable lining to protect the tea

To summarize then, tea, after being palletised and packed in chests, is transported from the estate factories to the auction centres in the producing countries. Since it serves a markedly diverse selection of consumers and there can exist extreme qualitative variations, even among tea grown on any one estate, tea is a commodity that is best suited for auction.

Section 3.5: Tea for Export

The time-honoured system of financing the movement of tea relied on low interest rates and the extended credit which they made possible. The whole process from the time tea left the estate to the moment it was paid for by the dealer (and ceased to be the grower's

responsibility) took in ninety days following the auction. These ninety days became known as the "prompt" period and was the time allowed for final settlement. There were successive reductions in the prompt period till it was finally abolished in 1975, thus ending the days of extended credit in the tea market.

Equally significant has been the increase in the number of major auction centres around the world in response to the incessant pressure for quick sales. In addition to the traditional centres of London, Calcutta and Colombo, new centres have appeared not only in Bangladesh and Indonesia, but also in Africa and Singapore. The centre in Singapore falls in a category by itself, for it is the first Eastern auction centre for tea in a non-producing country.

The general feeling among members of the tea community is that the auction centres work with both speed and efficiency. The auction prices closely resemble the prevailing supply and demand conditions of the commodity, so that the world price of tea can be said to be set by market conditions. That is, the price floor is dictated by the producer, and covers production cost and profit while the price ceiling follows the vagaries of supply and demand. Due to tea's intra-year storage capacity and the highly organized character of the industry, it is a commodity free from regularly marked seasonal price fluctuations. However, there do exist some year-to-year fluctuations. Unlike the case of coffee, where successive occurrences of bumper crops is extremely rare, a large tea crop sometimes follows an earlier bumper crop. This possibility combined with the fact that the commodity is partly storable from year to year has inhibited the potential success of effective stabilization operations through inventory adjustments.

Even with the small inter-year variability in prices, tea when compared to coffee enjoys relative price stability, which stems from several factors. As discussed above, it is less liable to annual fluctuations in supply so that abrupt disturbances of prices originating from the supply side are comparatively less severe. Tea is also amenable to "variable picking" and

fluctuations in weather affecting yield, as well as changes in demand conditions, can therefore be partly neutralized in the short run. Furthermore, world tea production, unlike coffee, is more geographically diversified, implying that the world supply is not influenced by the level of production concentrated in any one region. This absence of large fluctuations in supply and prices of tea, in turn, leads to the nonexistence of erratic speculation in the world tea markets.

Perhaps the single most important contributing factor is the organization of the tea industry. It is not divided into two distinct segments as in the case of coffee, where the agricultural part is carried on by disunited farmers, and the industrial part by large organized commercial units. The large-scale plantation system of cultivation with estates and factories owned and managed by one concern eliminates the need for a hierarchy of middlemen as exists in coffee production. In addition, tea growers are grouped in well-knit associations in all major tea-producing countries. This level of unity and the existence of vertically-integrated large enterprises has played a significant role in dampening price fluctuations, prevalent throughout the coffee industry.

Tea that is not bid for at an auction can be sold in one of two ways. When the producer wants to dispose of his crop quickly, the speedier method of sale is to sell directly from the tea garden to a local merchant or packer. In countries like India, where there is a large and heterogenous internal market, the scope for this method is obvious. In adopting this procedure, the producer not only avoids the uncertainty and expense of sale at an auction but he also receives his money with less delay. In some cases, where the estate owners might be desperate for immediate funds, use of this method sometimes leads to proprietors selling their leaf below normal value.

Another method which is becoming increasingly popular involves the tea being sold through private deals. This method is especially common among the company owned estates

and some of the larger, privately owned ones. They sell to merchant firms or actual packers who strike a deal either through their buyers' agents or through traditional brokers based in the major auction cities of the world. These multinational firms generally cater to an established North American and European clientele thus assuring producers of a stable market outlet Nowadays, bargains are also made by the big growers' own representatives at the importing end, either on sample or on recognised standards.

Though 'futures markets' have so far been rejected by the tea trade, 'forward contracts' are not uncommon, with sellers and buyers agreeing on prices for the delivery of specific quantities of tea due for manufacture within future periods of anything up to a year Such deals are made on the basis of "subject to approval of sample", allowing the buyer to reject the tea if, when manufactured, it is found to fall short of the characteristics and quality anticipated in the contract.

Section 3.6: Tea in the United States

Though the status of tea in the United Sates will never be as high as that of coffee, in tonnage terms, this country is third to the United Kingdom and Pakistan in the world league of consumers, only the USSR imported anything approaching a comparable amount by weight

The shifting pattern of the tea industry in the last decade have caused traditional market shares of imported teas to have undergone drastic changes The decisive event has been the advent of the tea-bag, usually filled with some nationally advertised blend According to some historians, the tea-bag came about more or less accidentally. In the early 1900s, a New York dealer named Thomas Sullivan started sending out samples to his retail and private customers in small hand-sewn silk bags. Some recipients thought they were meant for convenience in brewing

and criticized the silk. Sullivan then had the idea of replacing the silk with gauze and the tea-bag was born.

The tea-bag contains a carefully measured and very small quantity of leaf, which is said to provide more cups of tea than with the equivalent weight of loose tea. Since appearance does not count, tea-bags are manufactured from low quality teas and tea-powders, neither of which is calculated to send imports soaring, especially in the quality range. For example, until the mid-1960s, Indian and Sri Lankan teas, mostly in the quality range, made up sixty percent of the market, in 1983, they were down to seventeen percent.[6] Not only has there been a reduction in tonnage, but there have also been obvious shifts in prices. American imports have been consistently moving away from Indian and Sri Lankan growths in the ranges of US$2 to US$3 per kilogram, to low or medium priced teas falling between US$1.13 and US$1.60.[7] This perceptible decline in quality Indian and Sri Lankan teas is partially due to the newly-emergent tea-producing countries in Africa and Latin America who produce mainly 'common' teas. These teas have no special qualities of flavour or liquor, and are more or less internationally homogenous, characteristics which make them ideal for use in the tea-bag industry.

The pattern of trade in the US is complex and provides ample scope for 'wheeling and dealing' in these comparatively cheap teas. There are some thirty-six importers and packers, who are listed as supporting the Tea Council of the USA. Apart from the few major firms who organize their own channels of supply, packers buy mainly through the dealers and brokers, whose representatives are responsible for acquiring the tea at the major auction centres of the world.

The biggest corporate concern in the USA with the largest market share is undoubtedly the firm of Lipton, which is under Unilever ownership and commands roughly forty-

[6]Ibid., p.165.

[7]Ibid., p.166.

five percent of the market. Other coast-to-coast national brands include Salada Foods (owned by Kellogg), McCormick, Brooke Bond and Tetley. It was the last named, though of British origin, which first introduced tea-bags in the United Kingdom, the traditional stronghold of quality teas. At the retail level in the USA, two or three of the largest supermarket chains are making the greatest headway and may have obtained up to eighty-five percent of all sales, while some six hundred wholesalers service innumerable corner stores and catering outlets

Appendix 3.1: The Grading of Black Tea

This is neither a comprehensive nor uniform system of grading since it varies considerably from one country of origin to another. Only the two grades of black tea, Orthodox and CTC, have been covered in this list, and the grades shown below are an indication of size of leaf in descending order. The whole leaf grades and the 'tippy' and 'golden' brokens meet a specialised demand in various markets and thus play a minor role in mainstream grading.

Orthodox Grades:

Whole Leaf

- TGOP Tippy Golden Orange Pekoe
- GFOP Golden Flowery Orange Pekoe
- FOP1 Flowery Orange Pekoe One
- FOP Flowery Orange Pekoe
- OP Orange Pekoe

Brokens

- TGOP Tippy Golden Broken Orange Pekoe
- GBOP Golden Broken Orange Pekoe
- FBOP Flowery Broken Orange Pekoe
- BOP1 Broken Orange Pekoe One
- BOP Broken Orange Pekoe
- BP Broken Pekoe

Fannings

- BOPF Broken Orange Pekoe Fannings
- GOF Golden Orange Fannings
- OF Orange Fannings
- PF Pekoe Fannings

Dusts

- PD Pekoe Dust
- D1 Dust One
- D Dust

CTC Grades

Brokens

- BP1 Broken Pekoe One
- BP Broken Pekoe

Fannings

- PF1 Pekoe Fannings One
- PF Pekoe Fannings

Dusts

- PD Pekoe Dust
- D1 Dust One
- D Dust

CHAPTER 4

In the relatively high-income importing countries of the world, the consumption of tea is not expected to increase significantly, while the production of tea, even with its ability for variable plucking, has continued to show a strong tendency towards expansion. In addition, there is also the production by small growers, a fact that often goes unrecorded in official statistics. Thus, it can be argued that the long term prosperity of the world's tea industry would depend on the maintenance of a secular balance between global supply and demand at a remunerative level of prices. This would mean the adoption of an international tea agreement among producers which would facilitate the control of surpluses and maintenance of appropriate long-run adjustments.

This chapter begins with the background of the first tea agreement in Section 4.1 and continues on to discuss subsequent agreements and recent developments in Section 4.2. This is followed by a brief summary of recent changes and the world situation in the tea market in Section 4.3.

Section 4.1: History of the First Tea Agreement

Before 1933, India, Sri Lanka and the Netherlands East Indies were the main producers and suppliers of black tea to the markets of the world, and it was the governments of the Netherlands and the United Kingdom who controlled them or would have, had it not been for the laissez-faire philosophy of the times. In practise, producers and distributors were only subject to the restraints of customs and excise, and problems of labour and legislation. Even the emergency controls of World War I seemed to leave little permanent mark on this unhampered

state of affairs

After the effects of post-war decontrol had worked its way through their tea market, supply and demand regained their equilibrium and the market remained fairly stable between 1922 and about 1928 However, trouble was looming in the form of developments in the Netherlands' East Indies, where acreage and output showed explosive increases, while in India and Sri Lanka, only modest advances were made. It has been estimated that exports from the Netherlands East Indies climbed from 102 million pounds in 1920 to 160 million in 1929[1] Since demand remained unchanged, the result of this excess supply was a steady decline in tea prices through the late 1920s till in 1930, the producers' association agreed that for that year, exports would have to be reduced by some 57 million pounds, on the current total of 903 million pounds.

Accordingly, India exported twenty-four million pounds and Sri Lanka eight million pounds less of tea abroad, but the Netherlands East Indies sent only one million pounds less.[2] This policy of voluntary restriction was further undermined by events in Java and Sumatra. The effect of any scaling down on the big estates in Java and Sumatra was being offset by low-grade materials reaching the 'bought-leaf' factories -- the reverse of what had been aimed at. That is, the major producers had agreed to reduce exports in the hope of stopping the spiralling effect of tea prices, but, with low quality teas flooding the market, the price of tea continued to slide downwards, and producers were forced to explore other forms of control

The next move was towards a stricter form of enforcement, and it was the Dutch, who in October 1932, submitted a proposal before the Indian and Sri Lankan associations in London The proposal obtained the approval of all the members (which technically meant India, Sri Lanka and the Netherlands East Indies) and was ready for signature by the ninth of February,

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[1]Forrest, 1985, p.177.

[2]Ibid , p 178

1933. The central provision on which the regulation worked was the idea of 'Standard Exports', which would be established for each of the participating countries, based on the highest figures in the years 1929, 1930 and 1931. For the first regulation year (April 1933 - March 1934), quotas were set at eighty-five percent of Standard. There was no control of output though standard production figures were assigned by the three countries for their estates, so as to equitably spread the export quota. Government involvement in the respective countries was also necessary to insure that the regulatory scheme was effective, for legislatures were required to pass laws, which had to be subsequently policed.

Acreages were 'frozen' in the India, Sri Lanka and the Netherlands East Indies, meaning that replanting was limited to the same areas which had been uprooted. In addition, the tea producers and governments of British East Africa and Malaysia agreed to support the agreement, but only with respect to limiting their planted acreage in tea.

Estate owners were issued export licenses by their respective countries, and the possibilities of transfer of these licenses, which would seriously affect local economic interests, were minimized by various measures. Firstly, estate owners who wished to transfer export licenses in whole or in part from one of their estates to another had to do so with the approval of the authorities. Secondly, a system of joint licences was introduced by which owners received a single licence for all the estates belonging to them. This was to prevent owners selling licences from one of their estates to the estates of another owner.

Administration of the scheme was the responsibility of the International Tea Committee (ITC), composed of representatives from the tea industry of the different member countries. The administrative expenses were to be divided between the signatories of the Agreement in proportion to their Standard Export figures.

The ITC was successful in that members soon saw a net reduction in exports

towards the end of March 1934, and an increase in the price of tea, which climbed back to its 1929 levels. It is important to take note of the term 'net' reductions, for no mention was made of British East Africa or Malaysia beyond the taciturn agreement of limiting planted acreage. It was only during 1934, that the trinity of producers realised that some recognition must be paid to their African and Malayan counterparts, for tea estates in these countries were spreading rapidly and production was increasing fast. Consequently, they were brought into the scheme with generous export quotas and permission for a twenty-five percent increase in acreage.[3]

The net result was that while the original trio reduced exports, the 'newcomers' gained at their expense, capturing new market shares and forever changing the fabric of the tea industry For example, in 1933/34, the three original members of the ITC reduced exports by 171 million pounds, while the 'outsiders' made a gain of 9 million pounds.[4]

Section 4.2: Subsequent Developments in the Tea Agreements

The first tea Agreement was for a period of five years, ending in 1938, and since it worked with reasonable efficiency, it was renewed for a further five years, with minor adjustments to the quota scheme World War II interrupted the mechanism of the agreement, and an extension was made until March 1948. Following this was a producers' agreement between India, Pakistan, Sri Lanka and Indonesia, which went into effect for a further five years. However, these same four countries also signed a new five-year Agreement in 1950, with a significant difference in their attitude towards production. The new Agreement merely maintained production and did not restrict it in any way For example, new extensions on land not already planted with tea were restricted to five percent of 'permitted acreage', while replacements were

[3]Ibid , p 179.

[4]Ibid , p 179

allowed up to ten percent, but had to be accompanied by a simultaneous uprooting of a corresponding area of old tea plants.[5]

By 1955, when the Agreement was up for renewal, prices were in a boom phase, and producers saw no further need for any sort of regulation. Consequently, the Agreement was phased out though the ITC was allowed to continue as a centre for the collection and analysis of statistical and other data.

In the middle of the 1960s, prices had again begun to show signs of decline, and restriction of exports was a revived topic among producers. By now, the FAO, (Food and Agriculture Organisation) of the United Nations, had begun to take an interest in tea, which led to the establishment of a new Consultative Committee on Tea in January 1969. The Committee was empowered with providing temporary export quotas pending a long-term Agreement. The brunt of the responsibility for forming an integrated programme for tea eventually came to rest with another UNO body known as UNCTAD, (United Nations Conference on Trade and Development), charged with stabilizing world commodity markets and improving the earnings of developing countries.

At UNCTAD's "Third Preparatory Meeting on Tea" in May 1982 in Geneva, a working framework for action was finally arrived at. This gathering of tea producers however, was a world apart from the meeting of three signatories in 1933, who came together to sign the first Agreement and whose exports supplied virtually ninety percent of the world markets. At the time of the Geneva meeting, India, Sri Lanka and the territories that were the Netherlands East Indies controlled only sixty-three percent of the world market and were part of the seventeen countries representing ninety-five percent of world exports to attend the UNCTAD conference.[6]

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[5]Ibid., p.179.

[6]Ibid., p.181.

As is the case with any commodity agreement, negotiations on possible quotas were awkward, for UNCTAD was faced with the unenviable task of satisfying traditional growers of tea as well as new producers Finally, it was agreed that any future International Tea Agreement would have the following objectives.

1. To promote an orderly expansion of world trade in tea, while maintaining prices at levels which are remunerative and just to producers and equitable to consumers

2. To balance import demand and export supply and avoid excessive price fluctuations.

3 To improve market access for tea

4. To ensure adequate supplies to consumers.

5. To improve, and maintain where necessary, the quality of teas traded internationally.

6. To encourage the efficient development of the world tea economy by seeking to facilitate and promote improvements in the growing, processing, marketing and distribution of tea.

7 To promote and increase the consumption of tea.

Under 1 and 2 of the above, price objectives and intervention levels would be established, using an 'indicator price' computed on all teas sold on the Eastern and Mombassa auctions. A global quota was to be agreed on each year, between exporter and importer members of the Agreement, with price objectives for that year being taken into account. Furthermore, quotas would only apply to those countries whose average annual exports during the previous three years were equal to or greater than ten thousand tonnes. In addition, the Agreement specified that export quotas would not apply to trade in tea traditionally undertaken on an inter-governmental basis between the East-European bloc countries. Green tea exports were also not subject to the quota system

If the negotiations for implementation of a quota system sounds complex, it was the common consensus among the members of the tea community that the remaining objectives

were almost impossible to implement. In the world of tea, there is no central authority that governs. Policies are often shaped by the forces of nationalism on one hand and by the imperatives of the market-place on the other

Section 4.2: The World Market of Today

According to the World Agricultural Outlook Board, world tea production in 1989 fell slightly from the 1988 level of 2.48 million, and prices were estimated to be at their highest level since 1984.[7] This can be attributed to several reasons. Sri Lankan production had been adversely affected by civil unrest resulting in lower harvesting yields, and Soviet production had still not recovered from the 1986 Chernobyl accident. Thus, increased Soviet demand coupled with lower world production helped to create the unexpected boom in 1989 However, an abundance of low-quality teas on the market kept prices from rising any higher

Among the major producers, India's tea exports in 1989 were estimated to have approximated 1988 levels, half of which was sent as shipments to the Soviet Union under a bilateral trade agreement. Though Sri Lankan production fell by nine percent in 1989, sales to Iraq under an economic co-operation agreement amounted to around 27,000 tonnes.[8] Egypt and Iraq are seen as the principal markets for Sri Lankan tea exports in the 1989-90 period With low production costs and higher world prices, Indonesian production saw an all time high in 1989 The United States has become one of the principal markets for Indonesia's tea exports and was estimated to be the largest recipient of its shipments in 1988

The United States continues in its position as the world's third largest importer,

[7]United States Department of Agriculture FTEA 3-90, 1990, p 1.

[8]United States Department of Agriculture FTEA 3-90, 1990, p.3.

totalling 90,150 tonnes valued at 133 million dollars in 1989.[9] This is virtually the same level as in 1988, and lends credence to the projections of analysts in the field, who predict a stagnation in import requirements around the level of the mid-eighties. US per capita tea consumption over the past decade has been showing a downwards trend, possibly due to competition from coffee, soft drinks, alcoholic beverages and fruit juices. Increased sales of herbal teas and iced teas have also contributed to this decline in the consumption of tea as a hot beverage.[10]

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[9]United States Department of Agriculture FTEA 3-90, 1990, p.7.

[10]It is estimated that about eighty percent of US consumption is in the form of iced tea. Coupled with this is the rising popularity of herbal teas, 2,722 tonnes in 1989, as compared to 2,268 tonnes sold a year earlier. Source: United States Department of Agriculture FTEA 3-90, 1990, p.1.

CHAPTER 5

The purpose of this chapter is to review part of the large literature available on the commodity markets of coffee and tea. Due to the diversity of these studies, the review is organized according to similarities in study design. There are three main sections, two of which deal with studies done on the markets of coffee and tea The third section is a collection of relevant articles that study issues of price stabilization, and various other aspects of commodity markets

The literature search for this chapter has covered a group of important journals, over a period of twenty years, ranging from the disciplines of agricultural to statistical economics These journals are the following:

Journal of Economic Literature
Quarterly Journal of Economics
Review of Economics and Statistics
Indian Journal of Economics
Journal of Agricultural Economics
American Journal of Agricultural Economics
Canadian Journal of Agricultural Economics
Indian Journal of Agricultural Economics
World Bank Staff and Commodity Working Papers
IMF Staff and Commodity Working Papers
World Bank Economic Review

This chapter is organized as follows. Three summary tables of the studies on coffee, tea and commodity markets reported in this chapter is presented in Section 5 1 This is followed by annotated bibliographies for these three topics in Section 5 2, Section 5 3 and, Section 5.4, respectively. Section 5 5 is an asessment of the studies reviewed with implications for empirical analysis

Section 5.1: Summary Tables

Table 5.1 and Table 5 2 are tabular summaries of the coffee, and tea market studies that are later presented in the annotated bibliographies in Sections 5.2 and 5.3 below. The articles are arranged alphabetically and the tables give information on the author and year of publication, the period that the studies covered, the main equations used, and the objectives of the studies Both of these tables are divided into two sections Section A deals with mathematical studies and Section B presents the country case studies. Column two in Table 5 1 serves two purposes. It describes the range of years that the mathematical articles cover, as well as indicating the countries that are dealt with in the case studies. Table 5 2 omits the column that contains the main equations of the studies Since most of the articles on the tea market are case studies, it was felt pertinent to present the countries in which each of these studies was conducted

The miscellaneous nature of the studies on commodity markets would not allow an appropriate decomposition of them as used in the case of the other two markets on coffee and tea. Thus, only the author, the year of publication, and the objectives of the various studies are listed in Table 5.3, the articles being presented alphabetically as before.

Table 5.1: Tabular Summary of Coffee Market Studies

Model & year of publication	Period covered/ Countries covered	Main equations	Objective of the study
		A Mathematical Studies	
Akiyama, 1982	1963-1981	Demand & production	To project consumption, output and price
Akiyama, 1990	1974-1986	Demand, supply & export price of coffee	To analyze the impact of the ICA quota system on the world market.
Dietrich, 1973	NA	Actual & forecast values, MSE & LPF	To evaluate the performances of short-term forecasts
Edwards, 1976	1950-1972	Supply & prices	To suggest policies that stabilize export earnings
Gelb, 1979	1822-1969	Demand, supply & investment	To determine the factors behind market oscillations in coffee
Rourke, 1970	1945-1967	Production & prices	To develop a method by which to forecast production in the short-run
Saylor, 1974	1947-1970	Coffee area planted & prices	To test the efficiency of modified Nerlovian supply functions
Vries, 1975 supply,	1934-1974	Supply, demand & price of coffee	To analyze relationships between demand and prices
Wickens, 1973	NA	Coffee investment & supply	To develop on Nerlove's supply functions
		B Case Studies	
Bevan, 1990	Kenya	NA	To study the fiscal response of a coffee boom
Greene, 1981	Kenya & Tanzania	NA	To study the micro implications of a coffee boom

MSE= Mean Squared Error (That is, average squared difference between actual and forecast values).

LPF= Line of perfect forecast.

Table 5.2 Tabular Summary of Tea Market Studies

Model & year of publication	Countries covered	Period covered	Objective of the study
		A. Mathematical Studies	
Akiyama, 1987	W	1975-1983	Specification of supply, demand & price in the world economy.
Akiyama, 1987a	Kenya, India & Sri Lanka	1956-1984	To determine factors that affect that affect supply functions.
Roberts, 1989	Sri Lanka	1952-1973, 1980-1982	To provide policy information by studying a sample of tea estates
		B: Case Studies	
Dhinsa, 1983	UK & USA	1960-1978	To isolate factors that contribute to consumption trends.
Hartley, 1980	Sri Lanka	1956-1979	Explores supply & demand in the short-run with recommendations for policy-makers.
Misra, 1985	India	1961-1980	To use elasticities of supply to be able to predict production and price policies.
Sharma, 1982	Sri Lanka	NA	To attempt to estimate the factors that affect export supply, demand and price.
Singh, 1970	India	1954-1955, 1966-1967	To determine the factors that have caused India to lose international market shares.
Stern, 1972	Kenya	NA	Analyzes the strengths and weaknesses of the Kenyan Tea Development Agengy.
Veni, 1986	UK, USA, Canada & Australia	1950-1951, 1979-1980	To use elasticities of substitution to explain the decline of Indian tea to these countries

W= All producers and consumers of Tea.

Table 5.3: Tabular Summary of Commodity Market Studies

Model & year of publication	Objective of the study
Chu, 1978	Comparison between ARIMA models and reduced form models for forecasting commodity prices.
Chu, 1986	To determine the causes of primary commodity price movements during the oil recession of 1981-1982
Gardner, 1983	To use supply and demand elasticities to explain efficiency in redistribution
Hazell, 1990	To investigate the relationship between price instability and the return to growers in developing countries
Labys, 1975	To provide a background on methodology for future commodity model builders
Myers, 1972	To demonstrate how to combine statistics and theory in commodity forecasting
Peck, 1976	To investigate the effect of 'futures' markets on commodity prices using Nerlove's adaptive expectations model.

Section 5.2: Annotated Bibliography: Coffee Studies

A Mathematical Models

Akiyama, T & R C Duncan, "Analysis of the World Coffee Market", World Bank Commodity Working Paper #7, 1982

Reports the results from a new coffee model constructed to project consumption, output and price over the next decade The projections are based on econometric analysis of coffee demand and production in major consuming and producing countries and regions. The results indicate a pessimistic outlook for the growth in consumption and price, with stagnating demand in the US and future demand in W Europe highly dependent on income growth, while being under competitive pressure from substitutes like soft drinks, etc.. Prices were expected to decline towards the middle of the decade, under pressure from higher output Simulations of the model are carried out to show the susceptibility of coffee prices and export revenues to increase in production at rates faster than the growth in demand resulting from population and income increases

Akiyama, T & P. N Varangis, "The Impact of the ICA on Producing Countries", The World Bank Economic Review, 1990, Vol. 4, #2, pp 157-173.

Simulations of a global coffee model incorporating a vintage capital approach to production are run Over the recent period of operation of the ICA's export quota system, the authors find that the quota system had a stabilizing effect on world coffee prices. The quotas reduced real export revenues for most small exporting countries, but larger producers gained. However in terms of risk reduction, most small countries gained If a brief suspension of the quota occurs from time to time (caused, for example, by adverse weather which results in a shortfall in world supply), the quota system works like a buffer stock scheme That is, on average, producing countries as a whole lose transfer benefits but gain risk benefits

Dietrich, K J & A D Gutierrez, "An Evaluation of Short-term Forecasts of Coffee and Cocoa", American Journal of Agricultural Economics, 1973, Vol 55, #1, pp 93-100

Predictive performances of short-term forecasts of production is evaluated using a technique which minimizes the average squared difference between actual and forecast values Forecasting errors are decomposed into two components reflecting the forecast system and a residual component Results indicated that many forecasts resulted in underestimation and contained large but unsystematic errors

Edwards, R & A Parikh, "A Stochastic Policy Simulation of the World Coffee Economy", American Journal of Agricultural Economics, 1976, Vol 58, #2, pp.152-160

This paper analyzes the structure of the world coffee market and suggests policies that stabilize the export earnings of coffee exporting countries The major cyclical characteristics of the coffee economy may be explained by a simultaneous equations model, which considers the lagged response of supply to price The most successful policies include the development of rapidly maturing trees and the imposition of a quota on exports, both of which are effective in modifying the long-run cycle A buffer stock policy is shown to be effective in eliminating short-run fluctuations, given sufficient resources

Gelb, A H , "A Spectral Analysis of Coffee Market Oscillations", International Economic Review, 1979, Vol 20, #2, pp 495-514

The periodicity, power and generation of slow price oscillations peculiar to the world coffee economy are investigated using spectral methods A linearized coffee system model is shown to possess a gain function with cyclical peak near the 18 year period, about that of major movements in coffee consumer prices The model's transfer functions coincide closely with estimated spectral relationships A peculiar structural feature of the coffee economy - the response of producing countries' exchange rates to coffee prices - is shown to provide an explanation of why the coffee economy displays cyclical tendencies without expectation formation being naive

Rourke, B. E., "Short-range Forecasting of Coffee Production", Food Research Inst Studies, 1970, Vol 9, #3, pp 197-214

In spite of both the large stocks of coffee held by exporting countries and the ICO, prices of coffee in recent years have responded significantly to major year to-year changes in production The paper makes use of relationships established on the basis of production estimates for 1945-1967 and gives a guide to the assessment of current reports on coffee crop conditions This paper might be used to assist forecasting of the coffee crop some six to nine months before harvesting Importance of developments in Brazil is stressed

Vries, I de, Structure and Prospects of the World Coffee Economy, World Bank Staff Working Papers #208, 1975

This paper analyzes the relationships between supply, demand and prices of coffee with the help of an econometric model The extremely depressed level of coffee prices in 1975 is explained by the lag in adaptation to general inflation, as well as by the unfavourable income developments in the main consuming areas This situation reinforced the expectation of firm prices towards the end of the decade However, since investment in new production is seriously impaired by low prices, projections of supply, demand and, prices are made under different assumptions as to the development of income and inflation, as well as the occurrence of frosts in Brazil

Wickens, M R & J N Greenfield, "The Econometrics of Agricultural Supply An Application to the World Coffee Market", Review of Economics and Statistics, 1973, Vol 55, #4, pp.433-440

The dynamic structure of agricultural supply functions has not received much attention since Nerlove's path-breaking work in the 1950s A multi-period optimizing model of coffee investment and supply is developed in this paper from which it is shown that while Nerlove's approach closely approximated the investment decision, it fails to capture the importance of the gestation period for the supply function That is, Nerlove's ad hoc dynamics are better suited to tree crops where long gestation lags exist

B Case Studies

Bevan, D L , P. Collier & J W. Gunning, "Fiscal Response to a Temporary Trade Shock

The Aftermath of the Kenyan Coffee Boom", The World Bank Economic Review, 1990, Vol.3, #3, pp 359-378

The appropriate fiscal response to a temporary terms of trade windfall is difficult to determine, even in an unregulated economy But controls, such as those in force during the 1976-1979 coffee boom in Kenya, introduce special problems For example, foreign exchange controls make the private investment of boom income inefficient by causing it to be undertaken too rapidly This paper studies the case of Kenya, where the boom induced a massive increase in public expenditure, far in excess of the increase in public revenue The net effect on capital formation was negative because the fiscal response exacerbated the rise in the relative price of non-traded capital goods, and because resources were preempted for government consumption.

