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AN ESTIMATE OF THE EFFECT OF THE 1962 INTERNATIONAL COFFEE AGREEMENT ON REVENUE FROM GREEN COFFEE EXPORTS TO THE UNITED STATES OF SELECTED PRODUCING COUNTRIES, 1963-1966

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AN ESTIMATE OF THE EFFECT OF THE 1962 INTERNATIONAL COFFEE AGREEMENT ON REVENUE FROM GREEN COFFEE EXPORTS TO THE UNITED STATES OF SELECTED PRODUCING COUNTRIES, 1963-1966

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CHAPTER I

INTRODUCTION

In late 1962, delegates from fifty-four government signed the first comprehensive international commodity agreement ever negotiated between all major producing countries and consuming nations of a primary product--the International Coffee Agreement of 1962.

In principle, the 1962 Agreement was viewed as the logical test of an increased interest in international cooperation in the production and marketing of primary products. The Agreement regulated a commodity whose consumer demand was very price-inelastic; the accord provided for control over supply; and the world production of the affected commodity was dominated by one or two producing nations who were willing to abide by the

Agreement's provisions. All these factors were considered crucial pre-conditions to the success of a world commodity scheme.[1]

In the late 1960's, as the five-year accord is being considered for renewal or termination, it seems appropriate to review the effects of the 1962 International Coffee Agreement on the export price of green coffee, and its impact on the income which selected producing countries received from their green coffee sales to the United States.

Green coffee exports are the largest item in world trade after petroleum. In 1966, total earnings from coffee exports amounted to the equivalent of US $2.4 billion. Sixty-six countries produce the fruit seed which is used as a beverage base. However, ten producing countries account for the major part of the export proceeds: Brazil, Colombia, El Salvador, Guatemala, Mexico, and Costa Rica in Latin America; and Uganda, Ivory Coast, Angola, and Ethiopia in Africa. In 1966, these nations exported green coffee worht US $1.9 billion. Their exports represented about 80 percent of the value of all 1966 green coffee shipments.[2]

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[1] John A. Pincus, "Commodity Agreements: Bonanza or Illusion?", Columbia Journal of World Business, Vol. II, No. 1 (January-February, 1967), p. 46.

[2] Pan-American Coffee Bureau, Annual Coffee Statistics, 1966, (New York: Pan-American Coffee Bureau, 1968), pp. 16-18; Table REV-4, p. A-75.

Of the ten major green coffee producers, two nations predominate in world sales--Brazil and Colombia. In 1966, Brazil exported over US $770 million of green coffee, and Colombia exported US $340 billion (See Table 1). These two nations sold nearly half of all the green coffee exported that year. All of the ten major coffee exporters--except Mexico--received a significant share of their total foreign earnings from green coffee sales. Of the producing nations represented in Table 1, Ethiopia relied most heavily on green coffee exports as a source of foreign exchange. About 88 percent of that nation's export revenue was generated by coffee sales in 1966. For most other countries, green coffee exports accounted for 45 to 50 percent of total export proceeds. For all countries (except Mexico) green coffee was the most important single item that the nation exported.

Sixty-eight countries import the seed (or beans) for roasting and grinding into the soluble powder base for the coffee beverage.[3] In 1965, a total of 44.9 million bags of green coffee were shipped to consuming countries.[4] More than 90 percent of

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[3] Ibid., pp. 16-18.

[4] Ibid., Table EQ-1, p. A-9.

TABLE 1

TOTAL REVENUE FROM GREEN COFFEE EXPORTS AND THEIR PERCENT OF TOTAL EXPORT REVENUE, SELECTED PRODUCING COUNTRIES, BY COUNTRY, 1966[a]

Country	Value of Green Coffee Exports (Millions of U. S. Dollars)	Green Coffee Sales As A Percent of Total Export Revenue
Brazil	773.5	44.7
Colombia	339.2	67.0
Ivory Coast	111.4	36.6
Angola	107.4	48.5
Uganda	103.3	56.0
Guatemala	102.3	45.9
Ethiopia	98.0	87.5
El Salvador	90.6	47.2
Mexico	82.3	6.7
Costa Rica	52.2	42.1

[a]Source: Pan-American Coffee Bureau, Annual Coffee Statistics, 1966, (New York: Pan-American Coffee Bureau, 1968), Table REV-4, p. A-75.

the green coffee was exported to the United States and Western Europe (See Table 2).

The United States was the largest single purchaser of green coffee; 47 percent of all green coffee exports was shipped to the United States in 1965. The second largest buyer of green coffee was Germany, which accounted for about ten percent of all such exports.

The Nature of the Coffee Problem

In the early 1950's the physical quantity of world green coffee production of exportable quality closely approximated (on an annual basis) the physical quantity of world exports of green coffee. Green coffee production from 1953 through 1955 was, as Table 3 indicates, about equal to green coffee exports. However, beginning in 1956, increases in coffee production began to outpace increases in coffee exports. By 1962, exportable green coffee production exceeded green coffee exports by about 12 million bags. This unexported production represents, in most recent years, overproduction of about 25 percent per year relative to coffee export levels. Increases in production occurred in all coffee producing countries. In absolute terms, the greatest increase in exportable green coffee production was realized in Brazil; in relative terms, the African producers--notably Ethiopia, Ivory

TABLE 2

GREEN COFFEE IMPORTS, SELECTED COUNTRIES, 1965[a]

Importing Country	Green Coffee Imports	
	Amount (Millions of 60 Kg. Bags)	Percent of World Coffee Exports
United States	21.3	47.4
Germany	4.6	10.2
France	3.6	8.0
Italy	2.0	4.5
Benelux	2.5	5.6
Other Western European Countries	7.1	15.8

[a]Source: U. S. President, Second Annual Report of the President of the United States on the International Coffee Agreement, (Washington, D. C.: U. S. Government Printing Office, 1966), p. 4.

Coast, and Uganda--have increased their output of green coffee the most.[5]

Stocks of unsold green coffee have increased steadily because of the disparity between exportable green coffee production and green coffee exports (See Table 3). Although the level of green coffee stocks was relatively low in 1953 (5.6 million bags), by 1962 the green coffee stockpile had reached 72.4 million bags. This 1962 stock level represented nearly two years of physical exports at the 1962 export rate.

The existence of sizable green coffee stocks suggests that considerable efforts were exerted by individual producing countries (or groups of producing countries) to restrict the effective supply of green coffee. These attempts to control the supply of green coffee antedate the 1962 International Coffee Agreement, which also attempts to restrict the effective green coffee supply through systematic export quota allotments. The effect of the restricted coffee supply (i.e., the purposeful retention of a portion of coffee production) was to maintain export prices at a level above that which would have existed in the absence of such restrictions. Presumably, the reason for restricting the effective green coffee

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[5]See Appendix, Table 21 for annual data on exportable green coffee production from 1950 through 1966.

TABLE 3

TOTAL PRODUCTION, EXPORTS, AND END-OF-YEAR STOCKS OF GREEN COFFEE, ALL PRODUCING COUNTRIES, BY YEARS, ANNUALLY, 1953-1962[c]

(Thousands of 60 Kg. Bags)

Year	Exportable Green Coffee Production	Green Coffee Exports	End-of-Year Stocks
1953	32,887	34,647	5,611
1954	33,680	28,918	6,493
1955	32,953	33,509	11,196
1956	43,617	38,509	16,517
1957	34,582	36,057	14,956
1958	46,230	36,505	23,846
1959	52,001	42,587	36,870
1960	66,421	42,491	60,940
1961	52,814	43,725	66,534[a]
1962	58,275	46,256	72,448[b]

[a]Figure does not include 3 million bags which were allocated for industrial use in Brazil.

[b]Figure does not include 7 million bags which were destroyed in Brazil during the early part of the coffee year.

[c]Sources: U. S. Department of Agriculture, Foreign Agricultural Service, Foreign Agricultural Circular: Coffee, FCOF series, various issues, 1953 through 1963; Specific data on the end-of-year stocks from FCOF-1 (January, 1967), Table III, p. 9.

supply was not to maintain coffee export prices per se, but to maintain green coffee export revenue.

Despite the efforts in the mid 1950's to restrict the green coffee supply through coffee retention schemes, coffee export prices fell (See Table 4). The average annual price for green coffee exports in the New York market was US $86.88 per 60 Kg. bag in 1954. Export prices fell rather consistently thereafter; by 1962, the average value of a 60 Kg. bag in New York was only US $40.27. The substantial increases in coffee exports probably contributed to this downward trend.[6]

The coffee export prices of the larger producing countries fell rather sharply from 1956 through 1959, and then continued downward in a more moderate decline through 1962.[7]

Earnings from green coffee exports to the United States also fell during the 1954-1962 period. As Table 5 indicates, the value of all green coffee exports to the United States from all producing countries was US $1,484 million in 1954. In 1962 total green coffee sales to the United States amounted to only US $990

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[6] More careful consideration is given to this assertion in Chapters IV and V, in which the statistical analysis of the factors involved in influencing coffee export prices and revenue is presented.

[7] See Appendix, Tables 25 and 26.

TABLE 4

AVERAGE ANNUAL BAG PRICE FOR GREEN COFFEE EXPORTS TO THE UNITED STATES, FROM ALL PRODUCING COUNTRIES, BY YEARS, ANNUALLY, 1953-1962[a]

(U. S. Current Dollars per 60 Kg. Bag, Delivered in New York)

Year	Average Price per Bag
1953	69.70
1954	86.88
1955	69.02
1956	67.71
1957	65.88
1958	58.05
1959	47.15
1960	45.62
1961	42.91
1962	40.27

[a]Source: U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1953 through 1963.

TABLE 5

VALUE OF UNITED STATES PURCHASES OF GREEN COFFEE FROM ALL PRODUCING COUNTRIES, BY YEARS, ANNUALLY, 1953-1962[a]

(Millions of U. S. Current Dollars)

Year	Value of Green Coffee Exports
1953	1,468
1954	1,484
1955	1,356
1956	1,441
1957	1,375
1958	1,172
1959	1,097
1960	1,004
1961	964
1962	990

[a]Source: U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1953 through 1962.

million. This reduction of green coffee revenue represents a decline of about one-third in green coffee earnings from the 1954 level. In addition to the secular decline in green coffee earnings, there was also considerable fluctuation in the year-to-year earnings level of individual producing countries, as indicated by the variation in their sales to the United States.[8]

In Brazil, for example, the value of green coffee exports to the United States in 1954 was US $544 million; in 1955, green coffee sales to the United States amounted to US $486 million; in 1956, comparable exports totalled US $604 million.[9] Since green coffee revenue accounts for a large portion of Brazil's total foreign exchange earnings, any considerable change in green coffee income has a significant impact on Brazil's external liquidity. Fluctuations in green coffee earnings have similar external consequences for most of the other major coffee producing nations.

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[8] This study assumes that the changes in income from a nation's green coffee sales to the United States reflect the general movement in its total revenue from coffee exports to all countries. This assumption is identical to that made by the International Coffee Organization--the administrative organ of the 1962 Agreement--which chose the United States green coffee import market as the bellweather for world coffee sales.

[9] Pan American Coffee Bureau, Annual Coffee Statistics, 1954, 1955, and 1956 issues (Numbers 18, 19, and 20), Table IV-9. See also Appendix, Table 28 of this study.

The basic coffee problem as defined by the coffee producing nations themselves, comprised

> a tendency toward persistent disequilibrium between production and consumption, accumulation of burdensome stocks, and pronounced fluctuations in prices and green coffee export earnings. . . [10]

The 1962 International Coffee Agreement and The Coffee Problem

The desire to stabilize and/or increase green coffee earnings began to occupy the collective attention of coffee producers and consumers as early as 1954.[11] In 1962, eight years of international conferences, unilateral coffee retention programs, and interim multilateral producer agreements culminated in the adoption of the International Coffee Agreement of 1962. The six major objectives of the 1962 accord are:

> (1) To achieve a reasonable balance between supply and demand on a basis which will assure adequate supplies of coffee to consumers and markets for coffee to producers at equitable prices, and which will bring about long-term equilibrium between production and consumption;

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[10] United Nations Coffee Conference, 1962, Summary of Proceedings, (E/Conf. 42/7), "Preamble to the International Coffee Agreement, 1962", p. 56.

[11] Coffee producer and consumer negotiations and agreements are discussed in Chapter III.

> (2) To alleviate the serious hardship caused by burdensome surpluses and excessive fluctuations in the prices of coffee to the detriment of the interests of both producers and consumers;
>
> (3) To contribute to the development of productive resources and to the promotion and maintenance of employment and income in the Member countries, thereby helping to bring about fair wages, higher living standards, and better working conditions;
>
> (4) To assist in increasing the purchasing power of coffee-exporting countries by keeping prices at equitable levels and by increasing consumption;
>
> (5) To encourage the consumption of coffee by every possible means; and
>
> (6) In general, in recognition of the relationship of the trade in coffee to the economic stability of markets for industrial products, to further international co-operation in connection with world coffee problems.[12]

To achieve these goals, membership in the Agreement was solicited not only from green coffee producing nations, but also from green coffee importing countries.

Two major facets of the Agreement were to be implemented--one was a policy for the achievement of short-term objectives; the other was a program for the attainment of long-term goals. The short-term objectives of the Agreement were to reduce fluctuations in green coffee export prices and to increase the earnings from

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[12] United Nations Coffee Conference, 1962, op. cit., Article 1, p. 56.

green coffee sales.[13] The long-term goals of the Agreement were to promote increases in consumption (i. e., shift the demand schedule to the right more rapidly than the present rate of shift) and to adjust the production of green coffee to the probable level of consumption at remunerative prices.[14] Remunerative prices were considered to be green coffee prices which were not lower than their 1962 levels.[15] The long-term goals will not be discussed in this study.

The short-term objectives were to be accomplished through a systematic restriction of the green coffee supply. This restriction would be achieved by establishing green coffee export quotas for every coffee-producing nation which was a signatory of the 1962 International Coffee Agreement. Thirty-seven coffee-producing countries, which account for 97 percent of world green coffee exports, are subject to these green coffee export quotas.

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[13] Ibid., Article 27, paragraphs 1 and 2, p. 61.

[14] Ibid., Article 46, p. 64; Article 48, p. 65.

[15] At the time of the United Nations Coffee Conference in mid-1962, it appeared that 1962-63 world exportable green coffee production would approximate green coffee exports for the first time in almost a decade. 1962 prices were therefore considered to be near the equilibrium point, and therefore maintainable. See International Coffee Organization, Executive Board, History of International Coffee Agreements, (London: International Coffee Organization, 1963), p. 71.

Constraints upon coffee supply were considered to produce three implicit effects: (1) restrictive quotas would increase coffee prices; (2) higher coffee prices would generate larger green coffee earnings;[16] and (3) green coffee stocks would increase. Unexportable production was to be handled by each producer country in whatever manner it thought best. Stock accretions were considered only a temporary annoyance, because the achievement of long-term Agreement goals would eliminate the conditions which caused massive coffee stockpiling, namely "over-production".

The aid of the coffee consuming countries was solicited in enforcing the short-term policies of the Agreement. The twenty-two importing countries which are signatories of the International Coffee Agreement are required to admit into their countries only green coffee exports which are shipped under quota approval. Because these coffee-importing countries account for about 92 percent of all internationally traded coffee, the theoretical ability to enforce Agreement quota policies is substantial. The willingness of the coffee-importing countries to become party to a price- and foreign exchange-maintenance scheme for green coffee exporting

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[16] The important assumption is made by Agreement advocates that the demand for green coffee exports is inelastic. This assumption is examined carefully in Chapter IV.

nations stemmed from the desire of the coffee-consuming nations to underwrite the economic development efforts of the coffee-producing countries.

The major coffee-consuming nations are high-income, industrial societies. The major coffee-producing countries are low-income, agriculturally oriented economies. The higher price paid by the ultimate consumer in the industrial nation to the coffee producer in the agricultural economy was to be considered a transfer payment in the interest of a more equitable international distribution of income. In his 1966 report to the United States Congress on the International Coffee Agreement, President Lyndon Johnson expressed the view that:

> Fluctuating coffee prices hurt many of the developing countries of Latin America, Africa and Asia in two ways. First, sharp declines can be disastrous to all those connected with the coffee economy, and especially to farmers, many of whom operate small holdings. Second, because so many of the countries are heavily dependent on coffee exports for earning foreign exchange, sharp fluctuations in coffee prices can seriously disrupt economic development of the coffee growing countries and because we are far-and-away the largest coffee consuming country, the United States has an important role to play in maintaining the effectiveness of the International Coffee Agreement.[17]

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[17] U. S. President, Second Annual Report of the President of the United States on the International Coffee Agreement, (Washington, D. C. : U. S. Government Printing Office, 1966), pp. 3, 4.

The difficulty of Congressional approval for direct programs of economic aid to underdeveloped countries has made indirect taxation of consumers (through higher product prices) the more practical means of providing a measure of economic support to poor nations. The oligopolistic structure of the wholesale coffee importer-roaster-distributor industry means that the higher-than-equilibrium coffee prices which the Agreement seeks to impose would be passed on to the ultimate consumer of roasted coffee in the form of higher retail prices. Recent studies of the consumer roasted-coffee market suggest a highly price-inelastic purchase response of coffee drinkers to changes in the retail prices coffee.[18]

The highly inelastic responses mean that a backward shifting of the higher price onto distributors, importers, or producers in the form of reduced purchases of coffee is unlikely to occur. As an unorganized market of price-takers, the ultimate coffee consumers could be relied upon to bear silently the real cost of dampened price movements and increasing green coffee revenue for the producer nations.

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[18] See, for example, Rex F. Daly, "Coffee Consumption and Prices in the United States", Agricultural Economics Research, Vol. X, No. 3, (July, 1958), p. 62.

Purpose and Scope

This study has two main purposes. The first purpose is to estimate the static price-elasticity of demand for the green coffee exports to the United States for each of eight coffee-producing nations. No estimates of export market price-elasticities have been previously published. The second purpose is to estimate the annual impact on revenue from green coffee sales to the United States of the selected producing countries which might be imputed to the operation of the 1962 International Coffee Agreement from 1963 through 1966.

The study also draws some conclusions about the effectiveness of the 1962 International Coffee Agreement in achieving its short-term goals through the use of restrictive coffee export quotas.

Static demand functions were derived from least-squares estimates of multiple linear functions (in logarithmic form). The effect of the operation of the 1962 Agreement on the revenue from green coffee exports to the United States of the selected producer nations was estimated from a demand and supply model which was developed for each producing country.

The annual data from which the estimating functions were generated covered the period from January, 1953 through December, 1962. The revenue estimators include the following variables: average U. S. current dollar price per bag of green coffee; annual exportable coffee production in the selected country; annual exports of green coffee from the selected producer nation; and annual exports of green coffee from the selected producer nation to the United States. Other background variables which might affect the United States demand for green coffee exports from producing countries were considered--non-institutional U. S. population, U. S. personal consumption spending on food, U. S. disposable personal income, and the general level of coffee export prices in the U. S. market.

The primary sources of the statistical information used in this study are the U. S. Department of Agriculture, the U. S. Department of Commerce and the Pan-American Coffee Bureau.

The green coffee exports and green coffee revenue of eight producing countries (or country-groupings) are considered in this study. These countries are Brazil, Colombia, Costa Rica, El Salvador, Guatemala, Ethiopia, East Africa,[19] and Western

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[19]East Africa includes the coffee-producing nations of Uganda, Kenya, and Tanzania. In 1966, Uganda exported 63 percent of the volume of East African green coffee.

Africa.[20] These eight countries accounted for about 77 percent of the volume of green coffee exports in 1966. They received 71 percent of the total revenue from green coffee sales to the United States in 1966.

These eight producers are among the ten most significant exporters of green coffee. They also rely rather heavily on coffee exports as a source of foreign exchange revenue (See Table 1). The goals of the 1962 International Coffee Agreement are of great significance to the selected producing countries. The strict application of Agreement policies would mean relinquishing individual national coffee policies in favor of a unified international price maintenance scheme. In view of the selected countries' dependence on coffee as a major source of external liquidity, participation in the international pact is of more than passing interest to them.

Only two of the ten largest green coffee-exporting countries have been excluded from the research--Mexico and Angola. Mexico is a significant coffee producer, and is of some importance as a world green coffee exporter. In 1966, for example, Mexico exported about 3 percent of the volume of all green coffee exports.

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[20] Western Africa includes the coffee-producing nations of Ivory Coast, Cameroon, Madagascar, Togo Republic, Central African Republic, Congo (Brazzaville), Gabon, and Dahomey. In 1966, Ivory Coast exported 62 percent of the volume of Western Africa's green coffee.

It was not studied because of its relatively low dependence on green coffee earnings as a source of foreign exchange. Mexican coffee sales in 1966 accounted for only 6.7 percent of its total foreign earnings.[21]

Angola is the other significant producing country not considered. An inadequate amount of statistical information was available about the Portuguese dependency to draw economically and statistically meaningful inferences from the data. In 1966, Angola exported about 5 percent of the total volume of green coffee shipments. The eight producing countries or areas considered in this study ship the largest part of the volume of green coffee exports and receive the lion's share of green coffee revenue. They are also countries for which adequate statistical information was available.

Green coffee exports to the United States were selected as the indicative market for the estimation of the 1962 pact's effects on coffee export revenue. There are several reasons for this choice. Statistical information about U. S. purchases of green coffee is readily available and highly reliable. The data used in the study are based on customs declarations which are reported by the

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[21] International Coffee Organization, Foreign Exchange Earnings from Coffee Exports, ED-246/67(E), (London: International Coffee Organization, 1967), p. 1.

United States Department of Commerce.

The United States also buys about half of all green coffee exports; therefore any changes in market conditions (such as the price of green coffee, as influenced by Agreement policies) would be quite influential in the United States market. The International Coffee Council, the administrative organ of the 1962 Agreement, uses wholesale green coffee export market conditions in the United States as the basis for altering export quotas within years and for projecting changes in demand for future marketing periods.

Research was confined solely to the green coffee export market in the United States. No treatment is given to the retail consumer market in the United States. It is recognized, however, that wholesalers' and roasters' demand for green coffee exports is related to the ultimate consumers' desire for roasted and/or soluble coffee.

Excluded from consideration in this study was a treatment of the effects of the 1962 International Coffee Agreement on the implementation of national development programs in the coffee-producing countries. Much of the verbal rationale which was given in the 1962 International Coffee Conference in favor of creating a multi-lateral producer-consumer treaty addressed itself to the

need to promote higher living standards in the coffee producing nations.[22]

The short term goals of increased revenue from coffee sales and greater green coffee export price stability which emerged from the 1962 Coffee Conference discussions will be examined in this paper.

Method of Approach

This study compares actual revenue from green coffee sales to the United States of the selected producing nations with the revenue which is estimated to have been obtained from probable sales of green coffee to the United States in the absence of the 1962 International Coffee Agreement. This specific method of evaluating the impact of the Agreement is suggested by N. T. Wang:

> The impact of the International Coffee Agreement can be properly assessed only if a comparison can be made between the situation under the terms of the Agreement and what might happen without the Agreement.[23]

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[22] See United Nations Coffee Conference, 1962, Summary of Proceedings, (New York: United Nations, 1963), pp. 21, 22.

[23] N. T. Wang, New Proposals for the International Finance of Development, Essays in International Finance, No. 59, (April, 1967), (Princeton: Department of Economics, International Finance Section, Princeton University, 1967), p. 22.

The assumption is made that, if the 1962 Agreement had not become operative, the market behavior of green coffee producers, exporters, and importers during 1963 through 1966 would remain unchanged from their respective behavior patterns of the previous ten-year period. Specifically, producers would offer for sale in the world market the same proportion of their total annual output in 1963-1966 that they annually provided in 1953-1962. Exporters would channel the same percentage of their total annual sales to U. S. markets, and importers would react to varying quantities of annual green coffee offerings and changing green coffee export prices in a manner consistent with the 1953-1962 period.[24]

This assumption permits the use of annual observations on various economic variables from 1953 through 1962 as the basis for deriving functional relationships which would generate estimates of 1963-1966 green coffee revenue from U. S. sales which would have accrued in the absence of the International Coffee Agreement.

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[24] To be more precise, the 1963-1966 trends in the exports/production ratios and the trends in the share of exports going to the United States market were assumed to be consistent with the respective relationships during the 1953-1962 period. These assumptions are tested in Chapter V.

