

THE UNIVERSITY OF MANITOBA

COCOA PRICE FORMATION AND THE PROSPECTS  
OF ITS STABILIZATION

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES  
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE  
OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF AGRICULTURAL ECONOMICS

WINNIPEG, MANITOBA

May 1974

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A dissertation submitted to the Faculty of Graduate Studies of  
the University of Manitoba in partial fulfillment of the requirements  
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## ACKNOWLEDGEMENTS

A number of individuals made important contributions to this study. The author is indebted to Dr. N. J. Beaton under whose supervision this research was conducted. His advice and valuable criticisms as a thesis supervisor are most appreciated.

The author appreciates the excellent and helpful comments and directions given by Dr. A. A. Wood and Dr. P. Phillips, members of the thesis committee; and Dr. J. Leibfried, the external examiner who carefully read the dissertation and made many helpful suggestions and comments. The author also is deeply grateful to Dr. L. R. Rigaux who took the trouble of reading the first and the second drafts of the thesis and through whose guidance and suggestions led to the improvement of the final dissertation.

I would also like to acknowledge the contribution of Professor W. H. Lehn who read certain chapters of this thesis.

The financial support provided by the Canadian International Development Agency is gratefully appreciated.

Finally, my great indebtedness goes to my wife, Constance, and children who patiently spared me the time

to be without them and without whose continuous moral support this study would not have been completed. To them this study is dedicated.

ABSTRACT

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As worldwide concern has grown over the urgency of economic development for the developing countries, so has the attention of researchers and policymakers on price fluctuations in primary commodities produced by these countries. Such fluctuations impede the development process because they affect export earnings and hence the ability to obtain external resources for development. The focus on adverse price fluctuations has been accentuated by a concurrent persistent downward trend in prices during much of the post-war period.

In these circumstances attention has turned towards possible means of stabilizing the prices of primary commodities exported by developing countries.

The need for price stabilization is especially great for raw cocoa beans which are produced only in developing countries. Price fluctuations have been particularly severe in the world market for this commodity.

These price fluctuations have serious implications for those countries deriving the bulk of their export earnings from cocoa. Since cocoa is consumed mainly in developed countries and the raw beans cannot be stored in tropical climates where they are produced, stocks of raw cocoa beans are held in the consuming countries. Inventory policies sometimes add a further element of price instability to that arising from supply variations.

This study was designed to investigate the effects of an administered pricing scheme on the export earnings of cocoa producing countries. One such scheme was developed from the proposals made at international cocoa conferences. An analysis was made of impacts on demand and supply of alternative levels of a negotiated "remunerative" price. Provision was made for operation of a buffer stock as one of several alternative techniques for ensuring the success of the scheme. Results indicated a substantial potential for increasing the export earnings from the application of this remunerative pricing scheme.

The investigation postulated the setting of a "remunerative" price which is administered by an International Cocoa Council. Difficulties involved in negotiating such a price are recognized in view of the failure of the Cocoa Producers' Alliance to maintain high cocoa prices after 1964, and the causes of this failure which are identified. In this application of remunerative

price at a negotiated level the theory of consumers' and producers' surplus is used to measure the social cost of price fluctuations from this level. Comparisons were made of social costs over a five-year period following initial fluctuations from the equilibrium price under controlled and free market conditions. Annual supply and demand of cocoa beans were determined under both market conditions.

The results showed that for a five-year period the aggregate earnings from the controlled market could be \$4,132 million while the free market would earn \$3,435 million. Thus, if an international agreement on cocoa were signed, and put into operation in 1973 for five years, the producers' income could be increased by about \$697 million at a stabilized price of \$663 per ton.

The supply response to this price level was also analyzed to determine the aggregate supply of cocoa beans that must be isolated from the market for that price to be maintained. The results indicated that a cumulative total of 573 thousand tons would have to be so isolated over the five-year period.

An optimal stabilization policy model was developed, based on the operation by the Cocoa Council of a buffer stock mechanism to intervene in the market by purchasing or selling raw cocoa beans. This model is capable of minimizing the social cost of price fluctuations or the

intervention costs for buffer stock operation. In a deterministic market, ignoring stochastic factors, the optimal policy requires the buffer stock manager to trade a quantity which is proportional to the price deviation from equilibrium in the preceding period. The proportional factor is a function of the marginal social cost and the marginal intervention cost, the latter depending on the time limit imposed on the buffer stock manager. It is concluded that the application of this policy will reduce instability in the international price of raw cocoa beans and will minimize social costs of such instability while also minimizing intervention costs.



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## CHAPTER 1

### INTRODUCTION

International Commodity Agreements (ICAS)<sup>1</sup> in general, have as one important aim the moderation of fluctuations in commodity prices. Most ICAS also attempt to influence export incomes. One reason for the developed countries' interest in ICAS is that they feel responsible for instability in the less developed countries (LDCS), on the theory that fluctuations there merely "echo" fluctuations in their own economies,<sup>2</sup> and at the same time they are apprehensive about possible feedback effects through sympathetic fluctuations in LDCS' demand for imports from developed countries.

#### The Problem

Before the 1948 Havana Conference on international trade, a unanimous skepticism existed among economists with respect to international organization of commodity

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<sup>1</sup>In this study ICAS are defined as International Commodity Agreements which have both producer and consumer membership in accordance with the principles of the Havana Charter.

<sup>2</sup>Alasdair I. MacBean, Export Instability and Economic Development (London: George Allan and Unwin Ltd., 1966), p. 165.



trade, and international commodity agreements, because of two basic arguments against them. One argument deals with economic issues and the other with organizational issues. The economic argument is that ICAS lead to misallocation of resources, both between the commodity under the agreement and other commodities and between high and low cost areas producing the particular commodity. As a result, production of the commodity may be in surplus or deficit and this misallocation of resources may not occur in the least cost areas. The organization argument is that difficulties to be surmounted in the negotiations are too great and that an agreement cannot be implemented for any period of significant length because of the differences in the objective functions of the producers and the consumers.<sup>3</sup>

The success of the Havana Conference and the subsequent interest of the United Nations agencies (Food and Agriculture Organization, United Nations Conference on Trade and Development) in arranging for interested parties to meet and negotiate on an international level partially solved the organization problem. Economic interest in ICAS after World War II arose because of two basic difficulties facing the LDCs: (a) their adverse long-run

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<sup>3</sup>Alasdair I. MacBean, op. cit., Passim, Chapter 12. See also P. T. Bauer and F. W. Paish: "The Reduction of Fluctuations in the Incomes of Primary Producers", The Economic Journal (December 1952), Passim, pp. 751-80.

terms of trade and (b) price fluctuations in the primary commodities they produce.<sup>4</sup>

Economists such as Nurkse, Prebisch, and Pincus have supported the idea of an ICA on primary commodities as a means to resolve these two difficulties. Nurkse reasons that violent price fluctuations make economic growth and stability impossible in the LDCS,<sup>5</sup> and therefore that the removal of these price fluctuations will improve both growth and stability. Prebisch and Pincus focus on the long-run adverse terms of trade facing the LDCS and they propose the use of ICAS to correct this difficulty by transferring resources from the rich to the developing countries.<sup>6</sup>

Cocoa is one of the primary commodities produced by LDCS that has been subject to a typically high degree of instability in price.<sup>7</sup> Prices averaged about 5 cents

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<sup>4</sup>MacBean, op. cit., pp. 165-67.

<sup>5</sup>Ragnar Nurkse, Problems of Capital Formation in Underdeveloped Countries (New York: Oxford University Press, 1952), pp. 17-23.

<sup>6</sup>Paul Prebisch, Towards a New Trade Policy for Development (Geneva: U. N., 1964), p. 99; and John Pincus, Trade Aid and Development (New York: McGraw-Hill, 1967), pp. 227-41. OECD, 1953; pp. 31-34, also suggests ICAS as a supplement to financial aid.

<sup>7</sup>MacBean, op. cit., pp. 42 and 51.

a pound in the 1930's, and about 8 cents a pound in the 1940's, then jumped to a record average of 57 cents a pound in 1954. The highest recorded price in a single day (in 1954) was 72 cents. A futures market in raw cocoa has existed in New York and has been used by manufacturers to protect their inventory positions by hedging. Cocoa is subject at times to extreme speculation which exacerbates the price swings. Sometimes the price movements have been far beyond the range of economic values deriving from the fundamental supply and demand situation.<sup>8</sup> Because cocoa is of great economic significance to a number of producing countries, all in the process of development, these countries are gravely concerned with these sharp price fluctuations.

The high prices of 1954 also affected the operations of cocoa manufacturers adversely. Some of the small firms, especially in Belgium and Switzerland, were caught with short supplies of cocoa and were forced out of business.<sup>9</sup> The Swiss and Belgian governments approached

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<sup>8</sup>Commodity Year Book 1972 (New York: Commodity Research Bureau, Inc., 1972), ed. by Harry Jiler et al., p. 16. See also F. H. Weymar, The Dynamics of the World Cocoa Market (M. I. T. Press, 1968), p. 12.

<sup>9</sup>T. A. Kofi, "International Cocoa Draft Agreement", Discussion Paper 71-4 (Stanford, Food Research Institute, 1971), p. 7. See also J. E. Chapman, "The International Office of Cocoa and Chocolate" in Cocoa Growers' Bulletin No. 4, Feb. 1965 (London: Cadbury Brothers Ltd., 1965), pp. 8-9.

the Organization for European Economic Co-operation (OECE), and the United Nations (UN) and requested them to look into the cocoa price crisis. The UN approached the Interim Coordinating Committee on International Commodity Arrangements (ICCOICA) who, in turn, recommended to the Food and Agriculture Organization (FAO) to study the cocoa instability problem. The UN has called a number of conferences in an attempt to negotiate an ICA on cocoa since 1963.

If an ICA on cocoa can be designed to eliminate the violent price fluctuations, such an ICA will be of great assistance to LDCS whose exports are highly concentrated in cocoa. The nature of assistance that is actually achieved depends on whether the Nurkse or Prebisch-Pincus reasoning is accepted. According to Nurkse, both economic growth and economic stability would improve from elimination of price fluctuations alone, whereas Prebisch-Pincus imply that even if fluctuations are removed the long run terms of trade may continue to be adverse and this may yet impede growth. Whichever reasoning is accepted, the reduction of price fluctuations in cocoa would appear capable of bringing important benefits to LDCS.

Since 1956, attempts have been made, without success, to control the prices of cocoa and to arrest the continual downward trend. The Food and Agriculture Organization, the United Nations Conference on Trade and

Development (UNCTAD), and the producers and consumers have been negotiating very actively since 1960, but a binding agreement is still not in sight owing largely to the inability of the producing and the consuming countries to reach a mutually satisfactory price.<sup>10</sup>

International discussion within UNCTAD of the possibilities of organizing the world cocoa market goes back to the first UN Conference on Trade and Development held in Geneva in the summer of 1964. On this subject, the Conference recommended in its final act,

the establishment . . . of an ad hoc working party of government experts responsible for studying the proposals and preparing a programme of action for the international organization of commodity trade which will ensure that the developing countries will at all times be able to market their export products in increasing quantities and at remunerative prices, the 'purchasing power' of which should not decline in relation to the prices of the essential goods imported by those countries, devoting their attention during the first stage to the commodities of greatest importance to the international trade of the developing countries.<sup>11</sup>

The failures of the 1963, 1964, 1965, 1966, and the abrupt suspension of 1968 negotiations for an ICA for cocoa were basically due to disagreement on the price.<sup>12</sup>

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<sup>10</sup>Blackman Ricardo and Rake Alan, "What is Holding Up a Cocoa Agreement" in African Development (FAO, Rome, June 1970), pp. 12-13.

<sup>11</sup>UNCTAD Publication Document TD/B/A.11.8 Geneva Act, 1964.

<sup>12</sup>UNCTAD Publication Document TAD/167/(Com) Geneva, 19 December 1967.

Hence the problem confronting the producers and consumers in their efforts to negotiate an ICA for cocoa is to find a means for determining raw cocoa prices which will be acceptable to the objective functions of both parties. This requires information on projected responses in production and consumption under different conditions of demand and supply that may occur over time for raw cocoa and cocoa products. These prices should have attributes that enable them to function as equilibrium prices in the world cocoa market. Even advance knowledge of the market-clearing or equilibrium price for cocoa in any year may not result in advance agreement at the negotiations. An equilibrium price in this traditional sense can in any event never be known and may not be acceptable to the objective functions.

There is a need to define a new concept of equilibrium price applicable or related to the negotiation process. For negotiation purposes, equilibrium price is to be defined instead as an assumed arbitrary value (five-year moving average).

This suggests a need to analyze impacts on production and consumption to see how they match up to the objective functions or to the major changes of them. Hence the final or equilibrium price is the price resulting from the interaction of production and consumption.

A buffer stocks mechanism may be necessary as a tool to forestall further deviation of that price.

### The Need for the Study

A study is needed on an ICA for cocoa with reference to determination of equilibrium price. This type of study should also provide an insight into the present organization of the world cocoa market and should explore and apply the theoretical role of equilibrium pricing and welfare economics in stabilizing this market.

On September 17, 1966 the producing countries expressed deep disappointment at the failure of the negotiations and reiterated unanimously that efforts should be made by UNCTAD to draft an agreement which will answer their needs in conformity with the recommendations of the first session of UNCTAD. The following needs were especially mentioned:

- (a) Stable and remunerative prices;
- (b) Effective buffer-stock machinery for the maintenance of minimum price;
- (c) Prefinancing of the first buffer stock on favourable terms by international financial institutions or by the Governments of developed countries;
- (d) Effective means of control;

- (e) Adoption of measures for the reduction of barriers to the trade in cocoa and to its consumption.<sup>13</sup>

These needs are crucial for successful negotiation. This study will provide information of relevance to items (a), (b) and (d).

Eicher has indicated the dearth of studies dealing with international trade, and policy and planning for cocoa.<sup>14</sup> Contributing reasons for this lack of research relevant to the present day cocoa problem are the domination of rural development research in the 1950's by geographers and anthropologists, and the relative paucity of agricultural economists in the cocoa producing nations. Since there are very few professional agricultural economists<sup>15</sup> engaged in teaching and research in these countries, little research has therefore been completed on stabilization policies for cocoa.

The lack of relevance to the current cocoa problems of much of the research over the past twenty years is a

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<sup>13</sup>UNCTAD Publication Document 21st Session Supplement No. 15 (A/6315/Rev. 1) New York, September 1966.

<sup>14</sup>Carl K. Eicher, Research on Agricultural Development in Five English-Speaking Countries in West Africa (New York: Agricultural Development Council, 1970), p. 31.