Greene, D , R Liebenthal & S Acharya, "Economic Consequences of the Coffee Boom in E Africa", World Bank Research News, 1981, Vol.3, #1, pp.31-33

The years 1976-1978 saw a four-fold, though temporary, increase in the world price of coffee For those developing countries in which coffee is a major source of foreign exchange and domestic income, this increase led to a large temporary shift in relative prices and a large injection of income from abroad The study explores the consequences of the boom in Kenya and Tanzania, countries in which coffee is a major smallholder crop and a significant source of foreign exchange. Most studies of the economic consequences of price instability for major agricultural exports have dealt only with macroeconomic changes - this study traces the consequences to the micro level Its starting point is the existing economywide models of Kenya and Tanzania, though it will make use of the large amounts of micro-survey data that have recently become available

Saylor, G. R , "Alternative Measures of Supply Elasticities The Case of Sao Paulo Coffee", American Journal of Agricultural Economics, 1974, Vol.56, #1, pp 98-106

Nerlovian supply functions are fitted to post World War II coffee data for Sao Paulo, Brazil Thus the data period covered is from 1945-1969. Supply shifts are permitted through the use of dummy variables, and recent specifications of irreversible functions are tested. The modified Nerlovian functions are seen to perform best from both the economic and statistical point of view

Section 5.3: Annotated Bibliography: Tea Studies

A Mathematical Models

Akiyama, T & P K Trivedi, "A New Global Tea Model: Specification, Estimation and Simulation", World Bank Commodity Working Papers #17, 1987

This econometric model of the world tea economy consists of a supply and demand relation and an inventory demand equation which closes the model The model is superior to previous studies because it has a greater disaggregation by country and geographical zone. Inventory demand comprises speculative and transactions components, both of which involve expectations of future prices The insight that price depends upon expectations of future values of exogenous variables provide the basis for specifying and estimating a world price equation. The specification of the supply side is more detailed for the four leading producing and/or exporting countries, viz , India, Sri Lanka, Kenya, and Malawi, since there is some attempt to

model long-run decisions, such as new planting, replanting, and uprootings For the remaining producer countries in the model, the specification is simpler The results of the simulation exercises are presented to exhibit the properties and weaknesses of the model

Akiyama, T & P K Trivedi, "Vintage Production Approach to Perennial Crop Supply An Application to Tea in Major Producing Countries", Journal of Econometrics, 1987(a), Vol 36, #1/2, pp 133-161

New plantings and replanting decisions play a key role in determining the long-run response of perennial producers, and in accounting for observed differences in the patterns of agricultural development In this paper, a framework based on the vintage production model is proposed This links the producers' short-run and long-run decisions The empirical applications to tea production in Kenya, India and Sri Lanka illustrate the diversity of mechanisms determining the supply responses

Roberts, J , "A Micro-Economic Analysis of Tea Production Using a Separable Restricted Profit Function", Journal of Agricultural Economics, 1989, Vol 40, pp 185-197

To derive policy-relevant information, the translog form of a separable restricted profit function was used to model empirically the estate tea production in Sri Lanka Data consisted of 87 observations of prices and quantities for various inputs and outputs from 54 different Sri Lankan tea estates In different tests, the estimated model generally respected the properties implied by the underlying assumptions Results indicated increasing economies of scale in the factory across the sample, and optimal field size to be between 300 and 400 hectares Amongst estimated short-term elasticities, the supply elasticity of trade tea was found to be +0 94

B. Case Studies

Dhindsa, K. S , "The Determinants of Tea Consumption - Case of UK & USA", The Indian Journal of Economics, 1983, #251, Vol LXIII, pp 487-494

The level of consumption in any country is determined by certain set of factors, viz , the size of the population and its rate of growth, real disposable income, real retail prices of the commodity concerned and it's consumer's preferences, etc But the relative importance of factors may vary from time to time and from country to country This paper attempts to examine the consumption trends of tea in the UK and the USA, and identifies the factors affecting consumption of tea in these two major countries

Hartley, M J , "Econometric Models of the Supply of Perennials A Case Study of Rubber and Tea in Sri Lanka", World Bank Research News, 1980, Vol 1, #2, pp 20-21

The demand and supply of perennial crops are highly unresponsive to price changes in the short run, and this has caused great instability in their world prices and in the export earnings derived from them. The author developed vintage models of tea and rubber production, applicable at both the micro and the aggregate level The project collated and used the annual accounting statements that have been prepared by managers of rubber and tea estates over the large 15 years

It was hoped by the author that the research would be of use to government planners in Sri Lanka.

Misra, S R, " A Study of the Supply Response of a Perennial Crop - A Case Study of Tea", Indian Journal of Economics, 1985, #259, Vol.LXV, pp 477-486.

India remains the world's largest producer, consumer and exporter of tea In order to take care of both anticipated domestic consumption and the necessity of retaining a reasonable share in the world tea market, the positive attitude would be to increase production In this context, information on the elasticity of supply responses would offer a scope for identifying economic problems and difficulties in designing appropriate price and production policies for a crop like tea. It is easier to ascertain to what extent production policies can be influenced by price policy instruments if the policy maker knows the size of these elasticities Therefore, the principal objective of this paper is to examine the nature of the relationship between production of tea and its price

Sharma, J S, "Economic Determinants of Export Supply Price of Indian Tea", Indian Journal of Agricultural Economics, 1982, Vol. XXXVII, #1, pp 329-330.

An attempt is made to empirically estimate the effect of various factors on export supply, demand and price of Indian tea in the world market, using ordinary least squares and two stage least squares method The empirical findings indicate a declining trend in the export price of Indian tea. Contrary to popular belief, increases in the domestic output of tea has not been responsible for the decline in the export price On the other hand, increases in exports of tea from other countries other than India has adversely affected both the price and the quality of exports of Indian tea in the international market

Singh, I J. & J S Sharma, "Production and Export Potential of Tea in India", Indian Journal of Economics, 1970, #199, pp 423-428.

Although India's production of tea has considerably increased over the years, India's total tea exports and her contribution to the world import of tea has increased only marginally. This paper investigates the factors attributing to this phenomenon in order to predict a future course of action on production and export policies for the tea industry

Stern, N H, "Experience in the Mirrlees Method for an Appraisal of Smallholder Tea in Kenya", Bull Inst Econ & Stat, 1972, Vol 34, #1, pp 93-123

The project analyzed was the Third Planting Programme of the Kenyan Tea Development Authority (KTDA) The KTDA organize the provision of planting material, inspection and collection of tea and, the processing and selling for smallholders Problems of special notice were the valuation of land and agricultural labour, the treatment of uncertainty, and welfare weights on farmers' income The shadow price is higher than the market shadow price, which illustrates the export emphasis implicit in the method's concentration on world prices

Veni, I. K, "Elasticity of Substitution of India's tea Exports in Major Traditional Markets", Indian Journal of Economics, 1986, #262, pp 325-328.

This paper attempts to isolate the factors that have caused India's tea exports to traditional

markets to decline during the period of 1950-1951 and 1979-1980. The paper attempts to do this using elasticities of substitution for each of the traditional markets of USA, UK, Canada and Australia.

Section 5.4: Annotated Bibliography: Commodity Market Models

A Mathematical Models

Chu, K. Y., "Short-Run Forecasting of Commodity Prices An Application of Autoregressive Moving Average Models", IMF Staff Papers, 1978, Vol 25, pp 90-111

This paper reviews the relative merits of using ARIMA models for forecasting, compared with reduced forms derived from a simultaneous equations model The paper also attempts to apply the method of ARIMA models to a short run simulation of commodity prices The results suggest that the ARIMA models can yield quite satisfactory short run forecasts for the monthly prices of some commodities, and that they can be useful even for forecasting the yearly averages of monthly prices.

Gardner, B , "Efficient Redistribution through Commodity Markets", American Journal of Agricultural Economics, 1983, Vol.65, #2, pp 225-234

Efficiency in redistribution is measured in terms of deadweight loss generated per dollar of economic surplus transferred between consumers and producers of a commodity by means of market intervention The implications of supply and demand elasticities for efficiency in redistribution are examined with special attention to the comparison of production control and deficiency payment programs The results may be used to aid in the evaluation of commodity programs and as a basis for consideration of the hypothesis that observed policies are efficient, given the political power of interest groups

Hazell, P. B. R., M. Jaramillo & A. Williamson, "The Relationship between World Price Instability and the Prices Farmers Receive in Developing Countries", Journal of Agricultural Economics, 1990, Vol.41, #2, pp.227-241

World prices for agricultural commodities are traditionally unstable but they were particularly turbulent during the late 1970s and the early 1980s This paper uses available post-war data on individual commodity prices to test whether world price instability is increasing and to examine its impact on the prices producers receive in developing countries It is found that the recent turbulence was more a statistical fluke than the beginning of any longer term increase in market instability Further, while the variability in world prices has been almost entirely transmitted to developed countries in the dollar value of their export unit value, it has not been fully transmitted to average producer prices. Real exchange rates, domestic marketing arrangements and government intervention has acted to buffer price movements for producers in many developing countries.

Peck, A. E , "Futures Markets, Supply Responses and Price Stability", Quarterly Journal of Economics, 1976, Vol.90, #3, pp 407-423

It has long been recognized that if producers of agricultural commodities were forward-

oriented in their production planning, the apparent cobweb nature of prices and production for these commodities would be eliminated. Futures markets exist, however, for most agricultural commodities and generally provide a market determined forward price, which could be used to guide production decisions. Using Nerlove's adaptive expectation model as a base, this paper derives the comparative behaviour of prices assuming producers use futures prices in their production decisions. The results show that futures markets will in general stabilize interseasonal price fluctuations.

B General Studies

Chu, K. Y. & T. K. Morrison, "The 1981-1982 Recession and Non-Oil Primary Commodity Prices", IMF Staff Working Papers, 1986, pp.93-140.

This paper analyzes the depressed state of primary commodity markets during 1981-1982 in the context of developments over a historical period. The causes of primary commodity price movements are investigated, along with the relatively high price instability in recent years.

Labys, W. C., "The Problems and Challenges for International Commodity Models and Model Builders", American Journal of Agricultural Economics, 1975, Vol 57, pp 94-107.

Researchers today are encountering overwhelming economic and methological problems in specifying, estimating and simulating commodity models in an attempt to adopt them to our rapidly changing economic environment. These problems become intensified when dealing with international commodity markets where the uncertainties of political and economic behaviour increase, as do the variety of shocks to the system. Since the means of coping with these problems are limited, a substantial gap exists between the simplistic nature of our models and the complexities of international markets. This paper provides a background on methology and problems, and offers suggestions as to how model builders can cope accordingly.

Myers, W. M., "Combining Statistical Techniques with Economic Theory for Commodity Forecasting", American Journal of Agricultural Economics, 1972, Vol 54, #5, pp 784-789.

Research in price forecasting has attracted the attention of professional economists but, by and large, such research has contributed little to practical decision making. The major objectives of this paper are to outline a specific management problem involving significant price uncertainties and to demonstrate how we would combine conventional econometric techniques in reducing this uncertainty.

Section 5.5: Conclusion

In modelling the coffee market, the studies presented in this chapter have dealt mainly with problems of production and supply, and their relationship with the price of coffee. Various econometric methods have been used to project the future performances of variables like production, consumption and price. Of the many papers reviewed, the mathematical studies done

on the coffee market by Akiyama were found to be the most comprehensive. They adequately represent those years when the ICO was in existance by utilizing data covering the periods of 1963-1981 and 1974-1986. Analysis of price fluctuations and econometric modelling of the coffee market in the following chapters will also make use of data from the early 1960s to late 1980s.

The level of unity among producers of tea, and the existance of vertically integrated large enterprises prevalent in the tea world is one of the reasons why price fluctuations do not seriously hamper the tea market. In addition, the highly organized structure of the tea market leads to predictability, which renders its further econometric study ineffective, further support is provided by the papers reviewed in this chapter, where the majority of these concentrate on particular country cases and problems with supply.

Price modulations of the tea and coffee market are investigated in chapter six, followed in chapter seven by econometric analysis of coffee prices in the largest consuming country in the world, the United States. Tea prices in chapter seven are not analyzed separately, but rather in conjunction with coffee movements, in order to better understand the inter-relationship between the two markets.

CHAPTER 6

In the final months of the 1980s, the supply of coffee to the international market far outstripped demand, lowering prices of green beans. In addition, the coffee market has been operating under free market conditions since the suspension of the quota system in July 1989. Though the next ICA is expected to be reintroduced in September 1991, the issue uppermost in the minds of coffee market analysts is in the determination of the dominant trend of coffee prices in the 1990s, given the success or failure of the ICO meetings.

The breakup of the coffee pact in 1989 caused a freefall in coffee sales that depressed prices and also led to a loss of four billion dollars in the following year for coffee producing countries.[1] Coupled with this breakdown, there occurred a worldwide surplus of coffee, which effectively dampens any upturn that the market may experience. Brazil's suspension of coffee exports in March 1991, in order to push up prices, is an indication of the speculation and apprehension that is prevalent in the coffee market of the 1990s. There is also a fear that the industry may fail to maintain (amid strong promotion from competitive beverages, like tea) the favourable image of coffee as a 'desirable drink'. The evidence of the past year, in the form of the various advertising campaigns launched by the major coffee houses in addition to a move towards quality improvement, supports the prediction of a growing interest among roasters in encouraging higher consumption.

Thus, it is imperative that the coffee and tea markets of the major producing countries, be analyzed with respect to the prevailing world market conditions of the time. Keeping in mind the economic history of coffee, which has been one of continuing change rather

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[1]Financial Times, The Ottawa Citizen, March 23, E5, 1991.

than stability, it is clear that uncovering and identifying major trends in the coffee and tea markets will place in perspective the recent performances of coffee and tea prices This chapter covers the period of the 1960s to 1989 in order to examine how the markets of coffee and tea have operated under international agreements

Section 6 1 describes the variables used as relevant indicators, together with their respective sources Coffee export fluctuations for Brazil, Colombia and Kenya are covered in Section 6 2 This is followed in Section 6 3 by an explanation of the export performances of tea from Kenya, Sri Lanka and India These two groups of countries represent both the traditional and the new powers in the coffee and tea markets Brazil, Colombia, Kenya, Sri Lanka and India are also among the largest exporters to the American market Section 6 4 looks at four types of coffee traded on the New York exchange, and attempts to determine patterns of seasonality The section also considers the relationship between the annual movements of coffee and tea prices

Section 6.1: Variables

The variables used in this chapter are volume of export, export earnings and unit export prices Wholesale export prices have been used where unit export prices were not available All variables are annual except for those used in Section 6 4, where monthly values were used to calculate seasonality A list of all the annual variables is presented in Appendix 6 1 Appendix 6 2 contains the monthly variables together with calculations for the seasonality values The names, and sources of the variables used are summarized in Table 6 1

Table 6.1: Variables and Sources

Variable Name	Description & Source
Export Earnings	For both coffee and tea markets. In millions of dollars for Brazil and Colombia, millions of shillings for Kenya, and, millions of rupees for Sri Lanka **Source:** International Financial Statistics Yearbook, 1990, IMF. (1960-1989, annual averages)
Volume of Export	For both coffee and tea producing countries, the volume was normalized with 1985=100 **Source:** International Financial Statistics Yearbook, 1990, IMF. (1960-1989, annual averages)
Unit Export Price	For both coffee and tea prices For Brazil and Colombia, normalized to 1985=100, with indexes of unit values in US dollars. For Kenya, normalized to 1985=100, with indexes of unit values not mentioned in source **Source:** International Financial SDtatistics Yearbook, 1990, IMF. (1960-1989, annual averages)

Variable Name	Description & Source
Wholesale Export Price	Applicable to the tea prices for India, Kenya and Sri Lanka Normalized to 1985=100 **Source:** International Financial Statistics Yearbook, 1990, IMF (1960-1989, annual averages)
Coffee1	Colombian Mild Arabicas, Ex-Dock New York Calibrated in US cents/lb **Source:** Monthly Commodity Price Bulletin, UNCTAD (1960-1989, annual and monthly averages)
Coffee2	Brazilian and Other Arabicas, Ex-Dock New York Calibrated in US cents/lb **Source:** Monthly Commodity Price Bulletin, UNCTAD (1960-1989, annual and monthly averages)
Coffee3	Other Mild Arabicas, Ex-Dock New York Calibrated in US cents/lb **Source:** Monthly Commodity Price Bulletin, UNCTAD (1960-1989, annual and monthly averages)
Coffee4	Robustas, Ex-Dock New York. Calibrated in US cents/lb **Source:** Monthly Commodity Price Bulletin, UNCTAD (1960-1989, annual and monthly averages)
Annual Coffee Prices	All coffee traded on the New York exchange, in US cents/lb **Source:** International Financial Statistics Yearbook 1990, IMF (1960-1989, annual averages)
Annual Tea Prices	All tea traded in the London auction, in US cents/lb **Source:** International Financial Statistics Yearbook 1990, IMF (1960-1989, annual averages)

Section 6.2: Coffee Price Fluctuations

To aid in the discussion of coffee price and export fluctuations, seven graphs are included in this section. They reveal the paths of the volume of export, export earnings and unit export prices for coffee from 1960 to 1989. The countries of Brazil (Graphs 6.2.1-6.2.2), Colombia (Graphs 6.2.3-6.2.4) and Kenya (Graphs 6.2.5-6.2.6) are analyzed separately in that order, followed by a final graph which presents the unit coffee prices for all three countries.

BRAZIL

When the first ICA went into effect in 1963, it was to halt the downward decline

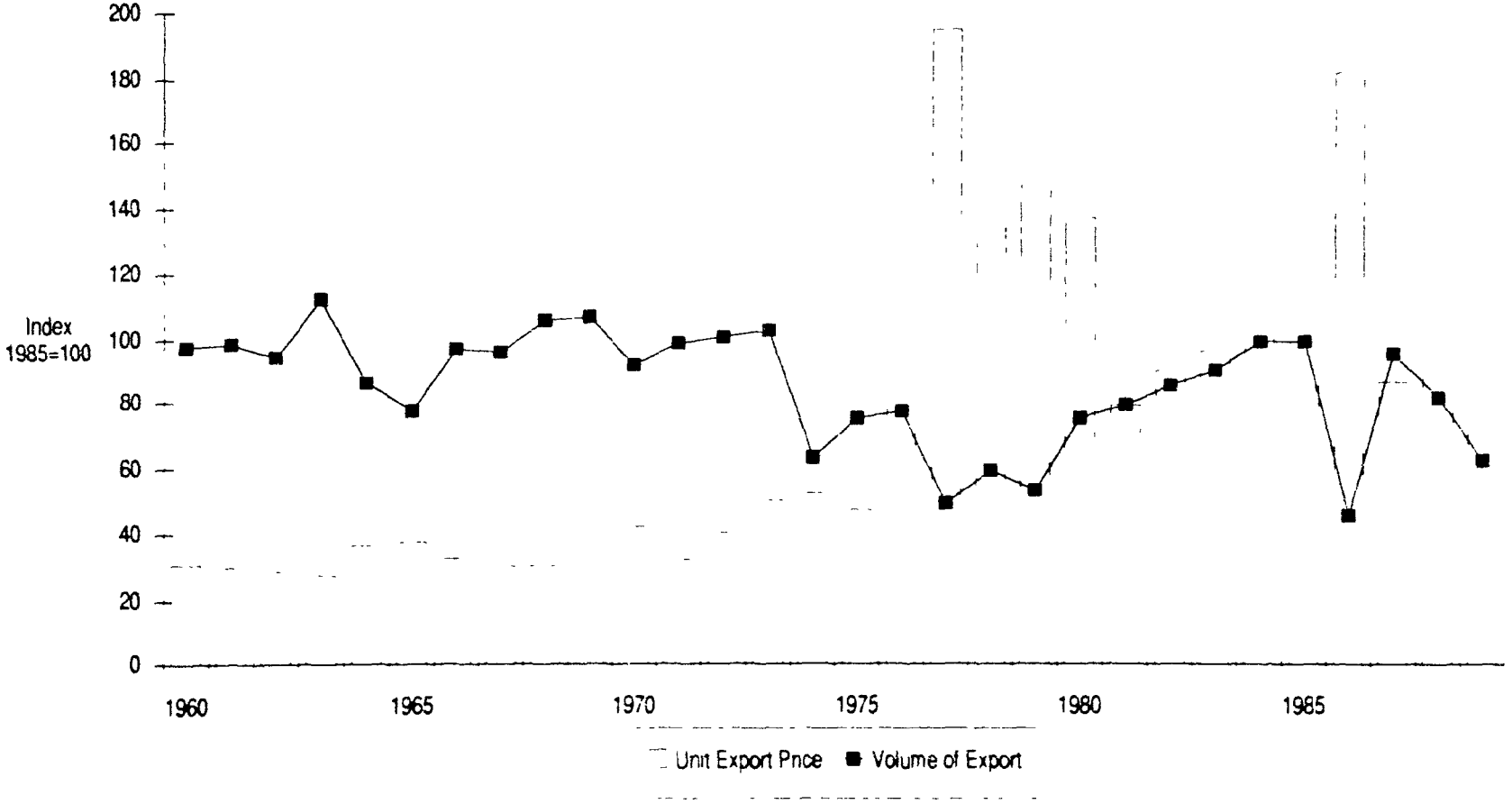
of prices. The graphs seem to indicate that the ICA did raise and maintain prices at a steady level in the period of 1963 to 1972. Export earnings and the volume of export both climbed after 1967, but while export earnings continued to exhibit growth, the general pattern for the volume of export since then has been a downward trend. Possible reasons may be the emergence of new powers in the coffee market, together with the changing pattern of the market itself.

The discussion of the troughs and peaks in Brazil's indicators has been divided into two parts: periods when the quota system was in operation (1964-1972, 1978-1979, 1980-1984 and 1987-1989) and periods when free market conditions prevailed in the world market (namely, 1973-1977 and 1985-1986).

The years of 1964 and 1987 are similar in that both years saw the introduction of an International Coffee Agreement -- the first year of operation of the 1963 ICA in 1964, and the reinstatement of the 1983 ICA in 1987. As indicated by graphs 6.2.1 and 6.2.2, 1964-1965 saw a decrease in the volume of export, and an increase in the unit export price, while export earnings remained stable. With the reintroduction of the quota system in 1987, the 1987-1989 period experienced a fall in the volume of export. There was an increase in the unit export price as in the 1964-1965 period, but unlike the earlier period, export earnings exhibited an overall decline. Though the recovery in export prices in 1987-1989 was much greater than the increase in export prices in 1964-1965, the sharp decline in volume of export in 1987-1989 offset the rise in unit export prices, causing a fall in export earnings.

Though the years of operation of the quasi-cartel Pancafe (1978-1979) and the period when the new quota system was in effect (1980-1984) should reveal similar effects in the indicators under discussion, the graphs show evidence to the contrary. Under Pancafe, the volume of export and export earnings declined while unit export prices increased. In the period 1980-1984, unit export prices fell below 1980 levels, while both the volume of export and export

Graph 6 2 1. Brazil
Unit Export Price & Volume of Export vs. Time



Graph 6.2.2
Brazil Export Earnings vs Time

earnings increased. This leads to the conclusion that under Pancafe, the drop in the volume of coffee exported was greater than the slight increase in price, causing a fall in export earnings However, when the quota system was in operation, the increase in volume exported offset the decrease in export prices, and led to an overall increase in export earnings The intermediate year of 1979-1980, the last year of operation of Pancafe, is seen to exhibit the same phenomenon as under the quota system That is, a slight fall in prices is accompanied by a large rise in the volume exported, and an increase in export earnings from 1800 to 2400 million US dollars

In 1973, the ICO failed to arrive at new quota regulations and free market conditions prevailed till 1980 Export earnings had reached a new peak of 102 million US dollars in 1970, and the volume of export increased till it plunged by forty units in 1973 The period of 1971-1973 was one where world coffee prices were low, and as expected, the sharp decline in Brazil's volume of export in 1973 caused unit export prices, and world prices, to increase during 1973 and 1974. Overall, the 1973-1975 period experienced a sharp decline in volume exported, so much so that the increase in unit export prices did not permit recovery of export earnings, which continued to fall till 1975

There are several similarities between the two other periods (1975-1977 and 1985-1986), and the one just discussed All three periods saw the coffee market operated under free market conditions with no quota restrictions The years 1975 and 1985 both experienced supply side shocks in the forms of a severe frost in Brazil in 1975 and a drought in 1985 Both natural disasters led to large drops in the volume exported Consequently, the unit export prices in the following years of 1977 and 1986 reached unprecedented peaks In addition, the periods of 1973 1975 and 1985-1986 both experienced the same movement in the indicators, with decreases in volume exported and export earnings, and increases in unit export price

The period of 1975-1977 also encountered decreases in the volume exported and

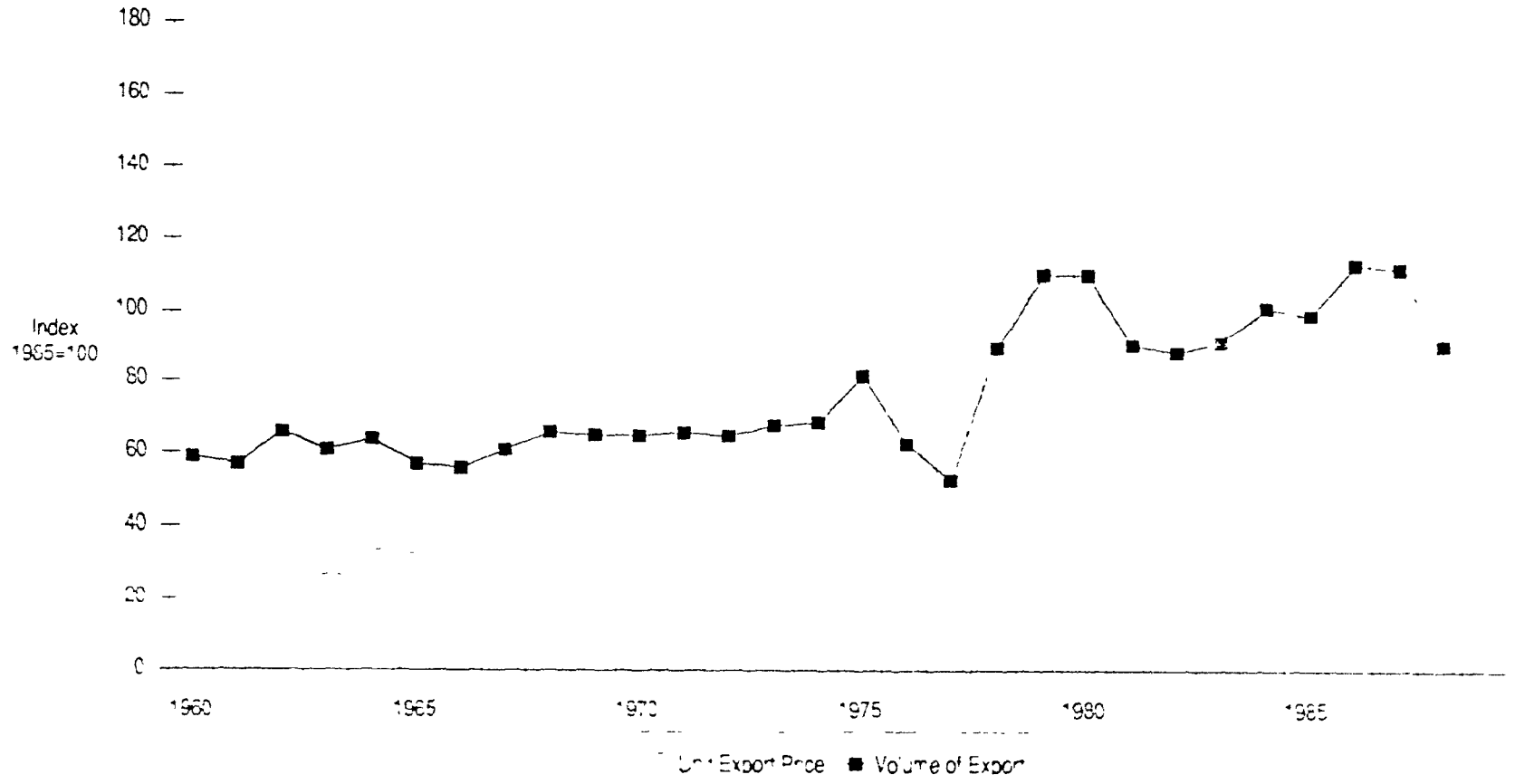
increases in unit export price, but unlike the 1985-1986 period, export earnings showed an overall increase. The drought that hit Brazil in 1985 caused an overall drop in export earnings during the 1985-1986 period due to the dramatic decrease in volume exported. Whereas, in 1975-1977, the fall in volume exported was overshadowed by the significant rise in unit export price, causing export earnings to peak in 1977.