The validity of the assumption of stable relationships between variables during the 1963-1966 period can be inferred from the explained variation of the derived functions during the 1953-1962 period. It can also be inferred from the significance of the F-ratio tests which were performed on each of the derived functions. The F-ratio test measures the statistical probability of the explained and unexplained variation being equal; i. e., it examines the possibility that the established functional relationship is due to chance. Information on coefficients of determination and F-ratio tests is given for all functions to provide the reader with an adequate basis for independent judgment about the validity of the consistent behavior assumption for each individual functional relationship of each selected producing nation.

Parts of the Estimator Model

The estimating model for the revenue from green coffee sales to the United States consists of three functional relationships. Each of the functional relationships was derived from a multiple regression program, using the simple least-squares method. One function is the relationship between annual exportable green coffee production of a country and that country's total annual green coffee exports. It is assumed that a nation's total exports depend upon its green coffee production.

The statistical significance of this relationship for any selected producing nation, as inferred from the appropriate F-ratio test, will suggest the validity of this assumption. The relationship between exports and production does not consider the influence of export prices for green coffee as a contributory (independent) variable to the variation in total green coffee exports. The omission of price as an independent variable makes the derived export functions perfectly price-inelastic (by implication). This property of the short-run (annual) export functions is supported by the high multiple coefficients of determination (R^2) demonstrated by these functional relationships. (See Table 10 in Chapter 5).

A second function is the relationship between a country's total annual green coffee exports and its annual green coffee exports to the United States. The assumption is made that there is a fixed relationship (which is not affected by green coffee export prices) between total green coffee exports and green coffee exports to the United States. High multiple coefficients of determination and low significance levels for the F-tests of the derived relationships support this contention. The selected country habitually sends a portion of its total coffee exports to the United States, regardless of green coffee export price structures; or else, the changes in coffee export prices among the world coffee import

centers are such that the distribution of green coffee exports is unaffected by the changing prices. Table 11 in Chapter V provides information about the relationship between total green coffee exports and the green coffee exports to the U. S.

The two aforementioned functions define the short-run "supply" of green coffee to the United States from the selected producing country. The annual offerings of green coffee to the United States market depend on the annual exportable green coffee production from each producing country. The determinants of exportable green coffee production were judged to be of a long-run character, and therefore outside the scope of this study. Exportable green coffee production is considered an exogenous variable in the revenue-estimating technique used in this study.

No adjustment to the reported data on exportable green coffee production was considered necessary to remove the influence of the 1962 accord. Presumably, in the long run, the general level of green coffee prices would influence the amount of resources devoted to coffee production. This study considers the effect of the 1962 International Coffee Agreement on green coffee revenues for four years--1963, 1964, 1965, and 1966. Five years is the minimum time required for new coffee-tree plantings to reach a

commerically-bearing maturity, so increases in desired output could not be reflected by the 4-year research period.

The destruction of coffee trees to reduce output was not a significant activity during the period studied. Destruction of existing green coffee stocks was not significant during the 1963-1966 period.[25] Subsequent to 1966, however, some major producers--most importantly, Brazil--did undertake massive destruction of commercially-bearing coffee trees.[26] The analytic techniques used in this study would therefore have to be modified to reflect the impact of these programs, if estimates of coffee revenue were to be calculated for 1967 or later.

The third function is the relationship between annual exports of green coffee to the United States and variables affecting the U. S. importer's willingness to purchase green coffee, such as average annual green coffee export prices to the United States, population size, and U. S. disposable income. First-order logarithmic transformations of the annual raw data were used to generate the most

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[25] U. S. Department of Agriculture, Foreign Agricultural Service, Foreign Agricultural Circular: Coffee, FCOF 1-67 (January, 1967), p. 9.

[26] Between July, 1965 and June, 1967, 434 million coffee trees were uprooted in Brazil; most of these were destroyed in late 1966. This program reduced annual green coffee production by about 3 million bags. See World Coffee and Tea, Vol. 7, No. 12 (April, 1967), p. 26.

statistically significant functions. The assumptions were made that the various quantities of green coffee imported into the United States depend upon the price of green coffee, and the other background variables. This causal relationship is doubtlessly artificially contrived. In a dynamic economic system, interaction of price on quantity demanded, and quantity demanded on price is likely.

The technique of regressing quantity demanded on price places primary emphasis upon variations in the physical quantity of U. S. green coffee imports and the ability of variations in price to explain those variations. This causal relationship provided a statistically significant demand function for the green coffee exports to the United States for most of the selected producers. (See Table 8 in Chapter IV). Use of the logarithmic transformation gives the coefficient of price-elasticity of demand for green coffee the property of constancy.

Constant price-elasticity of demand for a given commodity may be attributed to either a small range of relevant prices in the data from which the demand estimates are derived; or to a stable systemic response to price variations, regardless of their magnitude. The range of price variations was relatively large, and the assumption of an unvarying behavior in purchases of green coffee

in response to price changes seems unrealistic, because of the probable (untested) impact of importer expectations about future market conditions. Nonetheless, the assumption of constant price elasticity (a by-product of the logarithmic function) is supported by the amount of explained variation in the dependent variable.

Furthermore, the percent of explained variation in the dependent variable is higher for logarithmic demand functions than for the corresponding linear demand functions. F-ratio tests of the logarithmic functions were significant at more rigorous test levels than the linear approximations could withstand. (Compare Table 8 in Chapter IV with Table 19 in Appendix).

The components of the complete revenue estimating model can be summarized as follows: Exportable green coffee production in a given nation determines the amount of green coffee offered for export in a given year. Producers customarily ship a given portion of the total coffee exports to the United States. Variations in annual green coffee export prices act as the equilibrating mechanism to adjust importer willingness to purchase the given supply of green coffee. The market-clearing average green coffee export price times the physical quantity of green coffee shipments to the United States from the selected country provides the estimate of revenue from green coffee sales of the selected producing nation.

Organization of the Thesis

The study has two basic parts. Chapters II and III are basically descriptive material about the world coffee industry and some of its recent attempts to control "adverse" market conditions. Chapters IV and V present the results of empirical study of the green coffee import market in the United States and the estimates of green coffee revenue which theoretically would have resulted in the absence of the 1962 International Coffee Agreement.

In Chapter II, general physical and marketing characteristics of green coffee are considered. Specific information about production and marketing conditions in the eight selected producing nations is also given.

The ten-year period of negotiations and interim agreements which preceded the implementation of the 1962 International Coffee Agreement is discussed in Chapter III. The key provisions of the 1962 accord are also considered.

In Chapter IV, the statistical results of the empirical study of green coffee import demand in the United States are analyzed. The relationship and consistency of this study's findings on price-elasticity of demand for coffee with other coffee with other coffee demand studies is also considered.

In Chapter V, the statistical functions which characterize the supply of green coffee for the selected producers are considered. Estimates of the revenue which would have been generated from the green coffee sales to the United States of each selected producer-nation, if the 1962 Agreement had not become operative, is also presented. An analysis of the success of the 1962 International Coffee Agreement in achieving its short-term objectives follows. This analysis is based on inferences from the revenue estimates for 1963 through 1966.

The more important conclusions of the study are summarized in Chapter VI. An appendix of the data used and some derived statistical relationships follow.

The conclusions of this thesis, however consistent they may be with the basic results of the empirical study, are no more valid than the basic assumption underlying the whole thesis--i. e., if the 1962 Agreement had not come into definitive operation in the 1963-1966 period, the green coffee market would have continued to operate and behave in a manner consistent with its 1953-1962 operations. No one can say, with complete assurance, that this would be the case. It is the author's hope, however, that the technique of counterfactual analysis which is developed and employed in this study will provide some contribution to a systematic economic analysis of international commodity agreements.

CHAPTER II

CHARACTERISTICS OF WORLD COFFEE PRODUCTION

Coffee is not a standardized product, by any means. An understanding of coffee problems and of the 1962 International Coffee Agreement's attempt to alleviate the short-term effects of those problems requires some insight into the nature of coffee production and marketing. This chapter discusses the physical characteristics of coffee and coffee production, as well as the characteristics of the green coffee industry in the eight producing areas which are considered in this study.

Making beverages from the ground seeds of coffea arabica and coffea robusta trees is the only commercial use of green coffee. There are three major recognized coffee "types". The so-called "mild" arabicas are considered superior in flavor, and are grown in the wet climate of the intermediate mountain slopes (usually between 2,000 and 6,000 feet above sea level) of Central and South America, Kenya, and Tanganyika. "Brazils", like the "milds", are arabica variety coffee, but are grown at lower altitudes in sub-tropical conditions. Named for their major country of origin,

Brazils command generally lower prices than the "milds" because of their inferior taste. This type of coffee is grown mostly in Brazil and Ethiopia.

The robusta variety, cultivated for the first time in recent decades, is grown at much lower altitudes than the arabica types--2,000 feet down to sea level. This type of green coffee has a more profuse output, but a much coarser quality than the arabica variety. Robustas are grown in the African territories which were former French protectorates and the present Portuguese colonies. Uganda is a major source of the relatively low-valued robusta.

The three types of coffee are distinguished not only in flavor, price, and place grown; but also in appearance, resistance to disease and climate, and speed of commercial maturity.

Coffee is susceptible to relatively few insect pests and diseases. However the different varieties of coffee vary widely in their resistance to climatic conditions. Frost or drought, particularly in the months immediately preceding the flowering of the tree, can affect the next year's crop by as much as 50 percent.[27] However, coffee trees of the robusta variety seem to be less sensitive to the vagaries of the weather than the Western Hemisphere arabica varieties.

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[27] Merrill Lynch, Pierce, Fenner and Smith, Inc., Coffee, (New York: Merrill Lynch, Pierce, Fenner and Smith, Inc., 1965), p. 13.

The African robustas also mature more quickly than the arabica trees. Whereas about three to five years must elapse from the seedling stage to initial bearing stage for the arabicas, only two or three years are similarly required for the robusta tree.

Commercial bearing cannot begin for the milds and Brazils until approximately the eighth year, and they do not achieve full bearing maturity for 12 to 15 years after planting. The robusta tree, by contrast, is fully mature within 7-10 years, with commercial bearing possible within five years of the initial planting.

The problem of general overproduction of green coffee in recent years has been aggravated by the difficulty of accurately predicting year-to-year fluctuations in coffee output. V. D. Wickizer calls this uncertainty of production the "first and oldest problem of the coffee industry."[28]

Each coffee tree has its own yield cycle; it bears less in the years immediately following a bumper crop. Variations in yield are so wide that the output of a particular coffee plantation may at its high point be ten times the production at its low.[29]

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[28] V. D. Wickizer, The World Coffee Economy, (Stanford: Food Research Institute, 1943), p. 4.

[29] Ibid.

This marked variation in the yield of individual trees or plantations would not necessarily cause sizable fluctuations in year-to-year world green coffee output per se. However, the predominance of Brazil in coffee production means the climatic conditions which affect coffee output or the bearing cycle in that country's trees will virtually assure a change in world coffee production figures, and in green coffee export prices. The price-compensation possibilities of off-setting production variations in other countries are also reduced because of the coffee variety differentiation. The fluctuating supply of green coffee is most likely responsible for changes in green coffee export prices; demand for green coffee is fairly stable and changes in a predictable manner. "Annual consumption requirements are relatively stable, while the supply is highly variable because of wide variations in year-to-year crop yields."[30]

Expansion of green coffee production appears relatively easy to accomplish, for two reasons. First, a number of regions between 25° North and 30° South latitude possess the favorable characteristics of a warm, humid climate and a rich, well-drained soil. Second, the control of coffee production is not strongly

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[30] Ibid.

centralized. According to one recent estimate, there are 3 to 4 million coffee-producing farm units in the world, the overwhelming majority of which "belong to small farmers, each cultivating less than 5 acres of land. About half of all coffee is produced by farmers with 5-75 acre holdings."[31]

Costs on these plantations consist of three principal parts: (1) the "sunk" costs in the orchards themselves, (2) the labor expenses associated with the cultivation, harvesting, and market preparation of the coffee "cherries", and (3) the costs associated with storing or marketing the harvested coffee beans.

Wickizer has estimated that 75 percent of the cost structure of almost all plantations is inflexible; the portion of total costs that vary with the size of the crop is relatively small.

> The largest single item in total costs is for wages for the care of the trees, whether they yield a large or a small crop; and the largest item of variable costs is for wages of picking.[32]

Theoretically, the coffee plantation owner has three choices to make about disposition of a coffee crop during periods of falling export prices for green coffee. He could (1) permit the coffee

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[31] George C. McGhee, "International Coffee Agreement, 1962", Department of State Bulletin, April 1, 1963, p. 494.

[32] V. D. Wickizer, op. cit., p. 97.

cherries to remain on the trees unharvested; (2) undertake the expense and risk of harvesting and storing the coffee cherries, in expectation of improved coffee prices in the future; or (3) harvest and sell the coffee beans, regardless of green coffee export prices.

From an economic standpoint, the plantation owner should be willing to leave the cherries unharvested if the marginal cost of harvesting is more than the marginal revenue obtained from their sale. In practice, low marginal costs of harvesting tend to encourage the harvest of the cherries, even under the market conditions of low export price which have prevailed in the last decade.

About 75 percent of the costs of producing green coffee is fixed cost.[33] Preparation of new land for tree planting, the planting process, periodic pruning of the trees, cultivation and application of fertilizers (where used) are all sunk costs by the time harvest decisions are made. A decision not to harvest means a loss of all fixed costs. Furthermore, the moderate expense of picking the ripe cherries is usually more than repaid by the revenue received from the sale of the coffee.

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[33] V. D. Wickizer, op. cit., p. 97.

In long-established coffee producing areas like Brazil, where the fixed costs have been amortized, even the low green coffee export prices of the 1960's did not discourage harvesting. Harvesting continued even in producing areas which were identified by J. W. F. Rowe as "high cost" producers, despite the fact that the exporters received 50 percent or less of the free market value of the harvested coffee.[34] The first option in disposition of the harvest--to leave the cherries unpicked--does not seem to be an economically rational choice in most cases.

Few small plantation owners have the financial resources to underwrite the stockpiling of coffee in low price periods--the second possibility of disposing of the coffee crop. Coffee is often a farmer's only cash crop and the necessity of obtaining a means-of-exchange for required tools and products makes his coffee offerings virtually price-inelastic. Some larger plantation owners can finance temporary stockpiles of green coffee for short periods (up to a year or so), but they have no provision for, or interest in, long-term retention programs.

The third means of disposing of a coffee crop therefore seems the most likely alternative for most producers. The

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[34] J. W. F. Rowe, The World's Coffee, (London: H. M. Stationery Office, 1963), p. 46.

price-inelastic offering of green coffee production for export may be tempered by state retention schemes in some countries, as described later in this chapter. However, green coffee stored within the producing country is subject to some deterioration in quality, whether it is stored at the harvest site, in interior warehouses, or at the shipping ports. Tropical and sub-tropical areas are usually inferior to the temperate regions as places of storage.

> Most tropical food crops must be moved out before the rains begin, in order to avoid various hazards, all of which have an adverse effect upon quality.[35]

The certain discount in price which stored coffee will command in the market in later periods must be weighed against the uncertain possibility of green coffee export prices rising sufficiently to offset the discount and storage expenses. When world green coffee stocks are known to be large and increasing (as they had been in the decade preceding the 1962 accord) the possibility of coffee importers bidding up prices in the near future diminishes. All these considerations tend to produce bias in favor of marketing a new crop immediately, regardless of current market conditions.

Efforts to offset or eliminate price changes and severe fluctuations have chiefly taken the form of product differentiation

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[35] V. D. Wickizer, op. cit., p. 127.

via quality improvement. Many of the national coffee marketing organs are primarily concerned with grading and inspection of green coffee offered for export from their country. The stated purpose of these groups (as indicated in a later part of this chapter) is to up-grade the coffee sold in order to command a higher price. Export quality can be affected by harvest techniques and coffee cherry processing, as well.

Coffee cherries (the fruit containing the seed or "bean") on a tree rarely ripen at once. In order to insure a high quality batch of mature coffee beans, selective harvesting is required. Skilled pickers who are able to discern the proper degree of ripeness are required for this process. Each tree may have to be harvested several times in one season to extract its total output.

Two different processes may be used to remove the outer skins and fleshy fruit from the commerically useful seed. The dry process is the one most commonly applied to the Brazilian arabica and the African robusta coffee varieties. The cherries are dried in the sun; and hulled by machines to remove the dry husk and parchment of the coffee bean. The green coffee of commerce remains. In Brazil, where many coffee plantations are large commercial enterprises, this process is conducted on the farms themselves. In Africa, where smaller coffee holdings predominate, central factories process the cherries.

The wet process is used for mild arabica coffee. This technique is more complicated than the dry process, but it produces a commercially superior coffee bean. The cherries are first dumped into a large water-filled vat to float off any defective fruit. The remaining cherries are then pulped to remove the flesh. A fermentation and washing process removes a silver skin which envelopes the two coffee beans which are within each cherry. The beans, with a parchment-like substance attached, are dried and the parchment is removed by careful milling. In Colombia, this technique is accomplished by the coffee grower up to the parchment stage. In Central American countries, however, the entire wet process is done at a central factory.

The physical appearance of the coffee bean processed via the wet technique is superior to the dry-processed bean. The difference in appearance is an important factor in determining the quality and price of the bean for export. Description of a top-quality wet-processed coffee bean may include the fact that it has a "blue color, very well polished, flat shape". Grading of the more plebian "unwashed" (dry-processed) beans depends on the size of the bean and the amount of foreign matter included in the coffee bags for export (like stones, twigs, husks, shell, weevils). Very elaborate differentiation of coffee is therefore possible and

practiced in the green coffee export trade. The rather large price differentials which persist among the various coffee types indicate the degree of product distinctions in the green coffee export market.

Production Characteristics in Selected Countries

The eight coffee-producing countries considered in this study vary greatly in the magnitude and organization of their coffee industry. The largest world producer of green coffee--Brazil--produced nearly 35 million bags of green coffee in 1961/62. Brazil's output and commercial coffee tree population (3.7 billion trees) dwarf Costa Rica's industry, itself the tenth largest coffee producer in the world. Table 6 illustrates some of the significant distinctions among the eight selected producers.

Brazil

Coffee has been Brazil's most important export item since about 1900, when it displaced rubber as the major revenue-producer. In the 1950's coffee exports comprised over 60 percent of the value of all exports, and green coffee still accounts for almost 45 percent of the total export income. In the five-year period from 1963, coffee revenue amounted to an annual average dollar equivalent of $711 million.[36]

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[36] World Coffee and Tea. VII, No. 12 (April, 1967), p. 23.

TABLE 6

SELECTED CHARACTERISTICS OF THE GREEN COFFEE INDUSTRY IN EIGHT PRODUCING COUNTRIES, 1962[c]

Country	Type of Coffee	Number of Producing Trees (X 1 million)	1961/62 Crop Yield (1000 60-kilo) bags)	Work Force in Coffee Production (X 1000)	Acreage in Coffee (X 1000)
Brazil	Unwashed Arabica	3,726	34,695	6,571	10,600
Colombia	Mild Washed Arabica	1,806	8,035	1,319	1,949
Costa Rica	Mild Washed Arabica	150	1,098	186	--
El Salvador	Mild Washed Arabica	263	2,083	298	350
Guatemala	Mild Washed Arabica	270	1,676	398	590
Ethiopia	Unwashed Arabica	1,500[a]	2,123	714	1,100[a]
Ivory Coast	Robusta	540	2,500	1,626	1,334
Uganda	Robusta	167	1,963	2,064[b]	605

See notes on following page.

TABLE 6 (Continued)

[a]Acreage and number of producing trees in Ethiopia are not strictly comparable to other areas, because of the wild, uncultivated nature of much of the producing area.

[b]Includes Kenya, Uganda, and Tanganyika.

[c]Sources: Information on work force in coffee production from Pan American Coffee Bureau, Impact of Coffee on the U. S. Economy (New York: PACB, 1962). All other data from World Coffee and Tea Journal, April and June, 1967 issues.

All Brazil's coffee is arabica. Virtually all the commercial coffee production is concentrated in 4 of the 21 states: Sao Paulo, Minas Gerais, Espirito Santo and Paraná. The former two states have average coffee farms of about 150-200 acres. About two-thirds of Sao Paulo's trees are on farms having 8,000 to 128,000 trees. In Paraná, although farms with more than 128,000 trees account for only one percent of the number of farms, they grow 22 percent of the total crop.[37]

Picked coffee is usually processed on the plantation, using the dry method. The larger plantations, especially in Sao Paulo and Paraná do virtually all the necessary handling of the coffee prior to bagging for export (like washing, drying, hulling and sorting). Smaller plantations sell their coffee as dried cherries either to independent hulling mills or to the larger farms for final processing.

All Brazilian green coffee entering commercial trade must be registered with the Instituto Brasileira do Cafe, through agencies in each of the producing states. The Instituto controls all internal movements of green coffee. It registers and approves all coffee shipments going to the ports.

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[37] J. W. F. Rowe, The World's Coffee: A Study of the Economics and Politics of the Coffee Industries of Certain Countries and of the International Problem, (London: H. M. Stationery Office, 1963), p. 64.

The Instituto regulates export marketing through two devices: Shipping Regulations and the Financial Plan. The Shipping Regulations establish procedures for moving coffee from farm areas to ports, determine how much coffee is to be stocked in interior warehouses, how much is to be shipped to the ports, and how large port stocks should be. The Financial Plan sets minimum prices for crops and exports and arranges for the state purchase and resale of all coffee entering international trade. About 300 exporters and commission houses purchase coffee for export from the Instituto. The agency currently purchases about 60 to 70 percent of the total coffee crop from domestic producers and pays roughly half of the world market price to the farmer. The remainder of the crop is appropriated at much lower prices and is either used for domestic consumption or destroyed.[38]

Despite the heavy indirect taxation levied on the Brazilian coffee producers in the form of depressed prices, international prices remained high enough to encourage continued high production. By 1963, the usable stock of green coffee retained by the state to maintain external (export) prices was about 55 million bags.[39]

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[38] Winfield C. King, Brazil's Coffee Industry. (Washington, D. C.: Foreign Agricultural Service, USDA; 1962), p. 10.

[39] J. W. F. Rowe, op. cit., p. 73.

This represented about 3 years production at the 1962 level. Rowe suggests that the relative price stability in the international coffee market for 1960 through 1962 was the direct result of the purposeful, voluntary retention of massive quantities of Brazilian green coffee by the Instituto. Had Brazil dumped all her current production on the market, he estimates that Brazilian coffee would have dropped in price on the New York market from about 36 cents per pound to something less than 10 cents per pound. In short, the entire green coffee price structure would have collapsed.[40]

Colombia

About 16 percent of the world's green coffee output is produced in Colombia, making it second only to Brazil in coffee production. Colombia is the most significant producer of the mild varieties, which provide roughly 70 percent of that country's foreign exchange receipts. Most of the 200,000 coffee farmers--about 80 percent--are small, peasant-owned and -operated. The average farm size is about 50 acres; large plantations over 125 acres account for less than 9 percent of the total acreage under coffee cultivation. Most of the larger farms have resident managers.[41]

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[40] Ibid.

[41] World Coffee and Tea, Vol. VII, No. 12 (April, 1967), p. 32.

Freshly picked coffee cherries are wet-processed to the parchment stage on the farms themselves. The parchment coffee is then sold to one of the 600 or 700 local traders who, in turn, sell large lots of coffee to exporters and mills for final processing, classification and preparation for export. Most of the mills are owned by exporters or by the Federación Nacional de Cafeteros, the national coffee agency.

The Federación supervises the marketing of green coffee crops, maintains processing and storage facilities, and establishes quality and quantity specifications for Colombian coffee exports. The Federación supports internal green coffee prices; when private traders are unwilling to purchase the current crop at the floor price, the agency purchases the unsold coffee at the minimum level and stores the coffee (hopefully, for later marketing) in regional warehouses. Growers receive, on the average, approximately 60 percent of the prevailing export price from the Federación. The balance of the export price is retained in the form of various administration charges, taxes, and levies-in-kind.[42]

Colombian coffee policy seems to comprise two elements. One aspect is Colombia's support for the Brazilian retention policy

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[42] J. W. F. Rowe, op. cit., p. 124.

which began in 1957. This cooperation was manifest by increasing retention of mild coffee in Colombia. By July, 1962, the stock of green coffee being held in that country (above normal shipping inventories) had reached an estimated level of 5 million bags. This stock, though significant in absolute terms, had been accumulated over a number of years, and was really little more than a token support of Brazil's attempts to peg coffee prices above normal equilibrium rates.