<sup>15</sup>Ibid., p. 31. The actual figure quoted for 1969 by Eicher was fifteen. However the population of agricultural economists is far above this number in the 1970's.



reflection of (a) research being conducted primarily by itinerant or non-African scholars over the past years;<sup>16</sup> (b) anthropologist and geographers being on the "fringe" of the planning process--either by choice or through exclusion by economic planners; (c) rural development disciplines are in their infancy in most of the cocoa producing countries; and (d) problems of cocoa price instability have often been incorrectly diagnosed and as a result, cocoa manufacturing companies have been considered to be major obstacles to an ICA on cocoa whereas, in fact, effective demand constraints, pricing policies and international trade barriers are much more important as constraints on negotiations.<sup>17</sup>

### Objectives

The general objective is to develop a stabilization policy for consideration by both producers and consumers of cocoa with respect to an efficient organization of the cocoa market. For this to be achieved it is necessary to determine and follow several more specific objectives to guide the study. These are:

- (1) To evaluate the past effect of monopolistic

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<sup>16</sup>These nomadic scholars have been primarily oriented to their disciplines rather than to problem solving.

<sup>17</sup>Carl K. Eicher, op. cit., p. 33.

pricing by the Cocoa Producers Alliance (CPA).

(2) To evaluate the impacts on production and consumption of stabilizing prices at hypothetical "remunerative" price levels, and the earnings that might accrue to the producing countries at these different price levels.

(3) To illustrate how an effective optimal policy with the use of a buffer stock can be adopted under deterministic conditions to control the market.

#### Scope of this Study

The focus of this study is centered on the determination of equilibrium pricing and optimal stabilization policy for such pricing in organizing the world cocoa market. A theory of monopolistic pricing will be used in evaluating how the CPA would have fared if that pricing mechanism was adopted.

A remunerative price will be based on assumed equilibrium price and quantities. Since the demand for cocoa beans is a derived demand from the demand for manufactured cocoa products, consideration is necessary of elasticity of demand at both retail and wholesale levels of cocoa to evaluate the effects of different price levels on consumption and production. Such an evaluation will demonstrate the earnings that might accrue to the producing countries at different price levels.

The concept of equilibrium price with demand and supply of cocoa will be utilized in analyzing the cocoa market where prices tend to be highly volatile. Since in practice equilibrium pricing implies producers' and consumers' surplus, this concept will be explored in detail to illustrate a market control mechanism with respect to arriving at an optimal stabilization policy under deterministic conditions.

#### Limitations

This study is designed to provide information in the value of regulation of the cocoa market, however it has limitations. These limitations arise from some of the necessary assumptions that have to do with elasticities of demand and supply and all the underlying factors contributing to them. There is considerable evidence pertaining to these factors, nevertheless a choice has to be made and therefore in this sense this study must be taken as one having methodological value. One limitation is that in this initial study of the issue the deterministic approach to demand and supply functions has been taken. This means that it abstracts from unpredictable shifts in these functions, particularly for supply. Therefore the study has relevance mainly to assessing the initial gains and initial costs with respect to the equilibrium price in effect.

It will be a subject of another study to supply information on expected operating costs with respect to mechanisms for an equilibrium price.

### Organization of the Study

Chapter 2 briefly reviews some existing ICAS. These include such commodities as tin, wheat, sugar, and coffee. Chapter 3 describes the characteristics of the world cocoa market. Technical, commercial and economic characteristics are discussed. Chapter 4 concerns the operation of the cocoa market and the mechanism of price formation. Institutions involved in price formation in producing and consuming countries are identified and described. Chapter 5 evaluates the effect of past monopolistic pricing by the CPA. Reasons are explored for the failure of the CPA to achieve its objective of a higher cocoa price in 1963/64. This chapter further considers what the levels of export earnings of the producing countries would have been if the CPA was successful with its pricing policies during that year. Chapter 6 is devoted to an application of remunerative pricing. This chapter is divided into sections. The first deals with the application of a remunerative price scheme for cocoa: the second with the implication of raising price to a hypothetical remunerative level based on an assumed equilibrium price and quantity, and the third with the possible

means of achieving a remunerative price for cocoa. In Chapter 7 a deterministic model is utilized to illustrate how the International Cocoa Council could effectively control the cocoa market.

The eighth chapter summarizes the study, reports the conclusions drawn therefrom, and the implications of the results for cocoa stabilization policy.

## CHAPTER 2

### REVIEW OF ICAS ON SOME PRIMARY PRODUCTS

Interest in international commodity agreements was aroused as a result of the economic integration of Europe in general and as a result of a decline in the prices of the commodity exports of both developed and developing countries. Both these phenomena give rise mainly to schemes for price support or market rationalization rather than for the moderation of short-term fluctuations. Most recent discussions of ICAS seem to postulate their main role as that of supporting commodity prices at levels higher than such prices would reach in an open world market.<sup>1</sup> Hence ICAS with respect to LDC commodities thus became regarded as a form of economic aid which transfers resources via higher prices from consumers to producers.

Most ICAS make price stabilization their direct aim. Nevertheless, the methods adopted usually also involve some stabilization of the quantities exported.

Given that ICAS can reduce instability in world

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<sup>1</sup>Pincus, J., "What Policy for Commodities?" in Foreign Affairs, January 1964.

prices, their effect on developing countries depends not only on which commodities are subject to their control but also on form of agreement and means applied. At present these commodities are very few: tin, wheat, sugar and coffee. It is noteworthy that the International Wheat Agreement has been terminated, the Sugar Agreement has been disrupted by the Castro take over in Cuba, the Tin Agreement has run out of stocks or funds twice, and the Coffee Agreement is an untested venture.

Fortunately or unfortunately, despite all the advocacy of ICAS in UN, only these four commodity agreements have been formed in the post-war era.<sup>2</sup> There are probably many reasons why few agreements have been concluded: some political, some technical.

Most of the agreements during the inter-war period were national, or they were international only in the sense that several producing nations were involved. In general their objective was to raise prices and support the incomes of producers at the cost of reducing the quantities of the controlled commodities which were exported.<sup>3</sup>

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<sup>2</sup>Tea and coffee marketing arrangements are the only important post-war agreements which involved only producers.

<sup>3</sup>For a comprehensive account of agreements in this period see International Labour Office, *Intergovernmental Commodity Control Agreements*, 1943. J. S. Davis, "Experience Under Intergovernmental Commodity Agreements, 1902-1945", *JPE*, June 1946.

ICAS were most numerous during the period 1937-39. ICA-regulated commodities during this period were comprised of tin, tea, rubber, sugar, beef, lumber, fur seals, north Pacific halibut, whaling, and narcotic drugs. Almost none of these was universal in scope. ICA controls over sugar, lumber, and whaling were according to Davis especially far from complete.<sup>4</sup> The only ICAS that have effectually operated for as long as five years were those for tin, tea, rubber, fur seals, halibut, and drugs.

The inter-war experience with ICAS was scarcely happy, and this history has influenced the views of consuming nations about the merits and demerits of ICAS.

During the post-war period new ICAS have been tried. Elements of each of the main types of ICAS have found a place in the evolutions of post-war agreements on tin, sugar, coffee and wheat. After several years of negotiation, an attempt has been made to form a quota agreement for cocoa, but this broke down at the last moment because of failure to obtain agreement between producing and consuming nations on prices.

The International Tin Agreement (ITA). An ITA existed before World War II, and a new ICA for tin was signed in 1953. Years of delay elapsed between the signing

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<sup>4</sup>J. S. Davis, op. cit., p. 219.



and the implementation of this new agreement, and it was not until the latter half of 1956 that the buffer stock came into effect. The fourth 5-year ITA signed by seven major producing countries and 20 consuming nations, including for the first time the U.S.S.R., went into effect on July 1, 1971.

Producers attempt to justify a relatively high price by arguing that lower prices would result in closure of marginal mines which still have large deposits of ore. This may result in early exploitation of richer deposits and hence leads to possible retrieval costs later.

If the object of the scheme is to maximize producer incomes, a high-price policy may be rational. The short-run price elasticity of demand is fairly low, allowing the possibility of monopoly profits for some time. In the long-run technical change may be so great a risk to full utilization of tin in industrially advanced countries that future profits may be greatly reduced.

In theory, a combination of consuming nations' votes with low-cost producing countries' votes could lead to lower prices and larger quotas. Unfortunately, even the low-cost producers may be able to do better under the existing arrangements than if the scheme broke down or major producers did not participate.

In sum, the ITA, at least in intention, fits with many of the criteria proposed for sound ICAS. It has equal representation of consuming and producing countries. It is supposed to be concerned with moderation of short-term fluctuations and not with price support. It has a mechanism for frequent adjustment of the quotas, and these quotas are supposed to be modified so as to improve productive efficiency. However, its buffer stock/fund, though larger than the pre-war stock pile, proved inadequate to meet fluctuations in 1956 and 1958; and while prices for tin have been fairly stable during the course of its operation (except 1965 and 1970), the part played by the agreement may have been small. Boris Swerling claims that the ceiling on tin prices is governed not so much by the price range specified in the agreement itself as by the terms on which the U. S. disposes of tin in excess of the present needs of the strategic stock pile.<sup>5</sup> In general MacBean states that the contribution of the Tin Agreement toward stabilizing the export earnings of the less developed countries seems small.<sup>6</sup> Modest achievement on the stabilization aspects notwithstanding, it has almost certainly helped to continue a high price relationship vis-a-vis other metals, probably maintained high-cost producers, and may have damaged the long-term interests

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<sup>5</sup>B. C. Swerling, "Problems of International Commodity Stabilization", American Economic Review, May 1963, p. 68.

<sup>6</sup>A. I. MacBean, op. cit., p. 285.

of tin producing countries by stimulating the hunt for substitutes.

The International Wheat Agreement (IWA). The IWA of 1949 is perhaps the most important ICA of the post-war era. It represented an innovation in technique, since it neither imposed quotas nor held stocks. Exporters and importers simply entered into contracts by which they agreed to buy or sell specified quantities at specified prices. Unfortunately, these contracts deliberately did not cover all the trade in wheat, even of the participants. Consequently neither production nor exports were controlled, and a "free" market whose prices could indicate long-run tendencies in supply and demand for wheat remained. As with all ICAS this agreement took some time to become operational. The fifth International Wheat Conference in March, 1947, introduced the plan, but 2½ years elapsed before it commenced operation in August, 1949. Wheat is exported almost entirely by developed countries: the U. S., Canada, Australia and France. Argentina is the only significant exporter which might be classified as a developing country. Hence, the scheme, whether successful or not, could have little effect on the exports of developing nations. The main interest it holds for this study is that it illustrates the method of the multi-lateral contract agreement.

Given the market dominance of the major exporting countries and the nature of government control of marketing in them, it would not be surprising if a great deal of price stability could be ascribed to them rather than the Agreement. After 1953, joint action by the Canadian and American wheat-marketing agencies prevented wheat prices from ever reaching the 1953 agreement floor price.<sup>7</sup>

Probably on the grounds of too high a price and disagreement with the methods of adjustment, the United Kingdom, the major importing country, refused to join the 1953 agreement. In a sense the UK was proved correct, since the price trend afterwards declined and led to an enormous increase in world wheat stocks held by the exporting countries despite US surplus disposal on special concessionary terms. Only non-Agreement purchases in recent years by mainland China and by Russia have done anything to reduce these stocks by significant amounts. However world wheat production in 1971 rose about nine per cent to a record 314 million tons.

The IWA seems to have had only a slight influence on any reduction of instability in wheat prices and it has co-existed with serious imbalance between supply and demand

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<sup>7</sup>UN Demographic Yearbook, 1958, p. 121. "The testing of the Agreement floor price has thus far been avoided, since Canada and the United States have preferred to accumulate large stocks rather than unload them in the free market."

for a long time. This long-run disequilibrium results from the internal policies of the national governments of importing and exporting members. The IWA has not helped to get rid of these policies. Whether the policies would actually have been better or worse in the absence of an agreement is very debatable. What is fairly clear is that the IWA has done little to solve the problem of wheat surpluses and it is not surprising that the agreement was allowed to expire without it being renewed. The experiences of the IWA are not a strong recommendation for the extension of the system.

The International Sugar Agreement (ISA). The ISA of 1953 took the traditional export-quota form and allotted equal voting power to the exporting and the importing countries, but this balance of opposing interests was more apparent than real. The U. S. imported all her sugar requirements under preferential terms and thus had little direct interest in a low free market price. Similarly the U. K. also obtained most of its imports, under the Commonwealth Sugar Agreement, at prices generally above those of the free market. Further, Britain had already entered into a favourable contract for Cuban sugar at relatively low prices and held large stocks of sugar in 1953.<sup>8</sup> For both of these major sugar-importing countries political and

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<sup>8</sup>A. I. MacBean, op. cit., p. 288.

economic ties with exporting countries within their respective spheres of influence made relatively high free-market prices at least acceptable if not actually preferable. On the other hand, Cuba might have welcomed lower prices if this would have enabled her to sell the larger volumes of sugar which she could easily produce.<sup>9</sup> The attitudes of the U. S. and the U. K. governments illustrate an important practical feature of ICAS. This is the tendency for political considerations to overrule questions of efficiency and consumer interests.

The Agreement signed in 1953 ran for five years, and a second agreement was signed in October of 1958. This came to an end in 1961 because of a failure to reach agreement on quotas for Cuban sugar exports. The Sugar Council has remained intact and certain minor features of the agreement have continued.

Though price stabilization was a declared objective, of the 1953 ISA, quota provisions adjustable in accordance with current prices were introduced as a means of enforcing floor and ceiling prices for free-market sugar. In the end, the ISA of 1953 did little to correct the distortions of existing production and trade in sugar.

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<sup>9</sup>Cuba apparently voted for a relatively high volume and low price during the discussion on the ISA. See V. P. Timoshenko and B. C. Swerling, The World's Sugar (Stanford University Press, California, 1957), p. 336.

The real reasons for instability in the free market price of sugar as explained by MacBean<sup>10</sup> lie mainly in the narrowness of the market and its residual nature, in perverse reactions to the protective tariffs of importing nations, and in the two-price system which faces producers and encourages dumping on the free market. The ISA unfortunately made no attempt to deal with these political and institutional causes of instability and of surplus capacity in sugar production. Instead it concentrated on short-term solutions for the residual free market. The situation was aggravated by the poor sugar-beet crop in Europe. Exporter's stocks of cane sugar proved inadequate to meet the increased demand for free market sugar and prices rose higher.

Recognizing the political difficulties of the sugar market, it can be inferred that the major troubles of this market stem from the protectionist attitudes of the governments of the U. S. and Western Europe. These cause both structural imbalance in sugar production and consumption and force short-term instability on to the residual free market. It is understandable that the agreement should have little success in this environment. Its performance emphasizes the difficulties which ICAS run into when the attempt is made to transfer them from the drawing board

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<sup>10</sup>A. I. MacBean, op. cit., p. 289.

to the real world. The contribution, if any, which the ISA has made to stability in exports of developing countries seems negligible.