COLOMBIA

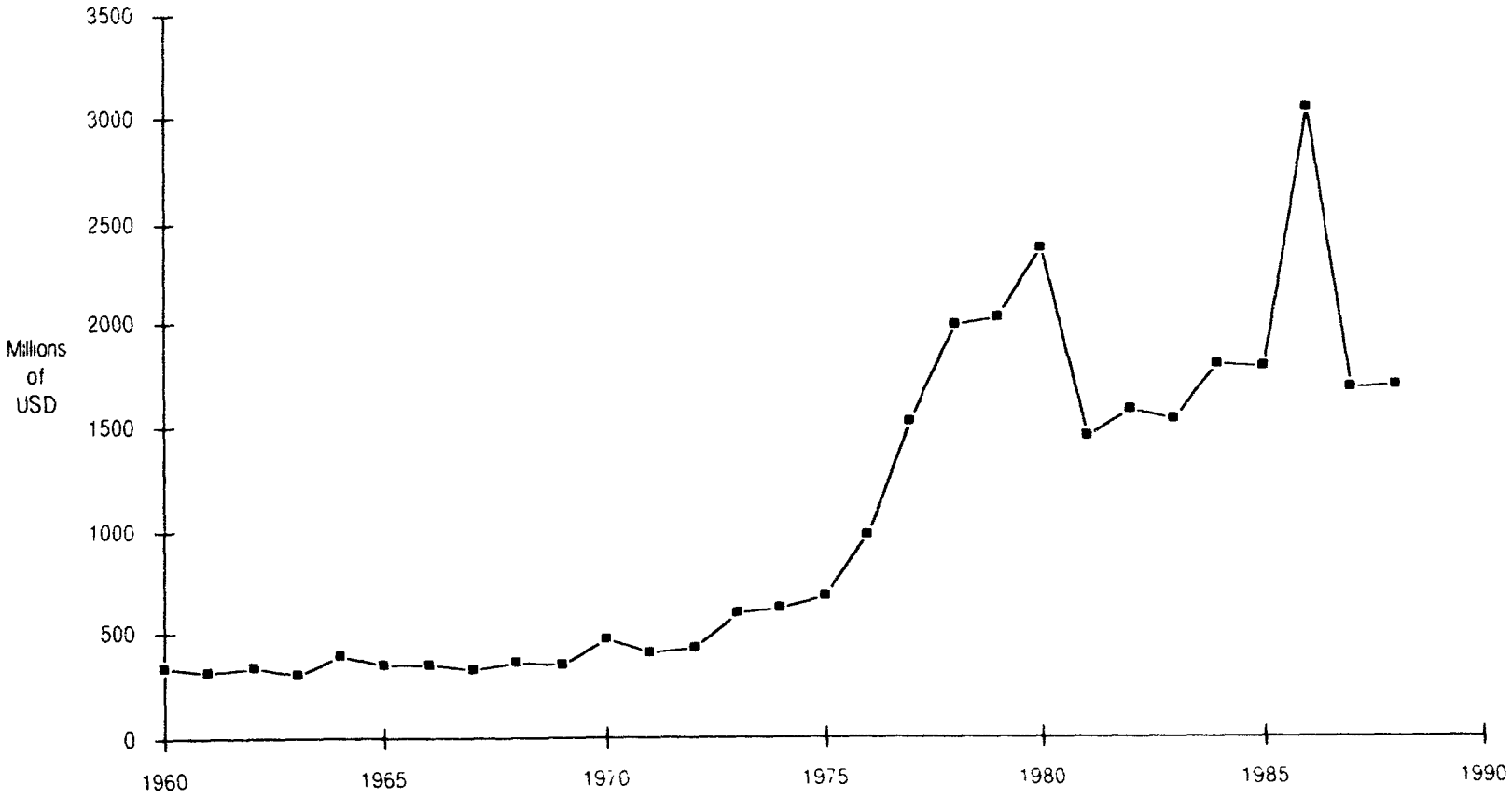
Though the ICA was successful in raising and maintaining stable prices from 1966 to 1972, Colombia exhibited fairly stable export prices and earnings from 1960 to 1972, as shown in Table 6.2.3 and Table 6.2.4, respectively. Unlike Brazil, Colombia's volume of export exhibits, in general, an upward trend, while export earnings, as in Brazil, show steady growth. As in the case of Brazil, the discussion can be divided between periods when quota systems were operational (1980-1984 and 1987-1988) and periods when they were not (1973-1975, 1975-1977, 1980-1984 and 1978-1979).

With the suspension of the quota system in 1973, export earnings showed a steady increase in the 1973-1975 period. The volume of exports showed a slight increase for this period, while unit export prices also increased. This scenario corresponds closely to that for the period of 1985-1986, when the drought in Brazil in 1985 pushed world prices so high that the ICO suspended quotas. Colombian export prices peaked in 1986 as did the volume exported, sending export earnings soaring to 2800 million US dollars. Following the frost in 1975 in Brazil, the third period (1975-1977) saw the coffee market operating under free market conditions. Export earnings increased, though for different reasons. There was also a frost in Colombia, which affected production and caused a reduction in the volume of coffee exported from that country. However, the accompanying increase in unit export prices offset the decline in exports and produced an increase in Colombia's export earnings. Even during the operation of Pancafe, in the

Graph 6.2.3: Colombia
Unit Export Price & Volume of Export vs Time



Graph 6.2.4
Colombia Export Earnings vs Time



1978-1979 period, the Colombian coffee market exhibited stable export prices and volume of export, with a slight increase in export earnings

In 1980, the new quota system became effective The period of 1980-1984 witnessed a sharp decline in both the volume of export and export earnings, with unit export prices also decreasing below 1980 levels However, after 1982, both export earnings and the volume of export showed a steady increase, peaking in 1986, when export earnings reached 2800 million US dollars With the reestablishment of the quota system in 1987, Colombia's volume of export exhibited a decrease to 1982 levels, while unit export prices increased somewhat, maintaining export earnings around 1600 million US dollars

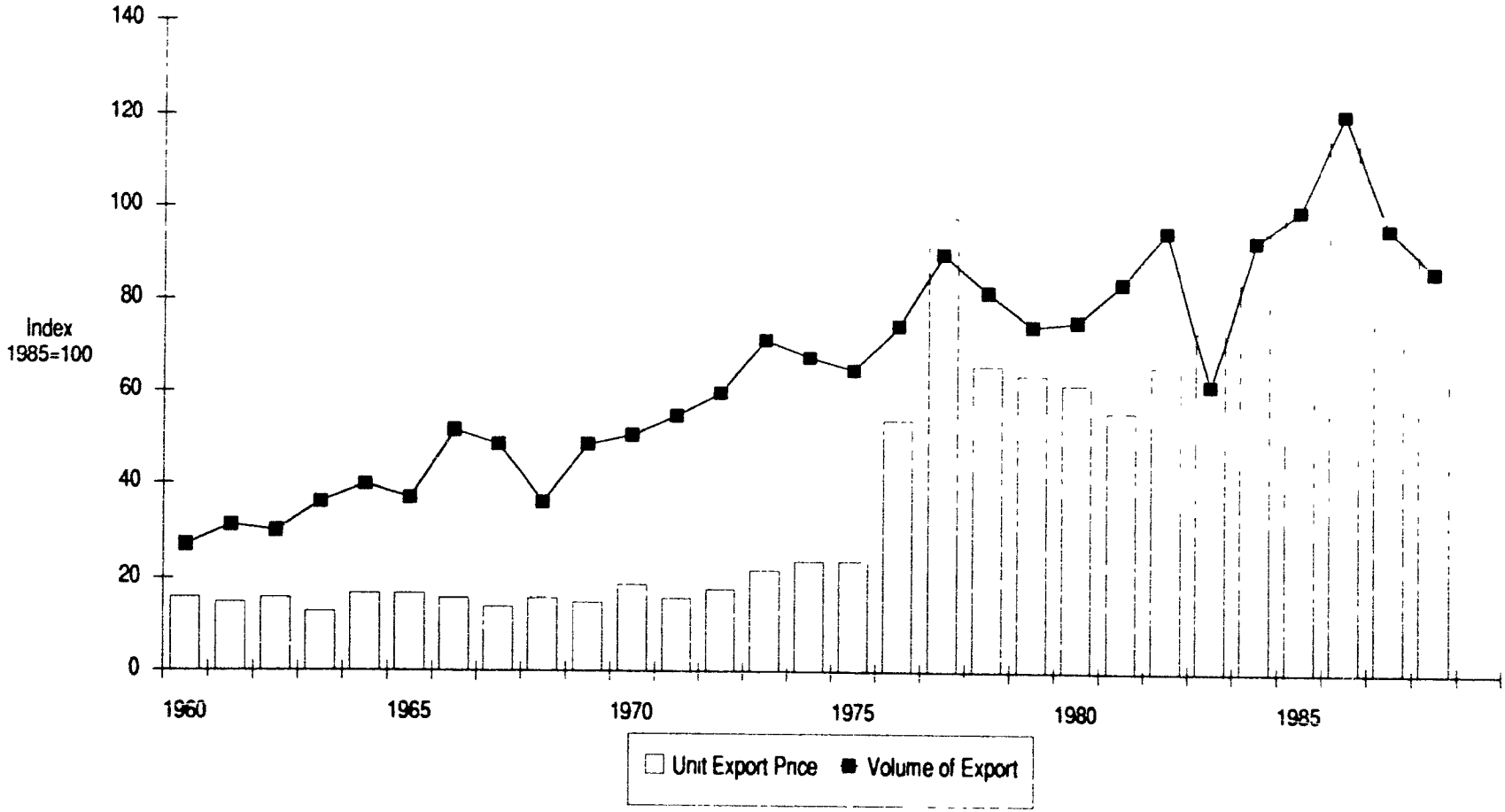
In conclusion, the historical evidence would seem to indicate that the Colombian coffee market thrives under freer market conditions

KENYA

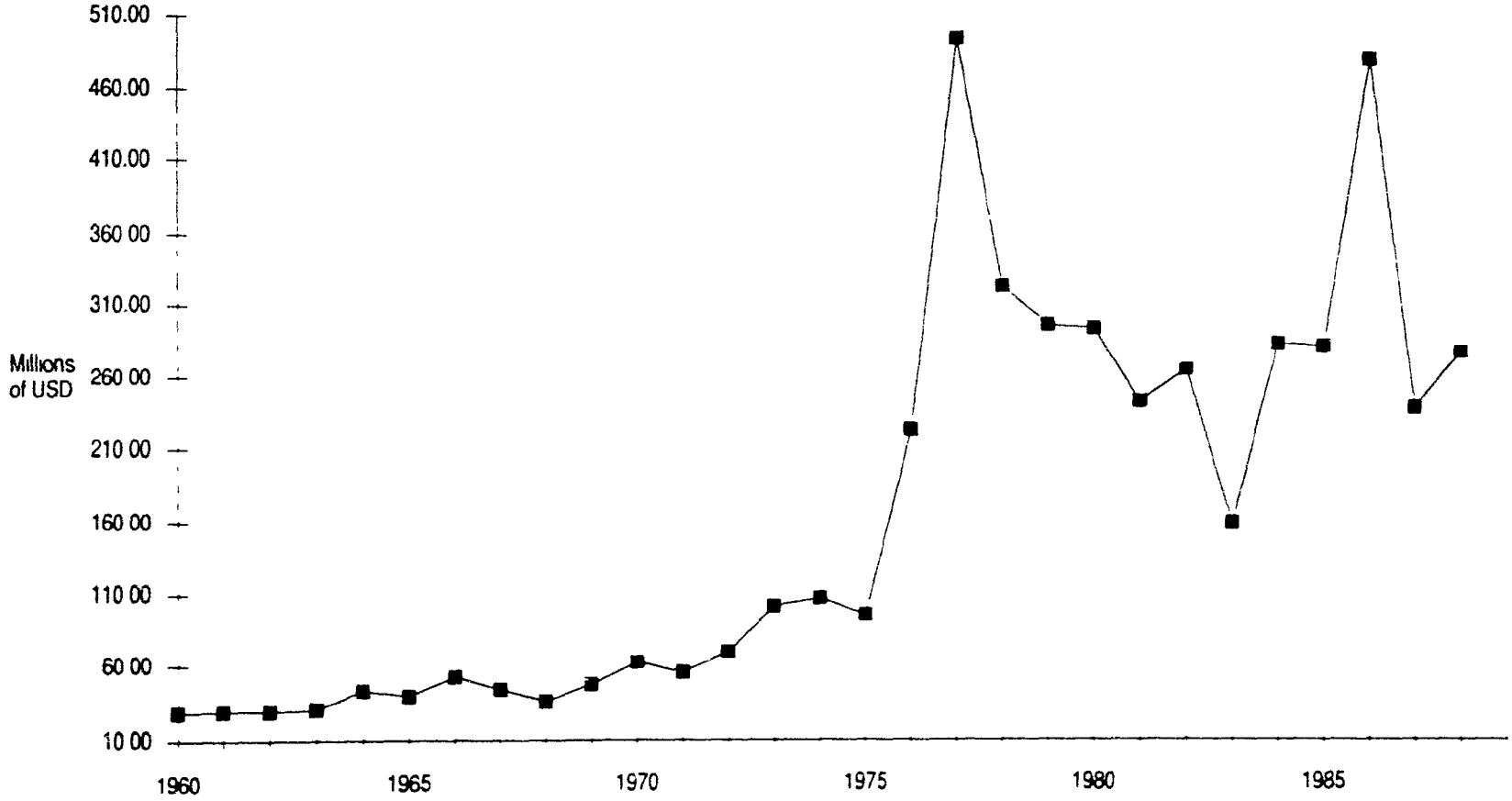
The export earnings for coffee in Kenya, Graph 6 2 6, show remarkable similarity to that of Colombia (Graph 6 2 4) As in Colombia, Kenya's export earnings for coffee remained steady till 1973, while the volume of export clearly exhibits an upward trend, with unit export prices remaining fairly constant till 1975

Under free market conditions, two periods 1973-1975 and 1978 1979 are unique in that they showed a decrease in export earnings Between 1973-1975, export prices remained stable while the volume exported declined, causing a fall in export earnings 1978 saw the formation of quasi-cartels to stabilize the price of coffee Kenya, being a newcomer, was not part of any of these qausi-cartels, and thus experienced reductions in export earnings, volume of export and unit export prices The frost and a drought in Brazil in 1975 and 1985, respectively, both caused sharp increases in volume exported and export earnings, with export earnings peaking in

Graph 6.2.5 Kenya - Coffee
Unit Export Price & Volume of Export vs Time



Graph 6.2.6 Kenya
Coffee Export Earnings vs Time



1977 at 500 million US dollars and, in 1986, at 480 million US dollars [2] Such peaks are not surprising since increased Brazilian coffee prices caused higher international prices, which corresponded to a period of increased production in Kenya

Following the 1976-1977 boom in coffee prices, the area sown with coffee increased dramatically, causing coffee production in Kenya to also rise sharply In addition, 1980 saw the reintroduction of the quota system These two factors explain the peak in the volume of exports in 1982 The consequent drop in the volume of export in 1983 can be attributed to a higher incidence of disease in some areas of Kenya, coupled with unfavourable agroclimatic conditions in other districts

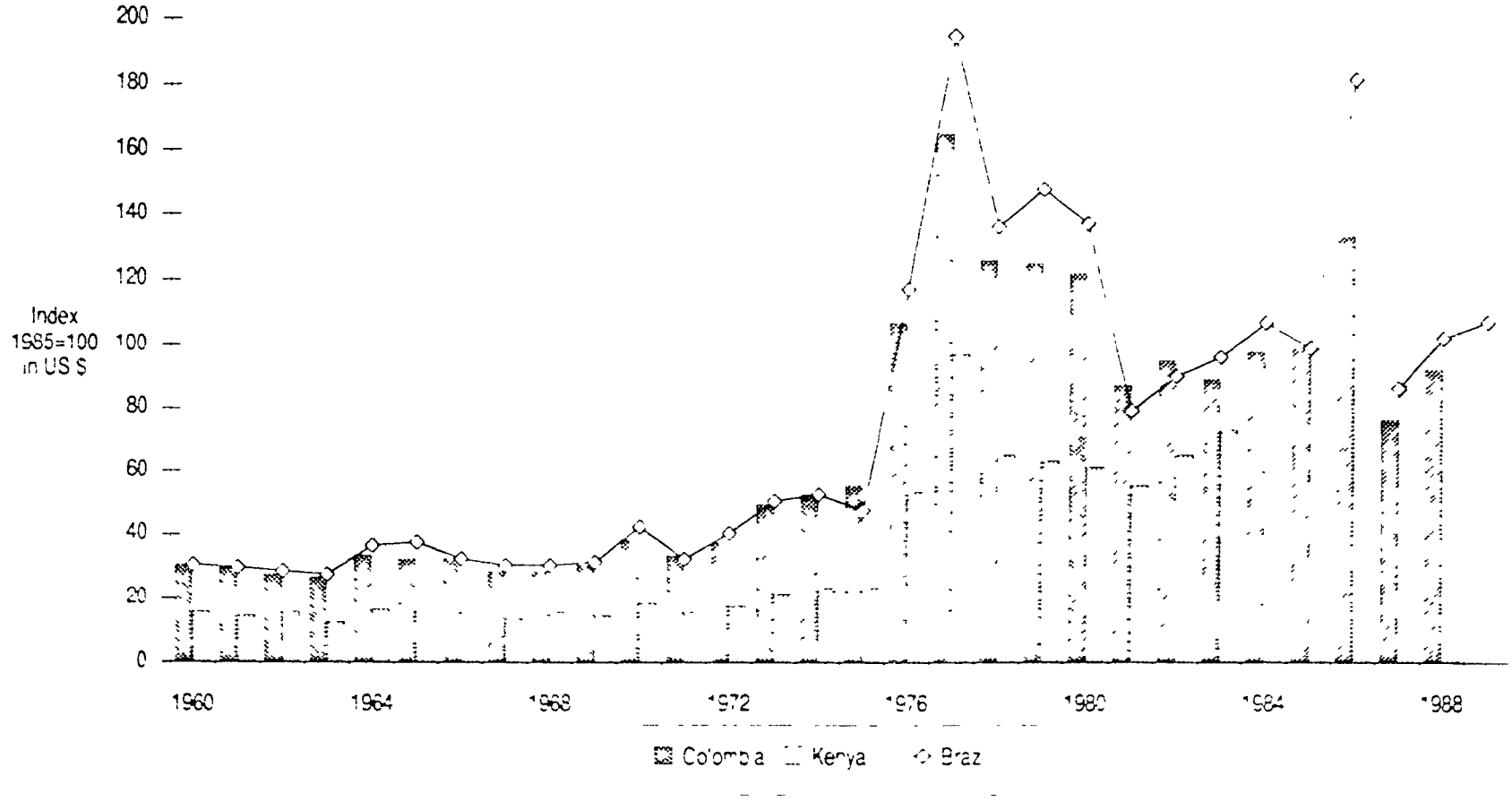
The fourth ICA became effective in 1983, and under the new quota system, Kenya was given generous quota blocks as reflected in higher export prices, volume of export and export earnings in the period of 1983-1984 The period of 1987-1988 saw an overall increase in export prices accompanied by a drop in volume exported However, the significant increase in export prices more than compensated for the decline in volume exported and led to a recovery in export earnings

BRAZIL, COLOMBIA and KENYA

Graph 6 2 7 seems to indicate Brazil to be the market leader in the coffee industry till the late 1980s Up to 1976, Colombia's export price closely follows the lead of Brazil's prices, with each peak and trough in Colombia's prices imitating Brazil's prices However, in 1977, Colombia's peak export price was well below Brazil's prices, (forty points), and continued to be so until 1981 Meanwhile, Kenya's unitised export price remained below that of Colombia's up to 1981, from where it climbed steadily to overshadow Colombia in 1986, and Brazil in 1988 The phenomenal rise in Kenyan export prices and the fall in Brazilian and Colombian prices may

[2]Period averages of exchange rates were used to convert shillings to US dollars. See Appendix 6.1.

Graph 6 2 7
Coffee Unit Prices vs Time



be due to several reasons

Beginning with the first ICA in 1963, and continuing on to this day, traditional coffee growers and newcomers to the market have been waging a continuous battle over the allocation of quotas Shifting world demand and the increase in productive capabilities in countries like Kenya have merely succeeded in adding 'fuel to the fire' Colombia and Brazil supply higher quality coffees to the world market but the popularity of instant coffees which use lower quality coffees, in the late 1970s and 1980s, have helped in increasing the market shares of countries like Kenya In addition, the late 1980s have seen the rising popularity among roasters using mild Arabicas, in the lower quality range, in their instant coffee blends, which led to a distinct improvement in quality Thus, the growing importance of lower quality coffees in favour of high quality Brazilian and Colombian blends has led to a decline in the price premia of the latter

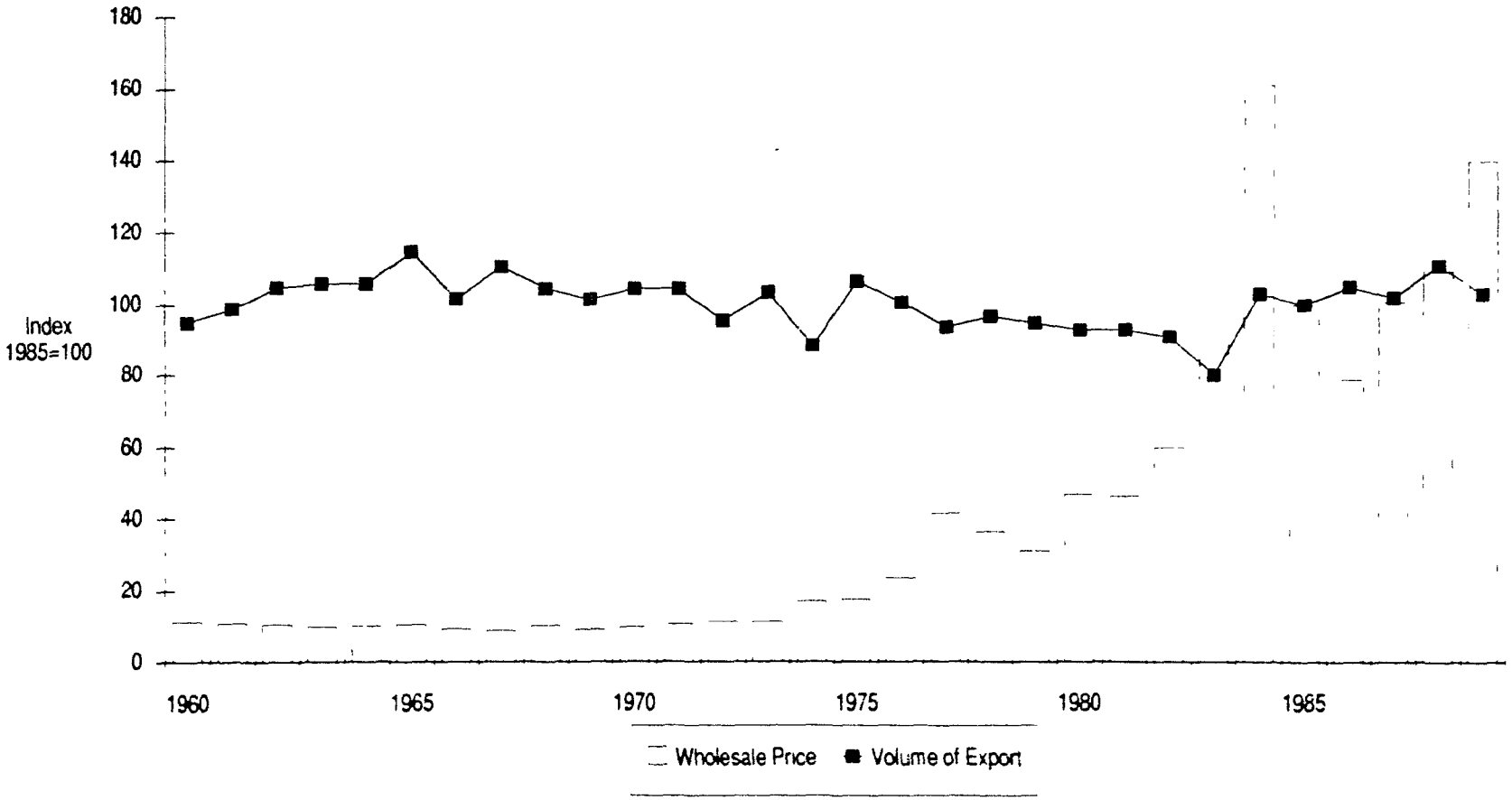
Section 6 3 Tea Price Fluctuations

As in section 6 2, there are six graphs in this section to aid in the discussion of tea market prices and export fluctuations The countries of Sri Lanka (Graphs 6 3 1-6 3.2) and Kenya (Graphs 6 3 3-6 3 4) represent, respectively, the traditional and the new power in the international tea market They are presented in that order, followed by two other graphs. The first of these, Graph 6 3 6, describes the wholesale price modulations for India, Sri Lanka and Kenya over the period of the study, and the other, Graph 6 3 7, is a representation of all teas, as traded on the London auction

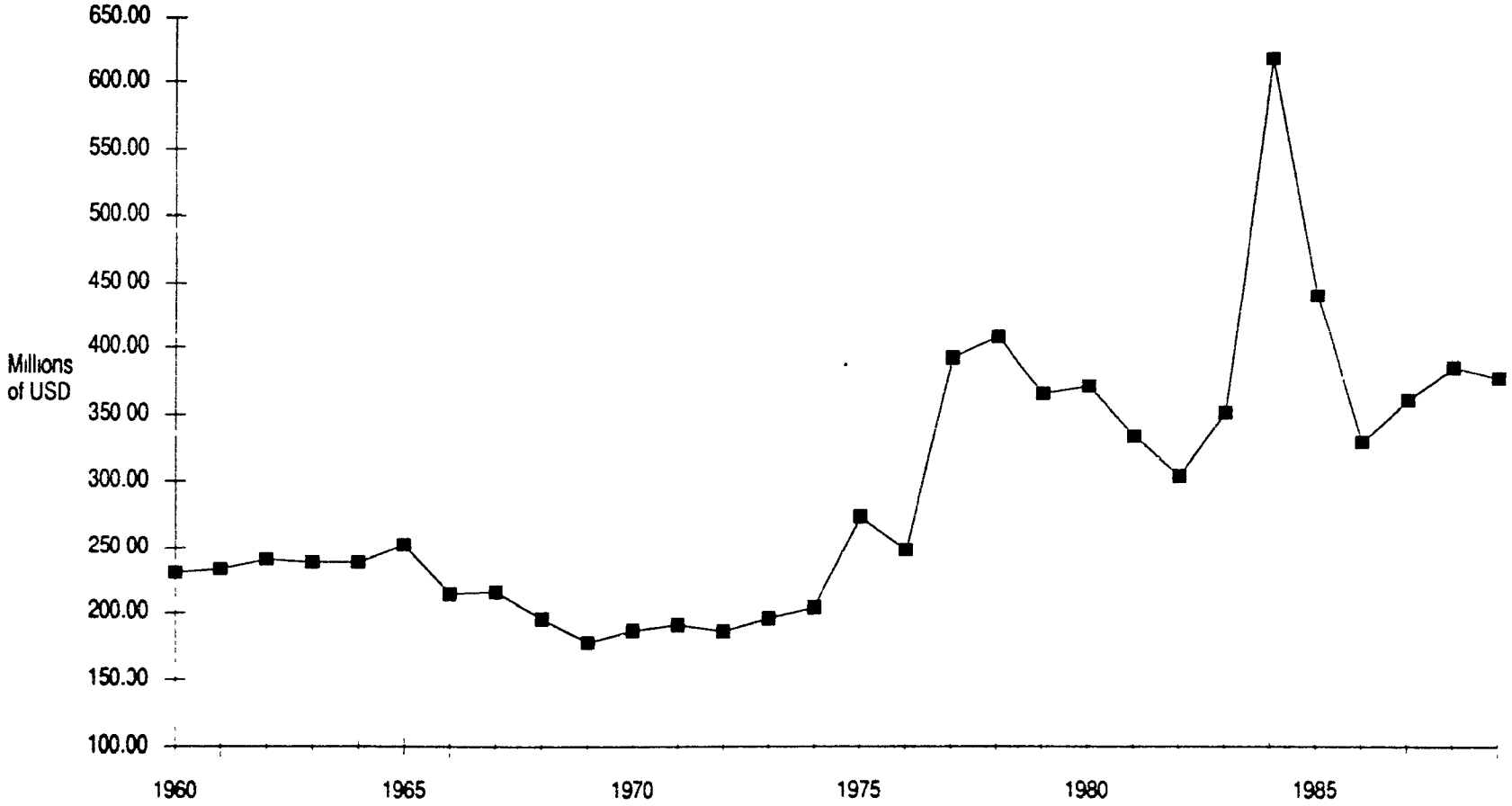
SRI LANKA

The Sri Lankan volume of export from the 1960s to 1989 is characterised by a continuous series of small peaks and troughs. In comparison, export earnings remained stable till

Graph 6.3.1: Sn Lanka - Tea
Wholesale Export Price & Volume of Export vs. Time



Graph 6.3.2: Sri Lanka
Export Earnings vs. Time



1975, and then climbed steadily to peak in 1984 at 640 million US dollars (15000 million rupees).[3] Wholesale export prices also remained steady till 1975, after which they exhibit a general upward trend

Within the 1970s, a peak in wholesale export prices occurred in 1977, and the growth in export earnings peaked in 1978 at 420 million US dollars. Between 1979 and 1982, export earnings remained fairly stable at around 320 million US dollars, while wholesale prices started a steady climb upwards to peak in 1984 at an all-time high level. The volume of export steadily declined from 1975 prior to a setback in 1983.