The other aspect of Colombian coffee policy has dealt with the long-term adjustment to natural market conditions. A program of diversification of cash crops grown on coffee plantations was in effect before the suggestion of such programs by the International Coffee Council. The introduction of hardier varieties planted in intensively cultivated plots promises to cut production costs. Colombia's long-term policy appears to view general green coffee price declines as inevitable. Lower costs through improved techniques and reduced supply via crop diversification have been Colombia's response.

Costa Rica

Green coffee production in Costa Rica is typically a small farm operation, with average acreage less than 20 acres. Only about 7 percent of the total number of farms, and approximately

20 percent of the crop are on plots greater than 425 acres.[43] Wet-processed "mild" arabica is the dominant coffee variety.

Most of the fresh cherry is sold to the 175 "beneficios" dispersed throughout the central mountain regions where most Costa Rican coffee is grown. The beneficios are responsible for wet-processing and marketing the coffee. About 30 exporters based in San José purchase government-approved quantities of beans from the processors. About 9 percent of the annual crop is set aside for sales to domestic roasters for internal consumption.[44]

Costa Rican coffee policy is promulgated by the Oficina del Café. Cost Rica is a relatively high-cost producer of mild coffee and is therefore quite vulnerable to the secular decline in green coffee prices. Because of the comparative unprofitability of coffee production, the Oficina del Café, as a semi-autonomous agency of the national government, has adopted a program of diversification into other cash crops, and implicit discouragement of new coffee plantings. There is no coffee price support program in Costa Rica, nor any government policy of purchasing surplus coffee.

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[43] World Coffee and Tea, Vol. VII, No. 12, (April, 1967), p. 36.

[44] Ibid., p. 38.

Diversification into cotton, corn, rice, bean, and livestock raising is encouraged by bank credit, guaranteed by the Government. There is a restrictive credit policy against coffee. No loans can be issued for new plantations, and coffee farms located in marginal areas have difficulty in obtaining bank financing for operational requirements.

Storage and retention of coffee surpluses is at growers' expense. There is, therefore, a strong pressure on most farms to market all output immediately, regardless of price, to avoid storage costs. Periodic flooding of the market with newly harvested coffee, especially in July and August, causes Costa Rican milds prices to demonstrate strong seasonal variations.

El Salvador

Nearly all of El Salvador's coffee is the wet-processed mild arabica variety. About 82 percent of the coffee farms are small (less than 25 acres), but these units account for only 14 percent of coffee output. Large farms (over 125 acres) are few numerically (only 4 percent of all coffee farms), but they produce almost 60 percent of all green coffee. The fresh cherry goes to about 145 beneficios for processing. Forty exporting firms, with headquarters in San Salvador, purchase the processed coffee for international trade.[45]

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[45] Ibid., p. 42.

Government regulation of coffee activity in El Salvador is minimal. The Asociacion Cafetelera de El Salvador is a coffee growers' organization which acts as a national lobby for producers at the national legislature. No group, including the Asociacion, does more than study problems associated with green coffee production.

Financing of coffee crops usually takes the form of forward contracts for sales of crops. These contracts are made with beneficios or larger growers, in the case of small farms; and are made with exporters, in the case of the larger producers. Coffee production costs are lower in El Salvador than in Costa Rica, primarily because of the lower living standards of he workers. Intensive cultivation by these workers makes El Salvador's green coffee yield per acre (about 845 pounds) one of the highest in the world.

Guatemala

Two thousand, nine hundred farms produce almost 90 percent of Guatemala's output of mild, "washed" arabica coffee. The balance is produced by approximately 30,000 small-scale growers whose annual output is less than 40 bags each. The official marketing agency is the quasi-official Asociacion Nacional del Cafe in Guatemala City. This organ directs the internal marketing

activities, as well as grades and classifies green coffee for export. It does not provide price supports for coffee exports, outside of its modest stock retention program.

Most of the 2,900 large coffee plantations mentioned above process their own harvested cherries to the parchment stage. Many then deliver the parchment coffee to beneficios for hulling. Six exporters, based in Guatemala City, account for the majority of green coffee purchases intended for foreign markets.

Ethiopia

Arabica coffee originated in Ethiopia and the word "coffee" is derived from the provincial name, Kaffa, where wild or semi-wild forests of arabica coffee are still harvested. There are nearly 1,100,000 acres of these forests ranging in altitude from 5,000 to 6,000 feet. Large estates, using native gatherers, account for only 10 percent of the total crop. The rest is harvested independently by thousands of peasant farmers, or by nomadic groups.

Most of the coffee prepared for export is dry-processed, although the wet technique is increasing in popularity. The dried coffee beans are collected by itinerant traders who make periodic journeys into the forest regions; the beans are also taken directly to exporters or traders for grading and shipping. Coffee trade is free from pervasive government regulations. The National Coffee

Board of Ethiopia is responsible for maintaining consistency in weight and grade standards, and for inspecting coffee processing and storage centers. It does not intervene in price movements; however, the rate of gathering of the generally wild coffee does not seem to respond greatly to changes in green coffee export prices, possibly because of the low costs associated with harvesting. Coffee storage in Ethiopian port locations is not feasible because of the high relative humidity. Consequently, exports reflect current production with very little variation.

East Africa

The geographical area which today comprises the nations of Uganda, Kenya, and Tanzania was, until late 1962, controlled as a unit by Britain. Statistics on coffee production were gathered for the original unit, and green coffee data for the present political units are not available before 1962. The previous patterns of statistical gathering make inferences about East African coffee prices, price-elasticity, and revenue difficult on the coffee-type basis established for the other countries in this study. Problems in calculations stem from the fact that Uganda, which accounts for roughly two-thirds of the green coffee output of East Africa, produces mainly robusta coffee; while Kenya and Tanzania (formerly Tanganyika and Zanzibar) are primarily mild, "washed" arabica

producers. Any price series, then, on East Africa will contain elements of both robusta and mild arabica responses. The price-elasticity or demand calculated for East Africa will lack precise definition. The significance of this producing region in the world coffee market, however, made it desirable to make some estimation of the average effect of altered market conditions on regional green coffee revenue.

Uganda alone ranks as the fifth largest coffee producer in the world, and the third largest producer of the robusta variety. Most of the crop is grown in small African-owned plots of one to four acres each. The majority of small growers sell the dried cherries at rural markets held during the harvesting season from November through February. Some sell the cherries directly to processing plants, where the coffee is prepared for bulk delivery to the Coffee Marketing Board, the only legal vendor in international coffee transactions.

The Board markets coffee in three ways. First, it conducts regular auctions in Uganda at which coffee is sold to licensed exporters for delivery in Mobasa, Kenya--Uganda's only sea outlet. Secondly, ad hoc sales to exporters may be made with Board approval between scheduled auctions. Thirdly, on occasion the Coffee Marketing Board will arrange direct sales of coffee to

foreign roasters, when large enough quantities are demanded to warrant direct sales.

Internal minimum coffee prices are established by the Board at the beginning of each coffee season, and strict export quotas applied at the processing level to prevent additional green coffee from entering into trade channels.[46]

The Kenyan coffee industry also consists of modest farms--although the average plot (about 100 to 150 acres) is considerably larger than in Uganda. The larger farm can be attributed to the elaborate organization of productive effort in Kenya.

All plantations are members of, and controlled by, one of 135 coffee growers' cooperative societies. These societies in turn are affiliated into 13 cooperative district coffee unions which are coordinated and controlled by the Coffee Board of Kenya. This latter body is responsible for the organization of coffee production, processing, and marketing. Every stage in the coffee process is closely supervised by the use of licensing.

The bulk of the crop is processed by the Nairobi Mills of the Kenya Planters' Co-operative Union, Ltd. The law requires that all Kenya coffee--regardless of its condition--must be

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[46] Coffee Marketing Board of Uganda, Uganda Coffee Industry. (Kampala: Publicity Services, Ltd., no date), p. 4.

delivered to a Board-approved mill. The Marketing Board's Liquoring Department assigns a quality grade to all coffee delivered, based on sample estimates of its market value. Planters are then paid for their crop the average export price realized during the season for each grade, less processing and marketing expenses. A percentage of the price is paid at the time of delivery, with the balance remitted at the end of the season.

About 65 percent of Tanzania's coffee is mild arabica, and the balance is robusta. Most Tanzanian coffee--approximately 80 percent, is grown on small holdings operated by native Africans. Virtually all Tanzania's robusta coffee is produced on these farms. Mild arabica coffees are controlled by the Tanganyika Coffee Board and are marketed by it in regional coffee auctions. Robusta coffee is regulated by provincial cooperative unions in much the same manner as the coffee industry of Kenya.

Western Africa

A problem of data interpretation somewhat similar to that of East Africa exists for the Western Africa region. A geographic area which today comprises Ivory Coast, Cameroon, Madagascar, Togo Republic, Central African Republic, the Congo (Brazzaville), Gabou, and Dahomey was, until late 1960, administered as a single French protectorate. Fortunately, however, more meaningful

analyses can be applied to Western Africa data because of the relative homogeneity of its coffee output. Almost all the coffee which is commercially exported from the region is the robusta variety. Price movements and derived price-elasticities of demand are more economically meaningful than can be the case for East Africa.

Ivory Coast produces over 60 percent of the region's coffee, and its characteristics of production and marketing are shared by other countries in Western Africa with little variation. About 95 percent of Ivory Coast's output is produced by small, independently owned farms, averaging one to five acres. These farms are located in low-lying humid forest regions parallel to the east coast and to a major internal river, the Sassandra.

Dry processing is used and is undertaken on the farms. The beans are sorted and rough-graded by the farmers and then sold in village market centers to buyers or cooperatives. The buyers in turn sell to trading firms or shippers who move the coffee by licensed private carriers to coastal shipping points--mostly Abidjan.

Official coffee policies are implemented by the Caisse de Stabilisation et de Soutien des Prix des Productions Agricoles. The Caisse approves all coffee exports and is responsible for world

marketing of Ivory Coast coffee. Its agents grade and inspect coffee, as well as act to stabilize export prices for its green coffee. At the beginning of each season, the government establishes minimum purchasing prices for coffee. These prices are revised periodically throughout the year to reflect current export prices for green coffee. Stocks of the coffee are accumulated during the October through December harvest season, and then are released for world export markets according to seasonal consumption patterns in the purchasing nations. No significant carry-over stocks were accumulated in Ivory Coast prior to the 1962 International Coffee Agreement.

The eight countries studied vary considerably in their coffee industry characteristics. Brazil, El Salvador and Guatemala rely on relatively large production units for much of their green coffee output, while the rest are characterized by small land holding units. African production comes from very small farms, for the most part of less than five acres each.

Government intervention in coffee production and marketing ranged from very close control in Brazil, Colombia, and East Africa; through essentially quality control regulation in Ethiopia and Guatemala; to virtually no intervention in El Salvador. In one nation (Costa Rica), the government pursues a restrictive policy against the coffee industry.

Price maintenance schemes are actively pursued in three regions (Brazil, Colombia, East Africa), and are not attempted in four others (Costa Rica, El Salvador, Guatemala, Ethiopia). In Western Africa, the government acts to smooth price fluctuations without attempting to interfere with long-term trends. Significant green coffee stocks, as of 1962, existed only in Brazil (55 million bags) and Colombia (5 million bags). The other countries did not appear to be pursuing any substantive program of stock retention.

Generalizations about a "typical" national coffee industry are obviously difficult to establish. It appears that a typical coffee farm is small (less than twenty-five acres) and is subject to some government regulations concerning quality and marketability. It seems that, while individual farmers may view their offerings of green coffee in a price-inelastic manner, some government regulatory agencies may not. The extent of government interference in export marketings appears limited, except for Brazil and Colombia. Therefore changes in internal coffee production will, in most cases, be reflected (with an appropriate lag) in the country's green coffee exports.

CHAPTER III

THE 1962 AGREEMENT AND ITS BACKGROUND

The twin problems of the coffee industry--widely fluctuating prices and persistent overproduction in the existing price range--are not of recent origin. In the early part of the twentieth century, coffee production far exceeded the quantity demanded, basically as a result of vastly increased Brazilian output. Green coffee prices plummeted on the New York market to 3.5 cents per pound in 1903.[47] Because Brazil's dominance in world coffee output was much greater in the early 1900's, (accounting for about three-fourths of all green coffee exports), that nation's ability to control coffee marketing conditions was substantial. The first attempt to influence prices on a broad scale came in response to the 1903 price decline.

The Brazilian states of Sao Paulo, Minas Gerais, and Rio de Janeiro immediately prohibited any further coffee tree plantings (Between 1890 and 1900, Brazilian coffee trees increased in number

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[47] Winfield C. King, Brazil's Coffee Industry, (Washington D. C.: Foreign Agricultural Service, U. S. Department of Agriculture, 1962), p. 5.

from 220 million to 525 million);[48] and pressure mounted from growers for some type of state aid and/or subsidy. In 1906, Sao Paulo (at the time the largest producing state) adopted a "valorization" program which attempted to stabilize coffee prices by entering the world coffee market as a buyer in periods of price weakness, and as a seller in periods of rising prices. This first stabilization scheme was a success, primarily because unusually small coffee crops in Brazil from 1911 through 1914 permitted sales of earlier accumulated green coffee stocks (11 million bags in toto) at prices which repaid the support loans. Two subsequent valorization plans in the 1919-1920 period were also successful, and led Brazilian growers to believe that government intervention in the world market was adequate protection for their economic interests. A more pervasive permanent "defense" of coffee was instituted in Brazil, with controls over internal coffee movements and port shipments.

These controls in Brazil, whatever other purposes may have been intended, encouraged continued high coffee production in Brazil, and the prospect of Brazilian price maintenance in world markets stimulated extensive coffee plantings in other countries.

By the early 1930's severe over-capacity in green coffee output existed. Between 1931 and 1944, the Brazilian government

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[48] Ibid., p. 4.

destroyed more than 78 million bags of exportable coffee, and the country requested other coffee producing nations to join her in a multilateral price-fixing agreement for coffee. The solicited producers, chiefly in Colombia and Central America, were benefitting from the supply reductions by Brazil, without any cost to themselves. They were, therefore, unwilling to participate in a joint program of coffee defense.

In November, 1937, after Brazil had unsuccessfully tried to institute a coffee control program at a conference in Havana, the nation substantially reduced its export tax on green coffee. The ensuing price drop stimulated exports of Brazilian coffee, and forced across-the-board price cuts for all green coffee exports, with relatively stable price differentials re-established between milds and Brazils. In June, 1940, another hemispheric conference on coffee led to the establishment of a war-time compact--the Inter-American Coffee Agreement. This treaty, signed by the United States and fourteen Latin American coffee-producing nations, was designed to guarantee each producer country a market for its coffee during the war. The agreement succeeded in keeping the United States open to Latin American coffee exports, and thereby minimized the adverse effect on coffee earnings which these nations had endured in previous wars. The agreement was terminated in 1948,

when bouyant economic conditions made export guarantees unnecessary.

In 1946, at the insistence of Brazilian growers, the restrictive government controls on internal coffee production and marketing were abandoned. Comparatively free marketing of green coffee ensued until 1952, when again Brazil felt constrained to act to prevent a radical price drop for Brazilian coffee exports. The Instituto Brasileiro do Cafe (IBC) was established to regulate internal coffee prices and to monitor and control green coffee exports (See Chapter II). At the same time Brazil began anew to seek the support and assistance of other coffee producers in restricting the coffee supply and increasing coffee export revenue. The ten years of conferences, and interim agreements which preceded the operation of the 1962 International Coffee Agreement are discussed below.

Preliminary Coffee Proposals, 1954-1958

World exports and production of green coffee stabilized in the early 1950's, and coffee export prices settled into a narrow range of variation until late 1953. When the fall harvesting in Brazil revealed the extent of frost damage of the previous July, prices rose sharply in export markets. Brazilian varieties which had been selling for 50 to 60 cents per pound in New York in late 1953 jumped

to 90 cents per pound by April, 1954.[49] A decrease in the quantity demanded of all coffee varieties resulted in a downward price drift during the rest of 1954. The higher coffee prices, however, increased the likelihood of vastly expanded plantings throughout the world. Brazil, in November, 1954, suggested that the Inter-American Economic and Social Council of the Organization of American States undertake a "detailed study of the world coffee situation and of its future outlook."[50]

In April, 1956, the Inter-American Economic and Social Council voted to draft an international coffee agreement, after special studies forecast a growing disparity between production and consumption of coffee. The United States, as the dominant coffee importer, refused to take part in any agreement which might result from such a proposal. A letter from United States Ambassador Harold M. Randall to the Inter-American Economic and Social Council indicated that the United States could not take part in negotiating an international coffee agreement which might modify natural market conditions, nor would it become a participant in

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[49] Ibid., p. 11.

[50] Inter-American Economic and Social Council of the Organization of American States, Record of Proceedings of the Meeting of Ministers of Finance or Economy, (Quitandinha, Brazil; November-December, 1954), Resolution 34.

such an agreement. The letter was considered a formulation of coffee policy by the United States, which served as the official view until early 1958.[51]

Frosts in Paraná (Brazil) in 1955 arrested price drops for all coffee types. Brazilian coffee prices settled into a 55 to 60 cents per pound range during 1955 and 1956. A reduced supply of mild coffee in 1956 increased the price differential between milds and Brazils, and helped stimulate Brazilian green coffee exports.

From 1955 through 1957 Colombia, Costa Rica, and El Salvador entered into informal agreements to stabilize mild coffee prices during the peak marketing season when export prices usually fell drastically. The loose character of these alliances is not well documented, but they apparently allowed each country to pursue its own marketing programs.[52] Although these nations did not attempt coordination of their stabilization efforts with other coffee producers--most notably, Brazil--their actions suggest that they were beginning to recognize the need for some form of concerted actions to minimize export price and coffee revenue fluctuations.

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[51] Thomas C. Mann, "The Coffee Study Group", Coffee Annual, 1958, p. 73.

[52] See Federal Reserve Bank of New York, "The Coffee Stabilization Agreement", Monthly Review, (October, 1959), p. 158.

Increased world coffee production after 1956 forced all coffee export prices downward. In May, 1957, representatives of Brazil and Colombia announced a joint sponsorship of a draft agreement without specific price-stabilizing provisions. The two largest coffee-producing nations established a coordinating group to make arrangements for an international meeting of producers to consider the proposal.

In October, 1957, a separate, unrelated concord was reached in Mexico City by the nations of Brazil, Colombia, Costa Rica, El Salvador, Guatemala, Mexico and Nicaragua. The Mexico City meeting was prompted by radical declines in coffee prices in late September and early October, 1957. Price fixing was not mentioned in the Agreement of Mexico, but quarterly export quotas were set, and an administrative organ established to monitor the pact.

Green coffee prices ceased their declines for about two months as a result of coffee retention by the signatories. In early 1958, however, continuing trade journal reports of increasing shipments of green coffee from non-signatory producers weakened the resolve of the seven signers. Balance-of-payments difficulties forced an early abandonment of the 1957 accord.

In January, 1958 the jointly-sponsored agreement of Brazil and Colombia was considered by Latin American coffee producers

at a meeting in Rio de Janeiro. At the conclusion of the meeting, fourteen nations signed what became known as the Rio Agreement. The agreement contained no provisions for marketing coffee, but was directed toward the encouragement of more systematic gathering and reporting of data on coffee production and marketing. It also sought to increase world consumption of coffee through coordination of national promotional efforts and through development of new uses for green coffee.

The lack of marketing restrictions in the 1958 Rio Agreement was due to a continuing conviction by most producers that overproduction was a cyclical, and not a secular problem. The cyclical difficulties could be best handled on an individual country (or perhaps coffee-type) basis. Bumper coffee crops in early 1958, however, overwhelmingly pointed to an unmanageable surplus. By June, 1958, Brazilian green coffee, for example, had dropped to 50 cents per pound in New York, and fell below 40 cents per pound in early 1959.[53]

The magnitude of the financial problems which countries that depended heavily on foreign coffee sales were facing created a shift in United States policy in 1958. Secretary of State, John Foster Dulles announced that:

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[53] Winfield C. King, op. cit., p. 11.

> . . . the United States Government realizes the potential consequences of violent fluctuations in the prices of Latin America's exports, and is daily searching for ways and means to contribute toward a solution of economic problems. [54]

That statement and subsequent communiques from the State Department signalled a definite reevaluation of United States commodity policies. With the major coffee-consuming nation now sympathetic to the difficulties of the coffee exporting countries, the time became ripe for a series of serious discussions between major coffee-importing nations and green coffee producers.

In June, 1958, the Coffee Study Group was established, with headquarters in Washington, D. C. and a membership of thirty producing and consuming nations. It was agreed that immediate restrictions on coffee entering international trade were imperative. However, the task of assigning specific export quotas to member producers for the 1958-59 crop year beginning in October proved impossible. The Latin American countries rejected an African producers' proposal which, in effect, would have forced the Latin American members to withhold 95 percent of all the coffee to be retained during the year. African producers, who had been enjoying

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[54] John Foster Dulles, Address at Pan American Day Ceremonies, Pan American Union, Washington, D. C., April 14, 1958. Department of State News Release No. 191 (April 14, 1958).

strong increases in the demand for the relatively low-priced robusta coffee were understandably hesitant to restrain their supplies. When informal efforts by the United States representatives of the Coffee Study Group failed to produce a plan acceptable to African producers and to Latin American producers, negotiations were terminated.

The Latin American representatives proceeded to draft a coffee retention plan for their group alone. On September 27, 1958, a one-year Latin American Coffee Agreement was signed by fifteen countries: Brazil, Colombia, Costa Rica, Cuba, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Peru, and Venezuela. France and Portugal indicated they would voluntarily limit exports from their African dependencies in support of the new agreement.

The Agreement of Mexico, which had been largely inoperative since its early actions in October, 1957 expired on September 30, 1958; on October 1 the Latin American Coffee Agreement went into effect. Although the Coffee Study Group was unsuccessful in obtaining a world coffee agreement in 1958, the achievement of mutual discussions about coffee problems and the consideration of proposals to cope with the fluctuations in price was, in itself, significant. Also of prime importance was the negotiation of a Latin American coffee pact; it represented the first operational

agreement encompassing all principal Latin American producers. In view of these achievements, and the continued willingness of many African producers to discuss coffee issues, it was agreed that the Coffee Study Group should continue to seek a basis for international agreement on coffee marketing policies.

The Negotiation of World Agreements, 1959-1962

During 1959 interest heightened in seeking solutions to long-term coffee production/consumption imbalances. The Coffee Study Group created a committee to prepare studies and recommendations on long-term proposals. Latin American, African,[55] and European representatives participated actively. Representatives of coffee-producing countries in Asia and Oceania were not interested in marketing agreements, and did not take part in negotiations for agreement.

By late August, 1959, the Latin American bloc had agreed among themselves on the terms which would be acceptable for a world coffee agreement. The Coffee Study Group then invited the African producers to a special meeting in London to discuss the basis for African participation. On September 24, delegates from

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[55] Ethiopia, among African producers, did not participate because it felt inadequate consideration in quota proposals was given to its unique production capacity--largely composed of wild coffee forests.

Portugal (representing its African protectorate, Angola), the French African Community, and Latin America concluded a producers' pact which limited world coffee exports through a system of individually administered export quotas for green coffee. The 1959 International Coffee Agreement succeeded in consolidating the producers interests of both Latin American and African coffees. Its seventeen participant nations accounted for about 85 percent of the world exportable green coffee production. In addition to the scope of its membership, the 1959 accord also contained some significant operational improvements. It abandoned the flexible retention-of-exportable production formulae which had previously served as the basis for international proposals. The agreement contained provisions for calculating and allocating specific quarterly export quotas, based on estimates of world coffee demand. Encouragement of coffee consumption in countries with low per-capita imports of the beverage was achieved through designation of "new market" nations. Producer countries could export green coffee to these specifically listed low-consumption nations without counting such exports against their allotted quotas.