The International Coffee Agreement 1962 (Export Quotas). The Coffee Agreement, signed in September, 1962, after two years of negotiations, began operation in 1964. This is the only ICA which covers most of the market for a commodity of real significance to the economic well-being of many developing countries. The main benefits go to Latin America, especially Brazil and Columbia as well as some countries in Africa, especially Ivory Coast and Kenya.

The chief concern of the producing nations has been the enormous surpluses, amounting in 1962 to the equivalent of about two years world shipments, and the steady decline in coffee prices from the peaks achieved in 1954-56.

The main stated objectives of the Agreement 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;

(2) to assist in increasing the purchasing power of coffee exporting countries by keeping prices at equitable levels and by increasing consumption.<sup>11</sup>

These make it clear that price support, not stabilization as thus defined, is the objective. If further confirmation

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<sup>11</sup>UN Document, "International Coffee Agreement", 1962, p. 7.



is required, Article 27 gives it:

[The members] agree on the desirability of operating the Agreement in a manner such that the real income derived from the export of coffee could be progressively increased so as to make it consonant with their needs for foreign exchange to support their programmes for social and economic progress.<sup>12</sup>

Exports are regulated through annual quotas. Quotas are also fixed on a quarterly basis to reduce seasonal fluctuations. Importing countries agree to regulate imports from non-members to the average of the preceeding three years. Revision of the basic export quota is possible by two-thirds majority vote. New measures commencing from and affecting 1971-72 quotas were taken by the Executive Board in mid 1970.

For its evident purposes the Coffee Agreement seems well designed. The agreement is already under pressure from some coffee exporting countries such as the Ivory Coast who believe their quotas to be too small for their present and potential production. The indications are that while the Coffee Agreement will probably do little to moderate fluctuations in export earnings around the trend levels it may succeed in holding export earnings higher than they would otherwise be. In the absence of such controls coffee prices would probably fall.

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<sup>12</sup>Ibid., p. 25.

The Need for Development of International  
Cocoa Agreements

In 1954 the price of cocoa on the New York Cocoa Exchange reached an all-time high of nearly 65 cents per pound. Less than two years later (April 1956) the price had fallen to 20 cents per pound. This drastic fluctuation led the U. N. Food and Agricultural Organization to establish a Cocoa Study Group, "to develop more complete cocoa statistics and begin to diagnose any market problem which might be thought to require attention by member countries."<sup>13</sup> Instead of diagnosing the market organization the Group directed its attention to ways to stabilize prices through an ICA.

During the 1956-57 season, prices rebounded and Brazil found herself in the position of residual supplier, facing a keen demand. The Brazilians attempted to maintain a minimum price of 31.6 cents per pound f.o.b., but in the absence of sales limitations, this price control attempt was short-lived.

In 1960 the FAO requested the Cocoa Study Group to appoint a Working Party on Price Stabilization to analyse technical aspects of the stabilization problem and to make recommendations concerning the draft of an agreement.

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<sup>13</sup>Merrill Lynch, Pierce Fenner and Smith, op. cit., pp. 4-5.

Without studying the market carefully and in detail the Working Party recommended an agreement based on export quotas.<sup>14</sup> The producers, however, suggested that sales quotas would prove more effective. These discussions in 1960 paved the way for a U. N. negotiating conference in 1963. Before that conference, the Cocoa Producers' Alliance (CPA), composed of the five leading producers--Ghana, Nigeria, Brazil, Ivory Coast, and Cameroon, who together produce 80 per cent of world output--met in 1962 to develop a joint marketing policy to help sustain prices.<sup>15</sup>

The U. N. Negotiating Conference met in Geneva in October of 1963. The New York Cocoa Exchange opposed price controls. However, they joined the negotiations. The Conference failed to reach an agreement due to divergence on the price offers. The "last offer" before the Conference adjourned was a demand of 27 cents per pound by the producers and an offer of 20 cents per pound by the consumers.

Due to the failure of the 1963 conference the Cocoa Producers' Alliance drafted its own agreement in May 1964. The agreement included sales quotas and a basic "indication price" of 23.75 cents per pound. By October of 1964

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<sup>14</sup>UNCTAD, Press Release, TD/B53 C TD/B/C.1/17 U. N. Cocoa Conference Working Party 1 (Prices and Quotas).

<sup>15</sup>UNCTAD, Cocoa Producers' Alliance Charter, Abidjan 1962. TD/B/47 (text), and TD/B/47, 66; TD/B/SR.71.

the world market price had fallen below the "indicator price" of 23.75 cents. The CPA failed to withhold supplies in order to force up the price. The period 1964-65 was a year of record supplies and the CPA began to lose its effectiveness.

In April of 1965, the U. N. Conference on Trade and Development (UNCTAD) joined the FAO in calling for a special meeting of the Working Party of the U. N. Cocoa Conference. The Working Party suggested a buffer stock agreement. A full-scale conference was convened in June 1966. The Conference broke down because the producers and the consumers failed to agree on the most important points: (a) the ways and means to finance the buffer stocks, and (b) the floor and ceiling prices of the buffer stock.

In December of 1969 Government representatives of leading cocoa producing and consuming countries met in Geneva to discuss the possibility of establishing an international agreement. The producing countries taking part were Ghana, Ivory Coast, and Brazil; and on the consumers' side were France, Britain and the United States. Nothing was concluded from these Geneva talks.

In Togo in March 1970, a representative of the UNCTAD met the CPA, comprising Cameroon, Ghana, Ivory Coast, Togo, Nigeria and Brazil. They reported considerable

progress, but no final agreement. At this meeting all the members of the CPA approved the Brazilian resolution to establish new ceiling and floor prices.

Some producing countries charge that the U. N. has made no progress in facilitating trade of the developing countries.<sup>16</sup> An imperfect Sugar Agreement, and the International Coffee Agreement stand as the only exceptions to the general failure to reorganize the international trade in primary commodities, which is of such overriding importance to the Third World.

In the case of cocoa, which is of vital interest to the developing countries, there have been many resolutions expressing support of the principle and declaring the intention to co-operate in working out an international agreement. But after twelve years of negotiation there is still no effective international cocoa agreement. Instead there has been establishment of a Cocoa Council in London operating on extracts from the International Coffee Agreement.<sup>17</sup>

One of the main cocoa buying houses in London claims that the slow progress of an ICA for cocoa lies with UNCTAD officials who simply do not understand the complexities of

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<sup>16</sup>R. Blackman and Rake Alan, *op. cit.*, p. 12.

<sup>17</sup>Cocoa Producers' Alliance, International Cocoa Agreement, Group Membership. Lagos: CPA-AC. 1972.

the cocoa market, particularly the futures market and are trying to foist a totally impracticable agreement on the industry.

From the preceding it is obvious that what is needed before any realistic agreement can be devised is a comprehensive, and practical study related to cocoa. By examining the particular problems of this commodity a broad range of the problems facing the international organization of the cocoa trade could be revealed.

Two major factors have been operating in the world cocoa market during the past decade. First, the serious fall in world cocoa price of the 1964-65 season called for short-term measures to rectify the situation. This consequently pushed discussion of wider means for organizing the market temporarily into the background. Secondly, the study is undertaken at a time when the convening of a U. N. negotiating conference is under serious discussion. Examination of the various possible means which might in theory be open for organizing the cocoa market must thus take place in this context, and, should the conference succeed in concluding a long-term agreement for cocoa, parts of this study may be superseded by the course of events. However, the study attempts to illustrate some of the broad questions pertaining to cocoa, by using certain assumed magnitudes, to show what might be the

general effect of managed 'remunerative' prices on the world cocoa market.

Finally in considering an ICA for cocoa it should be noted that controlled sales can only be effective if the crops are not too large. If the crops are too large, the market will usually outwait the producers and force them into selling competitively.

## CHAPTER 3

### CHARACTERISTICS OF THE WORLD COCOA MARKET

#### Technical and Commercial Characteristics

Cocoa is a tree crop produced from the fruit of "Theobroma cacao",<sup>1</sup> a small spreading tree indigenous to tropical South America. Several varieties which are now available in West Africa are clearly an improvement on the standard "Amelonado" sub-variety of the coarser and more robust "Forastero" type. The other important varieties are the Amazon and Trinitario types.

Cocoa is an exacting crop and its requirements as regards soil, drainage, rainfall and temperature must be met within relatively narrow limits if it is to do well. Under favourable conditions, trees become productive from three to seven years after planting. After this there is a comparatively protracted period of growing maturity during which production increases slowly until roughly

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<sup>1</sup>Cocoa trees thrive only within 20 degrees of the equator, and most of the world production is within 10 degrees. A mean shade temperature of approximately 80 degrees Fahrenheit with variations of not more than  $\pm 15$  degrees, a well-distributed rainfall of at least 50 inches annually, an altitude between a few hundred feet and a thousand feet above sea level, and protection from strong winds are requirements for optimum growth.



the twentieth year. Then (unless the tree succumbs to virus or other diseases)<sup>2</sup> production tends to decline after about thirty to forty years. In several countries, particularly in Latin America, many trees have been bearing for much longer, but yields become very low and the trees are more vulnerable to disease.

New planting of cocoa trees has been found to be influenced by the real price received by cocoa farmers and by special government incentives aimed at encouraging planting.<sup>3</sup>

The crop is borne in pods attached to the trunk and thicker branches by short stalks, each pod containing a mass of some twenty to forty seeds arranged in rows and covered in a white pulp. The seeds require only to be extracted from the pod, fermented with the pulp and dried to become the cocoa beans.

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<sup>2</sup>Though the cocoa trees are afflicted by many types of diseases, the most serious of these historically have been "witches broom" (in the West Indies) and "swollen shoot" (in Africa). These diseases are both viruses, for which no cure is currently known. With regard to swollen shoot, the virus is carried from tree to tree by insects, resulting in the disease being easily spread from a small pocket of affected trees to an increasingly large area. The only avenue of prevention is to cut out and burn affected trees as soon as the infection is observed. The main symptom of swollen shoot is a decline in yield over a period of from two to ten years until the infected trees yield little or no cocoa.

<sup>3</sup>R. Galletti, K. Baldwin, and I. Dina, Nigerian Cocoa Farmers (London: Oxford University Press, 1956), p. 3; see also A. Viton, CaCao: A Review of Current Trends in Production, Price, and Consumption, FAO Bulletin No. 27, Rome, 1955, p. 32.

There are two principal commercial types of cocoa: the fine or flavour cocoas and the ordinary bulk cocoas. The special qualities of the fine or flavour cocoas depend not only on variety but also on other factors including conditions of soil and climate. The relatively small quantities of fine cocoa (less than 10 per cent of total world cocoa output)<sup>4</sup> coming on to the market are in demand for blending processes in chocolate manufacture, and their supply is fairly constant. They are mostly grown in a number of Latin American and Far Eastern countries, in some cases together with bulk cocoa. With this distinction, cocoa is treated in this study as a homogeneous product.

There are usually two cocoa crops a year. In West Africa the main crop season is from September or October to January or February, while the small "mid crop" comes in about four or five months later. The time of harvesting and sale of the crop varies in other producing areas. The Brazilian crop normally reaches the world markets slightly before the West African crops and its peak exports occur usually between October and March. In San Domingo exports reach their peak between May and July; in Trinidad between February and May and in Ecuador, and Venezuela between April and June. The months of heaviest arrivals of all cocoas on the world markets coincide roughly with the West

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<sup>4</sup>V. D. Wickizer, Coffee, Tea and Cocoa (Stanford: Stanford University Press, 1951), p. 289.

African exporting season, and for statistical purposes the crop year is usually taken as from the beginning of October to the end of September.

Over 90 per cent of today's production comes from the equatorial regions of Africa and Latin America (Figure 3.1). Ghana alone accounted for about 37 per cent and 31 per cent of the 1962-63 and 1971-72 crop respectively while the five leading producers (Ghana, Nigeria, Brazil, Ivory Coast, and Cameroon) together produced about 76 per cent and 82 per cent of the 1962-63 and 1971-72 crop respectively.<sup>5</sup>

Cocoa is generally sold and exported rapidly to the major northern hemisphere consuming areas because the cocoa beans tend to deteriorate if stored for long periods in the tropical regions.

In processing, the cocoa bean can be broken down into two parts, which are used either separately or together: powder, which carries the distinct "cocoa" or chocolate aroma; and fat (cocoa butter). In addition to a number of special features, including traces of cocoa flavour and resistance to rancidity, the fat has the unique feature of melting at mouth temperature. Both parts are used in the manufacture of chocolate, the exact proportions depending

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<sup>5</sup>F. H. Weymar, op. cit., p. 1.