At UNCTAD's Geneva meeting in 1982, a working framework for an International Tea Agreement emerged Those major producers who participated agreed to reduce quotas in order to raise the depressed level of world tea prices In addition, civil and ethnic unrest in Sri Lanka erupted in 1983 in a series of terrorist activities, which adversely affected production. The combination of the two factors sent the volume of exports plummeting in 1983 but wholesale prices and export earnings rose rapidly in 1984. Another factor which might have boosted earnings and prices in Sri Lanka between 1983 and 1985 was India's governmental intervention in these years. In 1984, the Indian government ordered that at least seventy percent of all tea had to be sold through the auction centres Control measures, like the ban on CTC grade exports and the introduction of a minimum export price between 1983 and 1985 might also have given an unintended boost to the export efforts of competitors like Sri Lanka.

By 1984, the index of the volume of tea exports had climbed twenty-four points, and continued to climb very modestly in a short series of peaks and troughs. After 1984, export earnings and wholesale prices declined to a trough in 1986, after which both variables resumed an upward trend Export earnings dropped to 320 million US dollars in 1986 and ended the

[3]Period Averages of exchange rates were used to convert Rupees to US dollars See Appendix 6.1.

period, in 1989, at 380 million US dollars. Wholesale prices showed a steady increase to peak in 1989 at a level unseen since 1984. The cause of this boom in 1989 was the earlier disaster in Chernobyl in 1986. The accident seriously affected Soviet production so that the USSR was forced to turn to the international market. By 1989, it had emerged as the largest buyer in the international market.

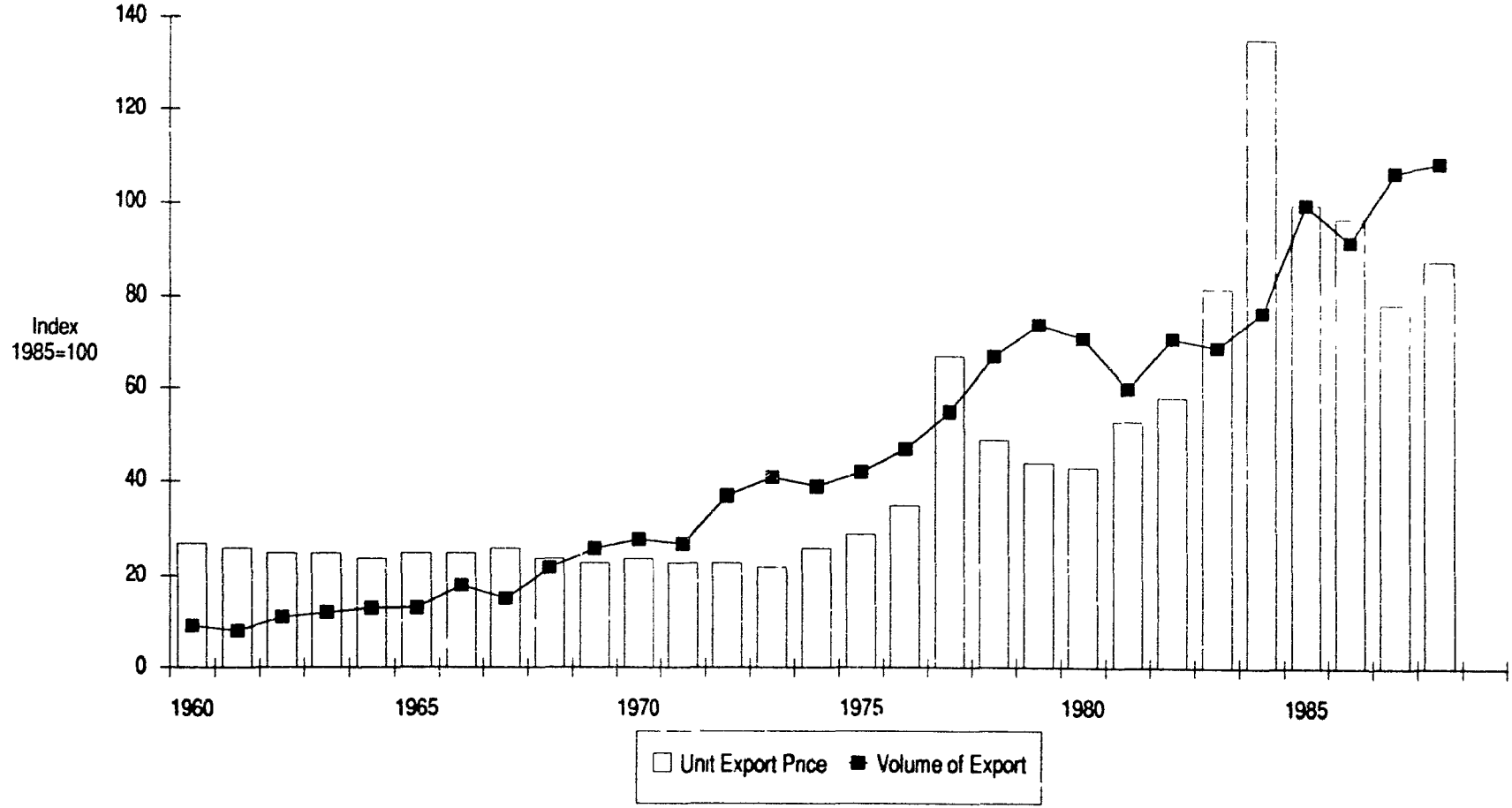
KENYA

Unlike Sri Lanka, Kenya's volume of export from the 1960s to 1989 clearly exhibits a persistent upward trend, with an increase of 107 units over the period. Export earnings show exponential growth while unit export prices, after remaining stable till 1973, also exhibits a general upward trend. The steady growth in Kenya's export is due to the type of tea that Kenya produces. A large component of the Kenyan teas for export fall into the category of low quality or 'common' teas, ideal for use in tea-bags. With the continuing popularity of tea-bags, the export potential for countries like Kenya seems highly favourable.

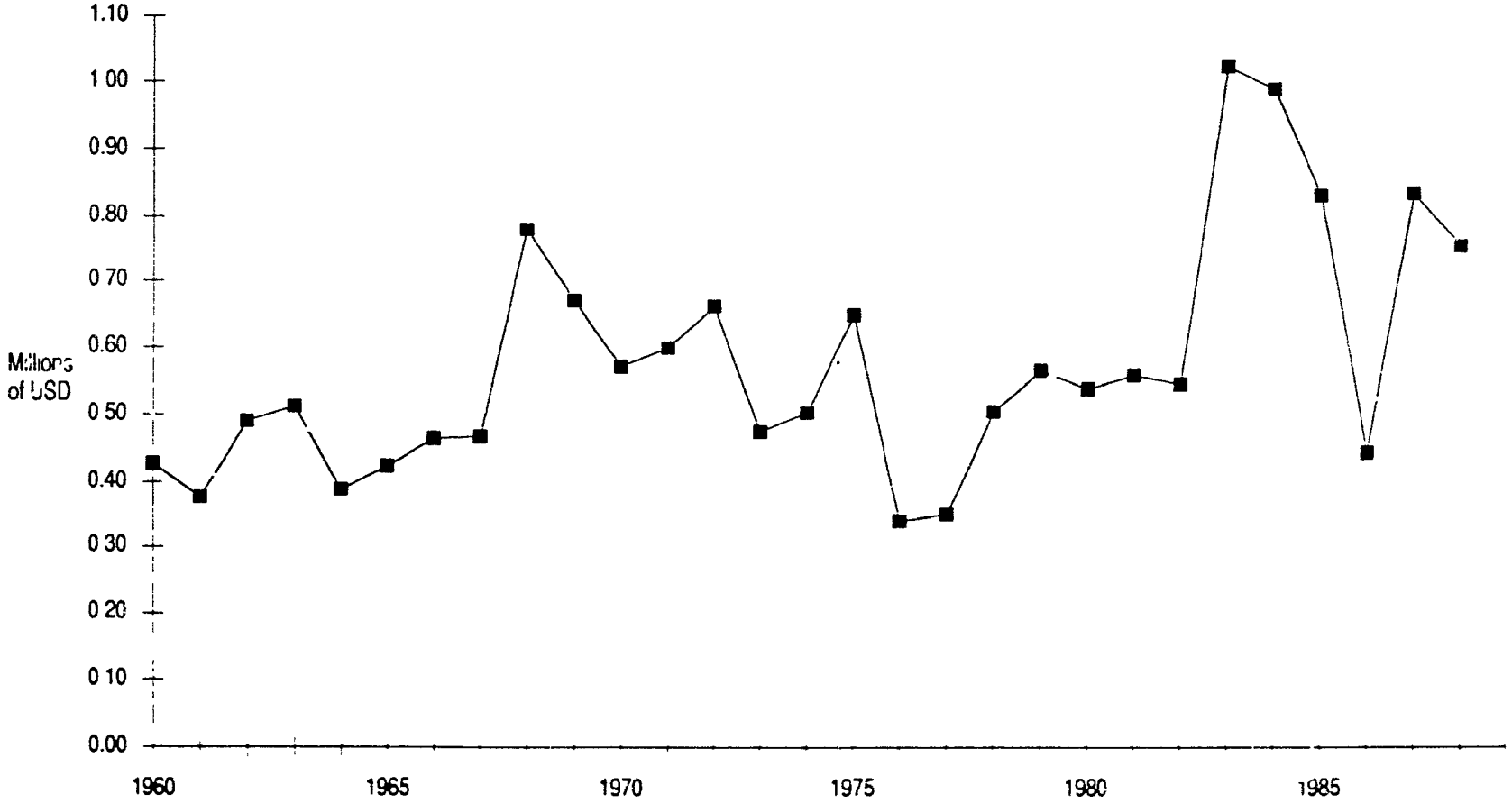
As before, 1977 saw a peak in unit export prices, while export earnings dropped to 350 thousand US dollars. Though unit prices dropped in 1978 and continued falling till 1980, the level of unit prices were higher in the 1970s than in Sri Lanka. This is mainly due to two factors. Firstly, Kenyan tea exports, after 1975, were of the CTC grade and the 1970s and 1980s saw CTC global exports gaining at the expense of the Orthodox teas. Secondly, there was a steady increase in Kenya's tea area and production during the period from 1971 to 1982. This enabled Kenya to increase exports at favourable prices.

Following the Geneva meeting in 1982, there was a slight drop in the volume of exports, and a major recovery in export prices which climbed to a peak in 1984. Export earnings also peaked in 1984, reaching 1000 million US dollars. The ban on CTC exports by the Indian government in 1984, coupled with the fact that most of the Sri Lankan export crop is of the

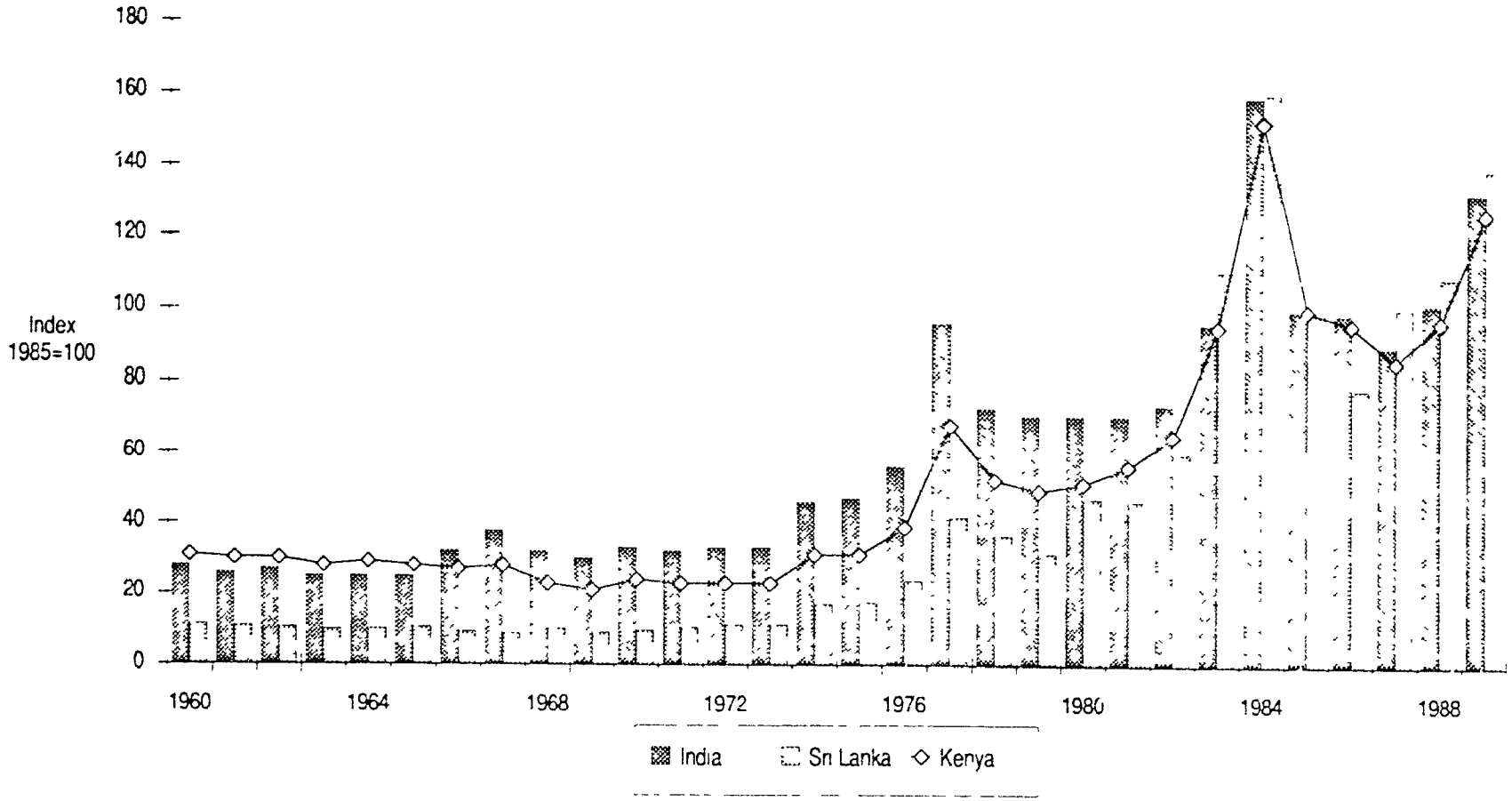
Graph 6 3.3: Kenya - Tea
Unit Export Price & Volume of Export vs Time



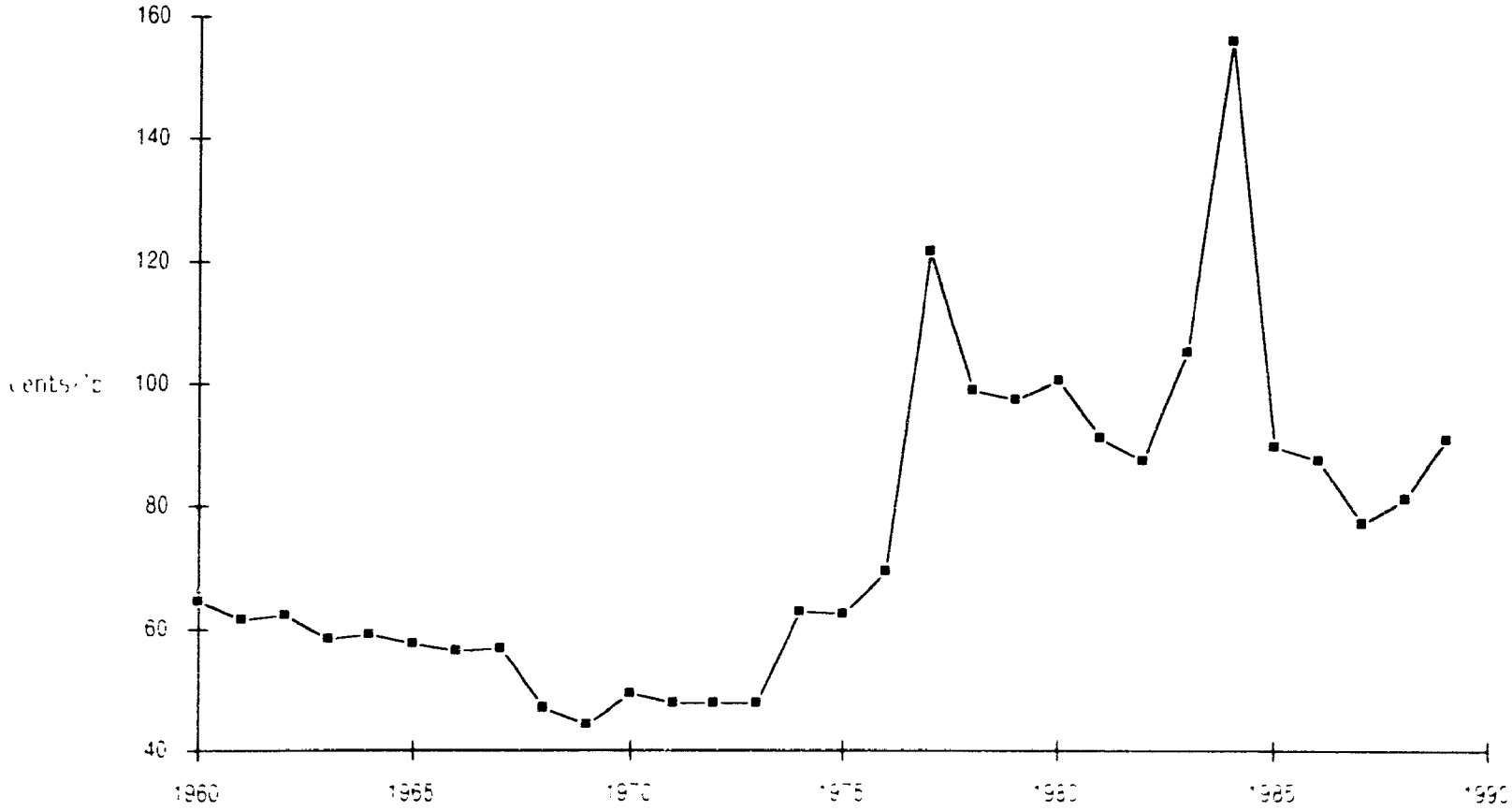
Graph 6.3.4: Kenya
Tea Export Earnings vs. Time



Graph 6.3 5
Tea Wholesale Prices vs. Time



Graph 6 3 6
Average Auction London Tea Prices vs Time



Orthodox grade, helped in causing the dramatic jump in the export earnings and unit prices for Kenya in 1984

Though the Chernobyl accident did raise world tea prices, as reflected in the high levels of export prices for Kenyan teas in 1986, prices fell in 1987, only to recover slightly in 1988. Export earnings also declined till 1987, and the volume of export, after peaking in 1985, fell again in 1986. Since the Soviet market is mostly comprised of the Orthodox grade, it is understandable that Kenyan teas would not benefit much from the Soviet mishap.

Although data were unavailable for 1989, the FAO reports that due to growing conditions and new plantings, this was a boom year for Kenyan tea exports, with export prices reaching 1988 levels.

KENYA, INDIA and SRI LANKA

Indian and Kenyan wholesale export prices followed each other closely till 1966, when Indian export prices began to overshadow Kenya's prices (Graph 6.3.5). Wholesale export prices for Indian tea continued to dominate the market until 1983, when Sri Lankan export prices gained the 'upper hand'. Though wholesale prices for Kenyan export of tea had lagged markedly behind those of India, after 1980 they climbed steadily to compete favourably with Sri Lankan export prices. 1987 was the only year after 1983 when Sri Lankan export prices fell below those of India and Kenya, though it ended 1989 at levels above that of both these countries.

Though global exports are still dominated by the Orthodox grade, the changing ratio in the Orthodox/CTC breakup throughout the last three decades accounts for this reversal of relative prices. The share of CTC in total production increased from 32.7% during 1967-1969 to 41.3% in 1977-1979, and then to 46.7% in 1987-1989.[4]

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[4]See Tea Industry, A Special Feature, Business Standard, April 1990, Ananda Bazaar Patrika, Calcutta, p. 41.

Section 6.4: Fluctuations Among Different Coffee Types

The patterns of growth for the prices of four different types of coffee (the Colombian Mild Arabicas, Brazilian and Other Arabicas, Other Mild Arabicas, and Robustas), as traded on the New York exchange, are first analyzed. Henceforth, the four types will be referred to as coffee 1, 2, 3 and 4, respectively. The evolutions of their prices are reproduced on graphs 6.4.1 through graphs 6.4.4. The next graph deals with the patterns of seasonality that might occur in the prices for these types of coffee. Finally, this section concludes with an analysis of annual coffee and tea prices as traded on the New York exchange and the auction centre in London.

DISCUSSION OF COFFEE TYPES

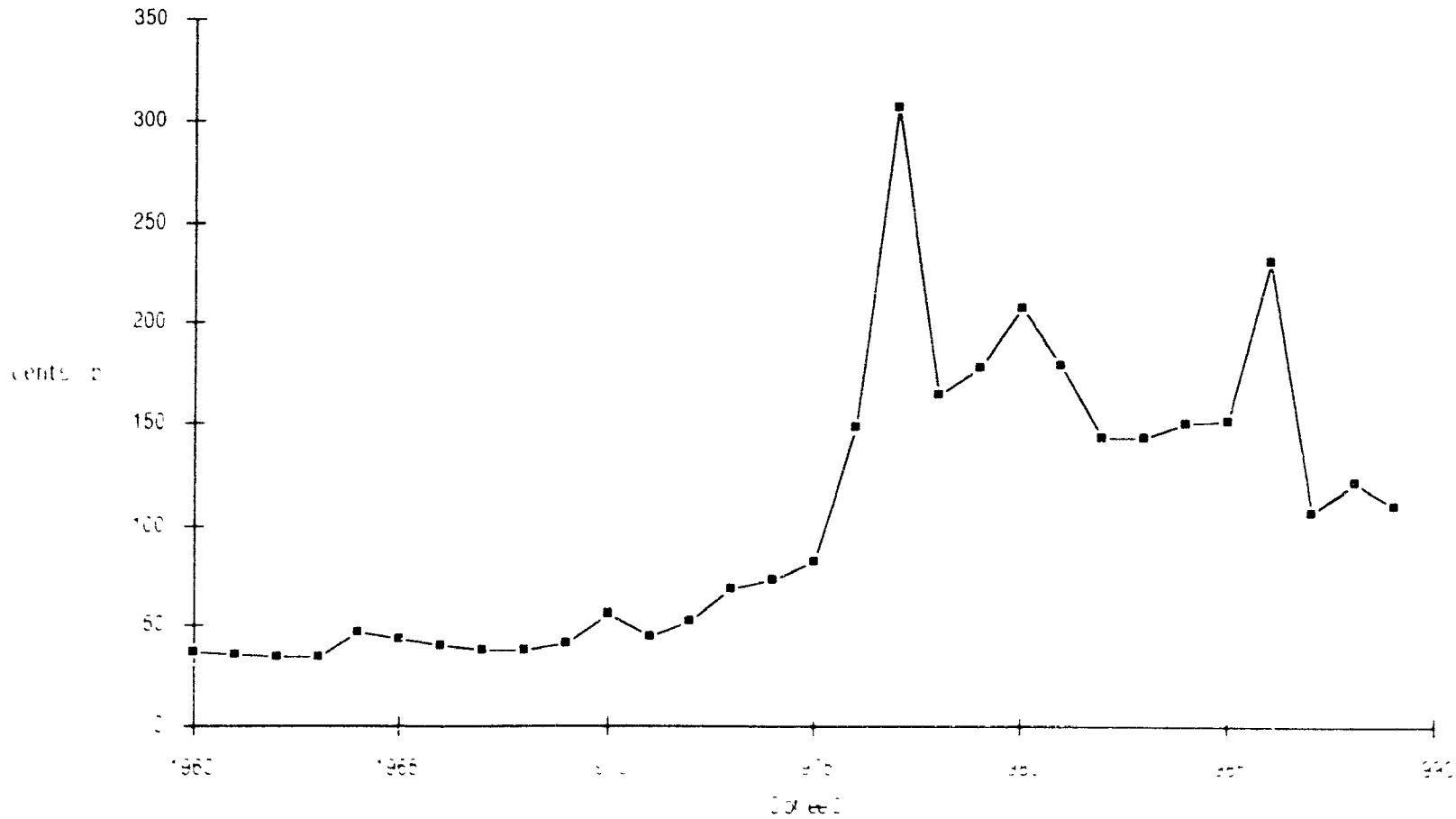
In general, all four coffee types seem to follow a similar pattern since the beginning of the 1960s. Coffee prices remained fairly stable until 1969, rose steadily to a peak in 1977, and then followed a downward trend through the 1980s, apart from a sharp increase in 1986. Coffee1, Coffee2 and Coffee3 all began the 1960s around 40 cents/lb., and ended 1975 at prices ranging between 60 cents/lb. and 80 cents/lb. In contrast, Coffee4 sold for 30 cents/lb. in 1960 and climbed to 60 cents/lb. in 1975. The boom in coffee prices in 1977 had the largest impact on the prices of Coffee2, which reached a peak price of 300 cents/lb.

The initial drop in prices after 1977 was also highest for Coffee2, with a fall of 140 cents/lb. Coffee4 following with a decline of 80 cents/lb., and the smallest decline in prices occurred in Coffee1 at 60 cents/lb. Although prices continued at a downward trend for all coffee types, there was a slight recovery in 1980, when the price of Coffee2 exhibited the largest increase and that of Coffee1 the smallest. The premium Brazilian and Colombian coffees exhibit more price volatility than the other types of coffee.