Basic annual quotas were negotiated for each country on the basis of its maximum annual exports in the period 1949-1958. After the initial quotas were established, quarterly export quotas were set as a percent of the basic annual quota. Although allowable

quarterly coffee exports for each signatory producer were to be established prior to each quarter, in practice the assessment of the previous quarter's market performance was not completed in time to allow official quotas to be established until about the middle of each period. Not all the participating nations had established central control agencies to administer quota restrictions on coffee marketing, in accordance with the provisions of the 1959 pact. By late 1960, the enforceability of the agreement came into serious question as several small producers exported significantly greater amounts of green coffee than had been authorized. Another problem of increasing seriousness also threatened the accord--transshipments of green coffee through designated "new market" countries into traditional market nations.

The pressure of unsold green coffee inventories, and the difficulty and expense of coffee stockpiling in many producer countries created a temptation to use resale ploys to obtain relief from restrictive quotas. Large quantities of coffee of Bulgarian origin began appearing in the United States. Since Bulgaria produces no coffee, it became apparent that some producers were using that eastern European nation as a resale point to quota markets. The Board of Directors of the International Coffee Agreement established a bag-marking system which was designed to indicate clearly the origin of all green coffee in international trade. Repackaging

of the transshipped coffee, however, made this detection measure ineffective.

The cooperation of the major importing countries became increasingly important as a control measure in the enforcement of quota regulations. Through the Coffee Study Group, efforts began to be directed toward drafting a long-term agreement which would involve participation of producer and consumer nations. The appeal to the coffee importing nations' representatives was primarily on the basis of economic development considerations. The industrial importing nations could consider support of coffee price maintenance schemes as a relatively low-cost form of foreign aid.

In the absence of specific control measures by the 1959 Agreement, Brazil and Colombia began to export less than their legal quotas in an effort to counterbalance the problems of inadequate coffee controls in other countries, and of transshipments which circumvented agreement strictures and weakened coffee export prices. For the 1959-1960 crop year, these two countries under-fulfilled their quotas by a combined total of 1,650,000 bags of green coffee.[56] The pressure on the Board of the new

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[56] International Coffee Organization, Executive Board, History of International Coffee Agreements: Their Background, Provisions, Operations and Related Developments, 1954-1963, ICC-1-1, 28 June, 1963, (London: International Coffee Organization, 1963), p. 21.

agreement to keep quotas relatively high reduced the importance of the quota mechanism. The 1959-1960 quota, as finally adjusted for all countries, was considerably larger than the traditional markets would absorb. Heavy reliance was placed, in effect, on the individual programs of coffee retention and internal (domestic) coffee price support policies by the producers themselves.

In 1960 and 1961 the Latin American producers who had participated in the defunct Agreement of Mexico met informally to study the reasons for the widespread evasions of the new agreement's provisions. After an in-depth study of the green coffee market, the producers concluded that

> . . . extraordinary pressures to sell develop at certain times of the year. For example, pressure to sell builds up as the harvests are readied for market in the last months of the year and the first months of the following year. Sales are made for forward delivery. Growers and exporters are eager to sell in order to realize returns, and central, or quasi-official, commercial banks are concerned with obtaining the proceeds of exports to replenish their holdings of foreign exchange, which have decreased during those months of the year when coffee, a principal or important source of foreign-exchange earnings, is moving abroad in small or negligible quantities. Unsettled political conditions and financial positions can move exporters to sell to foreign buyers as quickly as possible. In these circumstances export quotas, unsupported by other control mechanisms, may be too indirect a device to keep prices at desired levels.[57]

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[57] Ibid., p. 44.

The quota-setting mechanism of the International Coffee Agreement was plagued with progressively longer delays as time passed. By early 1961, the Board of the Agreement had resigned itself mainly to collecting data on green coffee exports ex post, and to issuing periodic admonitions about the dangers of flooding the market.

Mild coffee producers got together on an ad hoc basis to to recommend stop-gap measures for their respective governments. As a result of private negotiations Guatemala and Colombia agreed to stimulate world sales of mounting inventories of mild coffee in some other nations, notably Costa Rica, El Salvador, and Mexico.[58]

By 1961, general green coffee export prices had fallen to about 40 percent of their 1954 levels. Due in part to an increased interest in long-term development assistance to poor countries, and in part due to the continued discussions of coffee problems in the Coffee Study Group, the United States position on commodity agreements was liberalized.

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[58] Emil Zubryn, "Mexican Coffee Exports Aided by Colombia's Retirement from Market", Tea and Coffee Trade Journal, (March, 1961), pp. 54, 55.

On March 13, 1961, in a speech by President John Kennedy which outlined his ten-year proposal for improved standards of living in the Americas, he indicated that

> . . . the United States is ready to cooperate in serious case-by-case examinations of commodity market problems. Frequent violent changes in commodity prices seriously injure the economies of many Latin nations--drawing their resources and stultifying their growth. Together we must find practical methods of bringing an end to this pattern.[59]

In August, 1961, the Head of the United States Delegation at an Organization of American States conference in Uruguay declared the willingness of the United States to participate explicitly in a long-term coffee agreement. Late in 1961, negotiations were initiated to secure United States loans for mild coffee seasonal price supports in Central America. By early 1962, a loan of US $12 million was granted for that purpose.

Meanwhile, the Coffee Study Group met in plenary session in September to consider a staff paper on "Proposed Principles to Underlie a Long-Term Agreement".[60] After this paper was discussed a Coordinating and Drafting Committee, with representatives

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[59] The New York Times, March 14, 1961.

[60] Coffee Study Group, "Proposed Principles to Underlie a Long-Term Coffee Agreement", CSG-I- 8/61, Rev. 1 (September 29, 1961).

of ten producing and importing members of the Coffee Study Group, was appointed to draft an agreement proposal.

In early December, 1961, an agreement draft was circulated to the member governments of the Coffee Study Group, as well as to interested non-member nations. When the Group met again in plenary session in March, 1962, interest in the proposal seemed to warrant the convening of a formal negotiating conference. The Coffee Study Group therefore requested that the Acting Secretary-General of the United Nations make arrangements to hold such a conference under U. N. auspices. In May, the Secretary General of the United Nations formally invited all member states of the United Nations, of the Interim Commission for the International Trade Organization, of the Food and Agriculture Organization of the United Nations and of the Coffee Study Group to participate in the conference.[61] The invitation included the terms of reference for the meeting ". . . to discuss measures designed to meet the special difficulties which exist or are expected to arise concerning coffee."[62] Seventy-one coffee-exporting and -importing countries and interested international organizations were represented at the

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[61] International Coffee Organization, op. cit., p. 61.

[62] United Nations Coffee Conference, 1962; Summary of Proceedings, E/Conf. 42/8 (July, August 1962), p. 21.

conference; fifty-eight delegations actively engaged in the negotiations.

The United Nations Coffee Conference opened on July 9, 1962, and adjourned seven weeks later on August 25, after discussion and revision of the Coffee Study Group proposal. On September 28, the Conference was reconvened for one day, during which the entire text of the agreement was approved for signature by the delegations. By the November 30, 1962 deadline for signature, fifty-four governments had signed the 1962 International Coffee Agreement. Thirty-two coffee producing countries responsible for 95 percent of all green coffee exports were signatories. Twenty-two nations which accounted for almost 95 percent of total coffee imports had also signed the pact. However, delays in ratification of the world coffee pact by several governments (most notably the United States) prevented the definitive entry into full force of the new agreement until December 31, 1963.

General Provisions of the 1962 International Coffee Agreement

The feature of the 1962 pact which distinguished it most significantly from previous agreements was the explicit cooperation of the major coffee-importing countries. Like earlier accords, the 1962 Agreement used green coffee export quotas as its principal

instrument for stabilizing coffee prices and foreign exchange revenue. It also explicitly encouraged increased consumption of coffee through promotion activities financed by a per-bag levy on the producing members' coffee exports. Member producers were encouraged "to adjust the production of coffee while the Agreement remains in force to the amount needed for domestic consumption, exports, and stocks. . . [63]

Member importing nations were to limit total imports from nonmember producers as a group to not more than the average annual imports from those countries as a group during the period from 1961 through 1963. This provision effectively limited the expansion of non-member exports, since 95 percent of the coffee-consuming market was bound by the 1962 rules. The importing members were also to prohibit the importation of green coffee from member producers who shipped such coffee without quota approval. A producer nation who failed to comply with the Agreement quota regulations could be expelled from the pact. The prospect of being unable to profit from expanded exports to member consuming nations was hoped to provide adequate incentives to producers to enforce quota restrictions.

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[63] United Nations Coffee Conference, 1962, op. cit., Article 48, p. 65.

The International Coffee Organization, with headquarters in London, is the administrative organ established by the 1962 Agreement to supervise its operations. The highest authority of the Organization is vested in the International Coffee Council, which comprises all members of the Agreement. Although the Council may review any action taken to administer the Agreement, its chief role is to elect an Executive Board and Executive Director, to which group is delegated the responsibility for the day-to-day implementation of the Agreement goals.

The Executive Board consists of fourteen members, representatives of seven coffee-exporting nations and delegates from seven coffee-importing nations. The Board is given the discretionary authority to alter export quotas on a pro-rata basis within narrow limits during the coffee year, without prior Council approval. Annual quotas themselves must be established by the Council, although quarterly allotments may be revised by the Board with Council approval. The basic export quota assigned to each producing country in Annex A of the Agreement serves as the basis for all pro-rata adjustments. Until late December, 1966, selective adjustment of coffee export quotas to reflect differences in demand for the three major green coffee types (unwashed arabica, washed "mild" arabica, and robusta) was not permitted.

Like the 1959 Agreement, the 1962 pact allowed non-quota shipments of green coffee by members to specified regions of low per-capita coffee consumption. Bag markings and certificates-of-origin were required by the ICO to identify all quota-approved coffee in international trade. These devices were designed to prevent the clandestine transshipment of coffee to high-consumption areas.

The International Coffee Agreement of 1962 represents the culmination of a series of gradual shifts toward international collusion by coffee producers which began in 1954. Producers of various types of coffee were plagued in turn with declining green coffee export prices throughout the period as coffee production soared. Brazil, the mild coffee producers, and (finally) the African robusta producers recognized that production of green coffee for the export market, if allowed to increase unchecked, would continue to outpace the slow increase in coffee consumption. The extension of the 1959 producers' pact to include consuming nations as parties to the Agreement came only after the United States, the world's largest coffee-consuming country, altered its policy on participation in commodity agreements. The continued decline in the price of green coffee in Latin America, in addition to a heightened interest in hemispheric economic growth by President Kennedy, provided the final impetus to United States involvement. The possibilities

for improved earnings from an effective reduction of the coffee supply, however, depended upon the responsiveness of the market to changes in price. The price-elasticity of demand for green coffee exports is considered in the next chapter.

CHAPTER IV

THE PRICE-ELASTICITY OF COFFEE EXPORT DEMAND

The widely fluctuating green coffee exports and the secular decline in green coffee export earnings from 1953 through 1962 appear, in retrospect, to have been primarily caused by supply considerations; and not because of shifts in the demand for coffee exports. The coffee-tree bearing cycle and seasonal marketing of newly harvested coffee contributed to year-to-year supply shifts. The expanded plantings of new coffee trees (which came in response to high coffee export prices in the early 1950's) and the partial marketing protection from Brazilian coffee retentions increased world production of coffee more rapidly than the slow increase in green coffee exports. The short-run supply of green coffee was, for institutional and financial reasons, virtually perfectly price-inelastic. Inappropriate climates for long-term coffee storage, inadequate financial resources to support massive retention programs and weak regulatory agencies contributed to the pressures to sell newly harvested coffee, regardless of export price.

Chapter V provides empirical evidence to support the assumption of a perfectly inelastic green coffee supply function.

The 1962 International Coffee Agreement attempts to regulate the supply of coffee through quota restrictions in coffee exports. Quarterly quota allotments are designed to shift the price-inelastic supply of coffee in order to stabilize green coffee prices and revenue, presumably on an annual basis (the Agreement does not adopt annual stabilization explicitly, so one can only infer from its operation that that is its intention).

If the short-run coffee supply is perfectly price-inelastic (as this study assumes), variations in coffee prices at the export level will depend entirely on the nature of green coffee export demand. In essence, coffee export prices will be demand-determined.

The degree of price change in response to a given change in the quantity of coffee offered for export will depend on the price-elasticity of demand for coffee. In view of the nature of the green coffee exports, one may also expect that the elasticity of demand for different types of green coffee may vary through a considerable range. As Chapter II indicated, green coffee is a highly differentiated product, with subtle differences in size, color, and flavor within coffee types. These variations in coffee characteristics give

rise at the export level to many more products than the three major types--unwashed arabica, mild arabica, and robusta.

For example, Brazilian arabica coffees are classified into six major varieties: red bourbon, yellow bourbon, mundo novo, red caturra, yellow caturra, and Maragogipe. Each variety is further classified by type, according to the number of defects found in a 300 gram sample of the variety. The official classification table lists 41 different coffee types for each of the six varieties--yielding almost 250 variants of Brazilian coffee. Each distinct coffee type has its own unique price per bag in world export markets.[64]

In general, the sustained price differentials among the three major coffee varieties in the world--unwashed arabica, mild arabica, and robusta--indicate the willingness of the export market to pay a continuing premium in price for the mild (wet-processed) arabica varieties over the export prices prevailing for unwashed (dry-processed) arabica coffees. Furthermore, the rather persistent discount in robusta export prices in relation to unwashed arabica prices suggests the comparative inferiority of the robusta coffees vis-a-vis the other two major varieties.

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[64] World Coffee and Tea, Vol. 7, No. 12 (April, 1967), p. 26.

Representative average annual export prices for the three major coffee varieties are given in Table 7 for the 1953-1962 period. In view of the market preference for mild coffees, as compared with the other two coffee types, one might expect a relatively low price-elasticity of demand for mild coffee. This low price-elasticity would indicate importers' comparative reluctance to lower their purchases of green coffee as its price rose. By the same token, robusta coffees might well be characterized by relatively high price-elasticities of demand, because of its demonstrated inferiority in the export market--as compared with the arabica varieties. In any event, there is no a priori reason to believe that the demand for all types of coffee should have identical (or even similar) price-elasticities in their relevant export price ranges.

It would be possible, perhaps even instructive, to delineate demand functions for the three major coffee varieties, without regard to the country of production. However, the purposes of this study make selected coffee producing countries the focal point for coffee revenue research, and not the major coffee types per se.

Because of the unique characteristics of the coffee grown in each country, the use of a single demand equation for a major coffee variety (i. e., robusta) would not provide as precise an indication of the demand for the individual nation's unique coffee production

TABLE 7

AVERAGE ANNUAL GREEN COFFEE EXPORT PRICES FOR COFFEE DELIVERED IN NEW YORK, SELECTED UNWASHED ARABICA, MILD ARABICA, AND ROBUSTA VARIETIES, BY YEARS, ANNUALLY, 1953-1962[a]

(U. S. Dollars per 60 Kg. Bag)

Year	Unwashed Arabica[1]	Mild Arabica[2]	Robusta[3]
1953	70.00	74.00	58.00
1954	85.70	93.90	72.80
1955	63.10	82.80	47.10
1956	61.00	81.80	38.90
1957	59.45	84.11	41.27
1958	54.54	68.53	45.83
1959	42.52	59.54	34.84
1960	43.11	57.40	24.17
1961	42.64	55.45	22.97
1962	39.87	52.24	23.49

[1] Figures for unwashed arabica are average annual coffee export prices for Brazilian unwashed arabica coffee.

[2] Figures for mild arabica are average annual coffee export prices for Colombian mild arabica coffee.

[3] Figures for robusta are average annual coffee export prices for Western African robusta coffee.

[a] Source: U. S. Department of Commerce, Business and Defense Services Administration, Press Release BD-series, various issues, 1953 through 1963.

mix as the separate country or region approach does. Moreover, each member producing country of the 1962 International Coffee Agreement tends to view its coffee exports as a separate product, despite its generic relationship to other coffee types.

Successful administration of an agreement which purports to stabilize coffee prices and revenue must consider the price-elasticities of coffee export demand carefully to determine the appropriate quota policies to pursue. Economic consultants to the International Coffee Organization--most notably Gertrud Lovasy of the International Bank for Reconstruction and Development and George Kawata, formerly of the Pan American Coffee Bureau--have provided in-depth analyses of the consumer demand for roasted and soluble coffee, based primarily on United States market samples. These studies, described in greater detail elsewhere in this chapter, indicated a rather low absolute price-elasticity of consumer demand for roasted and soluble coffee--well within the inelastic range.

On the basis of the studies made by these researchers, the International Coffee Council apparently concluded that the appropriate action to increase revenue was to restrict the coffee supply and to raise green coffee export prices.

Control over the green coffee export supply was exerted through the coffee export quota mechanism of the International

Coffee Organization. In the initial stages of Agreement operation, annual world quotas were established by the International Coffee Council. The world quota was then divided among the member producing nations according to the proportions established by the basic Agreement quota for each country. Quarterly revisions of the quotas could be made, if market conditions appeared to justify them; but any quota adjustment had to be made on a pro-rata basis among all producing nations.

No selective quota changes were permitted. Unfortunately, no specific directives existed to assess market conditions and their relationship to quota adjustments. Therefore, in March, 1965, the Council approved a Brazilian proposal which would permit the Executive Director of the Agreement to alter world quotas (and country quotas on a pro-rata basis) if green coffee export prices moved beyond upper or lower indicator limits, as established by the Council.

An indicator price range of 38 to 44 cents was established for quota purposes; as long as indicator prices remained within the range, no quota adjustments were deemed necessary. The indicator price was determined by calculating the daily arithmetic mean of average New York import prices per pound for coffee in three major categories--unwashed arabica, mild arabica, and robusta.

If the indicator price rose above 44 cents per pound for 15 consecutive market days, or fell below 38 cents per pound for the same period, the Executive Director was obliged to adjust all export quotas in a manner which would bring the indicator price back within the permissible range.

The linkage of all coffee export supplies through the rigid pro-rata quota system proved burdensome to many producing countries. Market conditions for mild arabicas which might cause the indicator price to drop below 38 cents per pound automatically reduced the supply of unwashed arabicas and robustas, as well as that of mild arabicas. This pervasive quota change was effected, regardless of market conditions for the different coffee varieties. An increased number of requests for quota waivers followed in the wake of the quota adjustments; and these requests forced a reevaluation of the quota revision mechanism.[65] A selective quota system which was adopted in late 1966 permitted pro-rata quota adjustments within each of the three main coffee varieties. This action increased the flexibility of the quota mechanism and tended to correct the clumsy character of the original system.

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[65] The quota adjustment system and its revisions are discussed at length (with reproductions of the relevant International Coffee Council resolutions) in Pan American Coffee Bureau, Annual Coffee Statistics, 1964 (New York: Pan American Coffee Bureau, 1965), p. 4, 5; and Annual Coffee Statistics, 1965 (New York: Pan American Coffee Bureau, 1966), pp. 2-4.

A more fundamental problem in the application of coffee export quotas was the theoretical base on which restrictive quotas were established. Any short-run restraints on the coffee supply assume that the revenue gains from higher unit prices for coffee are not offset or overwhelmed by lower total unit sales; in short, green coffee quota restrictions are based on an assumption of a price-inelastic demand for green coffee.

Empirical studies on the retail demand for coffee have been conducted by several individuals over a period of years. The methodology and summary of the results of several of these studies are presented in the next section of this chapter.

The use of retail market coffee demand analysis as a primary decision-making input in the control of the coffee export market assumes a congruity between the demand elements in the two markets. A relationship indubitably exists between the export and retail markets for coffee, yet there are many differences in the two markets which would cast doubt on the use of retail market conditions to approximate behavior in the export market.

The wholesale product--green coffee--is highly differentiated, and is purchased and sold by knowledgeable individuals in large quantities for processing into an ultimate consumer form. Aggressive market behavior in the export sector gives the

competitive edge to the buyer who sees temporary price bargains among similar coffee grades and takes advantage of these differentials. In the United States almost 850 different companies bid for green coffee; but three companies--General Foods, Standard Brands, and Tenco--account for more than half of the retail sales and export purchases of coffee in the United States.[66]

In contrast to the highly organized and centralized export market, the retail market for roasted or soluble coffee is composed of relatively large numbers of uninformed consumers, for whom coffee is a conventional necessity. Because coffee consumption involves the purchase of a pleasantly habitual food item in quantities which require only a minor part of an individual's total money income, it would seem likely that retail coffee consumption would not normally respond greatly to price changes.

Furthermore, a recent study suggests that the cross-elasticity of demand between coffee and other beverages such as tea or cocoa is very low. United States coffee drinkers have negligible susceptibility to cocoa, regardless of coffee retail prices; and the cross-elasticity of demand for tea with respect to the price

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[66]"The Price of Instant Coffee", The Economist, Vol. 226, No. 6493, (February 3, 1968), p. 53.

of coffee is very low.[67] The retail market coffee product differs physically from the export market green coffee. The retail product is roasted, often ground, and sometimes dehydrated. In addition, the retail coffee product usually is a composite (or blend) of several different coffee varieties.

The individual coffee varieties vary considerably in flavor and aroma, but the blended coffees tend to mask and obscure the distinctions of the individual elements. The masked flavor of the blended coffee gives the roaster some latitude in the selection of green coffee ingredients for the consumer product, and some flexibility in the proportions of the coffee varieties used. Roasters and blenders routinely alter their blend mix when price differentials among coffee varieties make the substitution of cheaper coffee types for more expensive varieties possible without noticeably affecting the characteristics of the retail product.

When blend substitutions are considered with the possibilities for prolonged green coffee storage in the consuming country, an export price-elasticity of demand becomes plausible which is considerably higher than the elasticity of retail demand. In a coffee industry analysis prepared by Merrill Lynch, Pierce,

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[67] Muhammad I. Chaudhry, Demand Functions--Static and Dynamic for Coffee, Cocoa, and Tea, Unpublished Doctoral Dissertation (Harvard University: Department of Economics, 1965), p. 37.

Fenner and Smith, Inc., the observation is made that

> trade interests are more responsive to price changes and expected price changes than are final consumers. In periods of fairly restricted price movement, the trade is likely to take advantage of small price reductions to add to inventory or, on the other hand, abstain from buying when prices rise. . . . Importers and roasters typically keep a low physical inventory, less than a two-month supply. . . Should they decide to add even a few weeks' supply to their holdings, this makes a considerable difference to short-run demand.[68]

Elizabeth Gilboy, in her 1934 study of coffee and tea, derived a low negative coefficient (-0.34) of price-elasticity of demand for coffee. She observed that

> the existence of inelasticity of the curve makes it likely that the curve reflects consumers' demand and not dealers' (import) demand. The latter would certainly be considerably more elastic, and might even be positive.[69]

Later in this chapter, the present author's study on price-elasticity of demand for the various selected producers' green coffee exports is presented. This study supports the contention that the export demand for coffee is considerably more elastic than the retail consumer demand for coffee (as inferred from the recent consumer coffee demand studies presented below).

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[68] Merrill Lynch, Pierce, Fenner and Smith, Inc. Coffee. (New York: Merrill Lynch, Pierce, Fenner and Smith, 1965), pp. 32, 33.

[69] Elizabeth W. Gilboy, "Time Series and the Derivation of Demand and Supply Curves: A Study of Coffee and Tea, 1850-1930". Quarterly Journal of Economics, Vol. 48 (August, 1934), pp. 667, 678.

The crucial issue here is the relevance of consumer market demand analyses for the International Coffee Organization policies regarding desirable export allotments. If the price-elasticity of export demand for green coffee (the market behavior which actually affects international coffee export prices and revenue) does not closely approximate the price-elasticity of consumer demand for roasted and soluble coffee, then policy decisions about coffee supply restrictions which are based on estimates of the latter would be seriously in error concerning actual export market responsiveness. If the green coffee export demand were price-elastic while International Coffee Organization estimates of coffee responsiveness were based on price-inelastic consumer demand, their projections of coffee price movements would not only be in serious error, but also their estimates of coffee export revenue changes would be perverse.

An increase in green coffee export prices would, ceteris paribus, reduce green coffee export revenue; attempts to stabilize export income through quota controls would increase, rather than reduce, the magnitude of expected fluctuations in coffee export income.

A reasonable approximation of the price-elasticity of demand for green coffee exports is therefore crucial for accurate International Coffee Organization policy decisions. In view of its essentiality, it is quite surprising that no study of coffee export demand elasticity has been published. There is also no evidence

that consultants to the 1962 Agreement staff have provided any in-house studies on coffee export price-elasticities. In an interview with Miss Gertrud Lovasy, long-time coffee analyst for the International Monetary Fund and the International Bank for Reconstruction and Development, and now the principal economic adviser to the Agreement, she justified the absence of analysis of the export market demand elasticities by asserting that the demand for green coffee exports must reflect ultimate retail consumer demand for roasted coffee. She therefore felt no separate study of coffee export demand was necessary or desirable![70]

As background to the present study, a brief summary of recent consumer coffee demand studies is presented below. The statistical method used in the present study is then outlined; a summary of the findings on coffee export price-elasticities of demand follows.