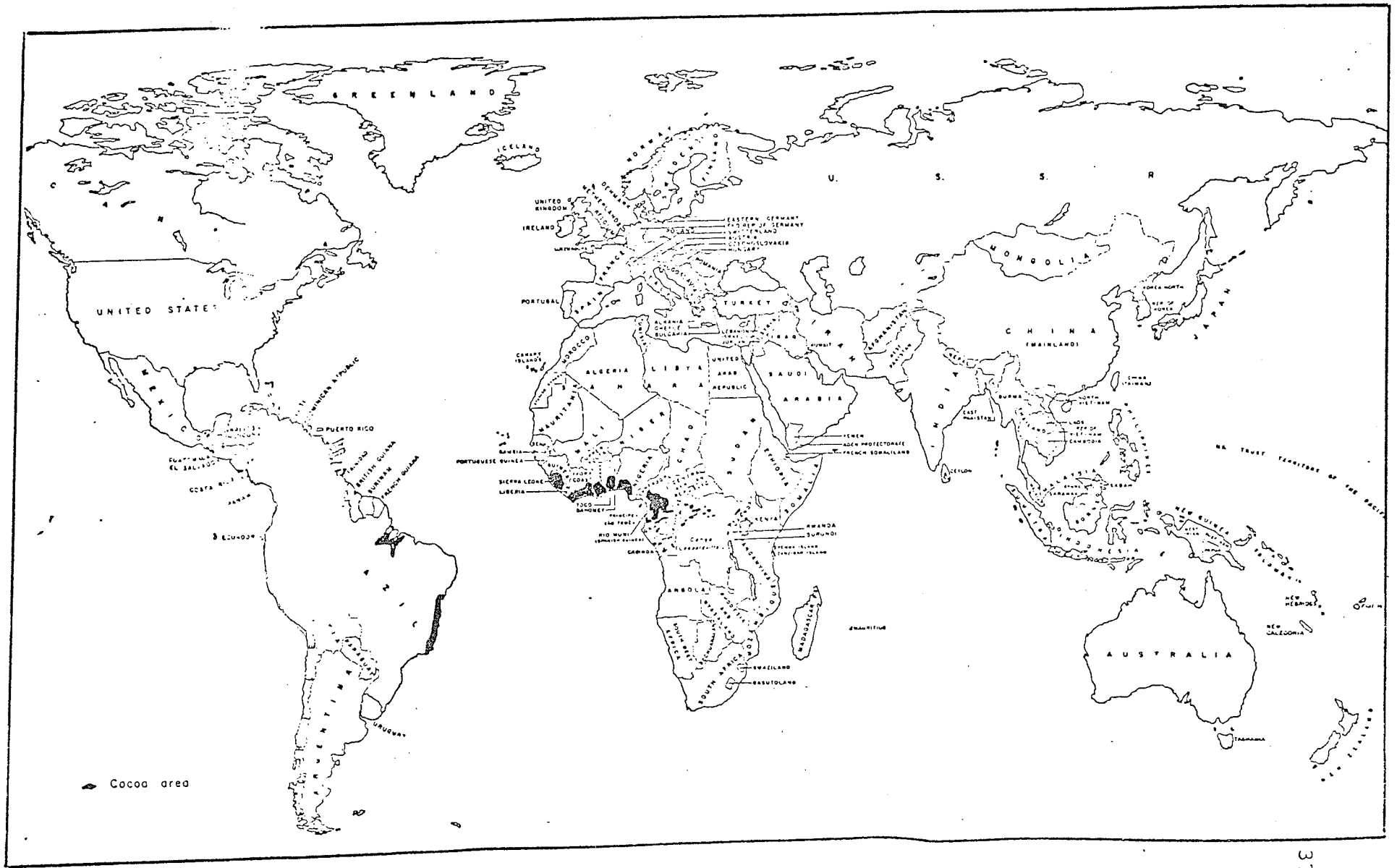


FIGURE 3.1. The World, showing cocoa areas.

on the type of chocolate. But the two parts are also used separately and both move separately in international trade. Cocoa powder is a flavouring agent for many types of beverages, pastries, desserts, ice cream and other foods.

The great price rises of 1953/54 and 1958/59 stimulated research on lower priced substitutes, especially for cocoa butter. In 1953, consumption in the United Kingdom, which during the previous year had accounted for almost 15 per cent of world net imports, increased sharply and unexpectedly in response to the lifting of wartime controls on confectionery consumption. Weymar attributes the cause of the increase in prices to a rapid deterioration of the world cocoa production outlook as the African crops were harvested.<sup>6</sup> Research indicates that substitute ingredients have gained ground in some countries and that use of the substitutes is responsive to the price of cocoa beans:<sup>7</sup> the higher the price of cocoa beans, the greater the usage of the substitutes. The use of substitutes is still under threat but not widespread or massive. As a beverage cocoa competes with coffee and tea but as an ingredient for confectionery it has no substitutes. For the purposes of this study, therefore, cocoa can be treated as a commodity

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<sup>6</sup>Weymer, op. cit., p. 14.

<sup>7</sup>FAO Cocoa Situation 1967, CCP/Cocoa/67/7. 1968.

without immediate close substitutes, though it seems clear that a period of prolonged high prices could alter this situation. The changes in the overall input mix of the final confectionery products in response to price changes are an important additional element affecting the level of cocoa consumption.

#### Economic Characteristics

An important feature of the cocoa market is the high concentration of both production and consumption. Five countries account for over 80 per cent of world production, and a similar number of countries account for about 70 per cent of world imports. In tropical Africa four countries (Ghana, Nigeria, Ivory Coast, Cameroon) produce almost two-thirds of world production; in Latin America, Brazil, Ecuador and the Dominican Republic account for an additional 20 per cent or more. On the consuming side, the United States alone absorbs some 30 per cent of world imports of beans, while in Europe, the Federal Republic of Germany has become the most important consumer, accounting for nearly 15 per cent of world imports. In aggregate, seven European importing countries absorb about 45 per cent of world trade. Other things being equal, this degree of concentration of production and consumption should make international agreement relatively easier to reach than for certain other commodities.

Although from a world standpoint cocoa is not one of the agricultural products of major importance, it is of great economic significance to a number of producing countries, all of which are in the process of development. It is one of the cornerstones of the economies of Ghana, the Western Region of Nigeria, the Cameroon Republic, the Ivory Coast, Togo, Ecuador, and is of vital and increasing importance to New Guinea, Papua and Western Samoa.<sup>8</sup> In Ghana the value of cocoa output has been around 30 per cent of the national product, and in Nigeria it is about 20 per cent. Cocoa contributes 20 to 60 per cent of the total value of exports of the six major producing countries. In many countries taxation of cocoa exports, direct and indirect, is an indispensable source of government revenue for economic and social development programmes. Countries which depend to such a large extent on earnings from this one commodity are bound to be gravely concerned both with the long term downward price trend, after the earlier substantial rise, and the sharp annual fluctuations of cocoa prices. Since some 70 per cent of the world supply is grown in West Africa, and about 15 per cent in the State

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<sup>8</sup>J. Kimball Dietrich and Alfredo D. Gutierrez, "An Evaluation of Short-Term Forecasts of Coffee and Cocoa," American Journal of Agricultural Economics, Vol. 55, No. 1 (February 1973), p. 93.

of Bahia in Brazil, weather conditions, and especially the timing of rainfall, in one of these areas can severely affect cocoa supplies in a particular season. Price reacts quickly, and often sharply. Temporary high prices may lead to severe disturbances in the economy and possible over-expansion;<sup>9</sup> while even a relatively short period of low prices may lead to difficulties in financing imports.

Price fluctuations are essentially related to production fluctuations, but their amplitude is much greater.<sup>10</sup> During 1947-61, year-to-year world price fluctuations averaged more than double the production fluctuations; in only one instance during this period did production change by over 20 per cent, but price fluctuations in excess of this percentage took place in eight years. Year-to-year fluctuations during 1950-61 averaged 16 per cent for Ghana, 22 per cent for Nigeria, 24 per cent for Cameroon and 21 per cent for the Ivory Coast; for the same period Brazil had higher fluctuations (29 per cent) because poor crops in some years coincided with low world prices.<sup>11</sup>

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<sup>9</sup>T. K. Warley, Agricultural Producers and Their Markets (Oxford: Basil Blackwell, 1967), p. 137.

<sup>10</sup>F. M. Gill and L. H. Duffus, Cocoa Statistics (December 1972), p. 4. See also F. H. Weymar, op. cit., pp. 12-15.

<sup>11</sup>UNCTAD Document "Memoranda on Diversion of Cocoa to Non-Traditional Uses TD/Cocoa", 1/WP. 1/R 20.



A number of factors explain why annual variations in price are so much greater than the year-to-year production changes, the most important being inherent in the nature and structure of the cocoa market. A recent FAO correlation analysis for the years 1950-70 of the deflated price of cocoa, available estimates of forthcoming production, and estimates of grindings showed that expectation of production is the most important factor influencing price changes.<sup>12</sup> At a production (and grindings) level of one million tons, the elasticity of price in relation to production was estimated at -2.4 i.e., a 10 per cent change in production expectations is associated with a 24 per cent change in price in the opposite direction. Price changes can thus be taken to be the main determining factor in fluctuations in cocoa export earnings. Furthermore, Weymar has demonstrated that prices develop during the year with no relation to the final production out-come,<sup>13</sup> which is of course known only after the end of the period, but in accordance with expectations and forecasts during the period. A comparison of forecasts of production with the final results shows that normally the final figures differ

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<sup>12</sup>UN Document, "Consumption", TD/Cocoa. 1/WP. 1/R.21. See also Cocoa Situation 1971, CCP/Cocoa/7/71, pp. 16-18.

<sup>13</sup>F. H. Weymar, op. cit., pp. 61-92.

considerably from the forecasts accepted by the market at the beginning of the year.<sup>14</sup> The reasons for these discrepancies are that some of the methods used in forecasting are biased and their predictive performance is therefore somewhat questionable. The study<sup>15</sup> by Dietrich and Gutierrez on the evaluation of short-term forecasts vividly illustrates this point. In all cases the South American forecasts are generally biased upwards while African forecasts tend to be biased downward.<sup>16</sup>

Another important factor is that the adjustment of grindings and final consumption to price of cocoa takes place only after a considerable time lag. In contrast, coffee and tea in particular move directly into consumption with only a small amount of processing. The consumer prices of these commodities (coffee and tea) therefore adjust quickly to changes in the wholesale prices. This enables consumers to react quickly to changes in supply. Cocoa beans, on the other hand, have to undergo elaborate transformation processes, during which they are combined with other foods (in varying proportions) to form products completely different from the original.

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<sup>14</sup>Ibid., p.77.

<sup>15</sup>J. K. Dietrich and Alfredo D. Gutierrez, op. cit., pp. 93-99.

<sup>16</sup>Ibid., pp. 98-99.

Due to the structure of the market--stocks, seasonality, advance sales, etc.--the maximum response in grinding demand to changes in the wholesale prices of cocoa beans comes only after a lapse of 6-9 months. As a result, while prices at wholesale may be rising because of lower crops, grinding and consumption demand may rise simultaneously because of earlier low prices of beans, thus compounding the pressure on supplies and the price advance. Figure 3.2 shows that availability and grinding move together. However the decline in grinding demand as a result of the high prices comes after a similar delay, and, if production in the new season is expected to be higher, the depressing effect on price of the higher crop expectation is compounded by reports of decreased grindings--as a result of the high prices in the previous year. These features give the problem of short-term price movements a special importance in any consideration of the possibilities of organizing the cocoa market.

#### Postwar Developments in the Cocoa Market

In the immediate postwar period production was low; the economies of the consuming countries of continental Europe had still to be rebuilt, and consumption in the United Kingdom was limited by rationing until 1953. However, demand gradually built up with the re-opening of the European market, which had no stocks and was starved for

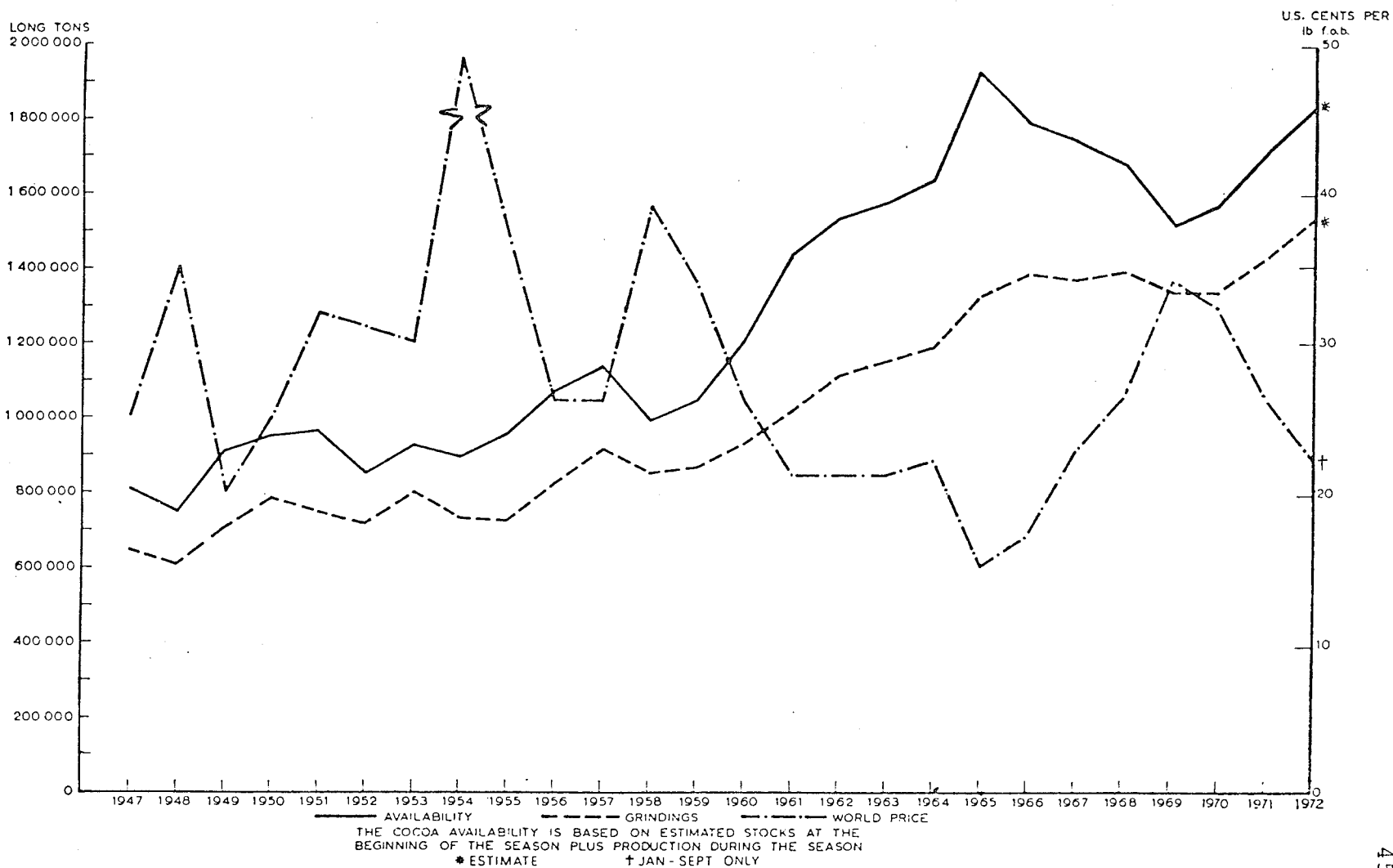


FIGURE 3.2. Cocoa--Postwar Supply, Demand and Price.

Source: Gill and Duffus, Cocoa Statistics, 1972, p. 3.

chocolate products. In 1954 the world price reached an all-time record of more than 57.8 cents per pound, in 1965 it fell to 17.28 cents per pound. The high price of 1954 was due to a temporary shortage because of increased demands coinciding with poor crops. Following this high price there was a surge forward in production which led to a temporary surplus. The downward trend until 1970 was accompanied by several sharp fluctuations.