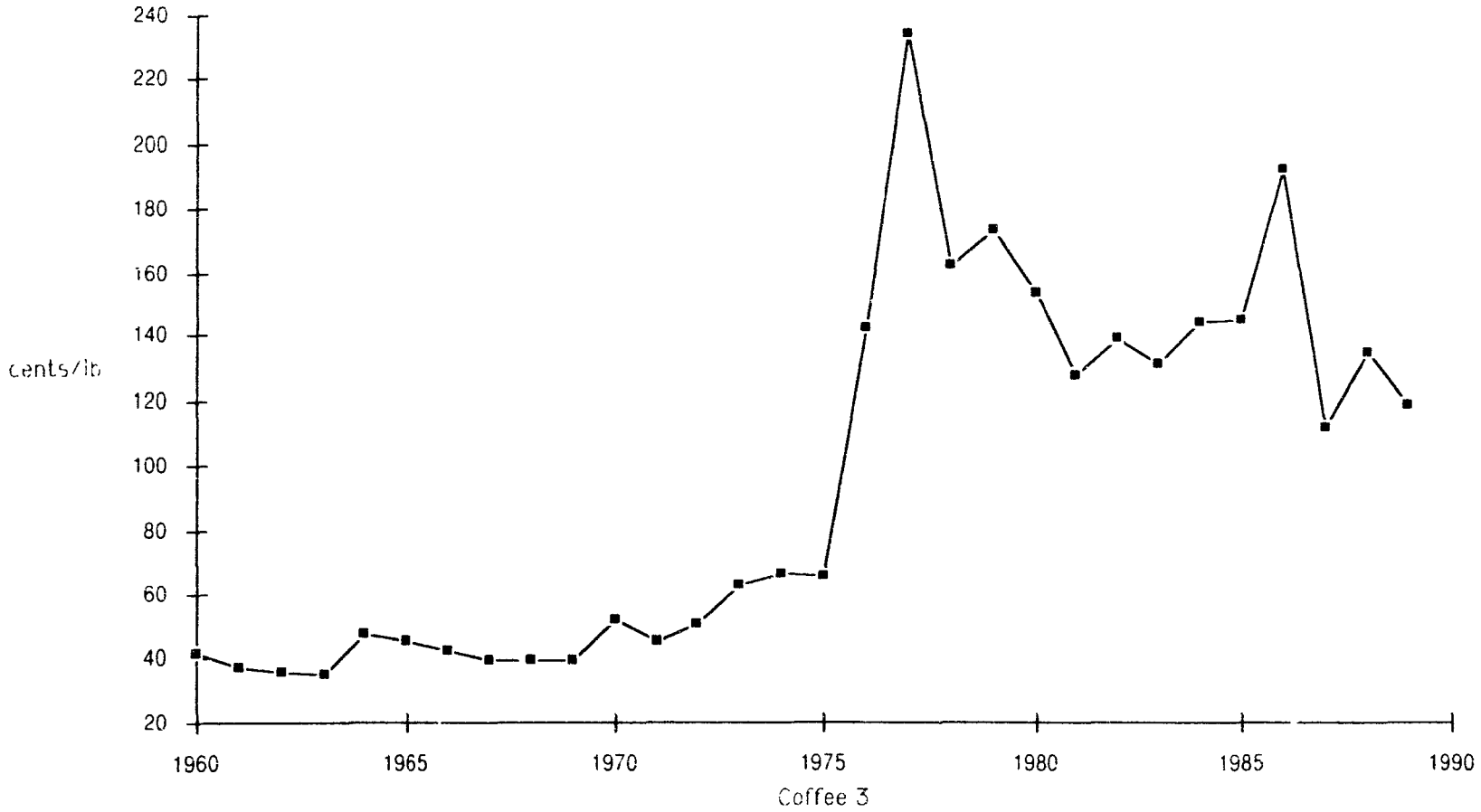
For all the coffee types, the period between 1978 and 1985 was characterized first by further declines in prices and then by modest stability. The growing popularity of mild

Graph 6 4 1
Colombian Mild Arabicas (Ex-Dock) vs Time

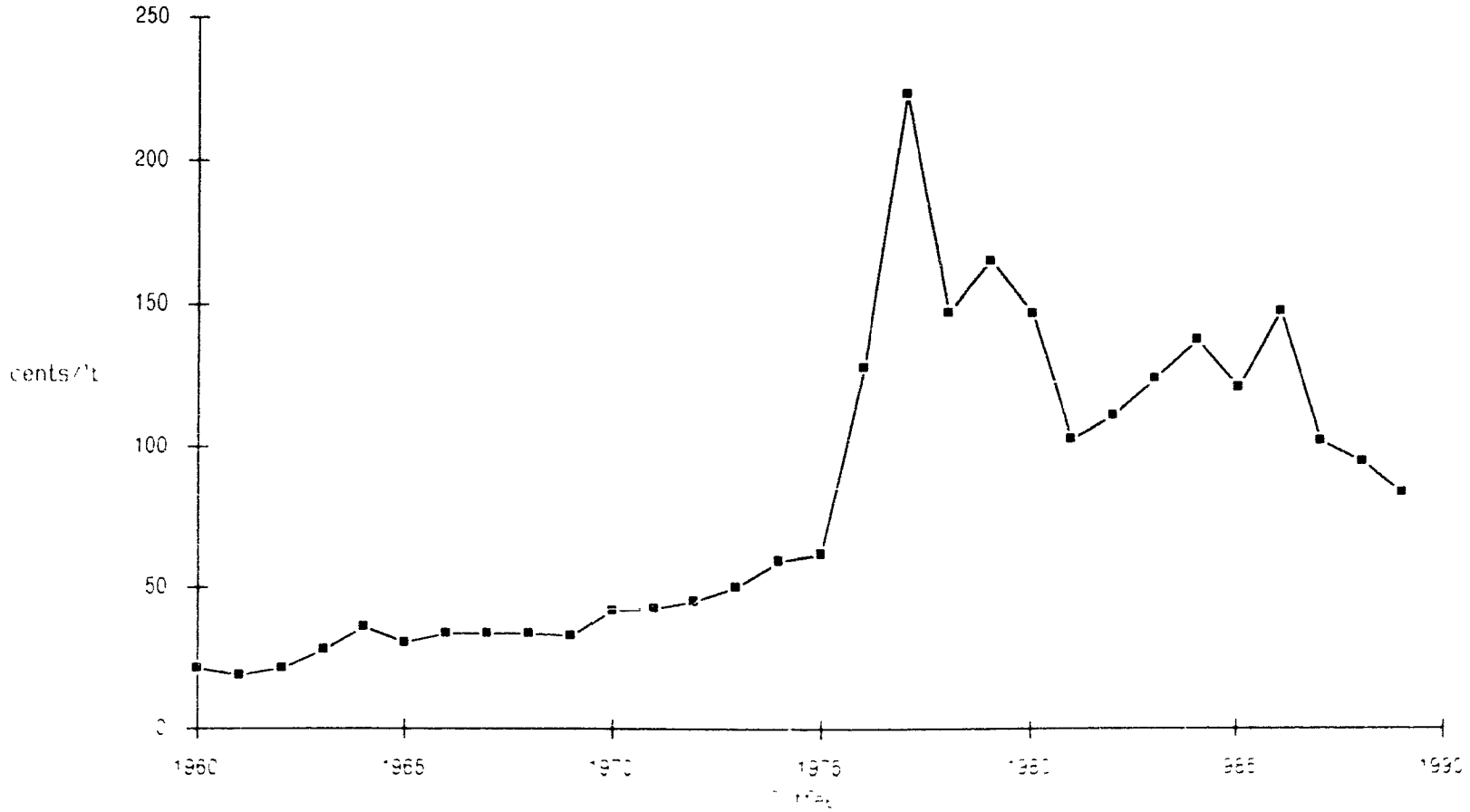
Graph 6.4.2
Brazilian & Other Arabicas (Ex Dock) vs Time



Graph 6 4 3
Other Mild Arabicas (Ex Dock) vs Time



Graph 6 4 4
Robustas (Ex-Dock) vs Time



arabicas for instant coffee blends began in the late 1980s as a means of improving quality. This explains differences that occurred for the peaks in 1985.

SEASONALITY

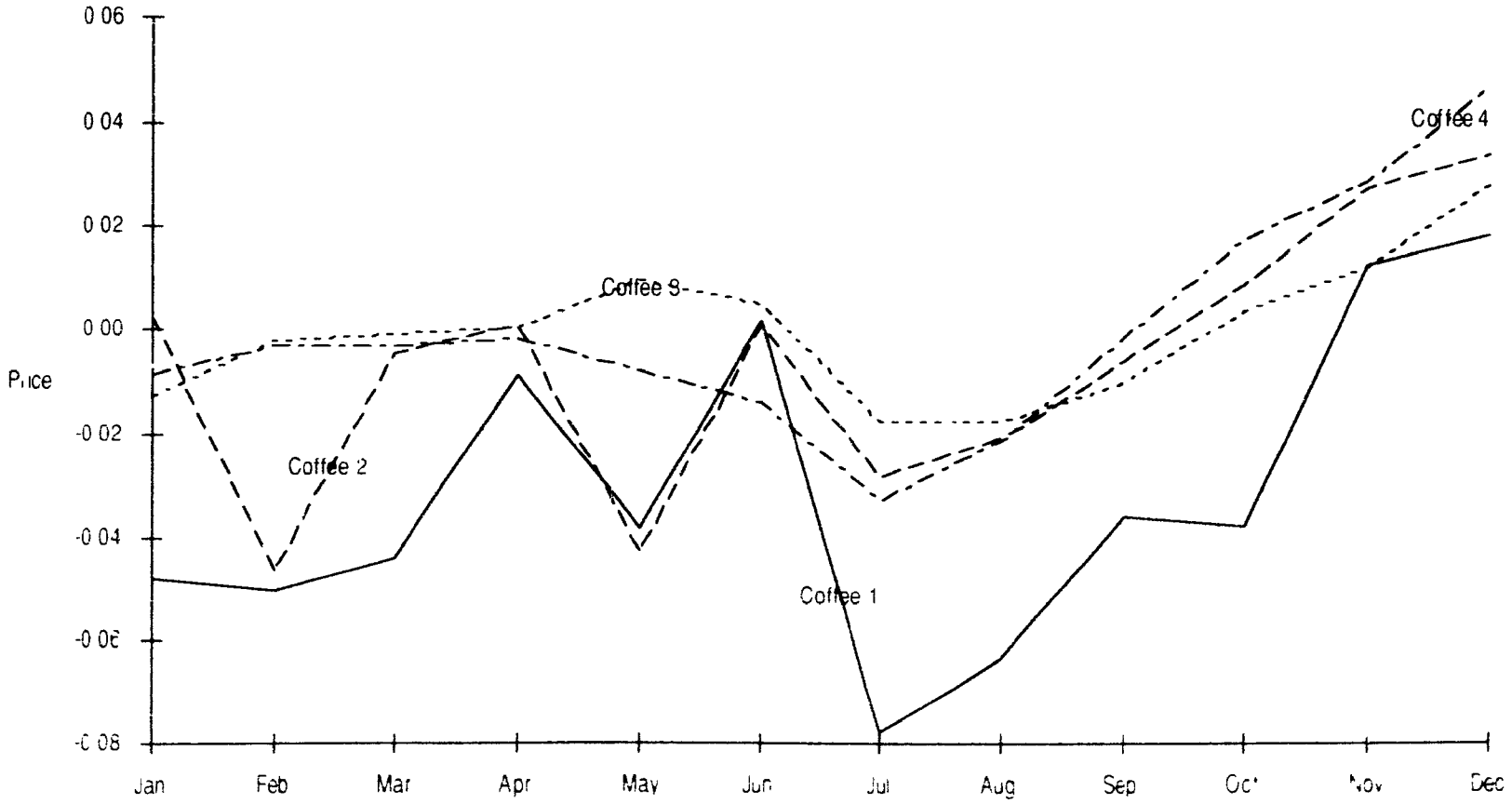
The monthly averages for the seasonal values were calculated in the following manner The monthly price values, X_{it}, for i-th month and t-th year, of the four types of coffee were divided by the yearly average, X_t, for a particular year. This resulted in a normalized value for each of the months, Y_{it}. The new monthly values for all the years were then averaged by month and plotted on graph 6.4 5

In general, the graph indicates that coffee prices for all coffee types increase from July, with the highest prices corresponding to the months of November and December. Colombian Mild Arabicas (Coffee1) exhibits greater seasonal effects than the other coffee types, with more variation throughout the year. Relative peaks in prices for Coffee1 were reached in the months of April, June, September and December. Correspondingly, troughs occurred in the months of February, May, July and October. The volume of export of coffee from Colombia, which is an Arabica producing country, for the years of 1984 to 1986 reveal peaks in the months of April to June, October to December and, January to March.

Brazilian and Other Arabicas (Coffee2) follows similar seasonal patterns to Coffee1 except for October. The volume of export of coffee from Brazil, which also produces Arabicas, for the years of 1984 to 1986 correspond closely to that of Colombia's. The increases in Coffee2 in the second half of the year matches those for Other Arabicas (Coffee3) and Robustas (Coffee4) The latter two types experience much less decline in the first half of the year.

Arabicas are picked throughout the year, and the graph indicates that they fetch the highest prices in the latter half of the year - in particular, the months of October, November and December. This corresponds to the peaks in export volume in coffee from Brazil and

Graoh 6 4 5 Seasonality by Month
1960 - 1989



Colombia. Robustas which are grown in hot and humid agroclimatic conditions and have a particular picking season, also have their highest prices at the end of the year. The volume of export of coffee from Kenya for the years of 1984 to 1986 show consistent peaks for the months of October to December, which is not surprising considering that the bulk of Kenya's coffee exports comprise of Robustas (Coffee4)

COFFEE and TEA

Tea prices began 1960 at levels well above those for coffee. However, tea prices fell throughout the 1960s to equal coffee prices by the end of the decade (see graph 6.4.6). Coffee prices then rose steadily from 1971 to peak in 1977 They experienced sharp drops in price after 1977 and 1986 Tea prices appear to have followed a similar pattern, with sharp declines after 1977 and 1984, and a peak in tea prices in 1977, which was much lower than those of coffee

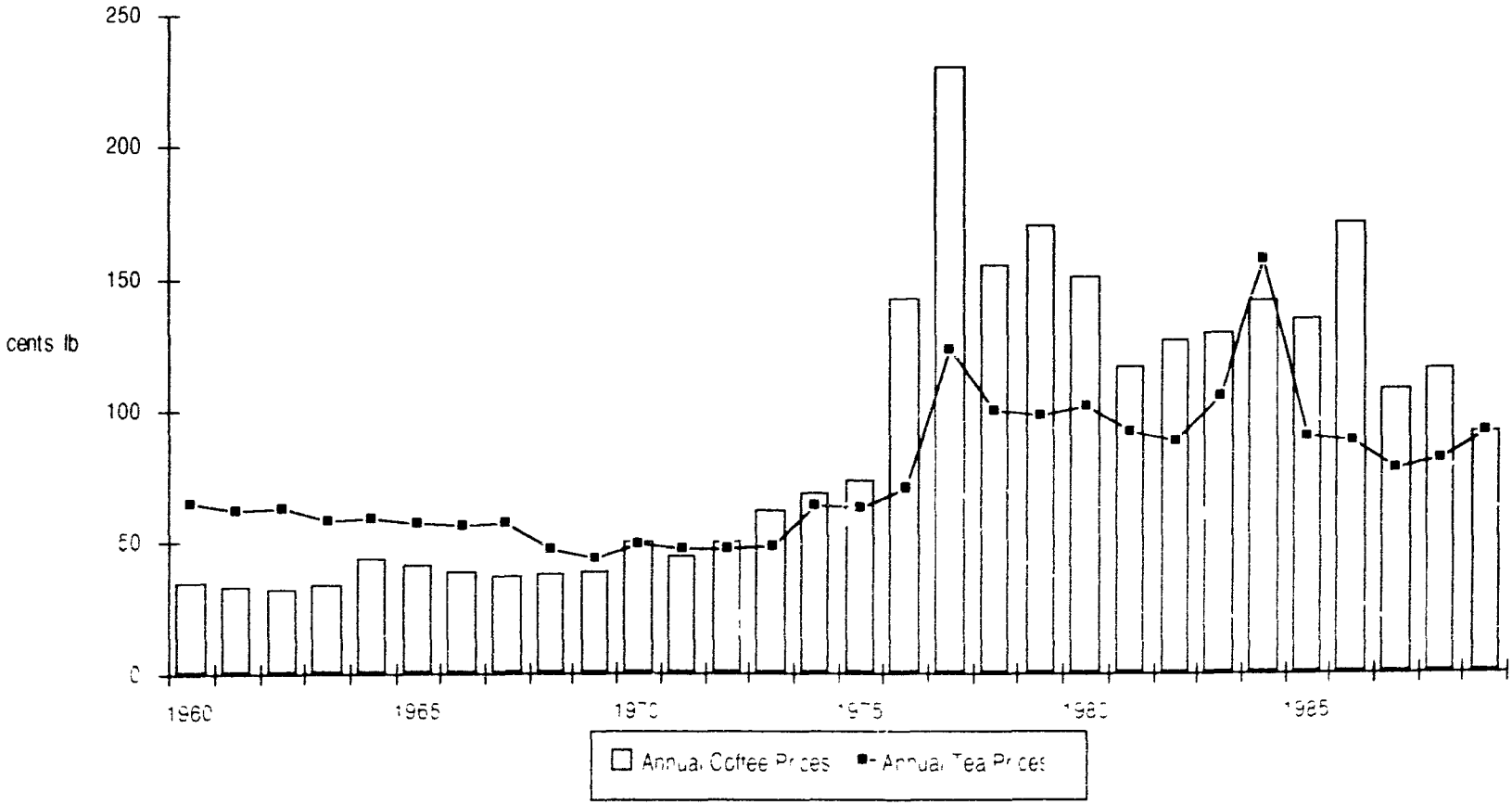
The sharp drop in coffee prices in 1981 seems to have affected the tea market as well, although both prices recovered after that year to peak in 1984, when the level of tea prices were briefly higher than those for coffee. Coffee prices peaked again in 1986 with dramatic declines in prices occuring thereafter After the sharp fall in tea prices in 1985, prices stabilized until 1989, when both coffee and tea prices were about 80 cents/lb.

Conclusion

The objective of this chapter has been to analyze the past performance of the coffee and tea markets in order to understand recent movements in prices and to be able to predict the effect of future economic shocks.

Analysis of the data shows that during those periods when the coffee market has operated under free market conditions, it has always experienced a downward trend in prices.

Graph 6 4 6 Coffee and Tea
New York and London Annual Average Prices vs Time



That is, initial increases in coffee prices, though generating a short term gain in export earnings for producers, also lead to increased plantings of the coffee crop. This in turn leads to overproduction and a subsequent decline in coffee prices

In addition, the changing pattern of the coffee market is reflected by a shift in the export volumes of the producing countries under study, which is further supported by analysis of the four main types of coffee sold on the international market Furthermore, the increasing importance of newcomers in the coffee and tea markets is demonstrated by analysing the increases in the export volumes and prices of coffee and tea from these countries

In the following chapter, factors affecting price fluctuations in the coffee market are studied together with their effect on the quantity of coffee demanded. Chapter seven also investigates the inter-relationships between the markets of coffee and tea.

Appendix 6.1

	BRAZIL: COFFEE			COLUMBIA: COFFEE			KENYA:COFFEE		
Year	Export Million USD	Vol of Export 1985 = 100	Unit Price 1985 = 100	Export Million USD	Vol of Export 1985 = 100	Unit Price 1985 = 100	Export Million SHIL	Vol of Export 1985 = 100	Unit Price 1985 = 100
1960	713 00	98 00	31 00	332 20	59 00	31 00	205 00	27 00	16 00
1961	710 00	99 00	30 00	307 80	57 00	30 00	212 00	31 00	15 00
1962	643 00	95 00	29 00	332 00	66 00	28 00	212 00	30 00	16 00
1963	748 00	113 00	28 00	303 00	61 00	27 00	220 00	36 00	13 00
1964	760 00	87 00	37 00	394 20	64 00	34 00	308 00	40 00	17 00
1965	707 00	78 00	38 00	343 90	57 00	33 00	282 00	37 00	17 00
1966	764 00	98 00	33 00	339 20	56 00	33 00	374 00	52 00	16 00
1967	705 00	97 00	31 00	322 40	61 00	29 00	314 00	49 00	14 00
1968	775 00	107 00	31 00	351 50	66 00	29 00	257 00	36 00	16 00
1969	815 00	108 00	32 00	343 90	65 00	31 00	337 00	49 00	15 00
1970	939 00	93 00	43 00	466 90	65 00	39 00	445 60	51 00	19 00
1971	773 00	100 00	33 00	399 70	66 00	34 00	396 00	55 00	16 00
1972	989 00	102 00	41 00	430 40	65 00	38 00	496 00	60 00	18 00
1973	1224 00	104 00	51 00	597 90	68 00	50 00	715 00	72 00	22 00
1974	864 00	64 00	53 00	624 80	69 00	53 00	769 00	68 00	24 00
1975	855 00	76 00	48 00	674 50	82 00	56 00	705 00	65 00	24 00
1976	2173 00	78 00	118 00	977 40	63 00	108 00	1869 00	75 00	54 00
1977	2299 00	50 00	196 00	1525 70	53 00	166 00	4088 00	90 00	98 00
1978	1947 00	60 00	137 00	1993 90	90 00	127 00	2495 00	82 00	66 00
1979	1918 00	54 00	149 00	2024 30	111 00	126 00	2214 00	75 00	64 00
1980	2486 00	76 00	138 00	2375 20	111 00	123 00	2178 00	76 00	62 00
1981	1517 00	80 00	80 00	1458 80	91 00	88 00	2187 00	84 00	56 00
1982	1858 00	86 00	91 00	1577 40	89 00	96 00	2889 00	95 00	66 00
1983	2096 00	91 00	97 00	1536 60	92 00	90 00	2110 00	62 00	74 00
1984	2564 00	100 00	108 00	1798 80	102 00	99 00	4074 00	93 00	95 00
1985	2369 00	100 00	100 00	1784 00	100 00	100 00	4610 00	00 00	100 00
1986	2006 00	46 00	183 00	3046 00	114 00	134 00	7766 00	12 00	139 00
1987	1959 00	96 00	87 00	1688 50	113 00	77 00	3892 00	96 00	88 00
1988	1998 00	82 00	103 00	1695 90	91 00	93 00	4900 00	87 00	122 00
1989	1610 00	63 00	108 00						

Appendix 6.1 (cont)

	KENYA:TEA				SRI LANKA:TEA			INDIA:TEA
Year	Export Million SHII	Vol of Export 1985=100	Unit Price 1985=100	Wholesale Pr 1985=100	EXPORT Million Rupees	Vol of Export 1985=100	Wholesale Pr 1985=100	Wholesale Pr 1985=100
1960	88 00	9 00	27 00	31 00	1096 00	95 00	11 40	28 00
1961	80 00	8 00	26 00	30 00	1115 00	99 00	10 90	26 00
1962	104 00	11 00	25 00	30 00	1149 00	105 00	10 50	27 00
1963	113 00	12 00	25 00	28 00	1140 00	106 00	9 90	25 00
1964	120 00	13 00	24 00	29 00	1142 00	106 00	10 00	25 00
1965	120 00	13 00	25 00	28 00	1210 00	115 00	10 50	25 00
1966	174 00	18 00	25 00	27 00	1024 00	102 00	9 30	32 00
1967	147 00	15 00	26 00	28 00	1061 00	111 00	8 90	38 00
1968	201 00	22 00	24 00	23 00	1161 00	105 00	10 30	32 00
1969	226 00	26 00	23 00	21 00	1061 00	102 00	9 10	30 00
1970	255 00	28 00	24 00	24 00	1119 00	105 00	9 70	33 00
1971	238 00	27 00	23 00	23 00	1144 00	105 00	10 60	32 00
1972	329 00	37 00	23 00	23 00	1162 00	96 00	11 30	33 00
1973	340 00	41 00	22 00	23 00	1261 00	104 00	11 30	33 00
1974	388 00	39 00	26 00	31 00	1360 00	89 00	17 20	46 00
1975	459 00	42 00	29 00	31 00	1932 00	107 00	17 70	47 00
1976	637 00	47 00	35 00	39 00	2100 00	101 00	23 70	56 00
1977	1436 00	55 00	67 00	68 00	3503 00	94 00	41 80	96 00
1978	1264 00	67 00	49 00	52 00	6401 00	97 00	36 60	73 00
1979	1257 00	74 00	44 00	49 00	5722 00	95 00	31 50	71 00
1980	1176 00	71 00	43 00	51 00	6170 00	93 00	47 00	71 00
1981	1225 00	60 00	53 00	56 00	6444 00	93 00	46 40	71 00
1982	1582 00	71 00	58 00	65 00	6342 00	91 00	60 10	74 00
1983	2164 00	69 00	82 00	95 00	8295 00	80 00	110 90	96 00
1984	4035 00	77 00	136 00	153 00	15764 00	103 00	161 00	160 00
1985	3850 00	100 00	100 00	100 00	12003 00	100 00	100 00	100 00
1986	3454 00	92 00	97 00	96 00	9253 00	105 00	78 60	99 00
1987	3264 00	107 00	79 00	86 00	10654 00	102 00	100 70	90 00
1988	3705 00	109 00	88 00	97 00	12299 00	111 00	109 60	102 00
1989				127 00	13664 00	103 00	140 00	133 00

Appendix 6.1 (cont.)

	KENYA: COFFEE		KENYA: TEA			SRI LANKA: TEA		
Year	Export Million SHIL	Exchange Rate Period Avg.	Export Million USD	Export Million SHIL	EXPORT Million USD	EXPORT Million Rupees	Exchange Rate Period Avg.	EXPORT Million USD
1960	205	7.143	28.70	88	0.43	1096	4.749	230.79
1961	212	7.143	29.68	80	0.38	1115	4.763	234.10
1962	212	7.143	29 68	104	0 49	1149	4.751	241 84
1963	220	7.143	30.80	113	0.51	1140	4 758	239.60
1964	308	7.143	43.12	120	0.39	1142	4 769	239 46
1965	282	7.143	39.48	120	0.43	1210	4.775	253 40
1966	374	7.143	52.36	174	0.47	1024	4.775	214 45
1967	314	7.143	43.96	147	0 47	1061	4 919	215.69
1968	257	7.143	35.98	201	0.78	1161	5.928	195.85
1969	337	7.143	47.18	226	0.67	1061	5 947	178 41
1970	445	7.143	62.30	255	0 57	1119	5 958	187 81
1971	396	7.143	55.44	238	0 60	1144	5 958	192 01
1972	496	7.143	69 44	329	0 66	1162	6 208	187.18
1973	715	7 001	102 13	340	0.48	1261	6 403	196 94
1974	769	7 143	107 66	388	0 50	1360	6 651	204 48
1975	705	7.343	96.01	459	0 65	1932	7.007	275.72
1976	1869	8.367	223.38	637	0 34	2100	8.412	249 64
1977	4088	8.277	493 90	1436	0 35	3503	8 873	394 79
1978	2495	7.729	322 81	1264	0 51	6401	15.611	410.03
1979	2214	7.475	296.19	1257	0 57	5722	15 572	367.45
1980	2178	7 42	293.53	1176	0 54	6170	16 534	373.17
1981	2187	9.048	241.71	1225	0 56	6444	19.246	334 82
1982	2889	10.922	264 51	1582	0 55	6342	20 812	304.73
1983	2110	13 312	158 50	2164	1.03	8295	23 529	352.54
1984	4074	14.414	282 64	4035	0.99	15764	25 438	619.70
1985	4610	16.432	280 55	3850	0 84	12003	27.163	441 89
1986	7766	16.226	478 61	3454	0 44	9253	28 017	330 26
1987	3892	16.455	236.52	3264	0 84	10654	29 445	361.83
1988	4900	17.747	276 10	3705	0.76	12299	31 807	386 68
1989		20 573				13664	36 047	379 06

Appendix 6.1 (cont)

Year	Coffee1	Coffee2	Coffee3	Coffee4
	US cents/lb			
1960	44 89	36 59	41 49	21 63
1961	43 62	36 00	37 55	19 02
1962	40 77	33 96	35 86	20.98
1963	39 55	34 11	35 47	28.04
1964	48 80	46 66	47 17	35 87
1965	48 23	43 92	45 31	30 61
1966	47 35	40 56	42 12	33 53
1967	41 61	37 72	39 20	33 52
1968	42 42	37 36	39 33	33.86
1969	44 44	40 90	39 78	33 11
1970	56 66	55 80	52 01	41 44
1971	49 01	44 71	44 99	42.26
1972	56 70	52 52	50 33	45.19
1973	72 51	69 20	62 30	49.88
1974	77 81	73 34	65 84	58 68
1975	81 31	82 57	65 41	61.05
1976	157 72	149 48	142 75	127 62
1977	240 21	308 04	234 67	223 76
1978	185 20	165 29	162 81	147 48
1979	183 41	178 47	173 53	165 47
1980	178 82	208 79	154 19	147 15
1981	145 33	179 55	128 09	102 87
1982	148 59	143 68	139 87	111 05
1983	141 61	142 75	131 61	124 12
1984	147 33	149 65	144 25	138 16
1985	155 87	151 77	145 56	121 37
1986	220 04	231 19	192 74	147 83
1987	123 45	106 37	112 29	102 33
1988		121 84	135 05	95 11
1989	120 26	110 14	119 17	83 24

Year	Ave auction price	All coffee NY exch
	US cents lb	
1960	64 93	33 81
1961	61 63	31 87
1962	62 45	31 09
1963	58 56	33 22
1964	59 43	43 51
1965	57 64	41 04
1966	56 67	38 19
1967	57 03	37 08
1968	47 24	37 36
1969	44 28	38 53
1970	49 55	50 53
1971	47 80	44 66
1972	47 81	50 40
1973	47 97	62 16
1974	63 29	67 95
1975	62 68	72 48
1976	69 70	141 96
1977	122 02	229 09
1978	99.29	155 00
1979	97 87	169 50
1980	101 06	150 71
1981	91 59	115 82
1982	87 62	125 62
1983	105 44	127 94
1984	156 79	141 24
1985	89 98	133 47
1986	87 48	170 28
1987	77 45	107 32
1988	81 18	115 11
1989	91 25	91 30

Appendix 6.2

Coffee I - cents/lb

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yrly Ave
1960	45.68	45.95	45.10	45.20	44.73	44.38	44.55	45.15	44.85	44.90	44.35	43.85	44.89
1961	44.48	44.58	44.30	43.90	43.50	43.33	43.50	43.53	43.33	43.15	43.05	42.80	43.62
1962	42.80	42.78	42.05	41.40	40.45	39.50	39.88	40.15	40.45	39.78	39.85	40.10	40.77
1963	40.50	39.43	39.78	39.65	39.15	39.25	39.58	39.50	39.38	39.48	39.60	39.28	39.55
1964	45.00	45.70	49.95	48.55	49.28	48.60	49.33	50.58	50.05	50.08	49.90	48.60	48.80
1965	48.88	49.60	46.75	47.17	46.78	47.34	47.48	48.35	48.85	48.31	49.76	49.40	48.23
1966	49.03	49.60	48.74	48.41	48.82	48.35	48.00	47.32	45.54	45.49	44.94	43.96	47.35
1967	43.22	42.36	40.89	41.37	42.11	42.42	41.55	40.68	40.25	40.53	42.77	41.14	41.61
1968	41.58	41.87	42.95	42.70	42.39	42.78	42.83	42.63	42.59	43.29	42.06	41.32	42.42
1969	41.36	41.34	40.62	39.79	39.66	40.28	40.35	41.52	44.76	52.51	55.35	55.80	44.44
1970	59.73	57.56	57.68	57.34	58.00	57.20	57.07	56.81	56.19	56.34	54.35	51.63	56.66
1971	51.73	49.98	49.75	48.38	48.49	47.60	47.57	48.09	47.70	47.61	49.18	52.08	49.01
1972	50.72	49.93	51.75	51.61	52.90	53.61	61.22	63.93	59.65	61.00	61.28	62.76	56.70
1973	68.62	73.66	75.39	70.55	73.60	76.16	75.53	73.38	72.29	71.14	70.83	71.03	72.51
1974	75.24	80.17	79.35	81.23	82.35	82.18	78.15	73.73	70.78	72.18	76.87	81.47	77.81
1975	78.78	76.08	69.38	66.80	65.57	72.60	83.02	100.38	90.73	90.30	88.03	94.00	81.31
1976	100.70	106.26	106.46	133.19	156.11	183.60	160.89	183.98	181.17	183.95	186.49	209.79	157.72
1977	221.35	246.57	31[illegible].04	320.78	291.71	208.7[illegible]	228.74	204.96	195.10	181.60	204.45	207.51	240.21
1978	206.59	199.18	185.61	193.85	192.18	192.67	174.93	177.35	181.38	173.67	172.73	172.21	185.20
1979	166.47	136.87	134.88	14[illegible].88	153.22	197.32	210.50	208.54	221.08	214.39	211.26	204.47	183.41
1980	184.25	184.20	205.19	192.54	202.12	192.17	180.32	185.00	187.27	152.24	147.00	133.5[illegible]	178.82
1981	\ \	\ \	\ \	140.75	139.38	129.45	142.34	153.86	143.19	149.93	156.43	152.67	145.33
1982	148.89	[illegible]56.76	[illegible]56.01	154.53	149.40	144.68	14[illegible].57	143.14	143.26	[illegible]49.07	148.23	[illegible]46.30	148.59
1983	143.23	[illegible]42.82	[illegible]37.85	[illegible]46.20	137.02	136.[illegible]5	\ \	\ \	\ \	\ \	148.10	151.48	141.61
1984	150.43	148.45	[illegible]49.69	15[illegible]	152.54	150.94	147.70	146.14	146.34	141.08	142.21	141.38	147.33
1985	146.03	[illegible]49.00	[illegible]46.88	[illegible]44.85	\ \	148.07	\ \	\ \	147.56	[illegible].94	65.92	202.69	155.87
1986	263.77	248.24	252.93	24[illegible].95	237.45	2[illegible]5.44	19[illegible].36	194.05	211.1[illegible]	207.62	206.69	[illegible]69.86	220.04
1987	155.83	[illegible]48.82	[illegible]7.50	[illegible]57	1[illegible].98	[illegible].02	[illegible]12.52	11[illegible].24	[illegible]	121.55	\ \	\ \	123.45
1988	\ \	\ \	\ \	\ \	\ \	\ \	\ \	\ \	\ \	\ \	\ \	\ \	\ \
1989	\ \	\ \	149.[illegible]7	15[illegible].65	146.65	[illegible]4.16	94.41	83.15	83.25	\ \	\ \	\ \	120.26
Mnthly Ave	100.66	99.92	[illegible]02.80	[illegible]04.45	103.[illegible]	104.72	97.23	98.04	99.65	99.00	10[illegible].54	[illegible]01.89	102.88