Recent Studies on Consumer Price-Elasticity of Demand

Most recent studies of retail consumer demand for roasted and soluble coffee have generated price-elasticities of static annual demand using logarithmic transformations of annual data. All of

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[70]Personal interview with Miss Gertrud Lovasy, Washington D. C., July 25, 1967.

the research reviewed have utilized multiple linear regression analyses of relationships established by the simple least squares method.

In these studies the per capita quantity of coffee consumed was the dependent variable; a measure of the price of roasted or soluble coffee was the independent variable. The regression coefficient of the independent variable, "price", in the logarithmic transformation is also the measure of price-elasticity of demand. Some studies, as indicated, also included other independent variables in the analysis which were thought to influence the quantity of coffee consumed.

All the studies on consumer demand indicate a highly inelastic demand for roasted coffee. Rex Daly estimated the 1958 per capita use of coffee for persons fifteen years of age or older in the United States to have a price-elasticity range of -0.25 to -0.30.[71] Daly regressed per capita coffee consumption on retail coffee price and on personal disposable income.

A more sophisticated approach to coffee demand analysis was provided by Muhammad Chaudhry in a 1965 Harvard University dissertation. Static logarithmic demand functions for coffee consumption were derived, using per capita consumption of coffee as

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[71] Rex F. Daly, "Coffee Consumption and Prices in the United States", Agricultural Economics Research, Vol. X, No. 3 (July, 1958), p. 62.

the dependent variable. Per capita real consumption expenditures and deflated retail coffee prices were used as the independent variables. Chaudhry introduced time lags into the relationship between variables and experimented with second-order transformations of coffee consumption, coffee prices, and disposable income. The short run price-elasticity of consumer coffee demand for the United States was estimated to be -0.23.[72]

Gertrud Lovasy and George Kawata, in a recent unpublished study for the International Coffee Organization, experimented with adjusted per capita consumption of coffee to reflect changes in cup yield per bag of green coffee, and used a variety of measures for coffee price in conjunction with restricted demand definitions (e.g., deflated retail coffee price, implicit cup price, price in eating places and at work). The price-elasticity of consumer demand for the various derived functions varied from -0.14 to -0.27 for the period 1953 to 1965[73]--roughly the same period for data observations used in the present study for deriving export demand price-elasticities.

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[72]Muhammad I. Chaudhry, Demand Functions--Static and Dynamic for Coffee, Cocoa, and Tea. Unpublished Doctoral Dissertation. (Harvard University: Department of Economics, 1965), p. 97.

[73]Gertrud Lovasy and George Kawata, "Developments in U.S. Coffee Consumption: U.S. Analysis and Forecast". Unpublished staff paper for the International Coffee Organization (London: International Coffee Organization, 1967), Annex II, pp. 1, 2.

The results of these studies of the consumer coffee market indicate that the static price-elasticity of demand for roasted and soluble coffee within the relevant price-range is about -0.25, a very low coefficient of price-elasticity in absolute terms.

Derivation of the Coffee Export Price-Elasticities

The theory of demand places no functional constraints upon the relationship between the various quantities of a product which a potential purchaser is willing to buy and the maximum price which he is willing to pay for each unit of those various quantities of the product, except to assert that the rational purchaser will be willing to buy more of the given product at relatively low prices than he would be willing to purchase at relatively high prices.

The theory of demand does not and cannot establish a single direction of causation between the price of a product and the quantity demanded of that product at the given price.. When a potential purchaser and seller of a good actively bargain with one another over the terms-of-sale of a given product, the quantity of the product is, in that transaction, a given value and becomes the independent variable. The terms-of-trade (in a money transaction, the price of the product) for the transaction is dependent upon the assessment of the product's relative value by the parties to the trade. Price is, in this case, the dependent variable.

In an impersonal market, the potential consumer may find himself unable to alter the terms-of-trade. Price may be fixed for a given product. The would-be consumer has the choice of purchasing the good or not; if he decides to purchase the product, the quantity of his purchases must then be determined. In this situation, the price of the given product is clearly the independent variable, and the quantity purchased is the dependent variable.

In the international coffee market, both manifestations of demand are present. Large roasters may negotiate directly with agencies in the coffee-producing country to obtain green coffee; or the more impersonal brokerage system in the New York may attract many small roasters, each of whom affects coffee price very little. Because the New York market's prices for green coffee are used as the basis of determining International Coffee Organization quota policies, this study will assume that the quantity demanded of green coffee exports is the dependent variable and that the export price of the green coffee is the independent variable which affects the quantity demanded. Other variables which might affect the quantity demanded of green coffee are also considered in conjunction with coffee export prices; U. S. population, private consumption spending on food, and personal disposable income are examples of such factors.

The demand function (consisting of the explicit relationships between the quantity demanded and the various independent variables) is assumed to be static over the period considered in this study. This period includes the data collection stage from 1953 through 1962, and the demand analysis and application phase from 1963 through 1966. This assumption permits all observations on the time-series data to be considered sequential revelations of an identical function. The validity of this assumption can be partially tested by the degree of multiple correlation between the dependent variable and the independent variables, and the ratio of explained to residual variation in the dependent variable. The F-ratio test is the measure used in this study for the latter statistic.

Since real-world observations cannot be taken on demand alone, but only on the revealed interaction of demand and supply in the market, serious limitations on interpretation of such data exist. Changes in price which are observed may be due not only to demand responses, but also to supply considerations. In other words, the use of price as an independent variable will affect the quantity demanded and the quantity supplied of green coffee. The actual time-series observations on coffee export price and coffee exports to the United States, for instance, would contain elements of both supply and demand responses and could not, therefore, be used alone as the basis for deriving demand functions.

The assumption of a perfectly price-inelastic supply of green coffee exports to the United States permits all changes in price to be attributed to demand considerations alone. Under this assumption, time-series data on price and quantity accurately depict the static demand function. The assertion of a perfectly price-inelastic supply of green coffee has been descriptively supported in Chapters II and III. Chapter V will provide empirical evidence for that contention, as well.

The dual assumptions of a static short-run demand function and of a perfectly price-inelastic supply of green coffee allow a time series data dispersion to visually depict a relationship between coffee export price and export quantity. However, the mathematical formulation of such a function requires the selection of a functional mode (e. g., linear, logarithmic, semi-logarithmic, etc.).

Logarithmic transformations of the data were used in this study for three reasons. First, logarithmic export demand functions would permit a direct comparison of export price elasticities with the retail coffee price elasticity coefficients which were presented. Second, the logarithmic form produces a unique coefficient of price elasticity for the relevant coffee price and quantity range. This unique coefficient may be contrasted with the multiple values which are associated with a linear function. Third, the logarithmic transformations provided a better fit for the data in multiple

regression analysis than did the linear form. Higher proportions of explained variation in the dependent variable and lower levels of significance for the F-ratio test characterized the logarithmic equations, in comparison with the linear equations (Compare Table 8 with Appendix, Table 19).

The procedure selected to generate mathematical formulations of green coffee export demand from the selected time-series data was a multiple regression program utilizing the simple least-squares method of regression. Regression coefficients which establish a functional relationship between the dependent variable and the independent variable(s) are generated as a result of this analysis of variance.

The regression procedure subsumes the serial independence of the disturbance terms--a highly unrealistic assumption to make about the time-series data used for this study. To use a technique, however, which explicitly treats the magnitude of the disturbance of one observation as being dependent on the magnitude of the disturbance term of another observation is quite complicated. The use of a procedure which attempts to remove the influence of auto-correlation requires additional assumptions about the exact nature of the autoregressive scheme. This study did not attempt to use these more complex analyses.

The multiple regression program was processed by electronic data processing equipment. An off-the-shelf program was used--"The Multiple Regression Package for the Card 1620".[74]

The general model used is of the form $Y = b_o + \sum_{i=1}^{N} b_i X_i$, where Y is the dependent variable, b_o is the constant term, b_i are the regression coefficients of the respective independent variables, and the X_i define the independent variables. This program allows regression of the dependent variable on up to 17 independent variables.

> The output for each (independent) variable consists of the coefficient b_i, its F ratio (b_i^2 divided by the variance of b_i), and the multiple correlation of the X_i with the other X's. Also included in the output are the constant term b_o, the multiple F-ratio with its degrees of freedom, and the residual variance.[75]

The input format allowed data for the dependent and independent variables to be regressed using the raw data or transformations of the raw data. Accordingly, the observations for the variables were processed both as raw data and as logarithmic transformations. The regression coefficients presented in the tables of this chapter are the results of mathematical formulations

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[74] Otto Dykstra, Jr., "Description of Multiple Regression Package for the Card 1620", (IBM 1620 General Program Library, No. 6.0.043).

[75] Ibid., p. 1.

based on the logarithmic data transformations. Results of the linear analysis are presented in the Appendix, Table 18.

The Results of the Price-Elasticity Study

Measurement of year-to-year demand responsiveness for green coffee exports is one of the major purposes of this thesis. A summary of the price-elasticities of green coffee export demand which were derived from logarithmic data transformations is presented in Table 8. The multiple correlation of the dependent variable (quantity of green coffee exports demanded) with the independent variable(s), such as the average annual green coffee export price, indicates the proportion of total variation in green coffee exports to the United States which can be imputed to variations in the independent variable(s). The multiple F-ratio for each price-elasticity coefficient represents the significance test applied to the entire demand regression equation. In general, the larger the value of the F-ratio, the smaller the likelihood that the derived regression equation contains spurious relationships. The sample size for all regression analyses was 10.

The absolute price-elasticity of United States demand for green coffee exports was greater than unity for total coffee exports, regardless of type or country of origin. The price-elasticities of demand for coffee of the eight selected producers ranged from -0.71

TABLE 8

PRICE-ELASTICITY OF ANNUAL UNITED STATES DEMAND FOR GREEN COFFEE EXPORTS, BY SELECTED PRODUCING COUNTRIES, BASED ON LOGARITHMIC TRANSFORMATION OF 1953-1962 DATA[a]

Country	Price-Elasticity of Export Demand	Multiple R^2	Multiple F-Ratio[1]
Total Exports	-1.34	0.83	38.3
Brazil	-4.94	0.87	22.9
Colombia	-1.76	0.91	35.8
Costa Rica	-1.72	0.97	302.3
El Salvador	-3.75	0.98	65.7
Guatemala	-0.96	0.74	23.0
Ethiopia	-3.70	0.92	38.5
East Africa	-0.71	0.98	660.8
Western Africa	-2.41	0.99	535.4

[1] All F-ratio values in the table indicate that the F-ratio test hypothesis (no significant difference between explained and residual variance) is rejected at the 0.01 level. Sample size is 10.

[a] Source: Calculated from annual data reported by the U. S. Department of Commerce and Pan American Coffee Bureau, using an EDP-processed multiple regression program.

to -4.94. Six of the eight selected producers' green coffee exports faced United States absolute price-elasticities of demand in excess of unity. Two countries--Guatemala and East Africa--had absolute price-elasticities of demand for their coffee somewhat less than unity. All price-elasticities were significant (i.e., the F-ratio test for the relevant equation was significant at the 0.01 level).

The proportion of explained variation in green coffee exports to the United States exceeded 0.90 for six of the eight coffee producing countries which were studied. Table 9 presents the regression coefficients for the derived demand equation, using logarithmic transformations of the annual input data for the years 1953 through 1962. The dependent variable--the quantity of annual green coffee exports to the United States--was simultaneously regressed on average annual green coffee export price, United States population, consumption spending on food, the general level of green coffee export prices in the United States, and personal disposable income.[76]

For all eight countries studied, the average annual export price for green coffee to the United States was found to be an explanatory variable which influenced United States purchases of that country's coffee. For exports from Costa Rica, Guatemala and East

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[76] A complete definition of all variables, and sources of data for observations on the variables is provided in the legend of Table 9.

TABLE 9

REGRESSION COEFFICIENTS OF ANNUAL UNITED STATES DEMAND FOR GREEN COFFEE EXPORTS OF SELECTED PRODUCING COUNTRIES, BY COUNTRY, BASED ON LOGARITHMIC TRANSFORMATION OF 1953-1962 DATA[a]

$$(Y = b_o + \sum_{i=1}^{5} b_i X_i)1$$

Country	b_0	b_1	b_2	b_3	b_4	b_5
Total exports	6.2146	-1.3425				
Brazil	9.2669	-4.9437			1.0956	
Colombia	8.7800	-1.7591		-1.3687		
Costa Rica	5.4051	-1.7194				
El Salvador	5.8826	-3.7531		-4.6291	1.3374	3.7012
Guatemala	4.4766	- .9610				
Ethiopia	6.7529	-3.6967			1.2397	
East Africa[2]	3.8041	- .7123				
Western Africa[3]	-.9949	-2.4081			1.2793	2.2238

[1]The b_i are regression coefficients for the respective independent variables; the definitions of variables for the regression equation describing United States demand for green coffee exports are as follows:

Y Volume of United States purchases of green coffee from indicated country of export, in thousands of 60 Kg. bags, annually on calendar year basis.

Source of data: Food Industries Division, Business and Defense Services Administration, U. S. Department of Commerce. (From customs declaration documents).

TABLE 9 (Continued)

b_o Constant term in regression equation.

X_1 Average annual price in U. S. current dollars per 60 Kg. bag for total annual volume of exports of green coffee from indicated country of export to the United States; calculated by dividing total declared value of annual coffee exports to the United States by the number of bags exported.
Source of data: Food Industries Division, Business and Defense Services Administration, U. S. Department of Commerce.

X_2 Non-institutional U. S. population, fourteen years of age and older, thousands of persons. Data for 1960 and later years includes the states of Hawaii and Alaska. Population of persons thirteen years of age and younger was excluded from the analysis on the assumption that this group contributes little to effective consumption demand for coffee.
Source of data: Bureau of Labor Statistics, U. S. Department of Labor.

X_3 Annual personal consumption expenditures on food, excluding alcoholic beverages, billions of U. S. current dollars.
Source of data: Office of Business Economics, U. S. Department of Commerce.

X_4 Average annual price of green coffee exported to the United States from all producing countries, U. S. current cents per pound.
Source of data: Department of Research, Pan-American Coffee Bureau, from data collected by the U. S. Department of Commerce.

X_5 Disposable personal income, national income account, billions of U. S. current dollars.
Source of data: Office of Business Economics, U. S. Department of Commerce.

[2]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[3]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1962).

[a]Source: Regression coefficients calculated from annual data of sources listed in footnote 1 (above), using an EDP-processed multiple regression program. Sample size is 10.

Africa, as well as for total export sales to the United States, the coffee export price was the only independent variable which had any influence on green coffee exports.

Four countries had coefficients of price cross-elasticity of demand vis-a-vis all other coffee prices of greater than unity. These countries were Brazil, El Salvador, Ethiopia, and Western Africa. The cross-elasticity coefficients ranged in value from 1.10 to 1.34. None of the other countries which were studied demonstrated any significant price cross-elasticities with other coffee varieties.

Each of the three major coffee varieties--unwashed arabica, mild arabica, and robusta--are represented in the exports of the four countries with demonstrated price cross-elasticities of demand. It is likely that strong cross-elasticities of demand exist for the coffee exports of all producing countries, in view of the considerable substitutability at the wholesale level among all coffee varieties and types.

The statistical requirement of a high ratio of explained to residual variation in the dependent variable cannot be fulfilled in a multiple regression scheme which includes interdependent variables as many different independent variables. The inclusion of separate coffee export price series for each coffee type tended to produce regression equations with unacceptably high residual variances.

When general coffee prices could be included in a statistically significant regression equation (as was the case for the four countries' export demand equations mentioned above), the coefficient of price-elasticity also tended to be high. The range of absolute values for the price elasticity coefficients of the countries which also demonstrated statistically significant price cross-elasticities was 2.41 to 4.94. There is, therefore, statistical evidence to support the contention that significant cross-elasticities of demand for coffee varieties are accompanied by high price elasticity coefficients. One may assume that, if explicit simultaneous treatment of many individual coffee varieties and green prices were statistically feasible, the effect on the derived price-elasticities of demand would be to increase their absolute values.

In general, the absolute price-elasticity of demand for unwashed arabicas (grown in Brazil and Ethiopia) is the highest of the three major varieties. The absolute price-elasticity of demand for robusta green coffee is somewhat lower than for unwashed arabicas. The robusta varieties are grown in East and Western Africa. The lowest absolute price elasticity of the three varieties is demonstrated by the mild arabica type--grown in Colombia,

Costa Rica, El Salvador, and Guatemala.[77]

This study of the United States demand for green coffee exports indicates that (1) the annual United States demand for green coffee exports is price-elastic for total coffee exports taken together. The elasticity coefficient is -1.34; (2) the price elasticity of United States demand for coffee exports from selected producing countries demonstrated a considerable range of values (-0.71 to -4.94).

The implication of this study for short-term coffee export maintenance schemes--such as the 1962 International Coffee Agreement--is considerable. The assertion of identical or similar price elasticities of demand for both retail consumer demand and green coffee export demand cannot be supported by the study. Policy decisions for the export market which are based on the assumption of consumer market elasticities of demand for roasted or soluble coffee will probably be frustrated by the actual responses in the green coffee export market.

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[77] Two issues cloud this generalization; (1) El Salvador exports demonstrate a higher absolute price elasticity coefficient (-3.8) than the other mild coffee producers. This demand elasticity is probably due to the cross-elasticity influence in the equation; (2) East Africa exports indicated a rather low price-elasticity of demand (-0.7), possibly because of the mixed nature of production in the region (i.e., robusta output in Uganda, and arabica production in Kenya and Tanzania).

For example, if retail price elasticities (about -0.30) had prevailed in the export market, the decline in annual green coffee revenue from sales to the United States would have been about $686 million, instead of the $494 million drop which was actually experienced with the elastic United States demand for green coffee.[78] Furthermore, efforts by the International Coffee Organization to raise prices through restrictive export quota allotments would tend to create movements in export revenue exactly opposite to those expected in the retail market.

If, for example, in 1963 the International Coffee Council had set world export quotas to increase overall United States coffee export prices to $60.00 per 60 Kg. bag from the $40.27 bag price in 1962, one would have expected the inelasticity of demand (as inferred from the retail coffee market) to increase revenue by about $268 million. However, this increase in coffee prices in the export market would, according to export market demand elasticities, cause a fall in revenue of about $483 million. The failure to

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[78]The point elasticity method for calculating demand elasticity does not always guarantee that falling prices and falling revenue will yield an absolute elasticity coefficient of less than unity. The United States demand for green coffee has a coefficient of price elasticity (-1.34) which appears to place the demand function in the elastic category; however, the point elasticity coefficient must equal or exceed approximately -1.67 in absolute value in order to yield a true elastic demand.

identify explicit price elasticities for the green coffee export market could be the fatal flaw in the operation of the 1962 International Coffee Agreement.

CHAPTER V

ESTIMATES OF CHANGES IN GREEN COFFEE REVENUE ATTRIBUTABLE TO THE 1962 AGREEMENT

The price-elasticities of demand for green coffee exports to the United States and the corresponding demand equations acquire operational meaning for coffee revenue only as a given quantity of green coffee exports from a selected producer country to the United States is considered. The willingness of producers to offer green coffee for sale in the United States market determines (in conjunction with U. S. importers' demand) the actual quantity exported to the United States in a given year. A need exists to estimate the nature of green coffee supply to the United States, in order to determine the revenue generated by such exports.

A supply function relating green coffee production in a given year to green coffee exports to the United States in that year involves two separable parts. One sub-function influencing green coffee exports to the United States is the relationship existing between a

given country's green coffee production of exportable quality and its actual total green coffee exports to all countries; the other subfunction indicates the United States share of that producing country's total green coffee offerings in the international market. Both subsidiary relationships were established independently in this study, and then merged to provide a two-stage function for the offer of green coffee exports to the United States.

The derivation of relationships between exportable coffee production and a country's green coffee exports is presented in this chapter. The statistical relationship between a country's total exports and its exports solely to the United States is also examined. The procedure which was used to generate the hypothetical revenue estimates for 1963-1966 sales to the United States is presented. The effect of the 1962 International Coffee Agreement on the levels of revenue and price and revenue fluctuations for the selected producing countries concludes this part of the study.

Derivation of the Short-run Green Coffee Supply for the U. S. Market

Exportable coffee production, as reported in the final estimates of production by the United States Department of Agriculture, is the exogenous variable in the two-stage coffee supply function. In the first stage, total annual green coffee

exports from each of the selected producing countries was regressed on annual exportable green coffee production to establish a least-squares estimate of the mathematical relationship between coffee production and total coffee exports.[79] In the absence of an a priori formulation of the exact character of short-run supply, both linear and logarithmic transformations of the cyclically adjusted data[80] were analyzed. The resulting regression equation demonstrating the highest degree of explained variation (in linear or in logarithmic forms) and the lowest level of F-ratio significance was adopted as the appropriate formulation of the exports/production relationship. The multiple regression analysis described in Chapter IV was used to generate regression coefficients, and their corresponding multiple R^2 and F-ratio tests.

A dummy variable, introduced to reflect the secular shift of independent variables other than exportable coffee production, was used to test the influence of unidentified environmental factors which might shift the coffee supply function through time. This

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[79] See Table 10, Footnote 1.

[80] Data variations due to the approximately two-year coffee tree bearing cycle were removed prior to the application of multiple regression analysis by using three-year center-weighted moving averages instead of the raw data for exportable production and total coffee exports.

dummy variable acquired significance only in the case of Brazil. The negative coefficient of the variable may indicate the increasing stringency of the Brazilian coffee retention program through the data collection period (1952-1963) for coffee production and total exports.

Table 10 summarizes the results of the regression analysis of exportable green coffee production and total green coffee exports from the selected producing countries. The linear format produced regression coefficients associated with a higher multiple R^2 and lower F-ratio significance level than for the corresponding logarithmic transformation in all countries, except Brazil and Ivory Coast. Logarithmic data was more statistically significant in terms of multiple R^2 and F in these latter cases. In three of the eight selected countries, exportable coffee production in a given year was correlated more significantly with total green coffee exports in the following year than it was associated with coffee exports in the same year. Because harvesting seasons vary considerably from country to country it would not be surprising to find this lagged temporal relationship existing in countries whose output came in the latter part of the calendar year, and could not be reflected in coffee shipments until the following year. Brazil, Ethiopia and Ivory Coast--the three countries with the lagged production--export

TABLE 10

REGRESSION COEFFICIENTS OF ANNUAL TOTAL GREEN COFFEE EXPORT SUPPLY FROM SELECTED PRODUCING COUNTRIES, BY COUNTRY, BASED ON 1952-1963 DATA[c]

$$(Y = b_o + \sum_{i=1}^{3} b_i X_i)^{1}$$

Country	b_o	b_1	b_2	b_3	Multiple F-Ratio	Multiple R^2
Total exports	2.2621		0.5019		192.55[a]	0.960
Brazil	2.4125		0.4254	-0.0062	17.76[a]	0.798
Colombia	3126.	0.4071			6.35[b]	0.388
Costa Rica	108.	0.7708			808.81[a]	0.988
El Salvador[2]	0.8909	0.7101			226.19[a]	0.958
Guatemala	106.	0.9273			949.82[a]	0.990
Ethiopia	-168.		1.2015		1118.74[a]	0.991
East Africa[3]	-0-	1.0421			6614.00[a]	0.998
West Africa[2,4]	-0-		1.0152		67169.68[a]	0.999

[1]The b_i are regression coefficients for the respective independent variables; the definitions of the variables for the regression equation describing annual total exports of green coffee from the indicated producing country are as follows:

Y Three-year moving average volume of total exports of green coffee from the indicated country of production, in thousands of 60 Kg. bags, annually on a calendar year basis.

TABLE 10 (Continued)

b_o Constant term in regression equation.

X_1 Three-year moving average volume of exportable green coffee production in indicated country of production, in thousands of 60 Kg. bags, annually on a coffee-crop year basis.

X_2 Three-year moving average volume of exportable green coffee production in indicated country of production (with one-year lead in production figures), in thousands of 60 Kg. bags, annually on a coffee-crop year basis.