Two developments followed the sharp price increases of 1954. One of these developments was short and the other longer-term. First, the sharp rise in prices brought about, after the inevitable time lag, a fall in consumption. In 1955 world grindings were lower than at any time since 1949. Secondly, the longer-term effect of the post-war price rise was to stimulate planting, particularly in West Africa, where competition from other export crops was less, and labour and land costs were very much lower than in most Latin American countries.<sup>17</sup>

Considerable price fluctuations took place during the following years, due to production fluctuations coupled with the time-lag in the response of grindings to price changes. During 1954/55 the crop was higher than in the previous year, but the rise in production would not

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<sup>17</sup>Galletti, Baldwin and Dina, op. cit., pp. 385-393.

have had by itself such a great effect on prices, if the increase had not come at a time of a steadily falling demand. The average price of beans fell from 57.8 cents per pound in 1954 to 37.5 cents in 1955, to 27.3 cents in 1956, in 1965 the lowest price was recorded at 17.3 cents per pound. The decline in prices during the period 1954-1956 stimulated a large rise in consumption in 1956-57, and prices rose despite an increase in production. In 1957-58 unfavourable weather conditions resulted in a short crop. This led to a sharp rise in prices to 44.3 cents per pound and necessarily had adverse effects on consumption, which fell by almost eight per cent in 1958.

In 1959 the world cocoa economy entered a new stage. The 1958/59 crop exceeded 900,000 tons for the first time, and in the following years rose above a million tons. The picture was blurred by the large annual fluctuations, which made it difficult to assess the relative importance of weather, new plantings, disease and pest control, and other factors influencing production. The 1959/60 crop of over one million tons--an increase of 14 per cent over the previous year and of 22 per cent over the 1954/59 average--demonstrated that production had moved to a new level. This was confirmed in

1961/62 and the subsequent years. Despite the fact that the crop fell short of the previous year's record by about 40,000 tons, it was still almost 90,000 above that of 1959/60.

Consumption and production were in relatively close balance in 1964, and prices were stable. The large production increase of 1964/65 created an excess supply which resulted in a very steep fall in prices. In 1969/70 production increased about 16 per cent over the 1968/69 crop. In 1971 there was record world production of cocoa and a resulting decline in prices.

#### Outlook and Problems of Longer-Term Forecasting

So far as the longer-run is concerned, it should not in theory be too difficult to forecast production some years ahead, since the main determining elements--number of trees, their age distribution, cultivation practices--are already in existence.<sup>18</sup> In practice, however, inadequate data on tree numbers and plantings make forecasting extremely difficult. The major producers are reported stating that further increases in production must be expected.<sup>19</sup> New planting has been taking place until

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<sup>18</sup>F. H. Weymar, op. cit., pp. 206-210 passim.

<sup>19</sup>Report of the Fourth Session of the FAO Cocoa Study Group, April 1961, CCP/Cocoa 61/0.

recently in Ghana, the Ivory Coast and Nigeria, the yields of which may continue to rise during the next few years. In Latin America the only notable expansion has been in Brazil, but that country's amount of good cocoa land in the present cocoa area is limited, and the replacement of existing ageing plantations will become of increasing importance in the future.

A recent study by UNFAO of the longer-term outlook for production and consumption<sup>20</sup> concluded that "under favourable economic and social conditions--of which prices on world markets and the real price received by farmers are the most important factors--production might be of the order of 1.2-1.3 million tons by 1970." The production levels of 1969/70 and 1970/71, however, indicate that this was a considerable underestimation because 1969/70 and 1970/71 levels were 1.4 and 1.5 million tons respectively, emphasizing the difficulties of forecasting in this sector.

While it is difficult to predict the rate of growth in production during the next five years, there is a somewhat better basis for forecasting consumption. Changes in consumption are determined largely by economic factors such as price and income; and forecasts can be made under different assumptions with respect to the various determinants. Unfortunately a major unknown factor on the demand side is the likely future level of imports into Eastern

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<sup>20</sup>FAO "Agricultural Commodities--Projections for 1970", May 1962.



Europe and the USSR whose imports have been increasing steadily at about 22 per cent per year. Despite the fact that in recent years, imports of cocoa into Eastern Europe have risen considerably, consumer incomes in some countries are not matched by proportionate levels of per capita cocoa consumption, largely because of balance of payments problems facing these countries.

What appears likely is that, if only for climatic reasons, production is likely to develop with considerable yearly fluctuations, while the upward movements of consumption will be more stable. Free market prices may thus show relatively large fluctuations. This means that in years of high production this could cause considerable balance of payment problems for many producing countries. In the long-run low prices will stimulate consumption, which will gradually tend to re-establish a balance between supply and demand, but short-term fluctuations in production may lead to severe price declines.

## CHAPTER 4

### OPERATION OF THE COCOA MARKET AND THE MECHANISM OF PRICE FORMATION

The price of cocoa fluctuates not only from year to year, but from week to week, from day to day, and even from hour to hour. Such price movements, while they are by no means peculiar to cocoa, are a marked inconvenience to manufacturers, and have undesirable effects in cocoa producing areas. Joss argues:

For a manufacturer it can today be a major disaster to buy the bulk of his cocoa at the 'wrong' times, and far too much turns on the ability with which he judges when to buy his cocoa. This puts an excessive premium on success in buying at a time when efficiency in production and the orderly marketing of the industry's products ought to be the manufacturer's consideration.<sup>1</sup>

Similarly, in producing countries other than those where price is stabilized by marketing schemes, short-term price fluctuations make the growers dependent on astuteness or (more probably) good luck in timing their sales, and give opportunities for profits in the buying process which are often obtained at the expense of the price paid to the producers.

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<sup>1</sup>D. H. Joss (Secretary of the Cocoa, Chocolate and Confectionery Alliance, London), Report of the Cocoa Conference (London: September 1955).

The objective of this chapter is to examine the function, form and operation of the institutions of the world cocoa market. The chapter discusses the function which these institutions constituting 'the world cocoa market' perform, and the reasons why the establishment of an equilibrium price for cocoa is a particularly delicate task. This sets the scene for an account of the structure of the domestic market (under the control of Cocoa Marketing Companies) and that of the external market (London and New York markets are very similar). Special attention is devoted to the role and policies of the cocoa marketing companies which are the outlet for all West African cocoa.

#### Marketing Boards

In Ghana and Nigeria, there are long-established marketing boards for cocoa.

In each country, these bodies purchase the entire output at fixed prices and act as sole exporters. Profits realized from their operations in years when world prices are high constitute reserves to compensate losses in years when prices decline. Specifically the Ghana Cocoa Marketing Board's original policy of paying producer prices below world prices was to allow for the accumulation of \$75 million in a stabilisation fund as insurance against the

"vagaries of the world market."<sup>2</sup> After this goal had been achieved, the Board stated in 1950 that:

in view of the increase in the world price of cocoa and the consequent increase in the price to the producer, the originally proposed amount for the Stabilization Fund of \$75 million is now considered to be insufficient and it is the intention eventually to build up this fund to a figure in the neighborhood of \$125 million.<sup>3</sup>

Still later, a goal of \$160 million for the Stabilization Fund was set, but the heavy government export duties initiated in 1951 and 1953 placed an upward limit on both the level of producer prices and the Board's ability to earn a net operating surplus.

Marketing Board reserves are also used for improving production and covering other expenses which relate either directly or indirectly to cocoa, including economic development.

In Nigeria, each of the regions has had its own marketing board since 1954/55, replacing earlier existing boards for specific commodities (e.g., cocoa, cotton, ground nuts, etc.) which extend across regional boundaries. For cocoa, the Board in the Western Region is of particular importance since production is concentrated in that area. This marketing board purchases all cocoa produced

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<sup>2</sup>Ghana Cocoa Marketing Board, Annual Report and Accounts for Season Ending September 30th, 1948, p. 4.

<sup>3</sup>Ghana Cocoa Marketing Board, Annual Report and Accounts for Season Ending September 30th, 1950, p. 1.

within the region and pays the price fixed by the Government ex-scale, at port of export. The buying, financing, and transportation to port are done by licensed buying agents (LBA). These are paid a fixed buying allowance per ton by the board which includes the cost of bags, insurance, interest and charges on financing, middlemen's allowances, overheads and fees.

In Ghana the marketing board exercises similar functions as sole purchaser and exporter of the crop. In 1961 the United Ghana Farmers' Co-operative Council became the sole buying agent of the Board. Prices to producers, which were fixed on a delivered-to-port basis up to 1962/63, are now standard for all official buying points. Until the 1965/66 crop, contributions made toward the Development Plan and the Agricultural Credit Bank were deducted from the price received.

With the objective of stabilizing farm incomes and of providing funds which could be used for improving cocoa production or for general economic development, the expenditure arising from producer prices fixed by the Boards each season have generally been lower than returns from prices realized over the season taken as a whole. However, the decline in world prices since 1950's has resulted in trading deficits and the gradual drawing down of the large reserves of the Boards built up in earlier

years.<sup>4</sup>

Nonetheless, in situations in which world prices were raised to 'remunerative' levels, e.g., under an organization of the market, the Marketing Boards would be fully capable of isolating farmers from the increase and stabilizing producer returns at lower levels by virtue of their monopoly buying power. The importance of this is developed in Chapter 5, and expanded in Chapter 6.

Marketing and Financing. The Case of Ghana

In 1947 the Gold Coast Cocoa Marketing Board was organized and set up to purchase the entire cocoa crop, prescribed the prices to be paid to producers, and was responsible for sales.

The purchasing was first done through private interests, most of them being the same firms which, before the war, traded on their own account. Later, co-operative societies were established which enabled the farmers themselves to collect the middlemen's profits. A Cocoa Purchasing Company was also established in 1952 as a subsidiary of the Cocoa Marketing Board.<sup>5</sup> The cocoa sales,

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<sup>4</sup>H. G. Wehner, Jr., *The Cocoa Marketing Board and Economic Development in Ghana: A Case Study* (Unpublished Ph.D. Dissertation, University of Michigan, 1963), pp. 240-242).

<sup>5</sup>The Cocoa Purchasing Company, like the co-operative societies, also acted as one of the Board's agencies for granting loans to farmers. Following certain

on the other hand, were arranged by the Board's subsidiary Marketing Company registered in London.

An appraisal of the Marketing Board's operations was given by the Royal Institute for International Affairs.

In its study the Institute stated:

The key to the Cocoa Marketing Board's role in Ghana's economy lies in its power to fix the price paid to farmers. The amount offered for their cocoa per ton has been divorced from the price obtained on the world market and has varied since 1950 only within the narrow limits of about \$325. As a result, the income of cocoa farmers has remained fairly constant and the Marketing Board accumulated large surpluses [see Table 4.1].

A different function of the Board has been to advance loans to the Government: by March 1956 a total of about \$17.5 million was outstanding, while a further loan of \$15 million had been authorized. Cocoa proceeds withheld from farmers were, in fact, shared between the Marketing Board and the Government . . . the Government began to absorb a large part of the surplus by raising the export duty and graduating the rates according to the world price for cocoa [see Table 4.1].

. . . in the 1956-1957 season, the Marketing Board had to draw on reserves in order to maintain the price paid to farmers, since the export duty and marketing expenses are adding up to producers' price, maintained

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accusations of corruption, a commission investigated the Purchasing Company's activities in 1956, and discovered that it was, in fact, controlled by the political party in power and used, "for the purpose of winning adherents for that Party, by giving loans out of government-provided funds mainly to party sympathizers. The loan-granting function was taken over by an Agricultural Credit Board." See F. M. Bourret, Ghana: The Road to Independence: 1919-1957 (Stanford: Stanford University Press, 1961), pp. 180-181; see also Royal Institute for International Affairs, Ghana: A Brief Political and Economic Survey (London: Oxford University Press, May 1957), pp. 25 and 45.

TABLE 4.1  
DISTRIBUTION OF COCOA PROCEEDS SELECTED YEARS

Year	Spot Price Cents/lb	Producer	Marketing Board <sup>1</sup>	Export Duty	Other <sup>2</sup>
(- - - Percentage of Spot Price - - -)					
1950/51	32.09	48.4	26.9	18.9	5.8
1951/52	35.59	60.9	3.9	28.6	6.6
1952/53	35.59	56.9	8.1	27.9	7.1
1953/54	37.09	37.5	12.5	45.6	4.4
1954/55	37.79	38.0	7.8	49.6	4.6
1955/56	37.49	66.9	(2.5)	27.9	8.0
1956/57	27.29	78.7	(12.0)	23.6	9.1
1957/58	30.59	44.1	8.0	41.0	.9
1958/59	44.29	48.1	9.4	35.2	7.3
1959/60	36.59	59.2	3.0	27.4	10.4
1960/61	28.39	76.9	(13.8)	21.5	15.4
1961/62	22.59	61.9		38.1 <sup>3</sup>	
1962/63	21.00	66.8		33.2	
1963/64	25.29	55.4		44.6	
1964/65	23.39	55.3		44.7	
1965/66	17.29	80.8		19.2	
1966/67	24.39	38.1		61.9	
1967/68	29.09	35.9		64.1	
1968/69	34.39	37.6		62.4	
1969/70	45.69	30.5		69.5	
1970/71	34.19	52.8		47.2	

<sup>1</sup>Source: Computed from Ghana (Gold Coast) Cocoa Marketing Board Bulletins. ( ) indicates deficit.

<sup>2</sup>Marketing Expenses from producer to port including exporter profits and middlemen's remuneration.

<sup>3</sup>From 1961/62 there was no breakdown of the distribution of cocoa proceeds. Since it was possible to calculate the share of the producer the remaining percentage reflects on the distribution that accrued to all the remaining categories.



since mid-1955 at nearly \$375 a ton. At the end of September 1955 total reserves amounted to nearly \$212.5 million; the part of total reserves earmarked for price stabilization was \$127.5 million.<sup>6</sup>

Distribution of cocoa proceeds as shown in Table 4.1 supports the above statements from the study of the Royal Institute for International Affairs.

The cocoa crop requires financing at two distinct stages. At the first stage--the one between the licensed buying agent and the farmer--the agent makes his own arrangements (mostly bank credit) for paying the farmer for the crop and for bringing the crop to a warehouse at a railroad or, preferably, a port. Once the crop has reached this point, the purchases are cleared to the Marketing Board as awaiting shipment, and the agent then becomes entitled to draw an advance from the Marketing Board up to 90 per cent of the value of the warehoused crop. This constitutes the second stage of the financing, i.e., that between the Board and its licensed buying agent. It is for this stage that the Board requires resources: while some time usually elapses before the warehoused cocoa is shipped, the Board must pay the buying agents 90 per cent of the purchases they declare and warehouse.

Up to the 1959-60 cocoa season, the Ghana Cocoa Marketing Board financed the cocoa crop mainly by using

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<sup>6</sup>Royal Institute for International Affairs, op. cit., pp. 46-47.

its own resources and partly--to the extent of approximately one-sixth of the total amount required--by borrowing.<sup>7</sup> This method is described in Figure 4.1.