Appendix 6.2 (cont)

Coffee2 - cents/lb

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yrly Ave
1960	36.33	37.05	36.95	36.95	37.25	37.00	36.48	35.98	36.23	36.25	36.35	36.25	36.59
1961	36.53	37.25	37.45	37.00	37.18	37.35	36.83	35.93	34.85	33.73	33.93	34.03	36.00
1962	34.20	34.05	34.08	34.08	34.43	34.73	34.55	34.08	33.40	33.18	33.33	33.40	33.96
1963	33.85	33.33	33.23	33.00	33.33	34.33	33.58	32.73	32.95	34.98	36.55	37.45	34.11
1964	44.83	46.30	49.85	48.60	47.35	46.90	46.65	45.83	45.00	46.58	46.88	45.18	46.66
1965	45.25	45.95	45.03	44.71	43.88	44.10	43.58	43.67	42.59	42.75	42.66	42.85	43.92
1966	42.60	41.48	40.66	40.55	40.82	40.75	40.59	40.32	40.04	39.00	39.45	39.50	40.56
1967	38.75	38.01	38.00	38.43	38.75	38.41	37.88	37.29	37.08	36.76	36.64	36.63	37.72
1968	36.93	37.13	37.32	37.83	37.39	37.25	37.25	37.25	37.25	37.52	37.65	37.50	37.36
1969	37.51	37.70	37.79	37.23	37.21	37.16	37.28	38.98	43.37	47.82	49.35	49.40	40.90
1970	52.70	53.00	53.04	53.85	54.18	54.54	56.32	57.88	59.11	59.33	58.65	57.00	55.80
1971	56.26	51.31	44.68	43.58	42.95	42.37	42.09	42.00	42.26	42.50	42.55	43.96	44.71
1972	44.42	44.92	45.95	46.85	48.25	48.56	56.34	61.09	58.70	57.59	58.70	58.82	52.52
1973	60.00	62.91	66.09	65.91	67.23	69.27	72.04	72.75	72.88	73.34	74.48	73.50	69.20
1974	70.69	74.36	78.00	78.86	80.00	75.54	72.60	69.50	69.28	69.71	69.07	71.59	73.34
1975	73.25	74.22	72.76	72.34	75.15	75.40	68.54	96.49	95.50	95.36	94.00	97.85	82.57
1976	109.00	119.08	116.11	133.81	149.35	151.08	151.57	151.50	155.21	163.05	182.84	211.12	149.48
1977	247.26	261.21	359.09	369.00	329.81	320.00	316.84	315.00	315.00	315.00	318.16	230.14	308.04
1978	216.90	201.56	166.04	169.90	157.92	177.73	148.18	144.57	152.80	153.57	150.98	143.30	165.29
1979	136.80	128.89	138.41	145.13	154.23	189.10	202.81	198.01	209.84	211.25	213.67	213.42	178.47
1980	213.07	197.25	204.12	208.17	215.21	208.62	207.32	208.93	211.27	210.43	208.19	212.88	208.79
1981	221.72	N/A	N/A	218.50	N/A	224.76	169.43	143.05	137.50	149.18	158.56	154.21	179.55
1982	148.95	153.11	143.70	143.86	141.33	144.42	138.17	142.05	142.92	141.51	141.63	142.69	143.68
1983	140.73	142.29	142.02	140.86	141.51	142.81	142.51	138.70	136.65	145.31	146.88	152.76	142.75
1984	155.15	155.38	152.82	149.80	145.91	149.45	146.99	150.62	151.55	147.63	144.93	145.59	149.65
1985	152.10	157.25	155.56	146.33	143.84	136.71	130.88	133.25	139.03	150.27	174.28	201.70	151.77
1986	303.42	276.26	286.68	288.55	280.24	229.10	183.40	190.43	210.36	187.59	175.58	162.40	231.19
1987	119.75	114.42	97.41	101.68	111.96	98.34	89.95	91.40	100.67	111.68	122.05	117.09	106.37
1988	117.35	130.40	126.21	123.30	121.02	122.81	126.01	111.89	118.79	115.65	118.53	136.11	121.84
1989	145.29	128.72	128.06	131.45	128.94	115.02	78.75	67.32	67.75	N/A	N/A	N/A	110.14
Mnthly Ave	105.72	100.51	102.31	107.34	102.64	105.45	99.31	98.95	100.99	103.09	105.08	104.08	103.76

Appendix 6.2 (cont)

Coffee3 - cents/lb

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yrly Ave
1960	41 29	41.55	41 41	41 50	41 82	41 79	41 75	41 68	41 56	41 90	41 42	40 23	41 49
1961	39 82	39 15	38 85	37 91	37 91	38 05	37 88	37 09	36 30	34 95	36 51	36 22	37 55
1962	36 49	37 10	37 50	36 69	36 50	35 94	35 15	34 80	34 27	34 53	35 35	35 97	35 86
1963	36 09	35 61	35 72	35 69	35 62	35 37	34 46	33 24	33 59	36 02	36 81	37 39	35 47
1964	44 21	45 02	49 25	47 53	47 15	46 46	46 57	48 60	48 13	48 34	48 51	46 92	47 17
1965	45 86	47 12	44 11	44 25	43 56	44 46	44 52	45 39	45 29	45 85	46 54	46 80	45 31
1966	45 03	44 13	43 27	43 27	42 02	41 87	41 59	41 62	40 78	40 27	40 24	39 59	42 12
1967	38 56	38 29	37 37	38 59	40 33	41 24	40 94	39 74	39 04	38 43	39 31	38 61	39 20
1968	39 28	39 42	40 01	40 19	39 99	40 28	39 98	39 29	38 73	38 76	38 49	37 50	39 33
1969	37 58	38 19	37 62	36 90	36 71	36 06	35 27	36 86	40 94	47 18	46 48	47 53	39 78
1970	51 57	51 95	53 12	54 56	55 20	54 71	54 28	53 06	52 63	50 79	46 62	44 34	52 01
1971	45 50	44 60	46 01	44 88	46 19	45 46	45 03	45 59	43 75	42 78	43 81	46 30	44 99
1972	44 93	45 34	46 23	45 88	47 07	48 52	56 07	54 47	53 01	55 45	55 79	55 22	50 33
1973	57 97	65 96	64 38	58 56	64 19	64 17	61 54	60 36	60 20	62 50	63 19	64 57	62 30
1974	69 42	74 69	71 46	70 30	71 02	72 11	69 09	62 55	54 61	56 78	59 28	58 78	65 84
1975	55 84	53 47	50 05	47 64	50 85	55 93	65 67	83 48	80 88	80 39	77 52	85 25	65 41
1976	92 85	99 22	99 60	122 48	135 46	149 58	137 24	153 73	159 36	173 34	182 99	207 11	142 75
1977	218 96	245 48	304 17	317 68	285 26	262 09	221 52	199 40	190 05	171 02	197 55	202 82	234 67
1978	206 16	197 59	175 10	178 57	169 63	168 50	133 80	138 22	155 33	155 65	146 16	151 07	162 81
1979	128 59	123 01	130 31	138 63	149 79	193 18	203 66	197 45	207 20	209 59	206 62	194 28	173 53
1980	168 67	164 83	184 38	180 81	190 54	181 41	155 67	135 99	125 88	126 09	124 86	121 21	154 19
1981	127 98	125 11	125 93	128 20	125 95	131 94	120 01	124 09	126 02	136 41	143 79	141 67	128 09
1982	143 00	155 00	144 83	141 14	137 00	141 02	133 11	132 83	136 [illegible]	[illegible]	137 86	133 79	139 87
1983	128 83	125 87	124 27	123 91	128 15	125 40	127 86	129 31	132 56	131 28	125 55	126 54	128 31
1984	143 14	145 72	148 2[illegible]	150 40	149 94	146 66	[illegible]	145 29	147 24	[illegible] 2	140 25	140 64	144 25
1985	145 58	143 73	141 27	140 66	141 96	141 [illegible]	[illegible]	132 93	133 07	140 48	134 85	96 [illegible]	145 56
1986	235 30	226 52	237 62	224 07	208 74	174 54	170 [illegible]	172 23	168 76	175 97	154 63	142 [illegible]	192 74
1987	121 75	119 60	102 04	106 30	116 38	103 72	98 56	101 90	110 00	118 26	124 [illegible]	125 22	112 29
1988	126 38	137 [illegible]4	134 74	134 30	136 39	141 83	138 60	128 89	134 83	140 [illegible]	142 09	144 95	135 05
1989	140 50	137 57	130 38	143 06	138 65	123 2[illegible]	135 9[illegible]	[illegible] 40	[illegible] 42	N A	N A	N A	139 [illegible]
Mnthly Ave	95 59	96 27	97 6[illegible]	98 46	98 36	96 89	9[illegible] 80	98 88	92 [illegible]	[illegible]	94 82	95 45	95 36

Appendix 6.2 (cont)

Cottee4 - cents lb

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yrly Ave
1960	23 41	23 73	22 72	22 48	22 40	21 58	19 45	20 10	20 60	21 56	21 29	20 26	21 63
1961	19 49	19 23	19 06	18 88	18 74	18 62	18 73	18 79	18 74	18 69	19 22	20 11	19 02
1962	20 09	19 90	20 14	20 45	20 98	20 96	20 92	20 79	20 88	21 48	21 79	21 42	20 98
1963	24 26	25 19	26 72	27 03	27 11	27 08	26 99	26 73	27 46	29 86	33 79	34 23	28 04
1964	39 09	39 63	40 68	39 58	38 81	37 01	34 56	33 66	31 96	32 42	32 53	30 50	35 87
1965	28 49	29 14	24 14	24 81	22 10	27 81	32 49	36 06	35 28	36 62	34 38	36 00	30 61
1966	36 36	34 38	33 74	34 51	34 70	33 61	33 09	32 61	31 73	32 47	32 67	32 44	33 53
1967	32 01	33 05	32 92	33 89	34 91	35 45	33 60	32 55	32 84	33 07	33 94	33 97	33 52
1968	34 41	34 32	34 25	34 17	34 25	34 33	34 01	33 91	33 99	33 57	32 87	32 19	33 86
1969	32 00	32 15	31 24	29 92	29 47	30 70	31 17	32 87	34 61	38 33	37 23	37 58	33 11
1970	39 11	38 45	39 37	41 41	42 64	42 18	42 75	42 85	42 58	42 71	41 55	41 66	41 44
1971	42 18	42 27	42 67	42 64	42 64	42 37	42 11	42 18	41 93	41 69	41 98	42 52	42 26
1972	42 17	42 22	43 07	43 67	43 76	43 66	47 35	47 20	46 93	47 03	47 40	47 77	45 19
1973	47 82	49 53	50 34	48 85	48 76	48 91	47 09	47 36	50 08	52 00	52 97	53 95	49 88
1974	55 65	60 55	62 72	64 03	64 53	61 80	59 13	56 01	53 92	54 94	55 66	55 18	58 68
1975	54 32	52 39	49 64	49 03	47 52	49 34	58 68	77 05	76 10	73 07	71 41	74 03	61 05
1976	79 13	82 69	82 41	107 79	121 64	150 06	126 29	132 26	137 08	151 90	176 26	203 96	127 62
1977	216 26	246 37	306 49	312 24	269 56	224 02	196 49	203 33	201 50	173 93	166 71	168 57	223 76
1978	177 13	174 56	157 64	144 80	136 09	151 14	126 54	128 45	146 90	150 12	144 26	132 08	147 48
1979	133 25	132 50	135 20	141 80	147 68	188 79	195 90	181 94	189 51	184 34	177 75	176 97	165 47
1980	162 56	162 00	169 89	162 90	174 06	169 01	147 94	132 05	124 96	125 49	116 36	118 54	147 15
1981	121 88	115 23	113 92	112 93	108 38	85 23	88 25	90 39	88 88	98 51	106 33	104 52	102 87
1982	106 01	115 63	112 83	106 67	102 96	102 85	99 67	103 79	112 00	118 27	123 15	128 76	111 05
1983	124 71	122 15	119 99	120 42	122 64	120 55	121 01	120 90	122 10	130 34	130 38	134 21	124 12
1984	134 24	137 19	138 88	137 58	146 24	143 67	138 32	140 11	142 05	135 01	135 47	129 13	138 16
1985	127 90	124 67	124 02	123 25	121 41	120 52	107 29	106 81	105 11	112 48	128 03	154 90	121 37
1986	172 22	163 32	169 79	157 53	142 56	125 79	126 42	135 17	163 80	148 58	142 71	126 02	147 83
1987	113 81	110 45	98 28	101 17	105 66	98 23	92 50	94 80	99 48	103 83	105 76	104 05	102 33
1988	103 19	104 09	99 82	96 60	94 94	94 15	85 39	81 58	89 98	95 24	94 13	102 17	95 11
1989	102 83	96 66	95 61	91 73	92 00	84 55	65 78	59 35	60 66	N/A	N/A	N/A	83 24
Mnthly Ave	81 53	82 12	83 27	83 09	81 97	80 47	76 69	77 06	79 45	80 61	81 31	82 75	80 87

CHAPTER 7

The United States is the largest consumer and importer of coffee in the world, and its internal demand clearly affects world coffee prices. US blenders and roasters have, in recent years, been aiming towards quality and price improvements in their markets for instant coffee. This led to a redistribution of market shares among the major exporters of coffee. To determine a meaningful relationship among the variables that govern the coffee market, a five-stage empirical process is followed below. The first phase of this process looks at the relationship between the quantity of coffee imported into the US and some independent variables. In the second phase, we assess the effect of the export volumes of coffee from Brazil, Colombia and Kenya on the average prices of coffee sold on the New York exchange. The next phase examines how the four main types of coffee affect the value of the total imports of coffee into the US[1]. Then, in the fourth phase, we develop a model to explore the relationship between export prices for coffee and tea and the quantity of coffee exported into the US. Finally, in the fifth phase, we briefly seek to confirm the normality of some of the data that we have been using.

The summary table of all regressions discussed in this chapter is presented in Section 7.1. The five empirical stages are explained in Sections 7.2 through 7.6, respectively. Two appendices describe the variables that were used for the analysis and they provide a summary of the probability plots produced by the test for normality.

[1]They are Colombian Mild Arabicas, Brazilian and Other Mild Arabicas, Other Mild Arabicas and Robustas, as in other chapters.

Section 7.1: Summary of Regressions

The assumptions that govern the eighteen models considered in the summary table below are presumed to be identical to the structure of the classical linear model. That is, assumptions involve normality in the errors, homoscedasticity and no autocorrelation In order to determine the validity of these particular assumptions, we made use of probability plots, residual plots and the Durbin-Watson statistic Such checks are necessary in order to judge the degree of reliability of the Student's t and F statistics, which are associated with tests of certain other hypothesis. The Student's t statistic, as used in the table (represented by the numbers in brackets), yields a test of the hypothesis that the corresponding model coefficient is zero, while the F statistics permit tests of the hypothesis that all the coefficients in a particular model are zero.

The number of observations, n, is specified for each of the models in the tabular summaries in Sections 7.2 through Section 7 5 Endnotes to this chapter clarify some of the differences in modelling among regressions presented in Table 7.1.

The regressions presented in the table can be best described when divided into four categories, each of which is presented in a separate section. They use either the quantity of coffee imported into the US (QCOF) or the prices of all coffee sold on the New York exchange (PCOF) as their dependent variable.

The first regression in Table 7.1 uses all twelve independent variables, while the second is a result of a procedure which eliminates those variables which contribute the least in explaining the dependent variable, QCOF. These two models represent category one and are discussed in Section 7 2 Category two contains models three through seven, which use the prices of all coffee, PCOF, as their dependent variable. These models study the relationship between the dependent variable and the volume of coffee imported into the US from major exporters. Models four through seven present adjustments to model three, of which a further explanation can

be found in the endnotes to this chapter. This group of models is discussed in Section 7.3. The third category includes models eight and nine and models thirteen through fifteen. They assess how the total import of coffee into the US is affected by the four main types of coffee sold on the world market. Here the dependent variable is the quantity of coffee imported, QCOF, or a dynamic transformation of this quantity. A detailed analysis of these models can be found in Section 7.4. The final category of regression models, which contains models twelve and sixteen through eighteen, is discussed in Section 7.5. These models assess the impact of the export prices of coffee and tea on the quantity of coffee imported into the US, QCOF, or a dynamic transformation of this quantity. Model twelve is the original regression, while models sixteen through eighteen are modified versions which attempt to correct for problems with serial correlation.

Table 7.1: Regression with levels of variables

Vars.	1	2	3	4	5	6
QCOF	Dep.var	Dep.var				
PCOF	6.31 (1.04)	5.67 (1.95)	Dep.var	Dep.var	Dep.var	Dep. var
INTER.	-2149.20 (-5.26)	-2268.13 (-6.71)	85.39 (1.92)	-2.08 (-0.06)	135.39 (3.39)	
PTEA	7.30 (1.02)	18.79 (5.31)				
VBR	6.91 (2.48)	7.48 (3.02)	-1.09 (-3.10)	-0.61 (-2.19)	-0.88 (-2.93)	-0.42 (-1.01)
VCOL	18.74 (7.13)	16.80 (8.14)	0.22 (0.54)	1.26 (3.42)	-0.58 (-1.40)	0.01 (0.01)
VKEN	8.25 (2.11)	11.58 (3.58)	1.22 (3.39)	0.62 (2.12)	0.72 (2.15)	1.06 (2.51)
PBR	8.07 (1.47)	11.86 (3.99)				
PCOL	10.16 (0.99)					
PKEN	-7.35 (-1.28)					
QTEA	-1.05 (-0.26)					
TKEN	24.37 (2.18)					
TIN	-20.42 (-2.97)	-20.62 (-7.87)				
TSR	-10.14 (-1.55)					
D1						35.17 (0.66)
D2						88.10 (1.63)
D3				138.88 (4.85)	64.44 (3.49)	62.42 (0.95)
D.W.	2.14	1.75	1.03	1.63	0.94	1.17
F	154.61	265.81	25.69	41.80	30.57	72.87

Table 7.1 (Contd.)

Vars.	7	8	9	10	11	12
QCOF		Dep.var	Dep. var	-0.0005 (-0.14)		Dep. var
PCOF	Dep. var				Dep var	
INTER.		207.79 (2.03)	172.64 (2.13)	-7.62 (-1.87)		251.76 (1.09)
VBR	-0.88 (-2.93)					
VCOL	-0.58 (-1.40)					
VKEN	0.72 (2.15)					
PBR				0.24 (1.25)	0 22 (1.22)	3.89 (0.46)
PCOL				1 03 (3 89)	1.07 (4 14)	32.10 (3 64)
PKEN				-0.17 (-1.54)	-0.15 (-1.40)	-10.41 (-1.67)
QTEA				0.26 (1.92)	0 29 (2 13)	
TKEN				-0.18 (-0 61)	-0 23 (-0 81)	17.23 (1 23)
TIN				-0.13 (-0 54)	-0.16 (-0.78)	-23.79 (-2 07)
TSR				0.20 (1.04)	0.27 (1 39)	7.21 (0.75)
D1	135.40 (3.39)				-9.08 (-2.24)	
D2	199.83 (4.02)				-15.51 (-1.94)	
COF1		37.57 (5.36)	35.57 (6.30)			
COF2		-4.48 (-1.39)	-5.78 (-2.25)			
COF3		-25.19 (-3.40)	-16.15 (-2.58)			
COF4		9.88 (2.09)	4.85 (1.23)			
D.W.	0.98	1.18	1.16	1.96	2.25	1.05
F	106.03	144.32	232.29	368.08	1311.13	56.15

Table 7.1 (Contd.)

Vars.	13	14	15	16	17	18
DQCOF	Dep var			Dep. var		
FQCOF		Dep var			Dep var	
QCOF			Dep var			Dep. var
INTER.	101 40 (0 40)	4 69 (99 99)	438 42 (2 19)	-825 79 (-2.47)	4 76 (52.06)	-107 38 (-0.29)
COF1	1 49 (-0 40)	0 02 (4 59)				
COF2	7 59 (0 97)	-0 003 (-2 16)				
COF3	-11 73 (-0 65)	-0 008 (-2 36)				
COF4	137 31 (0 62)	0 004 (2 00)				
LACOF1			36 22 (2.64)			
LACOF2			-14 81 (-2.34)			
LACOF3			-28 79 (-1.86)			
LACOF4			26 64 (2 74)			
PBR				18 47 (1 52)	-0.003 (-0.95)	
PCOL				-10 09 (-0.79)	0 028 (5 12)	
PKEN				-13 19 (-1.49)	-0 0029 (-1 21)	
TKEN				53.79 (2.56)	0.0008 (0.15)	
TIN				-10 52 (-0 62)	-0 0076 (-1.68)	
TSR				-32.68 (-2.32)	0 0065 (1.70)	
LAPBR						-28.54 (-2.04)
LAPCOL						65.80 (4.02)
LAPKEN						-14.64 (-1.50)
LATKEN						29.15 (1.26)
LATIN						-12.70 (-0 65)
LATSR						-6.55 (-0.43)
D.W.	1 96	1.56	2.07	1.75	1.34	1.97
F	0.90	118.32	32.55	4.20	69.98	20.23

Section 7.2: The Quantity of Coffee and Independent Variables

This section discusses two regressions, the first of which assumed that the value of coffee imported into the US (QCOF) can be adequately characterized by the linear relationship with the twelve independent variables, as presented in Table 7.2. The next regression, presented in Table 7.4, was the result of a 'backwards' elimination procedure conducted on the starting regression in Table 7.2.

Table 7.2: A Starting Regression

Dependent Var: QCOF		
Indep vars	Coeff	t-Stat
INTER	-2149.2	-5.27
PCOF	6.31	1.04
PTEA	7.30	1.02
VBR	6.91	2.49
VCOL	18.74	7.13
VKEN	8.25	2.11
PBR	8.07	1.47
PCOL	10.16	0.99
PKEN	-7.35	-1.28
QTEA	-1.05	-0.26
TKEN	24.37	2.18
TIN	-20.42	-2.97
TSR	-10.14	-1.55
DW 2.14		
F 154.61		
n 30		

The only variables not included here are those representing the four types of coffee sold in the New York exchange (COF1-COF4), together with the export earnings for the three principal coffee producing countries, namely Brazil, Colombia and Kenya (EBR, ECOL, EKEN). Export earnings were not included for they would be highly correlated with export prices and the volume of export, both of which are present in the model. In addition, it was felt that the

variable PCOF, which represents the prices of all coffee sold on the New York exchange, adequately captures the collective effect of the variables COF1-COF4

As indicated by the estimated coefficients in Table 7.2, the model had a high degree of explanatory power with regard to the quantity of coffee imported (QCOF). The volume of coffee exported from Colombia (VCOL), is highly significant, with a corresponding Student's t statistic of 7.13. This finding is consistent with the view that Colombian coffee exports have been steadily gaining ground at the expense of Brazilian coffee exports. Furthermore, Colombian coffees fall into the medium to high price range and they are very popular with the present blenders and roasters of instant coffee. The coefficient of the volume of Kenyan export (VKEN) also contributes more to the model than Brazilian exports (VBR). Though Kenyan coffee is of lower quality than the Brazilian brands, both Kenyan and Colombian coffees are used in instant coffee blends, unlike the more expensive Brazilian coffees. With the increasing popularity of instant coffees, this ensures a persistent demand for imports from Colombia and Kenya.

Among unit export prices for coffee from the three countries under discussion, Brazilian prices (PBR) show a positive and significant effect on quantity imported into the US (QCOF), as expected. Export prices for Colombian coffee (PCOL) were found to be not significantly different from zero, with a corresponding Student's t statistic of 0.991, while Kenyan export prices had a negative effect on QCOF. It is notable that Brazilian coffee prices move together with the quantity of coffee imported, confirming that Brazil is still a market leader, despite a loss in market shares to Colombia and other Mild Arabica producing countries.

In order to interpret export prices, it should be kept in mind that the quantity imported (QCOF) is a value, affected by both prices and volume imported. Assuming coffee is a normal good, and that supply is fairly elastic, the following scenario holds true. When Brazil's export prices increase (PBR), so do world coffee prices, causing QCOF to rise if the fall in the

volume of imports is less than the increase in prices. This hypothesis is further supported by the coefficient of PCOF, the variable that represents the prices of all coffee sold on the New York exchange because, although the individual regression coefficient for PCOF is low, with a t statistic of 1.04, it is positively related to the value term of the quantity of coffee imported, QCOF. Kenya, on the other hand, gains most by undercutting prices and thereby increasing its share of the world market. Thus, as expected, prices of Kenyan exports of coffee are negatively related to QCOF, with a corresponding Student's t statistic of 1.28.

Traditionally, evidence has shown that peaks in coffee prices have often been accompanied by similar peaks in tea prices.[2] This leads us to expect that the quantity of tea imported into the US (QTEA) should move together with the quantity of coffee imported, since QTEA is also a value including both prices and volume imported. The variable representing the prices of all tea, PTEA, supports this hypothesis in that the regression coefficient is positively related to QCOF, with a corresponding Student's t statistic of 1.02. Although the variable QTEA is negatively related to QCOF, its regression coefficient is not significantly different from zero, with a corresponding t statistic of 0.26.

The wholesale prices for export of tea from the countries of Kenya (TKEN), India (TIN) and Sri Lanka (TSR) are all significant and their coefficients exhibit the expected signs. That is, export prices from India (TIN) and Sri Lanka (TSR) are negatively related to the quantity of coffee imported (QCOF), while Kenyan exports of tea moved with QCOF.

India and Sri Lanka, the traditional suppliers of tea to the US, have been steadily losing tonnage, as well as price, to newcomers like Kenya, whose exports are comprised of 'generic' and 'powder' teas, ideal for use in tea-bags and instant tea mixes. In addition, Kenya is relatively more established than India or Sri Lanka in the export of spray-dried instant teas.

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[2]See chapter 6, section 6.4, graph 6.4.6, which illustrates the movements of the two markets.

As a result, Kenyan tea prices exhibit similar comovements to world coffee and tea prices, while India and Sri Lanka may need to reduce export prices in order to lure buyers.

Since time-series data tend to produce serially correlated residuals, the standardized residuals from this regression were plotted against time. The residuals tended to be randomly distributed around zero with no distinguishable pattern as such. The presence of serial correlation can also be detected by the Durbin Watson (DW) test for independence, where the DW statistic has to fall within a certain range in order to reject/accept the hypothesis of serial correlation. If the test statistic is too small or too large, it provides evidence for the presence of positive or negative serial correlation. For the purposes of this analysis, the DW statistic for supporting the hypothesis of no autocorrelation, must approximately fall within the range of 1.75 and 2.2. As presented in Table 7.2, the Durbin-Watson statistic was acceptable, with a DW statistic of 2.14.

The test of the composite hypothesis that all twelve regression coefficients are jointly zero was highly significant, with a corresponding F statistic of 154.61. With such a large F-statistic, it was felt prudent to generate the autocorrelation function (ACF) presented in Figure 7.1. This plots successive autocorrelations of regression residuals about the zero line, with dotted reference marks indicating the error band of approximately plus or minus two standard deviations for each point. There were unexplained spikes in the data at lag five (which exceeded beyond two standard errors), and at lag eleven, following which the data decayed in a geometric pattern. These unexplained spikes seem to be indicative of commodity cycles. More data may prove that the coffee market is indeed subject to ten year cycles, or, they might be the result of omitting some sort of cyclical element of the coffee market. One possible explanation for this curious behaviour may be the switching effect of the quota system of the International Coffee Agreements. In addition, the size of the sample period may have affected the calculations of the asymptotic

approximations, leading to poor estimates.