X_3 Dummy variable to relate changes in total green coffee exports in the indicated country to exogenous changes affected by the passage of time. Variable took on integral values on an annual basis, with the calendar year 1951 being assigned the unitary value.

[2]Regression coefficients for this country are the result of analysis using logarithmic transformations of the raw input data.

[3]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[4]Western Africa is defined as: French Africa and Madagascar (1952 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1963).

[a]The multiple F-ratio test of the null hypothesis that there is no significant difference between the explained and residual variation (i.e., the established relationship therefore has only random or chance significance) is rejected at 0.001 level.

[b]Multiple F-ratio test of null hypothesis (see 'a' above) is rejected at 0.05 level.

[c]Source: Regression coefficients were calculated from an EDP-processed regression program using (unless otherwise indicated in footnote 2 above) raw input data from the U. S. Department of Agriculture, Foreign Agricultural Service, Foreign Agricultural Circular: Coffee, FCOF series, various issues, 1951 through 1963. Annual exportable green coffee production data is the final estimate of production for each country made by the USDA. Sample size is 12.

relationships--have relatively late primary harvesting seasons.[81]

The proportion of explained variation in the dependent variable (total green coffee exports) was above 95 percent in all countries except Brazil and Colombia. About 80 percent of the variation in Brazil's green coffee exports was explained by variations in its green coffee production; almost 40 percent of the variation in Colombia's green coffee exports could be thus explained. Presumably the variations in coffee retention programs in these countries would account for much of the remaining variance.[82]

The F-ratio test of the explained and residual variance was significant at the 0.001 level for all countries' regression equations, except Colombia. The Colombia F-ratio test was rejected at the 0.05 level. It appears that the regression equations, in general, are both highly explanatory of total coffee exports and highly significant in terms of the F-ratio test.

The establishment of a relationship between the total green coffee exports of a coffee-producing nation and its green coffee

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[81] See World Coffee and Tea, Vol. VII, No. 12 (April 1967) p. 26, and Vol. VIII, No. 2 (June 1967) pp. 42, 46.

[82] Unfortunately, year-to-year estimates of green coffee stocks in individual countries are not available for observations on coffee stocks as a separate independent variable.

exports to the United States was necessary to complete the estimation of a U. S. green coffee supply system. This relationship would indicate the proportion of total green coffee exports habitually (or normally) shipped to the United States. The assumption of a constant relationship implies that demand (and price) shifts in the various major green coffee purchasing centers do not affect the share of total coffee exports offered to each center (such as New York, London, etc.); or else it implies that price differentials between export markets remain unchanged through time.

This relationship between green coffee exports to the United States and total green coffee exports from each selected producing nation was established by multiple regression analysis, using the simple least-squares approach. Green coffee exports to the United States from the selected producing nations were regressed on total green coffee exports for that producing nation. The stability of the export offering function was tested by means of a dummy independent variable, with annual incremented observations on time. The coefficient of the "time" variable indicated the degree to which variation in export offerings to the United States from the producing country was affected by influences other than total green coffee export variations. Regression of logarithmic transformations of total coffee exports and U. S. green coffee purchase data provided better fits of

the data than did regression of the raw data.[83] The regression coefficients for the relationship between green coffee purchases by the U. S., and total green coffee exports from each selected producer and the dummy "time" variable are presented in Table 11.

The derived statistical relationships were highly explanatory of variations in U. S. purchases of green coffee and statistically significant. The multiple R^2 exceeded 0.975 for all countries, and the F-ratio test was significant at the 0.001 level. Five of the eight countries demonstrated some secular drift in the relationship. Three countries (Brazil, Costa Rica, and Ethiopia) had rather stable functional relationships. Of the five countries with indications of change in the proportion of total coffee exports shipped to the United States, Colombia, El Salvador and Guatemala showed declining shares being shipped to the U. S. through time, and East Africa and Western Africa indicated an increasing proportion of total green coffee shipments being channelled into the United States.

The overall two-stage supply function for green coffee offerings in the United States market demonstrated the most unexplained variation at the production--total exports stage, and

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[83] Western African data had a better fit in a linear mode, so it is used in the supply analysis instead of logarithmic transformations.

TABLE 11

REGRESSION COEFFICIENTS OF THE RELATIONSHIP BETWEEN UNITED STATES GREEN COFFEE PURCHASES AND TOTAL GREEN COFFEE EXPORTS FROM SELECTED PRODUCING COUNTRIES, BY COUNTRY, BASED ON LOGARITHMIC TRANSFORMATION OF 1952-1953 DATA[b]

$$(Y = \sum_{i=1}^{2} b_i X_i)^1$$

Country	b_1	b_2	Multiple F-Ratio[a]	Multiple R^2
Total exports	0.9586	-0.0075	1294524.	0.999
Brazil	0.9443	-0-	184642.	0.999
Colombia	0.9932	-0.0105	185294.	0.999
Costa Rica	0.8554	-0-	3091.	0.996
El Salvador	0.9993	-0.0334	10729.	0.999
Guatemala	1.9829	-0.0108	32599.	0.999
Ethiopia	0.9275	-0-	7073.	0.998
East Africa[3]	0.7115	0.6345	8279.	0.999
Western Africa[2, 4]	0.4065	1.6488	182.	0.978

[1]The b_i are regression coefficients for the respective independent variables; the definitions of variables for the regression equation relating U. S. green coffee purchases from a given producing country to the total green coffee exports of that country are as follows:

Y Volume of United States purchases of green coffee from indicated country of export, in thousands of 60 Kg. bags, annually on calendar year basis, expressed in logarithms.
Source of data: Food Industries Division, Business and Defense Services Administration, U. S. Department of Commerce (from customs declaration documents).

TABLE 11 (Continued)

X_1 Volume of total exports of green coffee from indicated country of production, in thousands of 60 Kg. bags, annually on a calendar year basis, expressed in logarithms.
Source of data: U. S. Department of Agriculture, Foreign Agricultural Service, Foreign Agricultural Circular: Coffee, FCOF series, various issues, 1952 through 1963.

X_2 Dummy variable which relates changes in United States purchases of green coffee from indicated country of production to exogenous changes affected by the passage of time. Variable took on integral values on an annual basis, with the calendar year 1951 being assigned the unitary value.

[2]Western Africa data was regressed in linear (raw input) format to improve the data fit of the regression equation.

[3]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[4]West Africa is defined as: French Africa and Madagascar (1952 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1963).

[a]The multiple F-ratio test of the null hypothesis that there is no significant difference between the explained and residual variation in the established relationship (i.e., that the regression coefficients were the result of random or chance variation) is rejected in all cases at the 0.001 level.

[b]Source: Regression coefficients were calculated from annual data of sources listed in footnote 1 (above), using an EDP-processed multiple regression program. Sample size is 12.

not at the market shares stage. Both sets of derived relationships, however, demonstrated high statistical significance, as indicated in the level of the multiple R^2 and F-ratio statistics.

The Procedure for Estimating Green Coffee Revenue from U. S. Coffee Purchases

The establishment of the supply of and demand for green coffee exports to the United States from the eight selected producing countries is prologue to the basic question posed in this study; i. e., did the 1962 International Coffee Agreement significantly affect the revenue from coffee sales to the United States of the eight producers? The short-run supply and demand functions can serve as a basis for estimating the annual green coffee revenue from sales to the United States which would have accrued from 1964 through 1966, if the Agreement had not gone into effect.

The basic input data for estimating the coffee revenue received in the hypothetical absence of the Agreement comes from observations on the exogenous variables of the entire supply-demand system. These variables are exportable green coffee production in the selected country (as reported by the Foreign Agricultural Service of the USDA), annual consumption expenditures in the United States, and disposable personal income. These data generate (within the framework described below) the estimates of annual coffee revenue.

The estimation of green coffee export revenue from sales to the United States for each producer country was initiated by estimating the given year's total exports of green coffee from that nation. This estimate of total coffee exports made use of total export-exportable coffee production relationship which is summarized in Table 10. The United States' share of the estimated total coffee export offering was then calculated from the derived relationship between total green coffee exports from the country and United States purchases of that nation's coffee (See Table 11). Having determined the short-run perfectly price inelastic quantity supplied of green coffee to the U. S. market, the price at which such a quantity of coffee would be absorbed was determined from the relevant green coffee export demand functions for United States purchases from that producer. The price estimate made use of other background variables (such as disposable income and food spending) when their presence was functionally significant (See Table 9). Multiplication of the annual quantity exported by the estimated average annual export price of the green coffee provided the revenue estimates for each selected producer on an annual basis.

In mathematical notation, the estimation of annual coffee revenue for each country used the following procedure:

STEP ONE: $X = f(T)$

STEP TWO: $M = g(X)$

STEP THREE: $P = h(M)$

STEP FOUR: $R_e = PM$

where:

T is the volume of annual exportable green coffee production in the selected country;

X is the volume of total green coffee exports from the selected producing country;

M is the volume of green coffee exports to the United States;

P is the average annual United States import price for the green coffee of the selected producing country;

R_e is the estimated revenue generated by United States green coffee purchases from the selected country;

f(T) is the exports-production relationship derived from the 1953-1962 data regression (See Table 10);

g(X) is the U. S. imports-total exports relationship derived from the 1953-1962 data regression (See Table 11);

h(M) is the United States demand function for green coffee derived from 1953-1962 data regression (See Table 9).

The accuracy of the overall estimating procedure may be judged from the conformity of the estimates for 1953 through 1962 to the actual revenue from sales of green coffee to the United States during that period. If the estimating technique could not provide accurate revenue estimates for this period from which the various

equations were formulated, it could not reasonably be expected to generate meaningful estimates of revenue in subsequent periods. In order to test the procedure, only observations on the exogenous variables (exportable green coffee production, U. S. disposable income, food spending, etc.) were used as inputs for the revenue estimators.

Table 12 summarizes the results of these tests of the accuracy of the estimating procedure in explaining variations in revenue. The simple correlation coefficient indicates the degree of conformity between the two data series (estimated revenue and actual revenue). The multiple F-ratio test in this case examines the hypothesis that there is no significant relationship established between the estimated and actual revenue series (as measured by the ratio of explained to unexplained variation in the regression equation relating the estimates with the corresponding actual revenue figures).

The F-ratio test is significant for six of the eight countries at levels of significance ranging from 0.05 to 0.001; the two countries for which the estimating procedure appears to yield invalid results are Costa Rica and Ethiopia. Both had very low explained variations for the overall estimates, as reflected in the simple correlation coefficients of the two countries' techniques (0.46 for Costa Rica and 0.04 for Ethiopia). The principal apparent

TABLE 12

MEASURES OF STATISTICAL SIGNIFICANCE OF THE ESTIMATING TECHNIQUE, GREEN COFFEE REVENUE OF SELECTED PRODUCING COUNTRIES, BY COUNTRY, BASED ON REGRESSION OF 1953-1962 DATA[e]

Country	Multiple F-Ratio[1]	Simple Correlation Coefficient[2]
Total exports	7.517[a]	0.696
Brazil	11.374[b]	0.766
Colombia	148.521[c]	0.974
Costa Rica	2.084[d]	0.455
El Salvador	45.412[c]	0.922
Guatemala	13.523[b]	0.793
Ethiopia	0.010[d]	0.035
East Africa	103.095[c]	0.963
Western Africa	13.283[b]	0.790

[1]Multiple F-ratio is for regression equation: $Y = b_o + b_1X$, where Y is estimated green coffee revenue, b_o is the constant term, b_1 is the regression coefficient of X, and X is the actual green coffee revenue.

[2]Coefficient of simple correlation relates the estimated revenue generated by U. S. purchases of the indicated country's green coffee exports, and the actual revenue for such transactions.

[a]The multiple F-ratio test of the null hypothesis that there is no significant difference between the explained and residual variation (i.e., the established relationship between estimated and actual revenue is due to random or chance variation) is significant at the 0.05 level.

TABLE 12 (Continued)

[b]The multiple F-ratio test of the null hypothesis (see 'a' above) is significant at the 0.01 level.

[c]The multiple F-ratio test of the null hypothesis (see 'a' above) is significant at the 0.001 level.

[d]The multiple F-ratio test of the null hypothesis (see 'a' above) is not significant at the 0.05 level; therefore, the established relationship is considered to have no statistical significance.

[e]Source: The multiple F-ratio and simple correlation coefficient data were calculated from an EDP-processed multiple regression program, using as input estimates of coffee revenue generated from the procedure described in Chapter V and the actual revenue data as reported by the U. S. Department of Commerce. Sample size is 10.

cause of the failure of the estimates to conform to actual revenue data is the wide variation in export price and in total exports from both of these countries. Variations in average annual bag prices for the countries of Costa Rica and Ethiopia, for example, were higher than for any of the other six countries studied. (See Table 16 in a later section of this chapter).

An Evaluation of the Agreement's Short-term Goals

The extent of the accomplishment of the two principal short-term quantitative objectives of the 1962 International Coffee Agreement can now be evaluated in some detail. The objectives were, as indicated in preceding chapters, (1) to operate the Agreement "in a manner such that the real income derived from the export of coffee could be progressively increased. . . "[84] and (2) "to alleviate the serious hardship caused by . . . excessive fluctuations in the price of coffee. . . "[85]

The first part of this section will consider the impact of the 1962 Agreement on the level of coffee revenue between 1963 and 1966. The second part of the section will summarize the relationship of the Agreement to inter-year price and revenue fluctuations.

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[84]United Nations Coffee Conference, 1962, Summary of Proceedings, (E/Conf. 42/7), Article 27, Paragraph 1, p. 61.

[85]Ibid., "Preamble to the International Coffee Agreement, 1962", p. 56.

Trends in Green Coffee Revenue

The procedure for evaluating trends in green coffee revenue was (1) to assess the actual revenue data for 1963-1966 in terms of changing magnitudes and trends; (2) to compare actual revenue with estimates of coffee revenue which would have occurred in the period in the absence of the 1962 pact; and (3) to determine the cause of significant differences, if any, between the actual and the estimated data.

Total revenue from overall green coffee sales to the United States showed improvement during the four-year period. In 1966, total green coffee sales were about $1,069 million, compared with $990 million in 1962. This overall improvement in coffee sales, however, was not shared by all producers. In fact, three of the eight producers (Brazil, Colombia, and Costa Rica) generated less coffee revenue from 1963 through 1966 than their respective sales from 1954 through 1962. The remaining five countries posted increases in export revenue that more than offset the losses of the others. It is interesting to note that African producers all increased their revenue from coffee considerably, while the producing giants--Brazil and Colombia--both had reduced exports and sales (See Appendix, Table 27).

Estimates of revenue from 1963 through 1966 which would have occurred from sales in the absence of the 1962 Agreement were prepared, using the estimating procedure described in the previous section. The projection of these values into the 1963-1966 period assumed that the functions derived from the 1953-1962 data would have remained relevant without the operation of the Agreement. The estimated revenue is presented in Table 13. Differences in estimated and actual revenue are not significant per se. Any numerical differences must be interpreted within the context of their statistical significance.

It is difficult to establish an adequate statistical test for the differences between two samples of such modest size. A principal test of sample differences is the null hypothesis concerning the means of the samples. For a sample size larger than 10 or so, the probability distribution of sample means approximates normality, so that a Z-test of means is statistically feasible. For smaller sample sizes than 10, but greater than about 6, the student-T test is usually preferred, because of the relaxation of the Z-test assumption of normality. For sample sizes smaller than 6, no parametric statistical test can be applied with any real power efficiency.

As an alternative to the T-test, the non-parametric rank-sum test was selected to analyze the significance of the differences

TABLE 13

ESTIMATED REVENUE FROM GREEN COFFEE SALES TO THE UNITED STATES OF SELECTED PRODUCING COUNTRIES COMPARED WITH ACTUAL GREEN COFFEE REVENUE, BY COUNTRY, ANNUALLY, 1963-1966[a]

(Thousands of U. S. Dollars)[1]

Year	Actual Revenue	Estimated Revenue
	Total U. S. Green Coffee Purchases	
1963	957,000	1,019,000
1964	1,200,000	1,436,000
1965	1,061,000	1,252,000
1966	1,069,000	1,417,000
	Brazil	
1963	363,900	387,500
1964	377,700	370,100
1965	303,400	423,400
1966	327,400	307,100
	Colombia	
1963	197,400	214,000
1964	223,500	181,400
1965	199,600	156,400
1966	163,800	134,400
	Costa Rica[2]	
1963	12,770	17,000
1964	16,080	16,490
1965	17,210	15,740
1966	12,680	16,910
	El Salvador	
1963	32,510	24,920
1964	35,220	38,620
1965	40,210	27,450
1966	31,150	28,240
	Guatemala	
1963	47,060	36,370
1964	43,780	44,650
1965	50,960	48,520
1966	59,330	36,210

TABLE 13 (Continued)

Year	Actual Revenue	Estimated Revenue
	Ethiopia[3]	
1963	31,950	23,500
1964	49,440	36,150
1965	59,750	37,920
1966	40,670	32,860
	East Africa[4]	
1963	48,560	44,830
1964	67,370	89,930
1965	50,150	102,900
1966	71,510	124,500
	Western Africa[5]	
1963	21,970	20,420
1964	56,430	40,040
1965	38,880	50,190
1966	55,110	64,090

[1]Figures in the table have been rounded to four (4) significant digits.

[2]Estimates of green coffee revenue for Costa Rica are given for reference only. Analysis of the revenue estimating technique indicated that the derived relationships in the estimating procedure are probably due to chance variation.

[3]Estimates of green coffee revenue for Ethiopia are given for reference only. Analysis of the revenue estimating technique indicated that the derived relationships in the estimating procedure are probably due to chance variations.

[4]East Africa comprises Uganda, Kenya, and Tanzania.

[5]Western Africa is defined as: Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger.

[a]Source: Actual green coffee revenue data obtained from U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1963 through 1967; revenue estimates obtained from procedure described in Chapter V.

in actual and estimated revenue from 1963 through 1966, as well as for the differences between 1963-1966 actual green coffee revenue and 1959-1962 actual revenue. There were several reasons for the selection of this test: (1) the non-parametric nature of the rank-sum test places no requirements on the population distribution; i. e., the level of significance of the test is not affected by the lack of normal distribution of the sample means; (2) the rank-sum test is analogous to the T-test in that it is designed to detect shifts in means, but not in variances; (3) the rank-sum test has high power efficiency, even for low sample sizes; for example, a rank-sum test using sample sizes of 5 is as efficient as the student-T statistics for much larger samples; (4) the rank-sum test has only one restrictive assumption; it assumes that the samples are drawn in a random fashion from identically distributed populations.[86]

Using empirical data on coffee revenue between 1963 and 1966, as well as the statistical tests of significance and description information on the four-year period, it is possible to draw some conclusions about the effects of the Agreement on green coffee sales and revenue.

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[86]Information on the rank-sum test was complied from Wilfred J. Dixon and Frank J. Massey, Jr., Introduction to Statistical Analysis, (New York: McGraw-Hill Book Company, Inc., 1957), pp. 289, 290, 446.

For all green coffee exports to the United States, revenue from export sales from 1963 through 1966 exceeded the revenue received by all countries in the previous four-year period. 1963-1966 total revenue from coffee sales to the United States was, however, significantly lower than would have theoretically accrued in the absence of the Agreement. (See Table 14). However, the difference between actual and estimated revenue is not attributed to the operation of the Agreement per se. The major reason for the lower-than-estimated revenue can be traced to the behavior of Brazil and its voluntary efforts to reduce its own exports below authorized export quota levels. In the three-year period for which authorized exports can be accurately established (1964-1966), Brazil was authorized to ship about 52.4 million bags of green coffee. The country decided to ship only 45.5 million bags, roughly 13 percent less than authorized. Virtually all of the other countries' revenue, prices, and exports were strongly affected by this low export level in Brazil. The effect on market conditions of Brazil's lower green coffee sales in 1963, 1964, and 1965 was certainly greater than the quota "restrictions" of the Agreement.[87]

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[87] Some idea of the laxity of quota enforcement can be garnered from a significant action of the International Coffee Council--the administrative agency within the Agreement. The Council reported that almost 6 million bags of green coffee--nearly 15 per cent of a typical year's permissible exports--were known to have been shipped by member producing countries without

TABLE 14

RANK-SUM TEST[1] OF STATISTICAL SIGNIFICANCE OF 1963-1966 ANNUAL ESTIMATES OF GREEN COFFEE REVENUE FROM SALES OF GREEN COFFEE TO THE UNITED STATES BY SELECTING PRODUCING COUNTRY[b]

Country	SUM OF RANKS		Probability of Rank-Sum Occurrence
	Actual Revenue	Estimated Revenue	
Total exports	13	23	0.100[a]
Brazil	14	22	0.171
Colombia	22	14	0.171
Costa Rica	15	21	0.243
El Salvador	23	13	0.100[a]
Guatemala	23	13	0.100[a]
Ethiopia	23	13	0.100[a]
East Africa[2]	14	22	0.171
Western Africa[3]	18	18	0.557

[1]The rank-sum test for the comparison of two samples is defined as follows: Arrange the two samples together in order of size, and assign rank scores to the individual observations, scoring 1 for the smallest numerical value, 2 for the second smallest value, etc. All scores in each sample are then added to produce the rank-sum statistic. The probability of occurrence of this rank-sum statistic is then noted in a prepared table which records the percentiles of the sampling distribution of rank-sums. For purposes of this study, the hypothesis that the two samples are drawn from the same population is rejected (i.e., the test is significant) if the probability of the occurrence of a particular rank-sum is 0.100 or less.

[2]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[3]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]The rank-sum test of the null hypothesis (see footnote 1 above) is significant at the 0.100 level.

[b]Source: Rank-sums calculated using method described in footnote 1 (above), from data presented in Table 13.

TABLE 15

RANK-SUM TEST[1] OF STATISTICAL SIGNIFICANCE FOR DIFFERENCES BETWEEN 1959-1962 AND 1963-1966 SALES OF GREEN COFFEE TO THE UNITED STATES, BY SELECTED PRODUCING COUNTRY[b]

Country	Sum of Ranks		Probability of Rank-Sum Occurrences
	1959-1962 Revenue	1963-1966 Revenue	
Total exports	16	20	0.343
Brazil	23	13	0.100[a]
Colombia	26	10	0.014[a]
Costa Rica	21	15	0.243
El Salvador	13	23	0.100[a]
Guatemala	12	24	0.057[a]
Ethiopia	10	26	0.014[a]
East Africa[2]	10	26	0.014[a]
Western Africa[3]	10	26	0.014[a]

[1]See Footnote 1, Table 14, for complete description of test method.

[2]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[3]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]The rank-sum test of the hypothesis that the two samples are drawn from the same population is significant at the 0.100 level.

[b]Source: Rank-sums calculated using method described in Table 14, Footnote 1, and data presented in Table 27.

There was superficial plausibility to the failure of Brazil to meet its maximum export quotas. The total coffee production rate in the 1950's and the early 1960's had been in the low 30 million bag range in Brazil. During the 1963-1964 crop year, however, wide-spread frosts during the harvesting season reduced the 1963-64 total crop to about 23 million bags. Immediately following the harvest, range fires damaged and estroyed millions of coffee trees. The subsequent total coffee crop in 1964-65 was very low--about 18 million bags.[88] The effect of the fire on coffee output of exportable quality was more dramatic. From a lower-than-normal exportable production level of 21 million bags in 1964, Brazil dropped in exportable production to 3 million bags in 1965. One explanation for Brazil's failure to export the quota limit in green coffee in 1964 and 1965 traces to the unusually small crops. This reason becomes less valid, however, when one considers the large

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Agreement approval. The penalty levied on the violating nations by the Council indicates the lack of enforcement vigor. The countries' 1967 quotas were reduced by a total of 500,000 bags. The rest of the legally applicable 5.5 million bag penalty was suspended. See Pan-American Coffee Bureau, Annual Coffee Statistics, 1966. (New York: Pan-American Coffee Bureau, 1968), pp. 7, 8.

[88]International Coffee Organization, Report of the International Coffee Organization, Mimeograph, EB-466167(E), 7 February 1967 (London: International Coffee Organization, 1967), p. 15.

stocks of exportable green coffee in Brazil during this time. Although the actual level of coffee stocks in Brazil during 1964-65 is not known, it is estimated that world coffee stocks (of which Brazil was the major holder) were about 70 million bags in 1965.[89] One can assume that there were adequate stocks of green coffee in Brazil during the period of its small harvests to more than meet its quotas, had Brazil desired to do so.