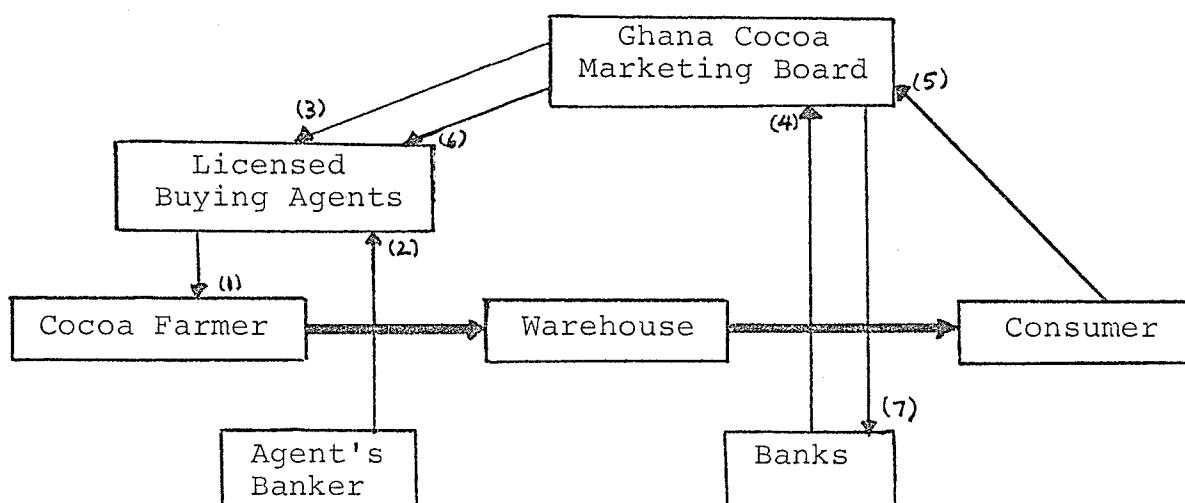


FIGURE 4.1. Cocoa Financing up to 1959-60 Season.

(1) Licensed buying agents pay cocoa farmers cash. . .

(2) . . . with borrowed funds, if necessary.

(3) Ghana Cocoa Marketing Board pays licensed buying agents 90 per cent of warehoused value; 5/6 out of its own resources . . .

(4) . . . and 1/6 out of funds borrowed on the London market.

(5) Consumer pays market price to Marketing Board.

(6) Marketing Board completes payment to buying agents.

(7) Marketing Board repays bank loans.

<sup>7</sup>Bank of Ghana, Report of the Board for the Financial Year Ending 30th of June, 1961 (Accra, 1961), p. 6.

The implications of such a procedure were twofold. First, it meant that the Ghana Cocoa Marketing Board had to maintain a substantial part of its own resources in very liquid assets and cash and to hold them idle for between six and nine months of the year due to the seasonality of the crop. Consequently, the Board had to keep extremely high balances on demand deposits and time deposits in London--it very often had as much as \$50 million on deposit account. The second implication was that the Board's financial affairs were conducted mainly in London, and not in Accra, inasmuch as the world cocoa market was in London. Since the Board had to borrow seasonally a substantial part of the funds it required, the rate of interest which applied to much of the Board's borrowing necessarily was the rate which could be obtained in the United Kingdom.

So long as it was cheaper to borrow in London than in Accra it was advantageous that the Board should be able to do so. But for the season 1958-59 and more so in 1959-60 the rates of interest on overdrafts in London were fairly high.<sup>8</sup>

The institution, in February 1960, of monthly issues and redemptions of Treasury Bills by the Bank of

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<sup>8</sup>Bank of Ghana, op. cit., p. 5. See also J. C. Abbott and H. C. Creupelandt, Agricultural Marketing Boards Their Establishment and Operation, FAO Publication No. 5, Rome, 1966, pp. 148-155.

Ghana opened the road toward the creation of a local money market: this was expected to prevent the seasonal flow of funds between Accra and the world's financial centers by providing the commercial banks with a suitable security in which they could invest their temporarily idle funds. A change in the Bank of Ghana's policy was expected, however, which would enable it to influence the local interest structure by fixing the rate of Treasury Bills independently of the market rates abroad.

When this scheme had first been outlined roughly 50 per cent of the financing was needed in Ghana and the other 50 per cent in London. The bill scheme was to cover only the part payable in Ghana. This was necessary because, at the time, the structure of the licensed buying agencies was such that payment was required in the proportion of 50 per cent in sterling and 50 per cent in Ghanaian pounds. By 1960, however, when the scheme was rounded into final form and put into operation, the licensed buying agency system was almost completely Ghanaian, so that payment was required to be entirely in Ghanaian pounds. The bill scheme was accordingly extended to cover not 50 per cent but the entire financing of the crop.

The essence of the plan was described in the following terms:

Under the bill finance scheme, the Board met its requirements of cash by drawing 90-day bills of exchange on its subsidiary marketing company in London--the Ghana Cocoa Marketing Company Limited. The Marketing Company accepted the bills which were then discounted by the Board with the Ghana Commercial Bank. By Government policy, the bill finance business was, during the first year of its operations, to be handled exclusively by the Ghana Commercial Bank--a Government owned bank. The Bank of Ghana backed the scheme by giving rediscounted facilities up to a limit arranged from time to time. The bills rediscounted (which were regarded as sterling bills) were taken into the Issue Department as part of the currency cover assets.<sup>9</sup> [See Figure 4.2]

This bill finance scheme was designated among British observers as a "pork upon pig" system--a slang expression for passing a postdated cheque--because the bills discounted by the Ghana Commercial Bank and considered as currency issue coverage when discounted by the Bank of Ghana could only be honoured when and if the cocoa was actually sold by the Marketing Company to the consumers or their agents. The operation of the scheme is so complicated that a hypothetical example is needed for explanation.

Assume situation at, say, the end of January, 1961:

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<sup>9</sup>Bank of Ghana, op. cit., p. 6. The financial year ends on June 30th. The main cocoa season extends from September to January and the mid-crop season from April to June. See also W. Birmingham, I. Neustadt and E. N. Onaboe, A Study of Contemporary Ghana, Vol. I (Evanston, Northwestern University Press, 1966), pp. 367-390.

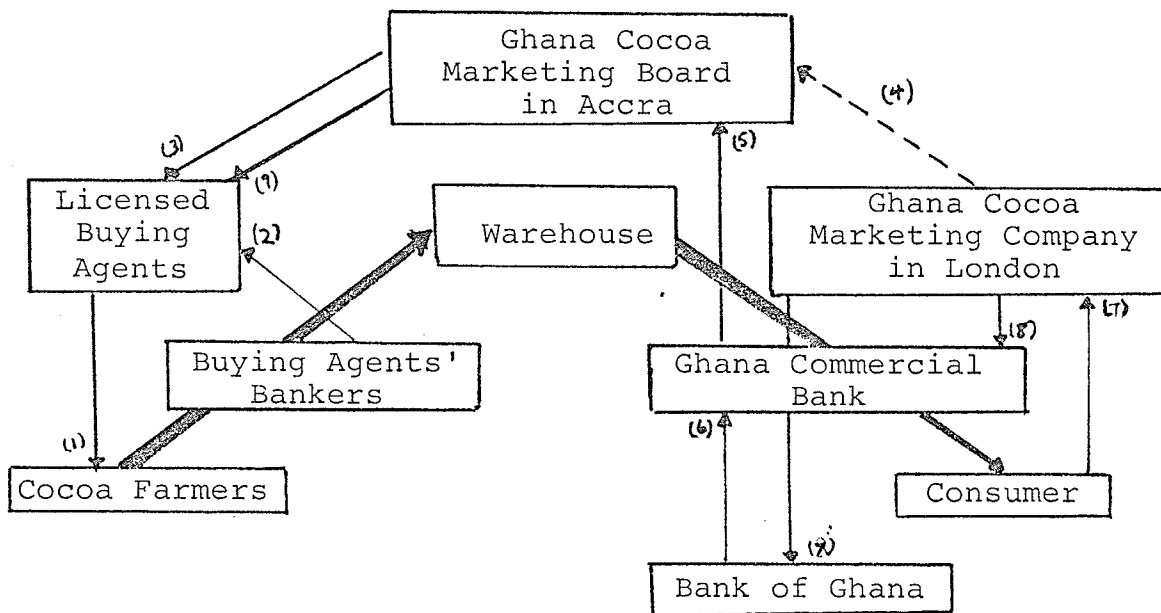


FIGURE 4.2. Cocoa Financing in the 1960-61 Season.

(1) Licensed buying agents pay the cocoa farmers cash . . .

(2) . . . with borrowed funds, if necessary.

(3) Ghana Cocoa Marketing Board pays the licensed buying agents 90 per cent of warehouse value . . .

(4) . . . with funds it has to raise. To do so, it draws 90-day bills of exchange on its subsidiary, the Cocoa Marketing Board, in London.

(5) After acceptance, these bills are discounted at 5 1/2 per cent by the Ghana Commercial Bank, which has the exclusive right to do so.

(6) The Bank of Ghana (central bank) backs the scheme by giving rediscounted facilities, at the rate of 4 1/2 per cent up to a limit arranged from time to time.

(7) The Consumer pays the Cocoa Marketing Company at market price.

(8) The Marketing Company honors its bills, either to the Ghana Commercial Bank or the Bank of Ghana (8').

(9) Ghana Cocoa Marketing Board completes its payments to licensed buying agents (if the quality of the beans has been accepted by the customer).

400,000 tons billed to Marketing Company in London at \$325 a ton, f.o.b. (\$275 paid to farmer plus \$50 for warehousing and handling cost of Marketing Board in Accra) . . . . .	\$130,000,000
120,000 tons sold and shipped to customers at \$450 a ton, f.o.b. (market price), less \$100 a ton for export duty payable to government. . . . .	42,000,000
130,000 tons sold to customers at \$450 a ton, f.o.b., less \$100 a ton for export duty, but not shipped . . . . .	<u>45,500,000</u>
No collateral for. . . . .	\$ 42,500,000

Until really sold, the remaining 150,000 tons of cocoa which were billed to the Marketing Company should not be considered as collateral for bill borrowing, in view of the risk that part of the crop might not be sold at all or that certain quantities might have to be sold at knockdown prices. The cocoa beans being highly perishable in the tropical climate and difficult to store over a prolonged period, this risk is particularly high. It actually happened in February 1961 that 35,000 tons were sold to one of the world's biggest cocoa consumers for \$275 a ton, i.e., less than the amount previously billed to the Cocoa Marketing Company. At the same time, the total amount of

bills rediscounted and held by the Bank of Ghana reached a peak of \$53.75 million.<sup>10</sup>

At the close of the 1960-61 season, the marketing of cocoa went through a complete reorganization in Ghana. The government established an Agricultural Produce Marketing Board<sup>11</sup> to deal with the marketing of cocoa, other exportable agricultural commodities, and locally consumed foodstuffs. This was a merger of the Cocoa Marketing Board and the Agricultural Development Corporation, which had previously handled all exportable commodities except cocoa. On the purchasing side (from farmers), the new scheme made the United Ghana Farmers' Council the sole buying agent for the entire crop. On the selling side, the authority remained with the Ghana Cocoa Marketing Company, but this was moved from London to Accra. This change implied that the whole financial plan had to be altered, since bills drawn on the Cocoa Marketing Company in Accra could not be considered as an adequate currency issue covered by the Bank of Ghana. A new arrangement was devised which provided the Ghanaian

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<sup>10</sup>Bank of Ghana, op. cit., 1961, p. 19.

<sup>11</sup>This Agricultural Produce Marketing Board was later found inefficient and corrupt after two years of its operations and was consequently dissolved. The Ghana Cocoa Marketing Board then took over the responsibilities of the Board, but the financing scheme remained the same.



banking system with a different kind of surety for its financing of the cocoa crop: the cocoa consumer, or his agent, was required to provide a banker's irrevocable letter of credit when placing his orders. This letter was issued to the Ghana Commercial Bank in favor of the Ghana Cocoa Marketing Board (Figure 4.3 explains this set up).

It was realized, however, that the request for a letter of credit created an additional cost to the consumer and might possibly discourage some of them from buying in Ghana. The United States customers were therefore authorized to continue paying cash against documents and were excluded from the new scheme.

The essential difference between the 1960-61 bill financing scheme and the 1961-62 letter of credit financing system was one of timing. In the bill scheme, provision of collateral preceded the banking system's advances to the Marketing Board. In the letter of credit plan, the collateral was provided after these advances were made. The quality of the collateral was improved, since this was no longer a promise from a subsidiary organization but a firm commitment from the actual purchaser. The total amount of these commitments, however, was not necessarily equal to the amount of the advances

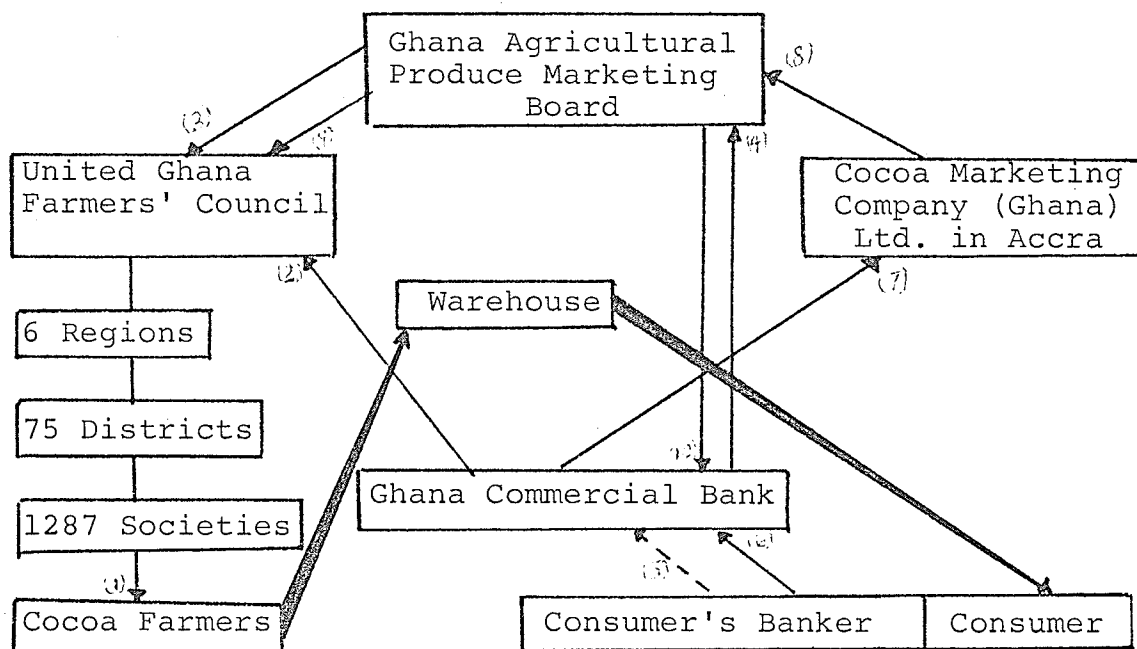


FIGURE 4.3. Cocoa Financing Scheme Started in 1961-62.