Table 7.3: ACF from Model in Table 7.1

```
                         ARIMA Procedure

               Name of variable = YRESID

               Mean of working series = 1.08E-12
               Standard deviation     = 104.3[illegible]
               Number of observations =       30

                          Autocorrelations

Lag Covariance  Correlation -1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1      Std
  0 10882.[illegible]   1.00000  |                    |********************|  0
  1 -1052.[illegible]  -0.09[illegible]  |                  **|                    |  0.18[illegible]4
  2 -128[illegible].[illegible]41  -0.11[illegible]  |                  **|                    |  0.184[illegible]
  3  1402.063   0.12152  |                    |***                 |  0.186785
  4 -2186.452  -0.20084  |                ****|                    |  0.189847
  5 -4[illegible]   -0.37990  |            ********|                    |  0.19[illegible]
  6  1658.949   0.15327  |                    |***                 |  0.219[illegible]
  7  1321.065   0.121[illegible]  |                    |**                  |  0.223211
  8 -2[illegible]  -0.2[illegible]  |               *****|                    |  0.225[illegible]
  9   [illegible]32.740   0.058[illegible]  |                    |*                   |  0.23[illegible]054
 10  2409.[illegible]   0.22130  |                    |****                |  0.2335[illegible]
 11 -[illegible]  -0.3[illegible]  |             *******|                    |  0.240[illegible]
 12   97[illegible].565   0.08[illegible]  |                    |**                  |  0.25[illegible]
 13  1750.[illegible]   0.16[illegible]94  |                    |***                 |  0.25[illegible]11[illegible]
 14 -1[illegible]  -0.17[illegible]  |                ****|                    |  0.2594[illegible]
 15 -1020.284  -0.09370  |                  **|                    |  0.262450
 16   622.15[illegible]   0.05[illegible]23  |                    |*                   |  0.264[illegible]
 17   558.986   0.05124  |                    |*                   |  0.264[illegible]71
 18   799.289   0.07341  |                    |*                   |  0.265302
 19  2078.494   0.19083  |                    |****                |  0.2659[illegible]
 20   735.501   0.06[illegible]  |                    |*                   |  0.2705[illegible]
 21 -1[illegible]  -0.1[illegible]  |                  **|                    |  0.2710[illegible]
 22 -[illegible]  -0.0[illegible]  |                   *|                    |  0.27[illegible]
 23 -1[illegible]  -0.1[illegible]384  |                  **|                    |  0.27[illegible]
 24 -1[illegible]  -0.[illegible]  |                  **|                    |  0.274[illegible]
                                    "." marks two standard errors
```

The following regression, presented in Table 7.4, was, as indicated, the result of a 'backwards' elimination procedure conducted on the model in Table 7.2. That is, the method starts with a full model, as in Table 7.2, eliminating variables from the model one at a time. At each step, the variable with the smallest contribution to the model is deleted.

The summary of the regression results in Table 7.4 show a strong relationship between the quantity of coffee imported (QCOF), and the seven independent variables. The most significant variable is the volume of coffee exported from Colombia, VCOL, with a Student's t statistic of 8.14, followed by TIN, the wholesale export price of Indian tea, with a Student's t

statistic of 7 87.

Keeping in mind that QCOF is a value comprising of both prices and volume imported, the following holds true When prices increase in the coffee market, there is an overall

Table 7.4: Summary of Results

Dependent variable QCOF		
Indep vars	Coeff	t-Stats
INTER	-2268 13	-6 71
PCOF	5.67	1 95
PTEA	18 79	5 31
VBR	7 48	3 02
VCOL	16.80	8 14
VKEN	11.58	3 58
PBR	11.86	3 99
TIN	-20 62	-7.87
F 265 81		
D W 1 747		
n 30		

increase in QCOF. This view is supported by the coefficient on the prices of all coffee, PCOF, which is positively related to QCOF. Secondly, the increase in the volume of Colombian exports is accompanied by an overall increase in QCOF, as is true in the cases of Brazil and Kenya. The high degree of significance of the variable VCOL, relative to export volumes from Brazil (VBR) and Kenya (VKEN), lead us to believe that the American market reflects the changing world market in its preference for Mild Arabicas, the bulk of which is supplied by Colombia.

The Durbin Watson statistic, which detects the presence of serial correlation, was just acceptable for this regression, with a value of 1 75 The composite hypothesis that all seven regression coefficients are zero was highly significant, with a corresponding F statistic of 265.81. The autocorrelation function was generated, and revealed the same patterns as before. In this case, an influence measure, known as Cook's D statistic, was also specified for this regression. The

Cook's D statistic is designed to measure the shift in the estimated coefficients when a particular observation is omitted. That is, it is a combined measure of the impact of that observation on all regression coefficients.

The observations for the years 1967, 1977, 1985 and 1986 had a significant influence on the fitted model. A thorough search of the data revealed no numerical error and coffee prices showed no aberrant behaviour in 1967. However, it was evident from the data that the years of 1966 and 1968 saw reduced levels of coffee imported into the US. Thus, the spike at 1967 could not be explained by itself. However, a probable explanation was possible if the three years were studied together. The first International Coffee Agreement, effective since 1963, ended in 1967 and was not renewed till the following year 1968. This meant quota systems were not effective in that year, which stimulated producers of coffee to export as much as possible. The years of 1985 and 1986 saw coffee and tea prices fluctuating yearly through peaks and troughs while, in 1977, both commodity prices peaked at levels that were very high.[3]

Section 7.3: Effect of Export Volumes on the Price of Coffee

To study the effect of the volume of export on the price of coffee, the average prices of all coffee sold on the New York exchange, PCOF, was regressed on the export volumes of coffee from Brazil, Colombia and Kenya (VBR, VCOL & VKEN). Brazil, being a market leader, has the ability to selectively 'dump' or withhold coffee exports, thus causing world prices to decrease or increase, respectively. As a result, the coefficient for Brazilian exports, VBR, is expected to be negatively related to the price of coffee. In addition, Colombian coffee movements have closely paralleled Brazilian movements, against a background of the growing popularity for Colombian beans among roasters and blenders. This popularity has led to increasing exports from

[3]For a detailed discussion of tea and coffee markets during these years, see Chapter 6.

Colombia to the US so that, in effect, Colombian coffee exports now influence the market in a manner similar to that of Brazilian exports

When prices in the coffee market increase, Kenyan coffee exports to the US are also expected to increase Kenya is chiefly an exporter of low quality coffees, ideal for use in the manufacture of soluble or instant coffees This procedure uses higher quality coffee beans combined with low quality Kenyan blends in an effort to be more cost efficient. An increase in coffee prices would lead blenders and roasters to replace more of the higher quality coffee beans by the still cheaper low grade coffees, which shift would be reflected in an increase in the volume of export from Kenya The results from the regression analysis are summarized in Table 7.5.

Table 7.5. Summary of Results

Dependent variable: PCOF		
Indep var	Coeff.	t-Stats
INTER	85 39	1.92
VBR	-1 09	-3 01
VCOL	0.22	0.54
VKEN	1 22	3.39
D.W. 1 03		
F 25 69		
n 30		

The coefficient for the volume exported from Colombia, VCOL, is not only positively related to prices of coffee but is also not significantly different from zero, with a Student's t statistic of 0 54. Although the coefficients on both the volume exported from Brazil, VBR, and Kenya, VKEN, were highly significant, with t statistics of 3.10 and 3.39 respectively, the variables did not exhibit a high degree of explanatory power with regard to the prices of all coffee sold on the New York exchange, PCOF. The test of the composite hypothesis that all three regression coefficients are zero seems highly significant, with a corresponding F statistic of 25.69.

However, the Durbin Watson statistic of 1.03, indicates problems with serial correlation and hence invalidates the F statistics and t statistics An analysis of the Cook's D statistic revealed significantly higher prices for coffee from 1976 to 1989, with unusually high prices for coffee in 1977 Further analysis of the coffee market showed that free market conditions prevailed from 1973 up to 1980 These factors are probable causes of the autocorrelation and estimate biases in the regression.

In order to correct such deficiencies, a series of further models were estimated The first of these used a dummy variable to represent the observations for the year 1977 because analysis showed that a severe frost in Brazil in 1975 caused world coffee prices to reach unprecedented levels in 1977[4]

The dummy variable representing the year 1977 had a high degree of explanatory power, with a Student's t statistic of 4 85, although the regression coefficients for the variables dealing with export volumes from Brazil and Kenya (VBR & VKEN) was not significantly different from zero The coefficient on the volume exported from Colombia, VCOL , showed a marginal improvement, while still being positively related to PCOF The composite hypothesis that all four regression coefficients are zero was highly significant, with a corresponding F statistic of 41.80, and the Durbin Watson statistic showed a distinct but insignificant improvement, with a DW statistic of 1.63, invalidating, as before, all F and t statistics in the regression

In order to deal with the unusual behaviour of coffee market prices from 1976 onwards, the next model incorporated a dummy which represented the years 1976 through 1989[5] The regression coefficient on the dummy variable was highly significant, with a Student's t statistic of 3 49 However, variables dealing with the export volumes from Brazil, Colombia and

[4]The results of this regression can be found in the summary table of regressions, labelled 4

[5]The results of this regression can be found in the summary table of regressions, labelled 5

Kenya, decreased in significance with additional loss in explanatory power. The volume exported from Colombia, VCOL, was negatively related to the prices of all coffee, PCOF, but was not different from zero, with a Student's t statistic of 1 40. However, the Durbin Watson statistic of 0.941, clearly indicated an increase in serial-correlation problems making further discussion of F and t statistics irrelevant

The two final simulations used multiple dummies to capture the following effects. The first regression incorporated three dummy variables to represent various periods. Dummy variable 1 (D1) covered the years 1960 through 1972, the early years of the International Coffee Agreement Free market conditions, which prevailed from 1973 through 1980, are captured by dummy variable 2 (D2), while the remaining years are represented by dummy variable 3 (D3).[6] The last model split the data into two periods. The first dummy variable contained all observations prior to 1977, while the other included all data after 1976, the period when coffee prices exhibited 'abherrent' behaviour.[7]

When the data were split to capture the effect of free market conditions in the coffee market, the only dummy variable which was significantly different from zero was the one representing the period from 1973 through 1980, with a Student's t statistic of 1.63. Among the coefficients on the volume exported from Brazil, Kenya and Colombia (VBR, VKEN & VCOL) only one partial regression coefficient, that for VKEN, was significant, with a Student's t statistic of 2.512. Although the Durbin Watson statistic of 1.17 is an improvement, the problem with serial correlation is still very much present in this simulation of the regression in Table 7 5.

The final model involved two dummy variables representing the pre 1977 and post 1977 periods, both of which were highly significant with corresponding Student's t statistics of

[6]The results of this regression can be found in the summary table of regressions, labelled 6.

[7]The results from this regression can be found in the summary table of all regressions, labelled 7.

3.389 and 4.022, respectively The coefficient on the volume exported from Colombia was negatively related to prices of coffee, PCOF, but was not different from zero, with a Student's t statistic of 1.404 Export volumes from Brazil and Kenya (VBR & VKEN) were both found to be significant, though with low explanatory powers with regard to PCOF Inclusion of these dummy variables worsened the problem with serial correlation, with the DW statistic falling to 0.94, negating any significance of the t or the F statistics.

Section 7.4: Effect of Coffee Types on the Import of Coffee

With the International Coffee Organization deadlocked in their decision over quota shares with regard to the classification of coffee known as Mild Arabicas, it is important to understand what proportion of the world price is commanded by the four main types of coffee traded on the market This section explores the relationship between the value term of the total import of coffee into the US (QCOF) and the four types of coffee. These are divided into Colombian Mild Arabicas, Brazilian and other Mild Arabicas, Other Mild Arabicas and Robustas, to be referred to throughout this section as COF1 through COF4, respectively

We would expect Brazilian and Other Mild Arabicas (COF2) to dominate the market and dictate prices, but with the growing popularity of Colombian Mild Arabicas (COF1) and Robustas (COF4), it seems prudent to expect that these two types of coffee would increasingly act as the market leaders. The results for the regression are presented in Table 7 6

As the table indicates, the model had a high degree of explanatory power with regard to the quantity of coffee imported (QCOF), as indicated by the coefficients of determination. Colombian Mild Arabicas, COF1, with a corresponding Student's t statistic of 5.36, is the most significant variable in this regression. This is not surprising considering that blenders and roasters have been demanding increasing amounts of COF1 for their instant coffee

mixes, in an attempt at quality improvement. The coefficient of COF3, Other Mild Arabicas, is also highly significant with a Student's t statistic of 3.40. Following this is the category of Robusta, COF4, the other important ingredient in soluble coffee mixtures, with a Student's t statistic of 2.09.

Table 7.6: Summary of Results

Dependent variable: QCOF		
Indep var	Coeff	t-Stat.
INTER	207.79	2.03
COF1	37.57	5.36
COF2	-4.48	-1.39
COF3	-25.19	-3.40
COF4	9.98	2.09
D.W. 1.18		
F 144.32		
n 30		

In order to interpret these results, it should be understood that the variable QCOF is a value, affected by both prices and volume of coffee imported. Thus, with an overall increase in QCOF, the two following scenarios are possible. When the world prices of coffee rise, and the volume imported into the US decreases, the prices of Colombian Mild Arabicas (COF1) and Robustas (COF4) also increase with the market, while the prices of Brazilian and Other Mild Arabicas (COF2) and Other Mild Arabicas (COF3) falls. In contrast, when world prices decrease, and the volume imported rises, the overall increase in QCOF is accompanied by a rise in the prices of COF1 and COF4, and a decrease in the prices of COF2 and COF3.

The changing shifts in the coffee market are nowhere so clearly illustrated as in the above analysis, which indicates that regardless of world coffee prices, the prices of Colombian Mild Arabicas (COF1) and Robustas (COF4) continue to increase. In addition, the fall in prices

of Other Mild Arabicas (COF3) and Brazilian and Other Mild Arabicas (COF2), substantiate Brazil's growing fear of losing market shares to Colombia and Kenya[8]

The joint hypothesis that all four regression coefficients are zero was strongly significant, with a corresponding F statistic of 144.32. Considering the high level of the *F* statistic, the autocorrelation function (ACF) for this regression was generated and is presented below. The data indicated an autoregressive correction of lag one, accompanied by unexplained spikes at lag three and ten. As in the case of the regression in Table 7.2, these unexplained spikes may be the result of omitting a cyclical element of the coffee market, or may be the result of the sample size, which in turn might have led to poor estimates. However, the Durbin Watson statistic of 1.18 for this regression makes the F statistic largely irrelevent

Table 7.7: ACF from Reg. 8

```
                              ARIMA Procedure

                    Name of variable = YRESID

                    Mean of working series = 7 51E-13
                    Standard deviation     = 175 6136
                    Number of observations =       29

                              Autocorrelations

Lag  Covariance  Correlation -1 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 1       Std
 0   30840 150    1 00000   |                    |********************|           0
 1   12950 702    0 42022   |                    |********            |    0 185695
 2    2203 822    0 07470   |                    |*                   |    0 216012
 3   -8768 437   -0 28432   |              ******|                    |    0 216901
 4   -6497 886   -0 21070   |                ****|                    |    0 229393
 5     702 050    0 02276   |                    |                    |    0 235971
 6    3680 054    0 11933   |                    |**                  |    0 236047
 7    6010 675    0 19490   |                    |****                |    0 238110
 8   -5607 495   -0 18182   |                ****|                    |    0 243557
 9   -5088 132   -0 16498   |                 ***|                    |    0 248193
10   -9289 855   -0 30123   |              ******|                    |    0 251947
11   -5747 921   -0 18638   |                ****|                    |    0 264073
12   -3761 930   -0 12198   |                  **|                    |    0 268571
13   -2099 931   -0 06809   |                   *|                    |    0 270475
14   -1202 283   -0 03944   |                   *|                    |    0 271065
15   -1100 770   -0 0[illegible]   |                   *|                    |    0 271[illegible]
16    2910 755    0 [illegible]   |                    |**                  |    0 271[illegible]
17     596 358    0 01934   |                    |                    |    0 272799
18  -72 335596   -0 [illegible]235   |                    |                    |    0 272846
19    -225 118   -0 [illegible]730   |                    |                    |    0 272847
20    1544 287    0 05007   |                    |*                   |    0 272853
21     645 210    0 02092   |                    |                    |    0 273170
22    1554 018    0 05039   |                    |*                   |    0 273225
23     789 194    0 02559   |                    |*                   |    0 273545
24     489 578    0 0[illegible]   |                    |                    |    0 273[illegible]
                                           "." marks two standard errors
```

[8]On March 23, 1991, the Financial Times reported that Brazil would be halting coffee exports in an attempt to boost depressed prices.

An analysis of the Cook's D statistic for this model indicated the years of 1977, 1980 and 1989 as having had significant influence on the data, which in turn could have caused the problem with serial correlation. Coffee prices skyrocketed in 1977 as a result of a severe frost in Brazil in 1975, while in 1980 the quota system of the International Coffee Organization was reinstated, after free market conditions had prevailed since 1973. Free market conditions had caused world coffee prices to stagnate, and the reintroduction of the quota scheme succeeded in raising and stabilizing prices. The observation for the year 1989 was an estimate, and because of its considerable effect on the results, it was deleted from the data and the model was run again.[9]

This regression without the observation year 1989 (n=29) was meaningful in that it reduced the significance of the coefficient on COF4, Robustas, to a Student's t statistic of 1.16 from 2.09. At the same time it increased the relevance of Brazilian and Other Mild Arabicas, COF2, from a Student's t statistic of 1.39 to 2.25, but the problem with serial correlation also worsened, with a DW statistic of 1.158.

In order to correct for serial correlation in the errors, a number of models were run, the results from which are reproduced in Table 7.8.

As the table indicates, first differencing of the dependent variable led to the results as presented in Reg 1. The Durbin Watson statistic of 1.96 was acceptable, however, not only did the t statistics indicate that none of the individual regression coefficients were significant, but the joint hypothesis that all regression coefficients are zero was also insignificant, with a corresponding F statistic of 0.90. The next step was to change the dependent variable QCOF from levels to rates of change. This yields Reg.2 in the Table 7.8. In this case, the Durbin Watson

[9]The results from this regression can be found in the summary table of regressions, labelled regression 9.

statistic indicated problems with serial correlation, with a DW statistic of 1.56

The final procedure, Reg 3 in the table below, used lagged dependent explanatory variables, with no change to the dependent variable, QCOF. Coefficients on all the independent variables were highly significant, with the Durbin Watson statistic of 2.07 falling within the acceptable range[10]. The composite hypothesis that all regression coefficients are zero was also highly significant, with a F Statistic of 32.55.

Table 7.8: Summary of Results

Vars.	Reg 1	Reg 2	Reg.3
DQCOF[1]	Dep var		
FQCOF[2]		Dep var	
QCOF			Dep var
INTER.	-101.40 (-0.40)	4.69 (99.99)	438.42 (2.19)
COF1	-1.49 (-0.4)	0.015 (4.59)	
COF2	7.59 (0.97)	-0.003 (- 2.16)	
COF3	-11.73 (-0.65)	-0.008 (- 2.36)	
COF4	7.31 (0.62)	0.004 (2.00)	
LACOF1[3]			36.22 (2.63)
LACOF2			-14.81 (-2.34)
LACOF3			-28.79 (-1.86)
LACOF4			26.64 (2.74)
D.W.	1.962	1.564	2.068
F	0.90	118.32	32.554

Notes:-

1. DQCOF: First differencing the variable QCOF

[10]It should be noted that in the presence of lagged dependent variables, it has been argued that a more appropriate test for serial correlation is the Durbin's h statistic or the Breush-Pagan statistics.

2. FQCOF· Rates of change; log y_t - log y_{t-1}, where y_t=QCOF.

3 LACOF1-LACOF4· The variables COF1-COF4 are lagged once to give LA LACOF1 through LACOF4

Section 7.5: Effect of Prices on Coffee Imported

In order to study the impact of export prices for coffee and tea on the quantity of coffee imported into the US, this section develops a model using the unitized export prices of coffee and tea from the countries of Brazil, Colombia, Kenya, India and Sri lanka. The results from this regression are presented in Table 7.9.

Although we would expect Brazilian prices (PBR) to have a significant effect on the quantity of coffee imported, QCOF, the regression coefficient is not significantly different from zero, with a Student's t statistic of 0 46.

Export prices for Colombian coffee show a positive and significant effect on QCOF, with a Student's t statistic of 3 64, while Kenyan export prices for coffee were significant and negatively

Table 7.9: Summary of Results

Dependent variable: QCOF		
Indep.var	Coeff.	t-Stats
INTER.	251.76	1.09
PBR	3.89	0.46
PCOL	32.10	3.64
PKEN	-10.41	-1.70
TKEN	17 23	1.23
TIN	-23.79	-2.07
TSR	7.21	0.75
D.W. 1.05		
F 56 15		
n 30		

related to the quantity of coffee imported. It is not surprising that Colombian coffee prices move

together with the quantity of coffee imported, for it confirms the hypothesis that Colombia is gaining market shares rapidly enough to be considered a market leader. Kenya, on the other hand, gains most by undercutting prices and increasing its share of the world market. Therefore, it is to be expected that prices of Kenyan exports of coffee be negatively related to QCOF, with a corresponding Student's t statistic of 1.70.

Traditionally, the main suppliers of tea to the US have been the countries of India and Sri Lanka. These countries have however, been steadily losing market shares in terms of both tonnage and price to newcomers such as Kenya, who supply 'generic' and 'powder' teas to the US. Thus, we would expect Kenyan export prices of tea to move together with the quantity of coffee exported; for evidence shows that peaks and troughs in the coffee market have been accompanied by similar peaks and troughs in the tea market. Since India and Sri Lanka have only recently started exporting the spray-dried instant teas that Kenya has been exporting for years, it is to their advantage to reduce export prices, in order to draw prospective buyers and regain market shares. Of the three exporters of tea, only the coefficient on the export prices for Indian teas is significantly different from zero, with a Student's t statistic of 2.07.

Serial correlation was detected by the Durbin Watson statistic of 1.05, which invalidates the t and F statistics for this regression. In order to correct for serial correlation, several models were run, the results from which are presented in Table 7.10

As the table indicates, the first modified model changed the dependent variable from levels to a first differenced form, leaving all else the same. This is presented in Reg. 1 in Table 7.10. The serial correlation problem is no longer evident, the Durbin Watson statistic of 1.75 being acceptable, but the composite hypothesis that all regression coefficients are zero is not significant, with a corresponding F statistic of 4.20.

Reg. 2 in the table uses rates of change instead of the level of the quantity

Table 7.10: Summary of Results

Vars.	Reg. 1	Reg. 2	Reg. 3
DQCOF[1]	Dep.var		
FQCOF[2]		Dep.var	
QCOF			Dep.var
INTER.	-825.79 (-2.47)	4.76 (52.06)	-107.38 (-0.29)
PBR	18.47 (1.52)	-0.003 (-0.95)	
PCOL	-10.09 (-0.79)	0.028 (5.12)	
PKEN	-13.19 (-1.49)	-0.0029 (-1.21)	
TKEN	53.79 (2.56)	0.0008 (0.15)	
TIN	-10.52 (-0.62)	-0.0076 (-1.68)	
TSR	-32.68 (-2.32)	0.0065 (1.70)	
LAPBR[3]			-28.54 (-2.04)
LAPCOL			65.80 (4.02)
LAPKEN			-14.64 (-1.50)
LATKEN			29.15 (1.26)
LATIN			-12.70 (-0.65)
LATSR			-6.55 (-0.43)
D.W.	1.749	1.343	1.969
F	4.201	63.98	20.233

Notes:-

1. DQCOF: First differencing the variable QCOF

2. FQCOF: Rates of change; log y_t - log y_{t-1}, where y_t=QCOF.

3. LACOF1-LACOF4: The variables COF1-COF4 are lagged once to give LACOF1 through LACOF4.

imported, QCOF. The serial correlation problem was again evident, with a DW statistic of 1.34. The final modification was to use lagged dependent variables, as presented in Reg 3. The composite hypothesis that all regression coefficients are zero was found to be significant, with a F statistic of 20.23. The Durbin Watson statistic was acceptable for this regression, and all independent variables exhibited the expected signs on their coefficients. None of the export prices for tea were significant, although the coefficients on the export prices for coffee were significantly different from zero.

Section 7.6: Confirming Normality

This section concludes the empirical process by testing for non-normality, using a procedure in SAS software known as PROC UNIVARIATE. This function uses the Shapiro-Wilk W statistic, and provides graphical displays of probability plots, frequency tables and boxplots. In addition, PROC UNIVARIATE reports skewness and kurtosis coefficients for the sample which are also used to detect normality.

Non-normality of errors does not affect the estimation of the paramaters, but is essential for tests of significance like the familiar t-test and F-test, which require the underlying random variables to be normally distributed. Two measures designed to detect non-normality of the residuals are discussed in this section: the normal probability plot and the skewness and kurtosis coefficients. The normal probability plots are presented in Appendix 7.2, together with the summary table of skewness and kurtosis coefficients for each of the variables.

The pattern of departure from the expected straight line in a normal plot suggests the potential nature of the non-normality. A skewed distribution will show a curved normal plot with the direction of the curve determined by the direction of the skewness. Thus, the skewness coefficient measures the asymmetry of the distribution whereas, kurtosis measures the tendency

of the distribution to be too flat or peaked. The table of skewness and kurtosis statistics indicates that subject to the major qualification of autocorrelation that we have already stressed, one could place a fair amount of confidence in the test statistics generated in the preceding exercises.

The normality plots presented in Appendix 7.2 display the data using asterisk (*), while a normal reference line is indicated by plus marks (+) Thus, any deviation from the reference indicates a heavy or light-tailed distribution, depending on the density of the data distribution Although the probability plots for some of the variables indicated problems with outliers, the data in general seemed (somewhat surprisingly) approximately normal.

Conclusion

Although there was some success in estimating a model explaining the quantity of coffee imported into the US, the analysis was plagued throughout with problems stemming from serial correlation A 'backwards' elimination procedure, first differencing of the dependent variable, and changing the dependent variable from levels to rates of change were all tried to correct for this problem but the results were not significantly improved.

We were unsuccessful in determining the effect of export volumes on the prices of coffee. Further, any attempt at capturing the effect of free market conditions was made worse by problems with serial correlation, which invalidated all inferential statistics. The same complication arose when trying to determine the effect of differing coffee types on the import of this commodity. However in this case, serial correlation problems were solved by using lagged dependent explanatory variables The model, dealing with differing coffee types versus the import of coffee, clearly illustrates the changing shifts in the coffee market, and provides evidence for the growing popularity of Colombian Mild Arabicas and Robustas, as reflected in increases in the prices of both these commodities. In determining the degree of inter-relationship between the

markets of coffee and tea, the model encountered serial correlation problems which were solved, as before, by using lagged dependent explanatory variables. Though the independent variables exhibited the expected signs on their coefficients, the statistical significance of these variables was very low.

The problem seems to lie with the size of our sample. It would appear that twenty-nine years is inadequate for a proper representation of the coffee market. The econometric difficulties encountered in this paper may diminish once the sample size has been extended.

Endnotes

1. Regression 4 is the same as model 3, apart from the exclusion of the variable for Yr=1977, which is represented by the dummy variable D3.
2. In regression 5, D3 is a dummy variable with a unit value for observations 17-30 and zero otherwise
3 Regression 6 incorporates three dummy variables which represent the following periods:

D1.- 1960 up to 1972
D2.- 1973 through 1980
D3 - 1980 through the end of the period, 1989.

4. Regression 7 is similar to regression 6, except that only two dummies are used. D1 and D2 break up the whole period into the two following subsections:

D1.- obs 1-16; Pre-1977
D2.- obs. 17-30, Post-1977

5. Regression 9 is like regression 8, except that the last observation, obs.30, has been removed. Thus, reg 9 only has 29 observations, as opposed to 30 in reg. 8.
6. All variables remain the same as in regression 10. The addition of the two dummy variables is to reflect the effect of the following periods:

D1.- obs. 1-16; Pre-1977
D2.- obs 17-30, Post-1977

7. In Table 7.1, abbreviations are defined as follows:

i) DQCOF. First differencing the variable QCOF
ii) FQCOF. Rates of change; log y_t - log y_{t-1}, where y_t=QCOF.
iii) LACOF1-LACOF4: The variables COF1-COF4 are lagged once to give LACOF1 through LACOF4.

Appendix 7.1: Description of Variables

The following is a list of the variables used in the regressions in this chapter. The shortened names of the variables is followed by their description

EBR Export Earnings for Brazil, in millions of dollars

ECOL Export Earnings for Colombia, in millions of dollars

ESKEN Export Earnings for Kenya, in millions of shillings

EKEN Export Earnings for Kenya, in millions of dollars.

VBR Volume of Export for Brazil, base 1985=100.

VCOL Volume of Export for Colombia, base 1985=100

VKEN Volume of Export for Kenya, base 1985=100

PBR Unit Price of Brazilian Coffee Exported, base 1985=100

PCOL Unit Price of Colombian Coffee Exported, base 1985=100

PKEN Unit Price of Kenyan Coffee Exported, base 1985=100

TKEN Wholesale Price of Kenyan Tea Exported, base 1985=100

TSR Wholesale Price of Sri Lankan Tea Exported, base 1985=100.

TIN Wholesale Price of Indian Tea Exported, base 1985=100

QCOF Total import of coffee into the US, in millions of dollars.