Brazil's export policy under the 1962 Agreement, like its policy prior to the pact's inception (see Chapter III), has been to maintain relatively high export prices in world markets for its coffee, while attempting to rationalize internal production through the artificial depression of coffee prices paid to producers by the official coffee marketing agency. It has been hoped that high-cost Brazilian producers would thus be squeezed out of business by the low prices, while foreign exchange earnings could be enhanced by the higher export prices. This export policy has been based on several fallacious assumptions.

First, the country has assumed that the demand for its own coffee was price-inelastic. The results of this study indicates a high price elasticity of demand for Brazilian coffee--in fact, the highest price-elasticity of the eight major producers which were

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[89] Ibid., p. 20.

studied. Much of the high price-elasticity is related to the considerable cross-elasticity of demand which was demonstrated for Brazilian green coffee exports vis-a-vis other producers' coffees. Higher Brazilian green coffee prices in 1964 and 1965 encouraged shifts in the pattern of export coffee demand in favor of the milds and the robustas. Higher prices for all coffee types can be traced back to the Brazilian retention program and its small 1963-64 and 1964-65 crops.

Over a longer period of time, the Brazilian decision to keep export prices high was a major cause of the expanded African production. The "umbrella" of Brazil in the maintenance of export prices encouraged increased planting of robusta coffee in Uganda and Ivory Coast. Ironically, the desire of Brazil to increase her own revenue from coffee production has contributed to that country's decreasing leverage over the world coffee market. In one decade (from 1955 to 1965) Brazil's share of total coffee revenue dropped from 60 per cent of the world sales to only 45 per cent (see Chapter II). Brazil's loss of its market share was almost entirely caused by the African robusta producers. In 1955 world robusta exports accounted for about 16 per cent of all sales; in 1966 they accounted for nearly 28 per cent of green coffee exports.[90]

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[90] World Coffee and Tea, Vol. 8, No. 2 (June, 1967), p. 21.

Brazil apparently hoped that the 1962 International Coffee Agreement would impose restrictive export quotas on all producing countries so that the cost of the price "umbrella" would be shared by all producers. However, the wide-spread evasions of the authorized quotas, particularly in 1965-66, and the lack of rigorous quota enforcement has left Brazil literally holding the bag.

An international coffee price war would seem the logical way for Brazil to reassert leadership in the coffee market. With both large production capacity in coffee and an enormous stockpile of previous harvest retentions, this country would be capable of lowering coffee export prices to a fraction of their 1965-66 levels. Two considerations have prevented this course of action. First, it is not clear what implications a sharp reduction in coffee prices would have on Brazil's annual foreign exchange earnings. Even the highly elastic demand for Brazil's coffee might become drastically altered at much higher export levels than the 15-20 million bag range on which it was based. With its heavy reliance on coffee sales for foreign exchange, Brazil cannot politically or economically afford to jeopardize coffee revenue.

A second reason for Brazil's reluctance to clash head-on with the African producers is related to their comparative cost of producing coffee. According to J. W. F. Rowe, Brazilian producers have considered African coffee production costs to be

lower than their own. Consequentially, Brazil assumed that a long-term coffee price war would force its own producers out of business before the Africans absorbed unacceptable losses. Rowe suggests, however, that Paraná production of coffee in Brazil has the lowest costs of production in the world. Brazil is therefore attempting to phase out coffee production in the traditional, but high-cost provinces of Minas Gerais, and Sao Paulo. This rationalization of coffee production would make Brazil a much more formidable world competitor on the basis of cost. Because Brazilian coffee is preferred to robustas in the world market (on the basis of taste), a reduction in the price differential of unwashed arabicas vis-a-vis robusta could mean a sharp reduction in demand for African growths.[91]

In summary, Brazil is biding its time in the world coffee market. Because of the ineffectiveness of the 1962 Agreement in enforcing quota restrictions, Brazil has been forced into an almost unilateral reduction of exports in an effort to keep prices high. Significantly reduced green coffee revenue and a declining market share have been the result of this export reduction.

Colombia has also felt that its interest lay in the restriction of green coffee supply. The nation's green coffee is the highest

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[91] See Rowe, op. cit., p. 74 ff.

priced coffee in the world, and maintenance of high standards of Colombian coffee output has been one of that country's goals. (See Chapter II). Feeling that its total coffee sales revenue would suffer from lower prices, Colombia carefully adhered to the authorized quota levels in the period studied. The lower level of exports, coupled with the elastic demand for Colombian mild coffee, produced significantly lower revenue in 1963-1966, as compared with the 1959-1962 period. However, 1964 and 1965 sales to the United States were well above the sales which were estimated for Colombia in those years. The reason for the differences is a shortcoming of the estimating procedure. The revenue estimates are based on a static demand pattern which allows for no short-term shifts in the demand function to reflect cross-elasticities of demand. The upward coffee price pressures in the 1963-64 and 1964-65 crops because of Brazilian crop shortages increased world (and United States) demand for substitute coffees, including Colombian mild coffees. As the world's second largest coffee producer, Colombia benefited from the demand shift in the form of higher-than-normal revenue. Large unauthorized mild coffee sales in El Salvador and Guatemala in late 1965 and throughout 1966 undermined Colombia's coffee prices and shifted some of the mild coffee demand away from Colombia to the Central American producers.

The international green coffee market price increases which Brazil created, and which Colombia abetted, significantly aided two Central American producers--El Salvador and Guatemala. Both countries received green coffee exchange earnings between 1963 and 1966 which were significantly above the 1959-1962 rate. They also benefited significantly from (1) demand shifts in their favor because of the small Brazilian crops in 1964 and 1965; (2) the Colombian mild coffee retention policy; and (3) flagrant violation of the International Coffee Agreement export quota for their respective countries. A comparison of the actual 1963-1966 export sales to the United States with the estimated sales (based on no demand shifts and normal export levels) suggests that the three factors added about $20 million to El Salvador's United States sales over the four-year period, and more than $35 million to Guatemala's coffee exports to the United States. Some indication of the seriousness of the quota violations can be inferred from the 1966 performance of the two nations. In that year, El Salvador actually shipped 110 per cent of its authorized quota, while Guatemala marketed 139 per cent of its legal export allotment.[92] The improved revenue position of these two countries could not be attributed to their compliance with 1962 Agreement policies.

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[92]A comparison of authorized export quotas (as given in Appendix, Table 23) with actual exports (as shown in Table 22) serves as the basis for these figures.

In Africa, all of the major producers which were studied very significantly increased their green revenue from sales to the United States in 1963-1966, as compared with the 1959-1962 period. In East Africa and Western Africa the lower-priced robustas increased their proportion of total world exports, in relation to the two arabica types. Several factors contributed to the unparalleled success of African countries in increasing revenue.

First, the robusta varieties are lower priced in world export markets than either the mild or the unwashed arabica coffees. In 1966, for example, Western African robustas sold in the United States market at an average bag price of $40.02; at the same time, Brazilian unwashed arabica coffee was being traded at an average bag price of $48.65; and Colombian mild coffee was being marketed at $60.30 per 60 kg. bag in the United States.

The robusta coffee, in short, was 18 per cent cheaper than unwashed arabica and about 34 per cent less expensive than the premium mild variety. Though not perfectly substitutable for the arabica types, the lower priced robusta varieties could be used in soluble coffee with little effect on the taste of the final consumer product. It is therefore unsurprising that the reduced availability of Brazilian coffee in 1964 and 1965--and higher prices for arabica varieties in general--led to considerable demand shifts in favor of the African growths.

The increases in the consumption of instant coffee in the United States and higher arabica prices coincided with much higher African coffee production in the four-year period from 1963 through 1966. The more rapid commercial maturation of robusta trees (See Chapter II) made possible a quicker response to higher prices for green coffee in the mid-1950's. As a result of the faster maturation period Africa produced nearly 43 percent of the world's exportable green coffee in the 1964-65 crop year, as compared with 30 percent of world output in 1953-54.[93]

In East Africa, the low absolute price elasticity of demand for that region's coffees (which include arabica and robusta output) possibly reduced the amount of foreign exchange earnings below the levels which could have been reached if the region had exported only its authorized quotas.

Ironically, East Africa--the one major coffee producing region with an inelastic demand for its overall coffee exports and the only major producing area with a demand elasticity for which the operational assumption of the 1962 Agreement was valid[94]--

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[93]Pan American Coffee Bureau, Annual Coffee Statistics, 1964, (New York: Pan American Coffee Bureau, 1965), p. 25.

[94]The price elasticity of Guatemala, although technically inelastic, is so close to unitary elasticity as to be considered unitary.

was the region which was the most flagrant violator of quota restrictions. In 1964 the region exported 112 percent of its authorized quota; in 1965 it shipped 136 percent of the legal export limit; and in 1966 the area sold 162 percent of the Agreement allotment for East Africa.

Strong fears of a crisis market for robusta growths encouraged sales on consignment by the national marketing boards during the latter part of the four-year period. Quota allotments and the protection of the 1962 pact were considered inadequate security for East African trade interests. As an example of this dumping practice, Uganda in 1964 shipped about 20,000 tons of robusta coffee to western markets without any firm offer to buy preceding it.[95] The 1962 Agreement did not have a measurable effect on East African coffee revenue between 1963 and 1966 because the region did not adhere to the pact's provisions.

The producing region of Western Africa did not regulate its exports according to Agreement restrictions. The rank-sum test of estimated and actual revenue for the 1963-1966 period supports the view that Western African offerings of green coffee during this time were consistent with the market behavior which would have occurred in the absence of the Agreement.

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[95] Pan American Coffee Bureau, Annual Coffee Statistics, 1964, (New York: Pan American Coffee Bureau, 1965), p. 26.

For two of the countries studied--Costa Rica and Ethiopia--comparisons between actual and estimated revenue were not meaningful. For both of these countries, estimating equations were derived which did not adequately conform to the actual data on which the equations were based. The preceding section of this chapter discussed these equations in more detail.

However, some descriptive analyses can be offered for these two countries' revenue performance over the first four years of the 1962 Agreement's operation. Costa Rican revenue suffered in the four-year period because of several natural disasters. An infestation of red spiders and leaf miner insects in the major coffee producing areas in 1965 damaged many producing trees. Drought during the 1963-64 growing season was followed by heavy rains during the harvest period. In 1965 and 1966 volcanic dust and sand from the volcano Irazu settled on many farms in the Central Plateau area, and destroyed much of the crop.[96] As a consequence of these many problems, Costa Rica failed to ship the overall authorized quota during the period from 1963 through 1966, and revenue probably suffered as a direct result.

Ethiopia clearly benefited from the Brazilian crop failures in 1964 and 1965. As indicated in Chapter II, the country's coffee

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[96] Ibid., p. 24.

is the same general type as that grown in Brazil--unwashed arabica. Ethiopia's unique wild coffee forests made possible a substantial response to the higher export prices for Brazil-type coffee during 1964 and 1965. The high absolute price elasticity of demand (-3.70) for the coffee exports of Ethiopia and the evidence of a strong cross-elasticity of demand (See Table 9) make it probable that Ethiopia's coffee market is very closely tied to Brazilian output and coffee prices. The reduction in Ethiopian coffee sales in 1966 is probably related to Brazil's return to normal production levels from its two-year decline.

The relationship of the 1962 Agreement to Ethiopia is not clear. The country did not adhere to the pact's export allocations in any of the years studied. Certainly the influence of Brazilian production was a primary factor in affecting the green coffee sales to the United States in this period.

On the basis of investigation of both descriptive and statistical evidence concerning green coffee revenue for the eight selected producing countries, one concludes that the 1962 International Coffee Agreement was not a significant factor in affecting coffee revenue from sales to the United States between 1963 and 1966. Sharp reductions in Brazilian coffee production in 1964 and 1965, Brazil's strong internal policy of voluntary coffee retention,

and Colombia's supporting quota adherence seem to account for the shifts in short-term coffee demand and the resulting changes in revenue accruing to the world's major coffee producers.

Fluctuations in Green Coffee Prices and Revenue

The green coffee export quotas which were established to increase revenue from world coffee sales were also used to moderate fluctuations in coffee export prices. The International Coffee Organization assumed that total revenue from green coffee sales fell when coffee export prices declined, and that revenue rose when coffee prices increased. This assumption is implicit in the Agreement's expressed attitude toward the undesirability of declines in green coffee export prices.

No serious consideration in the literature of the 1962 International Coffee Agreement is given to the prospect that the demand for the green coffee of many major producing countries might be price-elastic, and that price declines within an extensive range might improve green coffee income. In the summaries of International Coffee Organization policy decisions (as described in various issues of Annual Coffee Statistics--a publication of the Pan American Coffee Bureau) there is no explicit treatment of demand elasticity and its effects on green coffee income.

A presumably knowledgeable source, interviewed by the writer during a July, 1967, research trip to New York and Washington, D. C., indicated that the economic concepts which were used to implement the short-term objectives of the 1962 Agreement were limited to the most elementary principles of supply and demand; (1) a restriction of the volume of green coffee exports would cause coffee export prices to increase; a liberalization of permissible green coffee exports would tend to depress coffee export prices; (2) unit prices for green coffee exports were considered to be the determinant of total revenue; the higher the unit price, the higher export revenue would become; (3) year-to-year fluctuations in coffee prices caused year-to-year fluctuations in revenue from green coffee sales.

The quota adjustment system was designed to minimize fluctuations in coffee export prices. The adjustment process was based on the movements of certain coffee export prices in the New York export market.[97]

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[97] A daily indicator price for green coffee exports to the New York market was derived by calculating the arithmetic mean of the means of the prices of three groups of coffee: mild arabicas (as represented by certain coffees from El Salvador, Guatemala, Mexico, and Colombia); unwashed arabicas, represented by a single Brazilian variety; and robustas (as represented by coffees from Angola, Ivory Coast, and Uganda). Because of the method of calculating the Agreement indicator price, Brazilian coffee price fluctuations were given by far the heaviest weight in establishing price indicator trends. See Pan American Coffee Bureau, Annual Coffee Statistics, 1965, (New York: Pan American Coffee Bureau, 1966), p. 16.

For this study, variations in year-to-year average annual export prices between 1963 and 1966 were compared with variations in export prices during the previous four-year period (1959-1962) to determine the differences in the amount of variation, if any, between the two periods. The F-ratio test of variance was used to determine the statistical significance of the differences in price fluctuations (See Table 16).

Compared with the previous four-year period, the 1963-1966 average export prices for total green coffee sales to the United States demonstrated significantly less price variation.[98] The comparative stability of coffee export prices is related to the significantly more stable prices of Brazilian green coffee exports. There is little evidence that the 1962 Agreement was responsible for the stability of Brazilian prices; Brazil did not ship her authorized quota in any year except 1966. Changes in Brazil's quotas, therefore, are unlikely to have affected that nation's actual offerings of coffee or its export prices.

The stability of Brazilian coffee prices was probably a major factor in the reduction of price fluctuations for substitute varieties--the mild arabicas of Colombia and Central America.

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[98] A difference in variances between the two periods was considered significant if the F-ratio test was significant at the 0.05 level.

TABLE 16

MEASURES OF VARIATION IN AVERAGE ANNUAL BAG PRICE OF UNITED STATES GREEN COFFEE PURCHASES FROM SELECTED PRODUCING COUNTRIES, BY COUNTRY, BASED ON 1959-1962 AND 1963-1966 DATA[c]

Country	Standard Deviation (U. S. Dollars per 60 Kg. Bag) 1959-1962 Prices	1963-1966 Prices	F-Ratio[a]
Total purchases	2.12	0.43	24.73[b]
Brazil	1.25	0.22	31.22[b]
Colombia	2.26	1.54	2.15
Costa Rica	2.76	1.28	4.66
El Salvador	2.48	1.10	5.11
Guatemala	2.26	0.70	10.30
Ethiopia	1.45	1.41	1.05
East Africa[1]	2.28	1.92	1.41
Western Africa[2]	1.66	1.36	1.50

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]The F-ratio is the variance of the 1959-1962 average annual green coffee bag price divided by the variance of the 1963-1966 bag price; degrees of freedom are 3 and 3 respectively.

[b]F-ratio test of the hypothesis that there is no significant difference between the relevant variances (i.e., that the data in the two samples are drawn from the same population) is rejected at the 0.05 level. The earlier period's price data shows more variation than the 1963-1966 price data.

[c]Source: Standard Deviations and F-ratio tests were calculated from U. S. Department of Commerce data, using an EDP-processed program.

None of these countries--Colombia, Costa Rica, El Salvador, or Guatemala--had significantly lower price fluctuations during the period studied, but there were reductions in price variations.

Only Colombia shipped green coffee in amounts which approximated the authorized quotas. The Central American producers tended to ignore restrictions on exports imposed by the International Coffee Organization. It would therefore be difficult to attribute the lower price variations to Agreement policies.

Year-to-year fluctuations in African coffee export prices were very little affected by either the Brazilian production shortfalls or the Agreement quota adjustments. The variations in 1963-1966 export prices for Ethiopia, East Africa, and Western Africa were very close to their respective levels during the 1959-1962 period. Like the Central American producers, the African producers which were studied rendered quota adjustments and price "fine tuning" by the Agreement useless through persistent quota evasions.

One concludes that, although fluctuations in some green coffee export prices were reduced during the 1963 to 1966 period, most of the stability was caused by the reduced coffee output and the voluntary retention program in Brazil; and was not caused by the Agreement quota adjustment process. In view of the widespread

failures among the selected producing countries to adhere to quota levels, one may also suggest that the ability of the 1962 pact to regulate prices in a way that reduces their year-to-year variations was not adequately tested in this period.

Though fluctuations in coffee export prices were somewhat smaller in the 1963-1966 timespan, variations in revenue from green coffee sales of the selected producers tended to increase (See Table 17). Colombia, Costa Rica, Ethiopia, and East Africa had year-to-year fluctuations in revenue from coffee sales to the United States which were higher than the previous four-year period, though the increased variation was not statistically significant.

Guatemala and Western Africa had significantly higher revenue fluctuations in the 1963-1966 period than during 1959-1962. Both of these countries also increased their level of exports considerably during the period. It appears that the higher levels of exports also was accompanied by higher absolute year-to-year changes in exports, which in turn increased revenue fluctuations.

Only Brazil and El Salvador had lower variations in revenue from coffee sales to the United States from 1963 through 1966, as compared with 1959-1962. Because of the reduced fluctuations in the quantity of exports, and a reduced variation in prices for the two nations, the year-to-year changes in coffee revenue were also decreased. The predominance of Brazilian revenue in world coffee

TABLE 17

MEASURES OF VARIATION IN ANNUAL REVENUE FROM GREEN COFFEE SALES TO THE UNITED STATES OF SELECTED PRODUCING COUNTRIES, BY COUNTRY, BASED ON 1959-1962 AND 1963-1966 DATA[d]

Country	Standard Deviation (Thousands of U. S. Dollars) 1959-1962 Revenue	1963-1966 Revenue	4-Year F-Ratio[a]
Total sales[1]	13,867	1,730	64.27[b]
Brazil	19,062	9,044	4.44
Colombia	12,089	18,646	0.42
Costa Rica	965	1,158	0.70
El Salvador	4,142	2,046	4.10
Guatemala	998	5,224	0.04[c]
Ethiopia	2,012	2,764	0.53
East Africa[2]	3,432	6,994	0.24
Western Africa[3]	746	6,935	0.01[c]

[1]Total sales of green coffee to the United States by all producing countries.

[2]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[3]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]The F-ratio is the variance of the 1959-1962 annual revenue from green coffee sales to the United States divided by the variance of the 1963-1966 annual revenue from such sales, degrees of freedom are 3 and 3 respectively.

TABLE 17 (Continued)

[b]The F-ratio test of the hypothesis that there is no significant difference between the relevant variances (i.e., that the data in the two samples are drawn from the same population) is rejected at the 0.05 level. The earlier period's revenue data shows more variation than the 1963-1966 revenue data.

[c]The F-ratio test of the null hypothesis (see 'b' above) is rejected at the 0.05 level. The earlier period's revenue data indicated less variation than the 1963-1966 revenue data.

[d]Source: Standard deviations and F-ratio tests were calculated from U. S. Department of Commerce data, using an EDP-processed program.

sales was reflected in the significantly lower fluctuations of total green coffee revenue during the 1963-1966 period.

Although inter-year price stability is important to the individual coffee producer within a given country as the means by which his own income is stabilized, inter-year revenue stability is probably more important to the national development plan of the producing country. Year-to-year revenue fluctuations of a nation's major export product make planning and implementation of a long range development program very difficult.

The fluctuations in exports from the selected producing countries from 1963 through 1966 aggravated foreign exchange variations. The 1962 International Coffee Agreement is probably not responsible for the increased variation in coffee earnings; although to the extent that the Agreement succeeded in changing actual coffee export shipments through quota adjustments, it may have contributed to greater variations in coffee exports and export revenue than would have prevailed without its operation.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

In 1962, eight years of international conferences, unilateral coffee retention programs, and multilateral producer agreements culminated in the adoption of the International Coffee Agreement of 1962. The short-term objectives of the Agreement were to increase earnings from green coffee sales for its member-producing countries, and to reduce year-to-year fluctuations in the export prices of green coffee.

The short-term goals of the accord were to be accomplished through a systematic restriction of the green coffee supply. The International Coffee Organization, policy-making organ of the 1962 pact, was to determine a quota of the annual exports of green coffee which could be absorbed by the world's wholesale coffee markets at "equitable" prices. The basic annual quota was then divided among the Agreement's member-producing nations, who agreed not to ship more than the amounts of green coffee exports allotted to each of them.

With over 95 percent of the world's exportable green coffee supply thus regulated through the 37 producing countries which were signatories of the Agreement, the control over total coffee marketings theoretically was considerable. The fact that 22 coffee-importing countries were also members of the 1962 coffee pact strengthened the possibility of enforcement of green coffee export quotas. The member-consuming nations were to limit imports of green coffee from non-member producers and to prohibit the purchase of members' green coffee exports which were not authorized by the International Coffee Organization.

The need for international collective action grew out of individual nations' failure to cope with a two-fold coffee problem. First, year-to-year fluctuations in output cause sharp variations in green coffee export prices and revenue. These cyclical fluctuations were caused by the natural bearing cycle of the coffee trees themselves. A large coffee crop is almost inevitably followed by a small yield in the following year.

Second, favorable conditions for green coffee production exist in a large number of regions between 25° North and 30° South latitude. Expansion of coffee output is therefore relatively easy, and production increased substantially in the last decade. The failure of the traditional consuming markets in Western

Europe and the United States to absorb the extra output at existing market prices led to a secular decline in coffee prices and revenue. The need to restrict the output of coffee on an international basis required the broad authority of an international multilateral agreement.

The highly differentiated nature of the coffee product, and the segmented character of the export market for coffee made the adoption of a universally acceptable control scheme difficult. The African producers who were enjoying a rapid growth in the demand for robusta coffee were reluctant to accede to a restrictive quota program. Also, problems of control--involving both impotent domestic regulatory agencies in producing countries and the continuing possibility of clandestine transshipments through non-quota countries to avoid export disclosure--plagued many of the regional pacts which were established in the 1950's.

The road was not clear to the establishment of an enforceable international agreement until the United States relaxed its antagonism to commodity pacts in 1958. In a series of policy statements the United States indicated its willingness to cooperate in finding solutions to the problems of violent fluctuations in export prices and revenue, as well as helping to abate the secular decline in foreign exchange earnings from coffee sales.

The 1962 International Coffee Agreement was unique because of the explicit cooperation of the major coffee-importing countries. The Agreement also sought to reduce the possibilities of quota evasion by instituting a system of bag marking and requiring all certified exports to be accompanied by certificates-of-origin. Like earlier agreements, the 1962 accord attempted to stimulate sales of green coffee by encouraging increased retail coffee consumption through producer-financed media promotional activity.

The Agreement's major short-term goals, however, were to dampen green coffee export price fluctuations and to increase gradually the revenue from coffee sales. It was the intent of this study to investigate these two short-run objectives.

The evaluation of reduced export price variation was comparatively easy. The export price variance for the four-year period prior to the implementation of the 1962 Agreement was compared with the variance in the four years after the adoption of the pact. Any significant differences in the two variances (as determined by F-ratio tests) were then analyzed for economic causes.