(1) The United Ghana Farmer's Council, sole buying agent, pays the cocoa farmers cash, through its sub-organizations: regional, districts and co-operative societies.

(2) It borrows from the Ghana Commercial Bank, an overdraft, at the rate of 6 1/2 per cent to 8 per cent.

(3) The Ghana Agricultural Produce Marketing Board pays the Ghana Farmers' Council 90 per cent of the warehoused value of the crop.

(4) To do so, the Ghana Agricultural Produce Marketing Board borrows at 6 1/2 per cent on overdraft from the Ghana Commercial Bank.

(5) The bank's security follows; in this system, the consumer does not order through the Marketing Company any longer: he places his order with the Ghana Commercial Bank through his own banker who sends an irrevocable letter of credit; the Ghana Commercial Bank notifies the Marketing Company of the order.

(6) When the invoices are sent by the Marketing Company, the Ghana Commercial Bank draws on consumers' banker and . . .

(7) . . . credits the Marketing Company which . . .

(8) . . . credits the Ghana Agricultural Produce Marketing Board which . . .

(9) . . . credits the outstanding 10 per cent to the Ghana Farmers' Council.

(10) The Ghana Agricultural Produce Marketing Board balances its account with the Ghana Commercial Bank.

granted to the Marketing Board.<sup>12</sup> As in the bill financing scheme, these two amounts only balanced if: (a) the market price did not fall below the price paid to the farmers, plus storage, handling, and marketing costs, as well as export duty; (b) the quantities sold at market price were sufficient to cover these aggregate costs. Consequently, both schemes created an inflationary risk by overexpanding the money supply. There was correlation between a tendency toward rising prices and an extension of the money supply.<sup>13</sup>

It seemed obvious that some more comprehensive action was needed to meet this challenge, as well as to avoid the fluctuations of income which, being totally unpredictable, hindered the fulfillment and even the preparation of long-term plans for the country's economic development. Within the national boundaries, the marketing scheme seemed to have achieved the stabilization of each individual producer's nominal income by taxing exports in good times and subsidizing them in bad times. Avoiding the danger of inflation and steadying the country's global income, however, were goals which,

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<sup>12</sup>Quarterly Digest of Statistics (Accra: Central Bureau of Statistics, September 1962), pp. 53-54.

<sup>13</sup>Quarterly Digest of Statistics, op. cit., pp. 53-54, 57 and 62.

seemingly, could be achieved only by policies and schemes organized on an international basis.

#### Caisses de Stabilization

In the African cocoa-producing countries of the franc zone, Caisses de Stabilisation des Prix were set up in the mid 1950's. The legal framework which sanctions the Caisse is defined by the Republic of France. These cover over 20 per cent of total world production. The operations of the Caisses centre on the fixing of a price for the purchase of cocoa from farmers at the beginning of the crop year, and of a second, equivalent, f.o.b. export price, which takes into account expected costs and the remuneration of exporters (see Table 4.2). The schedule of producer and f.o.b. prices is prescribed by law.<sup>14</sup> If the realised price exceeds the fixed f.o.b. price, the exporter pays the difference, or a part thereof to the Caisse. If the realized price is less, the Caisse pays the difference to the exporter. While the Caisse has control over prices paid to producers and, through licensing, returns to exporters, the exporters keep their functions (unlike under Marketing Boards) of purchasing the crop and marketing it abroad (see Figure 4.4).

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<sup>14</sup> Republic of France Decree of 14th October 1954. See also Republic of Ivory Coast Decree 17th of August 1964. Further information given through personal interview with Mr. Margueron Michel, Director of Chamber of Commerce, Ivory Coast.

TABLE 4.2. Price Determination by Caisse.<sup>a/</sup>

(A)	CAF Price FF	FF 572,000
	Less Expenses and Freight	FF <u>-35,000</u>
	F.O.B.	FF <u><u>537,000</u></u>
(B)	537,000 = F.O.B. in Cameroon Francs	FF 268,000
(C)	F.O.B. Price less local expenses (C.F.A.)	FF <u>35,164</u>
	V.L.M.	FF 233,336
(D)	V.L.M. less packing, storage and local transfer	FF <u>8,900</u>
	Caisse NV - Bascuce Douala (On world price)	FF 224,436
	Official Price of Caisse	FF <u>70,000</u>
	Exporter pays to Caisse	FF <u>154,436</u>

<sup>a/</sup>Source: Information provided by Mr. Margueron Michel, Director of Chamber of Commerce, Ivory Coast, and M. Ndongo Joseph, Chef de Service Adjoint, Caisse de Stabilization, Doula. The figures shown above are hypothetical for illustration purposes only.

CAF represents CIF

FF represents French Francs

CFA represents African French Francs

VLM represents value locale magazine

NV represents Caisse price based on world price.

In the event of the Caisses' reserves being insufficient to compensate for the difference between world market prices and the equivalent f.o.b. price, advances may be obtained through the EEC "for the purpose of helping to alleviate the effects of temporary fluctuations in world prices".<sup>15</sup> These advances may be granted to existing stabilization funds or to ones set up in the future in the Associated States.

By and large, the activities of the national Caisses have sheltered farmers from large fluctuations in prices. As under the Marketing Boards, the price set for producers has normally been lower than realized prices after allowing for intervening marketing charges (Table 4.3). In the longer run, however, depressed prices in world markets and the consequent depletion of the Caisses' reserves have been reflected in a gradual reduction of prices to producers since the early 1960's. Uncertainty over the adequacy of the Caisses' resources, as a result of the large price fall in world markets in 1965 led to a substantial reduction in prices guaranteed to producers in several countries for the 1965/66 main crop. However, in the event of increased world prices, the Caisses, like the Boards, provided an institutional framework for

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<sup>15</sup> Convention of Association between the EEC and the Associated African and Malagasy States, Title II, Art. 17(4).

TABLE 4.3. Prices Paid or Guaranteed Local Farmers.

Year October/ September	New York, Ghana Cocoa Price (a)	Ghana Producer Price (b)	Nigeria Producer Price (c)	Ivory Coast Producer Price (d)	Cameroon Producer Price (e)
( - - - - - U.S. cents/lb - - - - - )					
1950/51	36.7	16.3	15.0	15.8	17.7
1951/52	35.2	18.7	21.3	20.2	19.3
1952/53	34.2	16.3	21.3	20.0	17.9
1953/54	56.5	16.7	20.8	37.9	36.6
1954/55	41.3	16.7	24.5	21.1	18.6
1955/56	28.8	18.7	24.5	13.9	12.1
1956/57	27.2	18.7	18.3	19.9	18.0
1957/58	43.6	16.7	18.3	19.9	19.2
1958/59	41.5	14.0	18.3	20.4	17.2
1959/60	29.9	14.0	19.5	21.5	18.2
1960/61	23.6	14.0	18.5	21.5	18.2
1961/62	21.0	12.6	24.5	15.6	16.9
1962/63	23.9	12.6	24.5	15.6	15.8
1963/64	24.1	11.7	12.6	15.6	17.1
1964/65	18.4	11.7	12.6	15.6	13.4
1965/66	23.1	9.3	11.9	12.5	15.4
1966/67	27.5	11.7	8.2	15.6	9.9
1967/68	29.1	10.6	10.2	15.6	11.8
1968/69	34.4	11.4	10.8	15.6	12.1
1969/70	45.7	13.9	13.9	15.6	13.4
1970/71	34.1	16.0	16.9	15.6	15.4
1971/72	26.8	13.0	16.6	15.4	15.7
1972/73	32.3	11.2	16.6	15.4	16.3

(a) Source: computed from Commodity Year Book issues from 1957-1972. Prices for 1972-73 are forecast from Gill and Duffus.

(b) Source: computed from Cocoa Marketing Board Annual Report various issues. Converted here into U. S. cents per pound. 1972-73 prices are forecasts from Gill and Duffus.

(c) Computed from Cocoa Marketing Board, Annual Report, various years, and Newsletter. 1951/52 and 53/54

TABLE 4.3 (continued)

values computed from FAO Commodity Services, Bulletin No. 27, Cocoa (Nov. 1955), thereafter from Gerald K. Helleiner, The Fiscal Role of the Marketing Board in Nigerian Economic Development, 1947-1961. Economic Journal (Sept. 1964). 1961-1973 from Gill and Duffus.

(d) Prices for 1950/51 to 1956/57 computed from France, Ministère de la France d'Outre-Mer. Service des Statistiques, Outre-Mer, 1958 in CFA referring to 'prix nuboscule, Cacao courant' in Abidjan but the figures have been recalculated into cents per pound. 1958-1973 prices from Gill and Duffus.

(e) Prices from 1950/51 - 1956/57 refer to quotations at Doula. Sources for these and later prices are the same as for the Ivory Coast, they have been converted into U. S. cents per pound. 1958-1968 prices calculated from Le Marche International Du Cacao, published by Government of the Republic of Cameroon 1970. Prices for 1968-1973 from Gill and Duffus.



stabilizing producer prices, and isolating the farmer from 'remunerative' increases in the world price.

In Cameroons there are two institutions: the Caisse de Stabilization is established and operates in Southern Cameroon while the Cocoa Marketing Board operates in Western Cameroon. However both South and West form the Federal Republic of Cameroon. In the West the Marketing Board collects cocoa from the co-operative farms and sells to the exporters at the going world market price. There are 9 exporters in every administrative division (there are 17 divisions in all, see Figure 4.4). Each exporter is allowed a maximum of 9 Licensed Buying Agents who buys for the exporter. This operation is similar to the Marketing Boards in Ghana and Nigeria.

The caisse set up in Ivory Coast and Southern Cameroon are similar. In both countries exporters transport cocoa to the port from the LBA who buys from middlemen. The middlemen procure their cocoa from farmers. At 5:30 p.m. every day the LBA informs the exporter of the quantity of cocoa bought. The exporter by law declares all purchases bought by his 9 middlemen before 6:00 p.m. to the Caisse. At 6:30 p.m. every day the Caisse is able to know the quantity of cocoa bought in the country by the exporters. The Caisse sets the price to be paid to producers for the whole season but exporters can pay higher prices above but

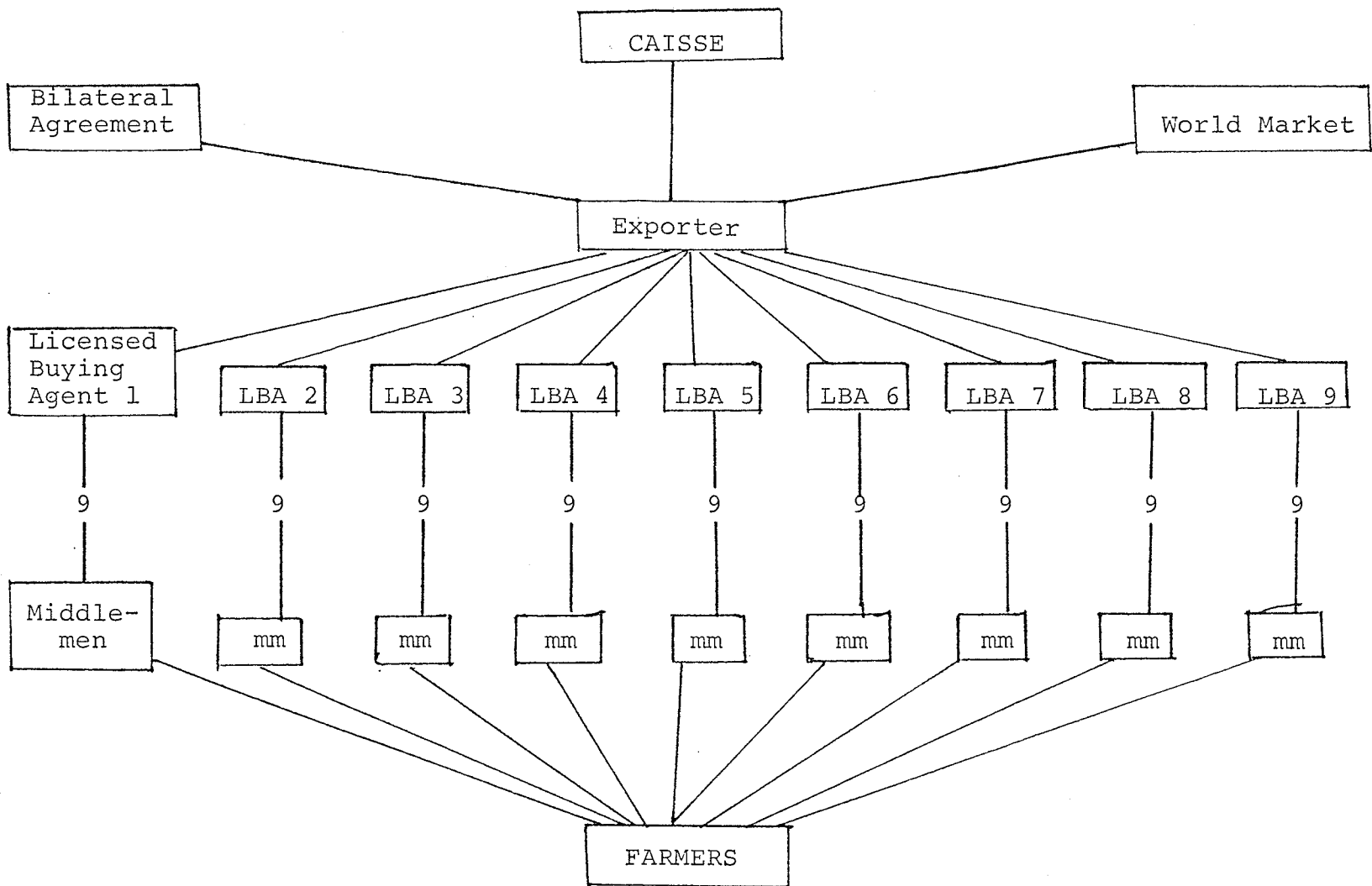


FIGURE 4.4. Marketing Channel of Caisse.

not below the price set by the Caisse.

There are basically three ways to sell cocoa under the Caisse system. (1) Exporters can sell directly abroad during the crop season; (2) exporters can sell before the crop season. This is not very acceptable because the exporter then knows before the crop season that he will be appointed for the season as an exporter. Some exporters have sizeable investments in cocoa and contribute financially towards the economic, social and political set up, thereby assuring that their names will not be eliminated from the exporters list;<sup>16</sup> (3) since the Communist block prefers bilateral agreement to buying from the open markets, the Caisse has mechanisms in its system whereby any exporter can be instructed to ship a specified quantity to any country on a contract basis, before or after the crop season. The Caisse does not depend upon the Government for funds.