QTEA Total import of tea into the US, in millions of dollars

PTEA Average auction prices of all tea, in US cents/lb

PCOF Average prices of all coffee traded in the New York exchange, in US cents/lb

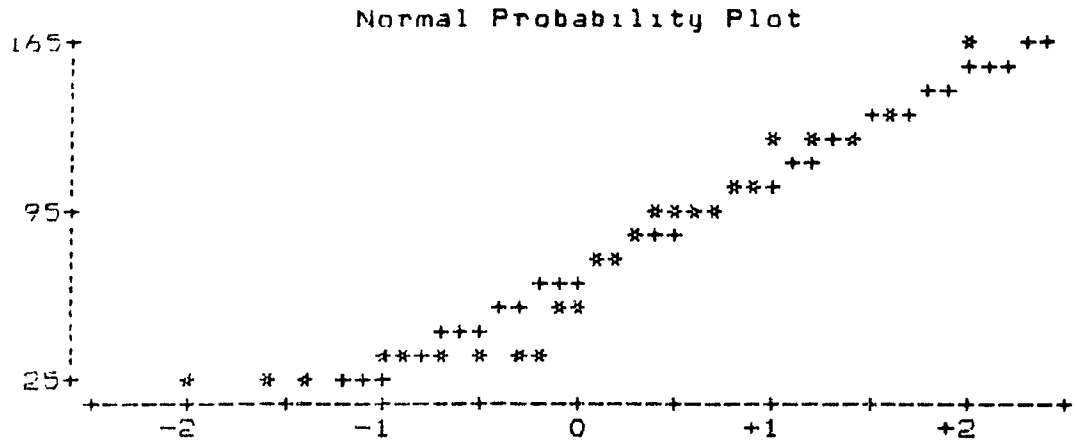
COF1 Average prices of Colombian Mild Arabicas, in US cents/lb.

COF2 Average prices of Brazilian and Other Mild Arabicas, in US cents/lb.

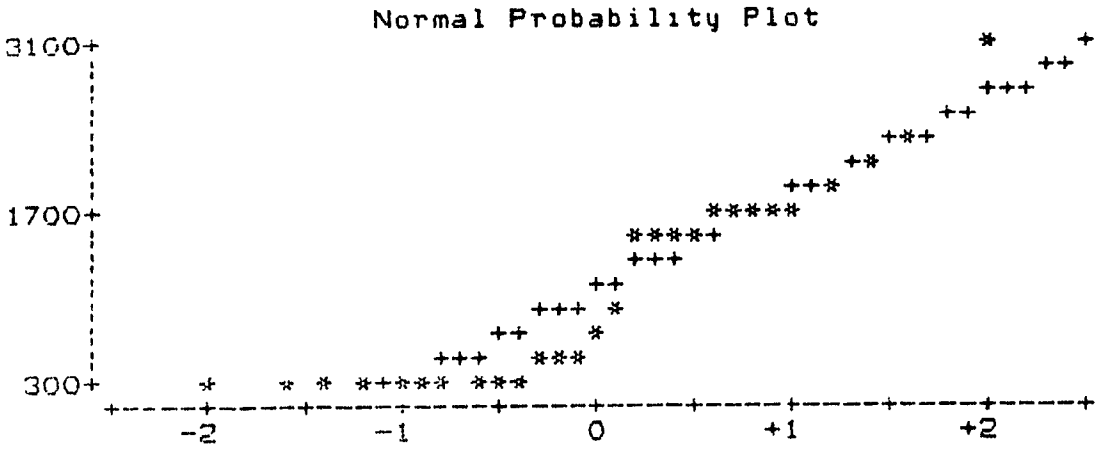
COF3 Average prices of Other Mild Arabicas, in US cents/lb

COF4 Average prices of Robustas, in US cents/lb

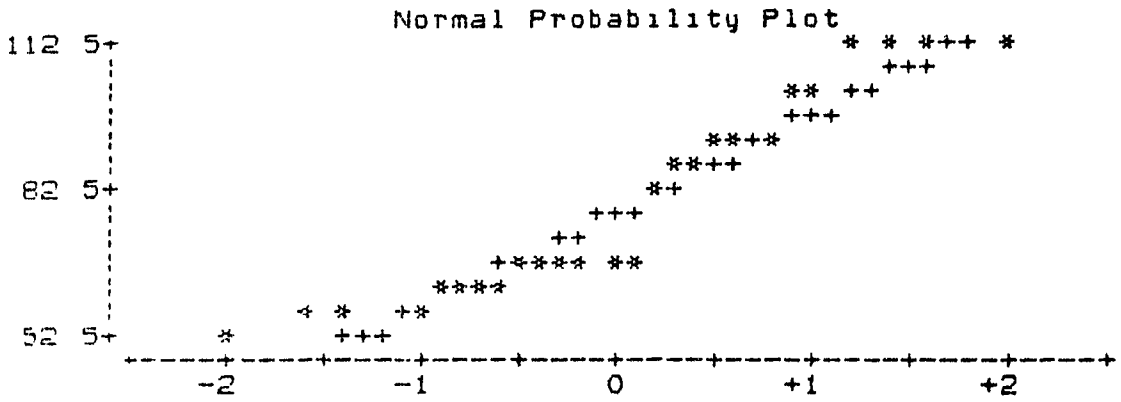
Appendix 7.2



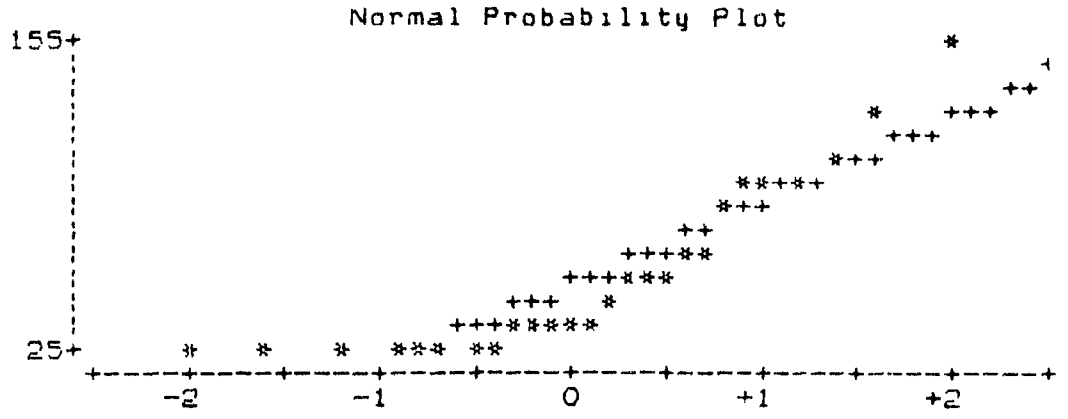
Variable: PCOL



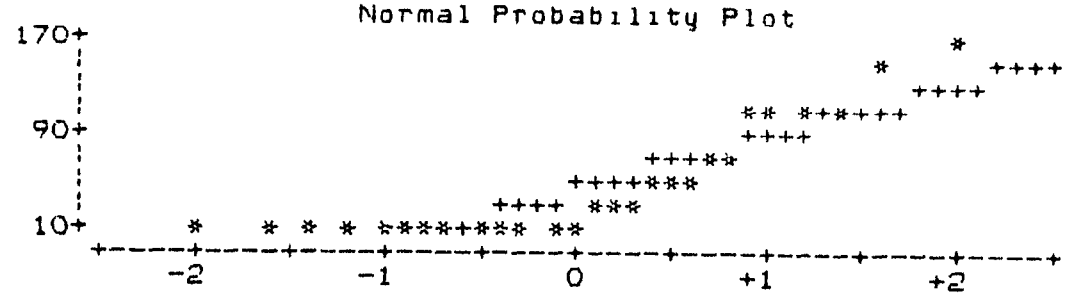
Variable: ECOL



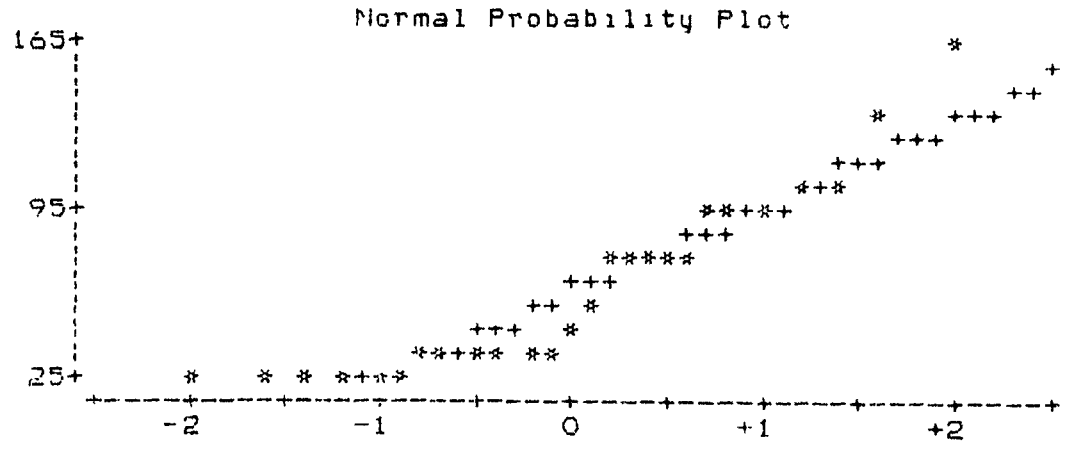
Variable: VCOL



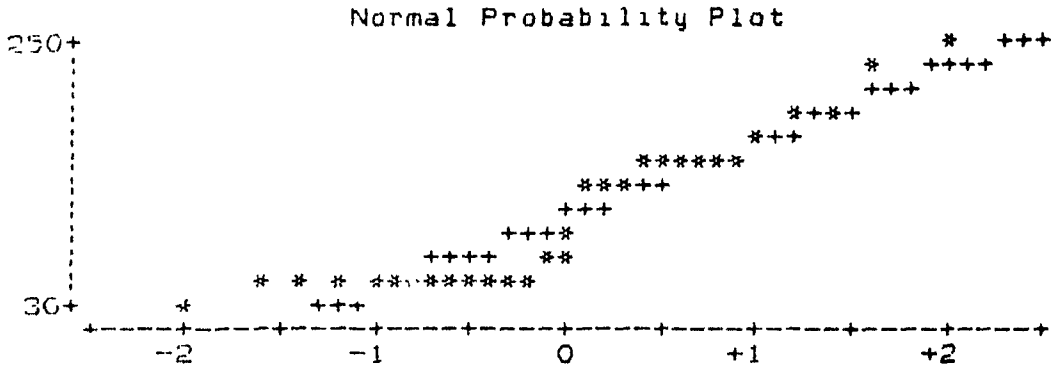
Variable: TKEN



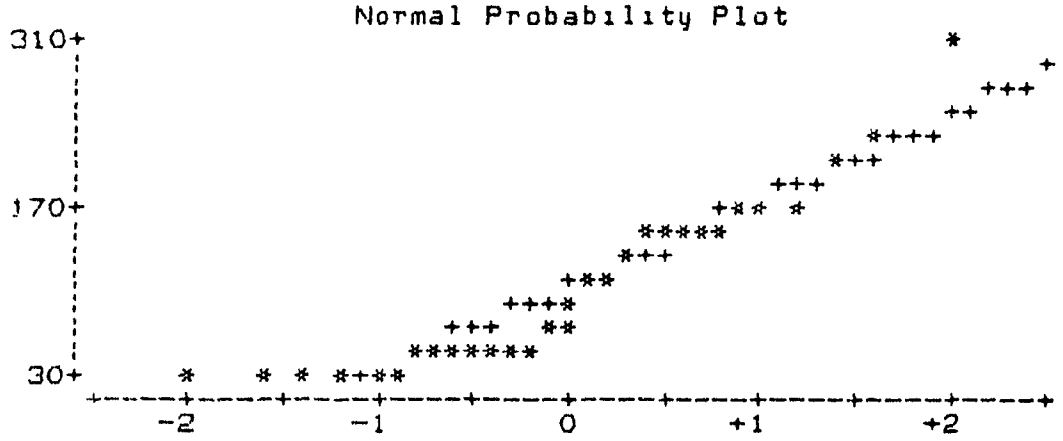
Variable: TSR



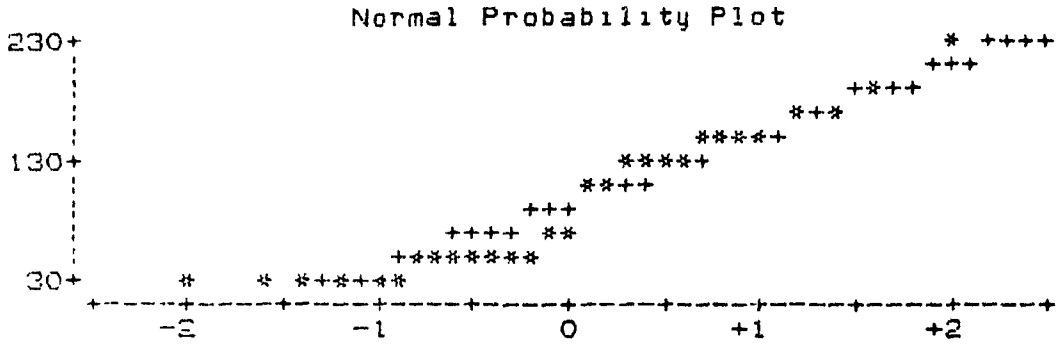
Variable: TIN



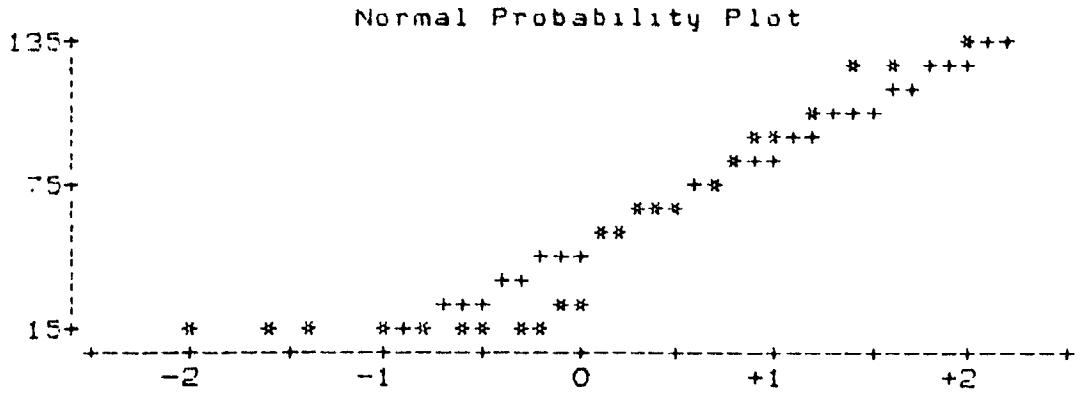
Variable: COF1



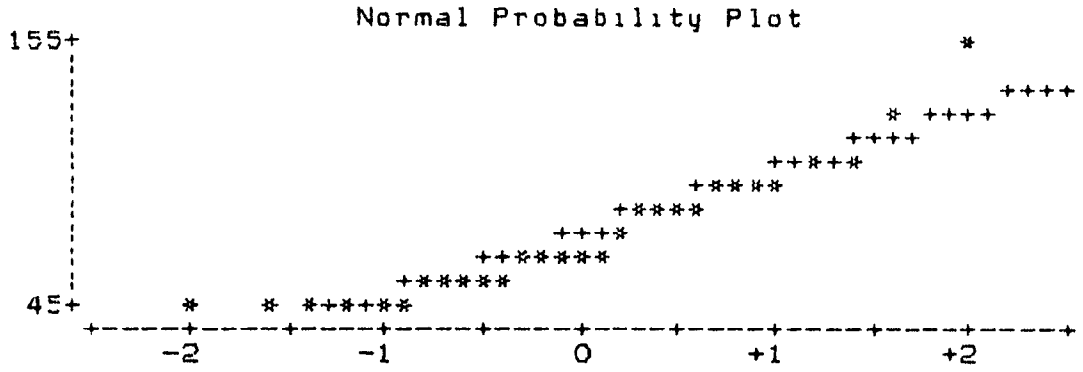
Variable: COF2



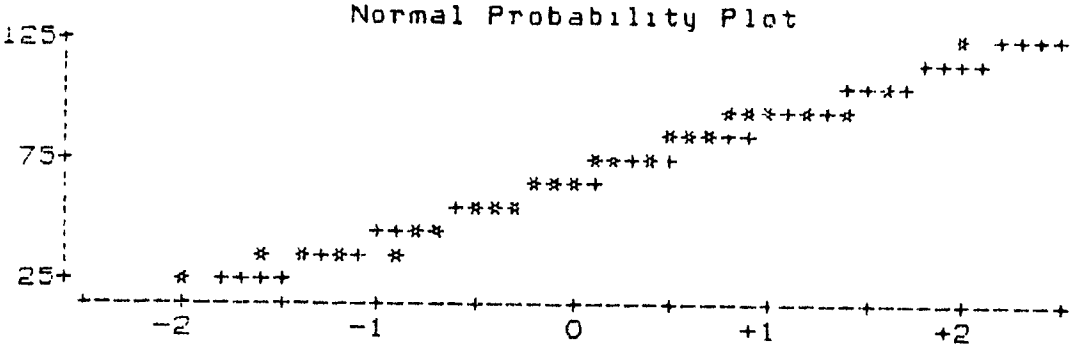
Variable: COF3



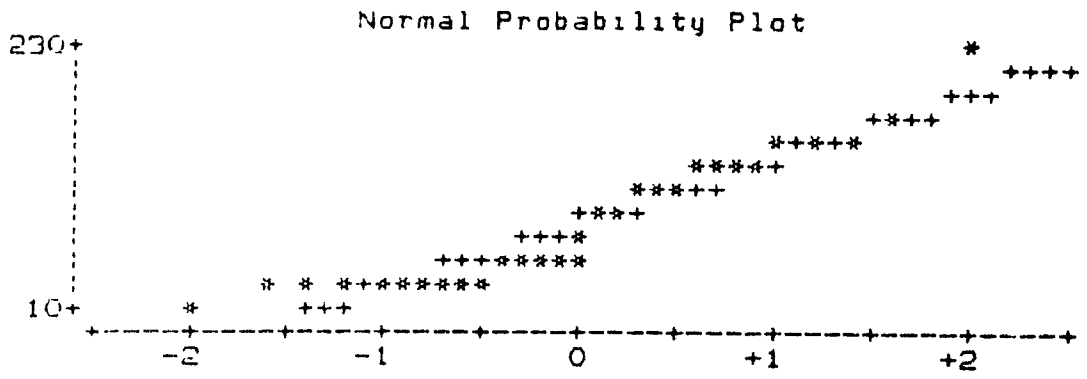
Variable: PKEN



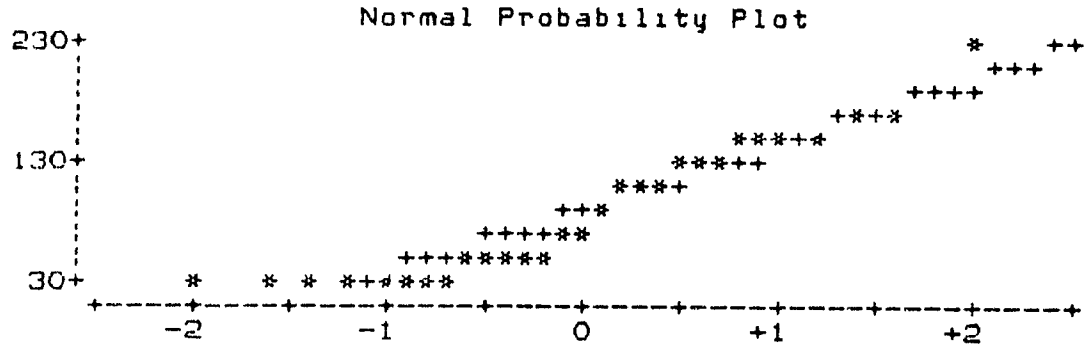
Variable: PTEA



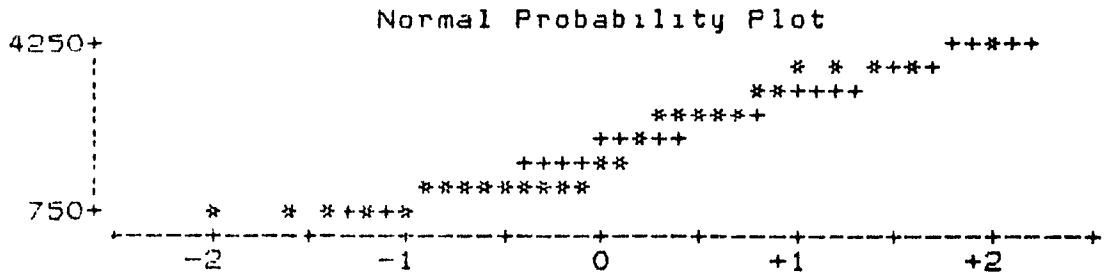
Variable: VKEN



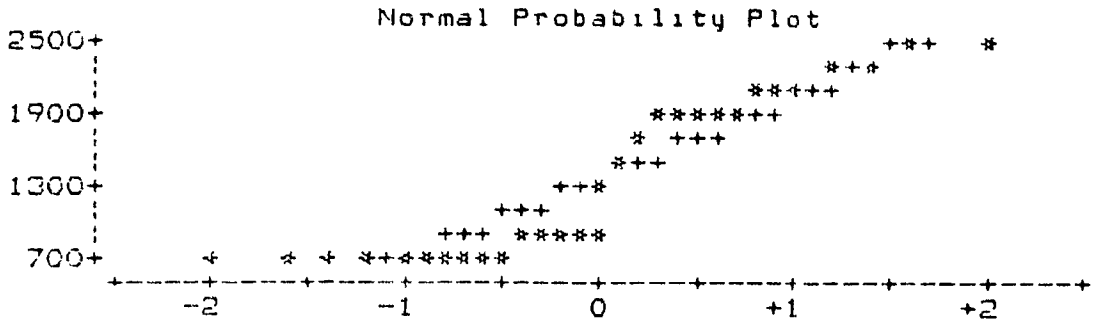
Variable: COF4



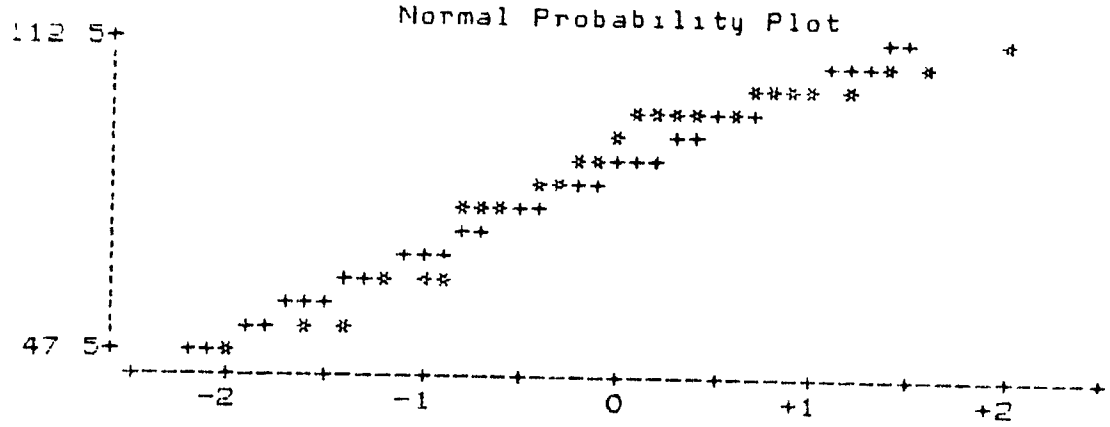
Variable: PCOF



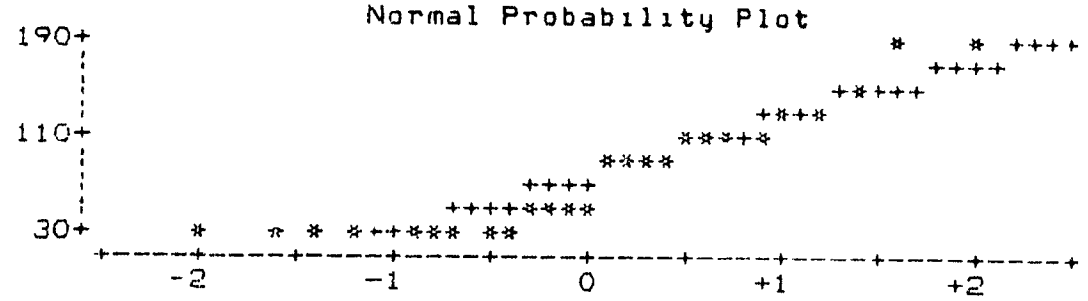
Variable: QCOF



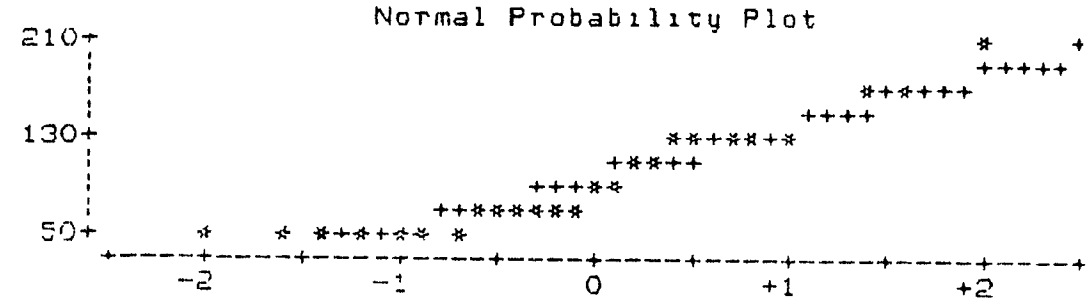
Variable: EBR



Variable: VBR



Variable: PBR



Variable: QTEA

Appendix 7.2 (Contd.)

Table of Skewness & Kurtosis Coefficients

Var	Skewness	Kurtosis	Var	Skewness	Kurtosis
EBR	0 35	-1 58	VBR	-0.74	-0.40
PBR	0 89	-0 11	ECOL	0 71	-0.48
VCOL	0 60	-1 07	PCOL	0.64	-0.71
PKEN	0 83	-0 58	VKEN	0.14	-0.82
TSR	1 34	0.71	TKEN	1 33	1.07
COF1	0.59	-0 89	TIN	1.02	0.50
COF3	0 60	-0.76	COF2	1.02	0 65
PTEA	1 23	1 90	COF4	0 75	-0.22
QCOF	0 69	-0.99	PCOF	0 68	-0 47
LPCOF	0 08	-1.58	QTEA	0 75	-0 33
ESKEN	1 25	1.25	LPTEA	0 48	-0.40
LVBR	-1 11	0 40	LVCOL	0.38	-1.32
LVKEN	-0 46	-0.84	LPBR	0 25	-1.47
LPCOL	0 14	-1 61	LPKEN	0 27	-1.69
LQTEA	0.28	-1.40	LTKEN	0.63	-0 96
LTIN	0 30	-1 32	LTSR	0.53	-1.33
LCOF1	0 12	-1 66	LCOF2	0.17	-1.45
LCOF3	0 13	-1.69	LCOF4	-0.04	-1 37
DQCOF	-0.34	2 10	LQCOF	0.32	-1 54
LLDQCOF	0 27	-1.58	FQCOF	0 32	-1 53
LACOF1	0 61	-0 93	LACOF2	1.01	0.55
LACOF3	0 64	-0 78	LACOF4	0.74	-0.31
LAPBR	0.97	-0 03	LAPCOL	0 66	-0.77
LAPKEN	0 92	-0.27	LATKEN	1.51	2.04
LATIN	1 13	1.16	LATSR	1.50	1.51

CONCLUSION

The objective of this paper was to present an analysis of coffee prices using such indicators as export potential and the price of coffee sold on the international market. The inter-relationship between the markets of coffee and tea were also studied to determine the degree of association between the two. The data were for a cross-section of traditional and new producers of coffee and tea, as well as price movements, for both commodities, in the largest consuming country for coffee -- the United States. Historical price movements in the coffee and tea markets were examined in order to understand and identify possible trends, and based on this, several coffee-price models were estimated.

We were reasonably successful in estimating a model explaining the quantity of coffee imported into the US, but serial correlation problems were present throughout the analysis, invalidating all inferential statistics. Similar problems were encountered when determining the effect of export volumes on the prices of coffee, and, the effect of differing coffee types on the import of coffee into the US. However, in the case of the latter, serial correlation problems were solved by using lagged dependent explanatory variables. The results from this regression provide evidence for the growing popularity of Colombian Mild Arabicas and Robustas in the international coffee market. Serial correlation problems appeared again when determining the inter-relationship between the markets of coffee and tea, and were also solved by using lagged dependent explanatory variables. Although the independent variables in this model exhibited the expected signs on their coefficients, their statistical significance was very low.

Analysis of the past performance of coffee prices showed periods of free market conditions in the coffee market being accompanied by a downward trend in prices, suggesting that though free market conditions initially raise coffee prices and increase short-term producer

earnings, it eventually leads to overproduction and an overall fall in coffee prices and long-term earnings for producers The changing pattern of the coffee market was reflected by a shift in the export volumes of the producing countries under study Brazil is seen to have lost considerable market shares to Colombia, while Robusta producing countries like Kenya have risen to the foreground of the international coffee market. In addition, increases in the export volumes and prices of coffee and tea from new producers were used to demonstrate the rising importance of newcomers to both these markets.

It would seem that the major problem in estimating our coffee-price models lies with the size of the sample period, which could be affecting the calculations of the asymptotic approximations, leading to poor estimates. The results might also be biased due to the omission of some sort of cyclical element of the coffee market Extending this study to a larger data set may not only improve the estimates but may also prove that the coffee market is indeed subject to regular price oscillations or cycles

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