Attribution of causes for changes in the magnitude of green coffee export earnings, however, required the construction of a statistical model to calculate green coffee income for the selected

producing nations on the basis of coffee production levels. The model was then used to generate estimates of green coffee revenue for 1963 through 1966 which were based on the observed systemic behavior of the period from 1953 through 1962. These 1963-1966 estimates were compared with the actual revenue from green coffee exports to the United States for the same period. Any statistically significant differences in actual and estimated sales (as determined by nonparametric rank-sum tests) were then evaluated to determine the economic justification for the statistical difference.

Conclusions

The evaluation of the short-term objectives of the 1962 International Agreement indicates that there is no evidence that the Agreement policies directly contributed to any significant increase in green coffee revenue from sales to the United States for any of the eight producing countries studied. Although year-to-year variations in green coffee export prices were smaller during the 1963-1966 period, this reduction cannot be traced to the operation of the Agreement.

During the four-year period covered by this study, fluctuations in green coffee revenue increased in six of the eight countries--Colombia, Costa Rica, Guatemala, Ethiopia, East Africa, and Western Africa. In Guatemala and Western Africa, 1963-1966 coffee income fluctuations were significantly above prior levels.

In general, those countries which showed considerable increases in revenue were the nations which paid little or no attention to the quotas established by the Agreement, or to whom generous allotments were made for exports. El Salvador and Guatemala succeeded in garnering modest increases in earnings through quota violations. Western Africa shipped a large and increasing amount of green coffee in quantities which closely approximated the nation's rapid increase in exportable production.

The dominant behavioral characteristics of the coffee industry which were established by the present study were the perfectly price-inelastic nature of green coffee export offerings in the world market and the rather high price-elasticity of demand for green coffee exports.

The statistical analysis of the coffee industries of the eight selected producing nations revealed that, in general, coffee farmers tended to offer the same proportion of total exportable green coffee production to world markets and to the United States, regardless of green coffee export prices. An examination of the typical coffee industry structure provided the underlying rationale for this result. The characteristic "price-taker" position of the many small producers of coffee, the high proportion of fixed costs associated with coffee production, inadequate coffee storage facilities, an inappropriate climate for long-term coffee storage, a lack of

agrarian credit facilities to finance coffee retention programs, and the pressing needs of the producing country for foreign exchange receipts create extraordinary pressures to sell the green coffee quickly, without regard to export price. Although individual countries, most notably Brazil and Colombia, have instituted fairly vigorous retention programs which modify the foregoing generalizations, a perfectly price-inelastic supply of green coffee seems to prevail.

On the other hand, the demand for green coffee exports is quite price-elastic--the price-elasticity of demand for all coffee exports shipped to the United States is about -1.34. The rather high absolute value of the elasticity coefficient is probably due to the storage capability in the temperate climates of the consuming countries and the considerable financing capabilities of wholesale green coffee importers. The ability to build up stocks in periods of low prices and to reduce stocks of accumulated green coffee during periods of relatively high export prices increases the responsiveness of importers to changing green coffee prices.

The price-elasticity of demand also showed a considerable range of variation among the various producing countries studied--from -0.71 to -4.94. This variation indicates both the degree of product differentiation which characterizes the coffee industry and

the opportunities that importers have to substitute among coffee varieties and between producing countries to take advantage of price differentials.

The implications of the research on green coffee export demand elasticities for the policies of the International Coffee Agreement are considerable. The International Coffee Organization has been assigning total green coffee quotas using the assumption that export demand elasticities closely approximate the price-elasticity of demand for retail roasted coffee, which other studies have indicated has an elasticity coefficient of about -0.25. This highly inelastic demand would justify restrictive supply programs as a means to increase coffee revenue.

The export demand for green coffee, however, is considerably more price-elastic than the policy-makers of the International Coffee Organization had supposed. In fact, because the absolute coefficient of price elasticity for exports exceeds unity by a considerable margin in almost all cases, a decline in green coffee export prices would tend to increase total revenue from coffee sales, and not reduce coffee income, as the Agreement administrators believed.

The 1962 International Coffee Agreement quota system was not adequately tested in the market during the 1963-1966 period. During two of the three years of the pact's definitive operation

(1964 and 1965), Brazil--the dominant coffee producer--experienced rather sharp reductions in exportable coffee production. This reduced availability of unwashed arabica coffee caused short-term shifts in the demand for other varieties, and caused prices to rise for all coffees. This feature of the 1963 through 1966 coffee market overwhelmed the efforts of the International Coffee Organization to control exports through a quota system.

Evasion of authorized quotas became widespread, particularly in 1965 and 1966. The failure of the Organization to penalize violators of quota allotments created the environment and incentive for an extensive and continuing disregard for the legal quotas. In short, the International Coffee Agreement's basic tool for achieving its short-term objectives--coffee export quotas--was not adequately implemented in the period studied.

On the basis of the derived price-elasticity coefficients, effective Agreement restrictions would appear to reduce revenue from green coffee sales; however, this conclusion seems to be inconsistent with the 1953-1962 data on coffee prices and revenue. Therefore, other factors not identified by this study must be influencing coffee revenue.

In any event, the effect of the 1962 International Coffee Agreement on the revenue from 1963-1966 sales of green coffee to the United States of the selected producing countries was negligible.

APPENDIX

TABLE 18

REGRESSION COEFFICIENTS OF ANNUAL UNITED STATES DEMAND FOR GREEN COFFEE EXPORTS OF SELECTED PRODUCING COUNTRIES, BY COUNTRY, BASED ON 1953-1962 DATA[a]

$$(Y = b_o + \sum_{i=1}^{5} b_i X_i)^{1}$$

Country	b_0	b_1	b_2	b_3	b_4	b_5
Total exports	28,567	-123.316				
Brazil	121,830		-1.342			159.615
Colombia	15,513	-39.465		-125.601		
Costa Rica	6,666		0.089		-11.577	-10.937
El Salvador	2,696	-19.690		-22.571	14.640	
Guatemala	1,176	5.155				
Ethiopia	1,717		0.018			
East Africa[2]	3,356	-16.235		45.507	33.988	
Western Africa[3]	8,885		0.079			

[1]The b_i are regression coefficients for the respective independent variables; the definitions of variables for the regression equation describing United States demand for green coffee exports are as follows:

Y Volume of United States purchases of green coffee from indicated country of export, in thousands of 60 Kg. bags, annually on calendar year basis.

Source of data: Food Industries Division, Business and Defense Services Administration, U. S. Department of Commerce. (From customs declaration documents).

TABLE 18 (Continued)

b_o Constant term in regression equation.

X_1 Average annual price in U. S. current dollars per 60 Kg. bag for total annual volume of exports of green coffee from indicated country of export to the United States by the number of bags exported.
Source of data: Food Industries Division, Business and Defense Services Administration, U. S. Department of Commerce.

X_2 Non-institutional U. S. population, fourteen years of age and older, thousands of persons. Data for 1960 and later years includes the states of Hawaii and Alaska. Population of persons thirteen years of age and younger was excluded from the analysis on the assumption that this group contributes little to effective consumption demand for coffee.
Source of data: Bureau of Labor Statistics, U. S. Department of Labor.

X_3 Annual personal consumption expenditures on food, excluding alcoholic beverages, billions of U. S. current dollars.
Source of data: Office of Business Economics, U. S. Department of Commerce.

X_4 Average annual price of green coffee exported to the United States from all producing countries, U. S. current cents per pound.
Source of data: Department of Research, Pan-American Coffee Bureau, from data collected by the U. S. Department of Commerce.

X_5 Disposable personal income, national income account, billions of U. S. current dollars.
Source of data: Office of Business Economics, U. S. Department of Commerce.

[2]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[3]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1962).

[a]Source: Regression coefficients calculated from annual data of sources listed in footnote 1 (above), using an EDP-processed multiple regression program. Sample size is 10.

TABLE 19

MEASURES OF STATISTICAL SIGNIFICANCE OF REGRESSION COEFFICIENTS FOR ANNUAL UNITED STATES DEMAND FOR GREEN COFFEE OF SELECTED PRODUCING COUNTRIES, BY COUNTRY, BASED ON 1953-1962 DATA[b]

Country	Multiple R^2	Multiple F-Ratio
Total exports	0.81	33.8[a]
Brazil	0.57	4.6
Colombia	0.85	19.3[a]
Costa Rica	0.84	10.8[a]
El Salvador	0.49	1.9
Guatemala	0.61	12.8[a]
Ethiopia	0.43	6.1
East Africa[1]	0.95	30.1[a]
Western Africa[2]	0.94	141.7[a]

See notes on following page.

TABLE 19 (Continued)

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1962).

[a]F-ratio value indicated that the hypothesis of no significant difference between explained and residual variance is rejected at the 0.05 level; sample size is 10.

[b]Source: Calculated from annual data reported by the U. S. Department of Commerce and the Pan-American Coffee Bureau, using an EDP-processed multiple regression program.

TABLE 20

VALUES OF INDEPENDENT VARIABLES ANALYZED FOR AN INFLUENCE ON THE ANNUAL QUANTITY OF GREEN COFFEE DEMANDED IN THE UNITED STATES, BY YEARS, ANNUALLY, 1953-1966

Year	Population[a] (Thousands of Persons)	Food Spending[b] (Billions of U.S. Dollars)	Overall Coffee Prices[c] (U.S. Cents per Pound)	Personal Disposable Income[d] (Billions of U.S. Dollars)
1953	115,094	55.5	52.70	252.6
1954	116,219	56.5	65.68	257.4
1955	117,388	58.1	52.18	275.3
1956	118,734	60.4	51.17	293.2
1957	120,445	63.9	49.82	308.5
1958	121,950	66.6	43.89	318.8
1959	123,366	68.4	35.65	337.3
1960	125,368	70.1	34.34	350.0
1961	127,852	72.2	32.44	364.4
1962	130,081	74.4	30.44	385.3
1963	132,124	76.5	30.28	404.6
1964	134,143	80.4	39.63	436.6
1965	136,241	85.4	37.56	469.1
1966	138,385	91.3	36.53	505.3

See notes on following page.

TABLE 20 (Continued)

[a]Non-institutional U. S. population, fourteen years of age and older, thousands of persons. Data for 1960 and later years includes the states of Hawaii and Alaska. Population of persons thirteen years of age and younger was excluded from the analysis on the assumption that this group contributes little to effective consumption demand for coffee.
Source of data: Bureau of Labor Statistics, U. S. Department of Labor.

[b]Annual personal consumption expenditures on food, excluding alcoholic beverages, billions of U. S. current dollars.
Source of data: Office of Business Economics, U. S. Department of Commerce.

[c]Average annual price of green coffee exported to the United States from all producing countries, U. S. current cents per pound.
Source of data: Office of Business Economics, U. S. Department of Commerce.

[d]Disposable personal income, national income account, billions of U. S. current dollars.
Source of data: Office of Business Economics, U. S. Department of Commerce.

TABLE 21

VOLUME OF EXPORTABLE GREEN COFFEE PRODUCTION IN SELECTED PRODUCING COUNTRIES, BY COUNTRY, ANNUALLY, 1950-1966[a]

(Thousands of 60 Kg. Bags)

Year	Total World	Brazil	Colombia	Costa Rica	El Salvador	Guatemala	Ethiopia	East Africa[1]	Western Africa[2]
1950	28390	14300	5600	300	1035	900	425	660	1350
1951	30285	15692	4750	275	1000	811	481	990	1085
1952	29796	14300	5175	305	1100	1000	520	1150	1100
1953	32887	14700	5550	375	1125	1100	585	1250	1185
1954	33680	14300	6348	331	927	951	587	1154	1940
1955	32953	14200	5665	508	1190	892	696	1711	1953
1956	43617	21300	6100	364	1105	917	833	1977	2282
1957	34582	11700	5750	587	1400	1050	765	1970	2250
1958	46230	20800	7000	725	1280	1225	850	2130	2295
1959	52001	26000	6900	815	1375	1200	850	2155	3138
1960	66421	37000	7000	800	1475	1400	905	2768	3273
1961	52814	22000	7000	1050	1350	1300	960	2925	3498
1962	58275	28000	6800	1025	1800	1500	1100	2828	2000
1963	53416	20000	6500	930	1540	1700	1150	4000	3686
1964	56891	21200	7200	980	1885	1580	1250	4135	4699
1965	36601	3000	6500	700	1935	1420	1300	3675	3694
1966	66459	30200	7000	895	1770	1835	1245	4175	5289

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: French Africa and Madagascar (1950 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]Source: U. S. Department of Agriculture, Foreign Agricultural Service, Foreign Agricultural Circular: Coffee, FCOF series, various issues, 1951 through 1966.

TABLE 22

VOLUME OF TOTAL GREEN COFFEE EXPORTS, SELECTED PRODUCING COUNTRIES, BY COUNTRY, ANNUALLY, 1950-1966[a]

(Thousands of 60 Kg. Bags)

Year	Total World	Brazil	Colombia	Costa Rica	El Salvador	Guatemala	Ethiopia	East Africa[1]	Western Africa[2]
1950	29136	14835	4472	312	1107	919	315	1000	1272
1951	31840	16358	4792	309	1059	848	326	1213	1302
1952	32133	15821	5032	333	1098	1007	424	1325	1326
1953	34647	15562	6632	465	1149	1159	467	1108	1193
1954	28918	10918	5754	365	996	885	550	1156	1901
1955	33509	13696	5867	463	1185	982	600	1874	1959
1956	38394	16804	5070	393	1132	1026	496	2166	2685
1957	36057	14319	4824	468	1270	1038	845	2079	2324
1958	36505	12882	5441	782	1399	1205	891	2129	2505
1959	42587	17723	6413	712	1345	1385	754	2274	2489
1960	42491	16819	5938	766	1178	1329	849	2846	3158
1961	43725	16971	5651	835	1431	1255	950	2780	3189
1962	46256	16377	6561	902	1478	1552	1023	3232	3245
1963	45850	19514	6134	929	1586	1667	1080	3443	3097
1964	42693	14948	6412	841	1755	1446	1234	3629	4068
1965	44267	13498	5635	793	1655	1510	1360	3631	3589
1966	50339	17031	5566	901	1619	1864	1012	4732	5453

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: French Africa and Madagascar (1950 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]Source: U. S. Department of Agriculture, Foreign Agricultural Service, Foreign Agricultural Circular: Coffee, FCOF series, various issues, 1951 through 1966.

TABLE 23

AUTHORIZED ANNUAL GREEN COFFEE EXPORTS FROM EIGHT SELECTED PRODUCING COUNTRIES, BY COUNTRY, ANNUALLY, 1964-1966[a]

(Thousands of 60 Kg. Bags)

Country	1964	1965	1966
Brazil	18,858	16,451	17,060
Colombia	6,345	5,617	5,527
Costa Rica	977	917	900
El Salvador	1,700	1,582	1,467
Guatemala	1,526	1,257	1,342
Ethiopia	1,063	1,293	1,188
East Africa[1]	3,249	2,665	2,929
Western Africa[2]	4,817	4,006	4,406

[1]East Africa comprises Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger.

[a]Calculated from: Sum of quarterly quotas for each selected country per year, as assessed by the International Coffee Organization, with the Annex 'B' (New markets) allotment pro-rated among the producing countries on the basis of established market shares.

TABLE 24

VOLUME OF UNITED STATES PURCHASES OF GREEN COFFEE FROM SELECTED PRODUCING COUNTRIES, BY COUNTRY, ANNUALLY, 1953-1966[a]

(Thousands of 60 Kg. Bags)

Year	Total Imports	Brazil	Colombia	Costa Rica	El Salvador	Guatemala	Ethiopia	East Africa[1]	Western Africa[2]
1953	21065	8970	5606	267	1019	809	456	148	3
1954	17084	6345	4911	132	767	697	358	208	284
1955	19650	7701	4934	145	855	816	471	538	276
1956	21288	9899	4557	80	604	815	309	460	522
19[illegible]	20865	8888	4135	165	676	830	466	766	513
1958	20185	7453	4246	302	724	882	458	766	468
1959	23266	10646	4902	247	621	988	267	730	388
1960	22104	9253	4259	271	446	799	566	932	658
1961	22464	8633	4087	369	583	950	679	1246	736
1962	24574	9093	4334	385	847	966	661	1413	584
1963	23894	9278	3952	287	763	1079	816	1497	706
1964	22892	7213	3712	293	683	789	924	1382	1305
1965	21347	5744	3324	305	714	904	1158	1349	1071
1966	22092	6731	2716	231	593	1110	792	1629	801

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]Source: U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1953 through 1967.

TABLE 25

AVERAGE ANNUAL BAG PRICE OF UNITED STATES GREEN COFFEE PURCHASES FROM SELECTED PRODUCING COUNTRIES, BY COUNTRY, ANNUALLY, 1953-1966[a]

(U. S. Current Dollars per 60 Kg. Bag)

Year	Total Imports	Brazil	Colombia	Costa Rica	El Salvador	Guatemala	Ethiopia	East Africa[1]	Western Africa[2]
1953	69.70	70.00	74.00	72.60	63.20	65.40	64.80	60.60	58.00
1954	86.88	85.70	93.90	90.00	78.40	79.20	86.00	76.50	72.80
1955	69.02	63.10	82.80	77.10	71.30	72.20	58.60	49.40	47.10
1956	67.71	61.00	81.80	89.80	72.20	80.20	67.10	59.80	38.90
1957	65.88	59.45	84.11	80.96	70.48	73.53	63.83	48.66	41.27
1958	58.05	54.54	68.53	63.72	56.20	60.46	55.57	49.27	45.83
1959	47.15	42.52	59.54	53.31	48.77	50.38	43.71	37.95	34.84
1960	45.42	43.11	57.40	52.16	50.13	51.23	43.56	31.76	24.17
1961	42.91	42.64	55.45	47.02	45.93	46.02	43.38	29.60	22.97
1962	40.27	39.87	52.24	44.46	42.54	44.00	40.21	27.83	23.49
1963	40.05	39.22	49.95	44.48	42.61	43.62	39.16	32.44	31.12
1964	52.43	52.36	60.22	54.87	51.57	55.49	53.51	48.75	43.24
1965	49.68	52.82	60.05	56.44	56.31	56.37	51.60	37.17	36.29
1966	48.37	48.65	60.30	54.88	52.70	53.45	51.35	43.89	40.02

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]Source: U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1953 through 1967.

TABLE 26

YEAR-TO-YEAR FLUCTUATIONS IN AVERAGE ANNUAL BAG PRICE OF UNITED STATES GREEN COFFEE PURCHASES FROM SELECTED PRODUCING COUNTRIES, BY COUNTRY, ANNUALLY, 1953-1966[a]

(Percent Change in U. S. Dollar Price per 60 Kg. Bag)

Year	Total Purchases	Brazil	Colombia	Costa Rica
1953-54	24.6	22.4	26.9	24.0
1954-55	-20.6	-26.4	-11.8	-14.3
1955-56	- 1.9	- 3.3	- 1.2	16.5
1956-57	- 2.7	- 2.5	2.8	- 9.8
1957-58	-11.9	- 8.3	-18.5	-21.3
1958-59	-18.8	-22.0	-13.1	-16.3
1959-60	- 3.7	1.4	- 3.6	- 2.2
1960-61	- 5.5	- 1.1	- 3.4	- 9.9
1961-62	- 6.2	- 6.5	- 5.8	- 5.4
1962-63	- 0.5	- 1.6	- 4.4	-0-
1963-64	30.9	33.5	20.6	23.4
1964-65	- 5.2	0.9	- 0.3	2.9
1965-66	- 2.6	- 7.9	0.4	- 2.8

See notes at end of table.

TABLE 26 (Continued)

El Salvador	Guatemala	Ethiopia	East Africa[1]	Western Africa[2]
24.1	21.1	32.7	26.2	25.5
- 9.1	- 8.8	-31.9	-35.4	-35.3
1.3	11.1	14.5	21.1	-17.4
- 2.4	- 8.3	- 4.9	-18.6	6.1
-20.3	-17.8	-12.9	1.3	11.0
-13.2	-16.7	-21.3	-23.0	-24.0
2.8	1.7	- 0.3	-16.3	-30.6
- 8.4	-10.2	- 0.4	- 6.8	- 5.0
- 7.4	- 4.4	- 7.3	- 6.0	- 2.3
0.2	- 0.9	- 2.6	16.6	32.5
21.0	27.2	36.6	50.3	38.9
9.2	1.6	- 3.6	-23.8	-16.1
- 6.4	- 5.2	- 0.5	18.1	10.3

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]Source: U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1953 through 1967.

TABLE 27

VALUE OF UNITED STATES PURCHASES OF GREEN COFFEE FROM SELECTED PRODUCING COUNTRIES, BY COUNTRY, ANNUALLY, 1953-1966[a]

(Thousands of U. S. Current Dollars)

Year	Total Imports	Brazil	Colombia	Costa Rica	El Salvador	Guatemala	Ethiopia	East Africa[1]	Western Africa[2]
1953	1468247	627856	415109	19373	64368	52909	29541	8976	174
1954	1484177	543789	461170	11871	60138	55270	30749	15960	20697
1955	1356262	486218	408391	11153	60915	58886	27591	26590	12966
1956	1441401	604248	372571	7174	43636	65362	20744	27501	20259
1957	1374573	528367	347779	13358	47646	61027	29743	37277	21171
1958	1171771	406469	290995	19264	40700	53326	25447	37753	21456
1959	1096971	452650	291874	13168	30288	49779	11670	27703	13519
1960	1004017	398858	244469	14151	22337	40932	24669	29618	15895
1961	964018	368141	226609	17349	26778	43721	29453	36876	16905
1962	989644	362528	226398	17119	36034	42505	26577	39326	13718
1963	956912	363901	197416	12767	35508	47062	31953	48556	21974
1964	1200281	377664	223524	16078	35221	43780	49442	67369	56427
1965	1060531	303385	199593	17214	40207	50962	59752	50149	38877
1966	1068580	327430	163784	12678	31253	59333	40666	71509	55108

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]West Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]Source: U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1953 through 1967.

TABLE 28

YEAR-TO-YEAR FLUCTUATIONS IN ANNUAL REVENUE FROM GREEN COFFEE SALES TO THE UNITED STATES OF SELECTED PRODUCING COUNTRIES, BY COUNTRY, ANNUALLY, 1953-1966[a]

(Percent Change in U. S. Dollar Annual Revenue)

Year	Total Purchases	Brazil	Colombia	Costa Rica
1953-54	1.1	-13.4	11.1	-38.7
1954-55	-8.6	-10.6	-11.4	-6.0
1955-56	6.3	24.3	-8.8	-35.7
1956-57	-4.6	-12.6	-6.7	86.2
1957-58	-14.8	-23.1	-16.3	44.2
1958-59	-6.4	11.4	0.3	-31.6
1959-60	-8.5	-11.9	-16.2	7.5
1960-61	-4.0	-7.7	-7.3	22.6
1961-62	2.7	-1.5	-0.1	-1.3
1962-63	-3.3	0.4	-12.8	-25.4
1963-64	25.4	3.8	13.2	25.9
1964-65	-11.6	-19.7	-10.7	7.1
1965-66	0.8	7.9	-17.9	-26.4

[a]Source: Calculated from customs declarations figures, as provided by the U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1953 through 1967.

TABLE 28 (Continued)

El Salvador	Guatemala	Ethiopia	East Africa[1]	Western Africa[2]
-6.6	4.5	4.1	77.8	...[a]
1.3	6.5	-10.3	66.6	-37.4
-28.4	11.0	-24.8	3.4	56.2
9.2	-6.6	43.4	35.5	4.5
-14.6	-12.6	-14.4	1.3	1.3
-25.6	-6.7	-54.1	-26.6	-37.0
-26.3	-17.8	111.4	6.9	17.6
-19.9	6.8	19.4	24.5	6.4
34.6	-2.8	-9.8	6.6	-18.2
-9.8	10.7	20.2	23.5	60.2
8.3	-7.0	54.7	38.7	156.8
14.2	16.4	20.9	-25.6	-31.1
-22.3	16.4	-31.9	42.6	41.7

[1]East Africa comprises the countries of Uganda, Kenya, and Tanzania.

[2]Western Africa is defined as: French Africa and Madagascar (1953 through 1959); Ivory Coast, Togo, Guinea, Mali, Dahomey, Upper Volta, Mauritania, and Niger (1960 through 1966).

[a]Source: Calculated from customs declarations figures, as provided by the U. S. Department of Commerce, Business and Defense Services Administration, Press Release, BD-series, various issues, 1953 through 1967.

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