Under the third method the Caisse can stop all exporters exporting cocoa abroad except through the Caisse especially during periods of depressed world cocoa prices.

Exporters who have been authorized by the Caisse to export cocoa for the crop season obtain credit facilities

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<sup>16</sup>Information given by Mr. Kritikos, a leading exporter of cocoa in southern Cameroon.

from the Banque Central d'Afrique.

When the exporter declares his purchases for the day the Caisse publishes what the world price is and at what price it expects the exporters to sell their beans. Assume in January the Caisse publishes world price to be 500 F and an exporter had declared 10,000 tons for that month at producer price of say 70 F per kilo. If in February world price falls to 400 F the difference of 100 F is entirely a loss to the exporter if he is left with an unsold quantity from January purchases. However, if he sells it over the 500 F the excess is a gain to the exporter. After the exporter has sold his cocoa he pays to the Caisse the difference between the two Caisse established prices i.e., the established world price less the established producer price. Actually world price - c.i.f. + Custom duties = Caisse Price (to exporter) (see Table 4.4). The exporters sell usually in bulk at the end of the month though the Caisse determines the exporter price every day according to the daily world price fluctuations. But the producer price is set for the whole season without any change. Hence the only outlet opened to the exporters to make profits is to sell over and above the price quoted by the Caisse. The exporters have agents in all the leading world markets and these try to obtain good prices for the exporter either in the futures market or in

TABLE 4.4. Derivation of Cocoa Quotation by  
Caisse: Cameroon.

			CIF FF: 673.489 per ton	
New York	Amsterdam	France		
cents/lb	FIH/lb	In FF		
37.85	572		1. Weight Freight	10.697
			2. Maritime Insurance	
			0.67% of CIF	
			3. Loss in Transit	
			1.75% of CIF	
In FF	In FF		4. Cost of Supervision	
x 10.88422	x 1.3638		at dock	.210
411.968	780.094	625,000	5. Financial Expense	
			for Maritime trans-	
			port 0.50% FF	
			6. Brokerage Fee	
			0.75% CIF	
			7. European Storage Cost	
			0.50% CIF	
			= 4.17% (2+3+5+6+7)	
			of 673,489	<u>28.084</u>
			TOTAL IN FF (1+4+7)	38.991
			F.O.B. in FF	
			(673.489-38991)	634.498
			In CFA (Cameroon	
			currency) <u>634.498=</u>	317.249
				<u>2</u>
			8. Transport Cost	.250
			9. Port Tax	.607
			10. Fumigation Cost	.075
			11. Toll	.020
			12. Fee of Attorney in Customs	250
			13. Loading Tax	.712
			14. Export Permit	27.200
			15. Marketing Board Tax	1.000
			16. Packaging Tax	.550
			17. Plant Quarantine Tax	.050
			18. General African Course	3.200
			19. Commission to Exporter	<u>1.250</u>
			TOTAL Charges	<u>35.164</u>
				VLM <u>282.085</u>
			20. Packaging	2.010
			21. Warehouse Rent	.150
				2.325
			22. Warehouse Insurance	.165
			23. Financial Cost (6% for 3	
			months of VLM less losses)	1.5%
				<u>4.189</u>
			24. Loss During Repacking and	
			Storage (1% of VLM-Packaging)	<u>2.801</u>
			25. Handling and Shipping	<u>.800</u>
			TOTAL	<u>10.115</u>
			Price of 1 Ton of Cocoa at Doula CFA	271.970/ton

Source: Calculated from Accounts Books of Messrs.

Kritikos and Co. Doula.

the open market.

It is important to note that the Caisse takes the average price of the four leading world markets (Amsterdam, New York, Paris, London) before setting the price for the exporter.

The Caisse withdrew about 1,500,000 CFA to support producer price during the 1964/65 decline in world prices.

#### Marketing Organization in Brazil

In Brazil, the production and marketing of cocoa are also affected, though more indirectly than in Africa, by the activities of public or semi-public organizations. Here, the organizations are the Bahia Cocoa Trade Commission and the Foreign Trade Department of the Bank of Brazil (CACEX). The marketing system in Brazil has been changed a number of times in recent years, as a result of changing world market conditions for the crop. While the most recent system is of greatest interest in any consideration of proposals to organize the world cocoa market, it is also useful to consider briefly the system in effect during a previous period of high prices.

At the time of high world prices in 1958, regulation was achieved through a combination of guaranteed prices to producers, fixed prices at which CACEX undertook to purchase cocoa from exporters, minimum authorized export prices, and multiple exchange rates for export earnings

from cocoa and cocoa products. During the earlier periods of low prices, these measures aimed at stabilizing returns to producers and exporters.<sup>17</sup> Minimum export prices combined with licensing procedures were used in an attempt to regulate the prices at which Brazilian cocoa was made available on world markets.

Several quantitative changes in the regulatory system took place during the 1958/59 season. Prices guaranteed to producers were increased, and the price at which CACEX would make purchases from exporters, as well as the minimum authorized export price, were also raised. During the period there was an increasing disparity between the free market rate for foreign exchange and the official rate.<sup>18</sup> While the rates of exchange for a wide range of commodity exports were increased due to an increase in foreign export bonuses, those for cocoa beans remained unchanged, and that for cocoa butter was reduced. In an earlier period (1952), maintenance of a less favourable exchange rate for cocoa exports was said to be justified by the high prices being obtained in world markets, since it was believed that more favourable rates would have the

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<sup>17</sup>Pan-American Union, "Documentary Material on Cocoa," . . . Part I (Washington, D. C., May 1957), p. 3.

<sup>18</sup>General Cocoa, Inc. Market Bulletin of Aug. 16, 1960, p. 7.

disadvantage of stimulating excessive expansion of production which might ultimately bring about reduced world prices.<sup>19</sup>

The most recent system of cocoa marketing in Brazil, and that currently in effect was developed during the second quarter of 1965. Commencing from 1964/65 the harvesting of the Bahia main crop saw an intensification of the difficulties facing farmers. A series of emergency measures were operative through the early part of April 1965. Thereafter, because of prices prevailing in overseas markets, the exporters could only afford to buy cocoa at prices which were unacceptable to farmers. An agreement was consequently reached whereby exporters and the processing industry would purchase directly from the farmer, paying prices equivalent to current world market levels. The difference between this price and price guaranteed to farmers is made up by CACEX through the Executive Commission for Cocoa Planting (CEPIAC). However, with a continuing deterioration in the market, subsidies to farmers have been reduced through changes in the method of calculating the domestic equivalent of current world prices.

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<sup>19</sup>Conjuntura Economica, March 1953, p. 57. Quoted in U. S. Federal Trade Commission, Economic Report of the Investigation of Coffee Prices, July 1954, p. 114.



Stabilization of cocoa producer prices, in Brazil is currently aimed at mitigating the effects of low world prices. In situations involving higher world prices, neither the present Brazilian system nor one similar to that in existence during the 1958 season provides the framework for isolating the farmer from the world market, since both systems involve guaranteed prices to farmers which constitute only lower limits on returns. Hence, should the organization of the world market at higher prices require the isolation of the producer from such increases, means to accomplish this, whether of a fiscal nature or otherwise, would have to be devised in Brazil as well as in other countries where relatively 'free' marketing systems are currently in operation.

Prices in Consuming Countries.

The Commodity Markets

Since most of each season's cocoa export supply becomes available during the late fall and winter with the harvesting of the main crops in West Africa and Brazil,<sup>20</sup> manufacturers, who hold the bulk of cocoa stocks, purchase their supplies well in advance of current production needs. Other dealers in consuming countries also carry inventories

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<sup>20</sup>FAO, World Cocoa Survey (UN FAO, Rome, 1964), p. 4; 112; 124; 138. See also Commodity Year Book 1972, ed. by Harry Jiler and others, op. cit., p. 13.

permitting them to meet processors' needs over the year for various grades of cocoa. These requirements are mostly met through purchases in the commodity markets in consuming countries.

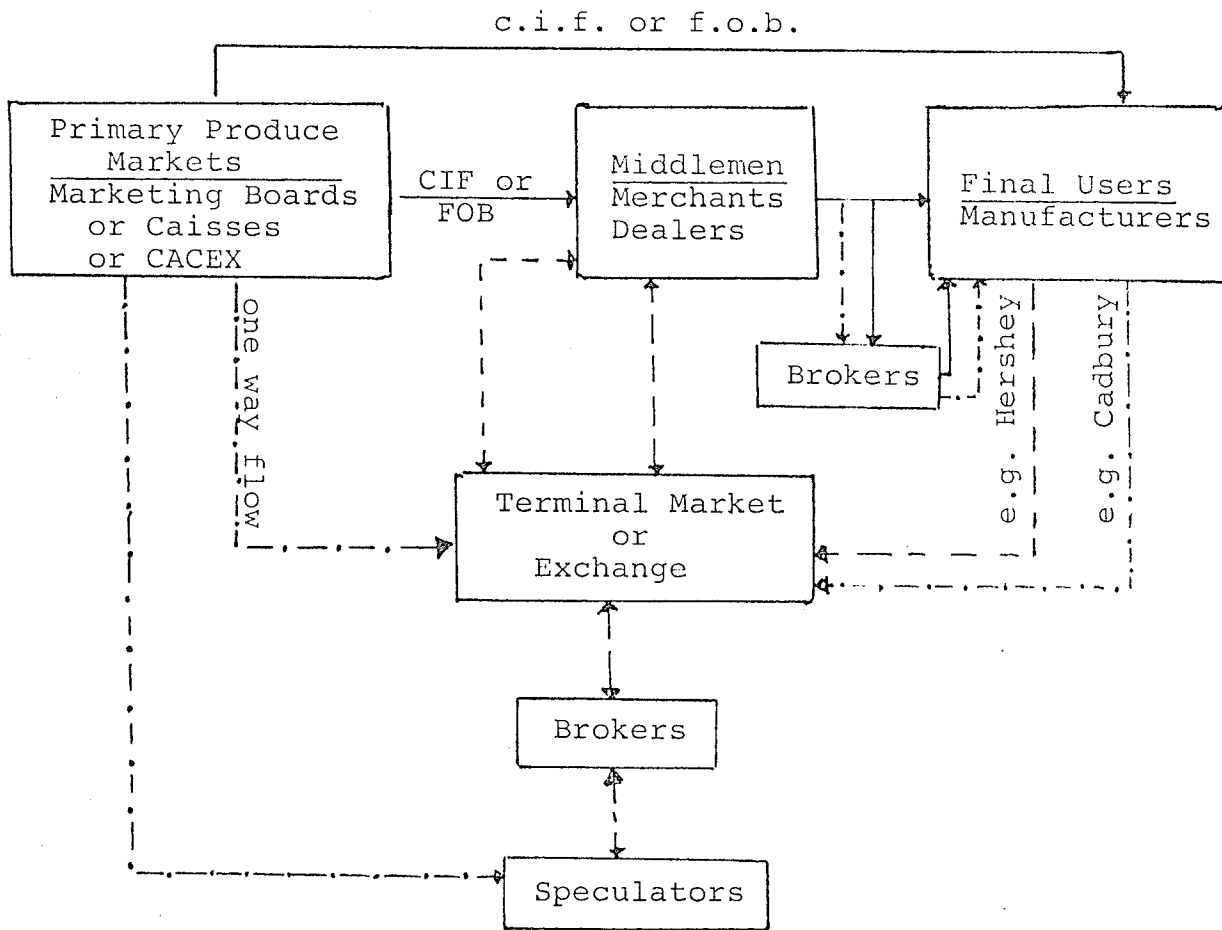
With the establishment of the New York Cocoa Exchange in 1925 and the London Terminal Market the following year, pricing efficiency was further improved. It has been shown that futures markets are superior to cash markets in price determination because they provide central market prices established in open competitive bargaining, among other virtues.<sup>21</sup>

The following description applies to the London market. The organization of the New York market appears to be very similar.

The London market may be divided into two sections, the 'actuals market' and the terminal market. It is through the 'actuals market' that manufacturers buy the bulk of their cocoa; little cocoa changes hands in the terminal market, which is primarily concerned with paper transactions as depicted in Figure 4.5. The "Actuals Market"<sup>22</sup> is merely a convenient term for the sum of trans-

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<sup>21</sup>Henry H. Bakker, "The Factors Favouring a Futures Contract for Live Hogs Outweigh Those Against It," in Futures Trading in Livestock Origins and Concepts, H. H. Bakker, ed., Madison, Wisconsin, Mimir Publishers, Inc., 1970. For comprehensive work on cocoa futures markets advantages see Weymar, op. cit., pp. 38-52. See also T. A. Kofi, "A Framework for Comparing the Efficiency of Futures Markets,"



Flows of actual cocoa —————>  
 Paper flows - - -> hedging and speculation <- - - - ->  
 Information flows <- . . . . .>

FIGURE 4.5. Cocoa Bean Pricing Channels and Institutions.

Source: T. A. Kofi, Vertical Price Relations. Mimeo, Food Research Institute, Stanford University, Stanford, July 1973, p. 28.

actions the main purpose of which is the actual buying and selling of cocoa. Transactions on the actuals market are not necessarily public. Direct information about prices is therefore somewhat imperfect, although it appears that buyers and sellers can in fact keep themselves reasonably well informed, and one important element--the price currently quoted by the Marketing Companies--is public knowledge. By contrast, all transactions in the terminal market have to be made by "public outcry".

The actuals market is in three layers. There is an extensive class of brokers and dealers between the importers and the manufacturers. A broker purchases on the orders of particular buyers, taking a commission (0.5 per cent in London). His main economic function is to look after the legal formalities of the transaction. A manufacturer may buy from the marketing companies through a broker, and the transaction is then virtually a direct one between the manufacturer and the Marketing Companies. Dealers, on the other hand, "take a position" and buy cocoa for which they have not yet found a customer, or contract

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AJAE, Vol. 55, No. 4, Part 1, Nov. 1973, pp. 584-594. See also Thomas A. Hieronymus, Economics of Futures Trading (New York, Commodity Research Bureau, Inc., 1971), pp. 238-240.

<sup>22</sup>The "actuals market" is named here in inverted commas, since it is not in fact a unified market at all.

to supply cocoa which they have not yet bought, hoping to make a profit.<sup>23</sup>

One may correctly ask what is the function of the dealers. The answer is simple, they introduce an element of flexibility into the actuals market. Their function is to take advantage of the full facilities of the market on behalf of small manufacturers, who have neither the funds nor the knowledge to do so for themselves; the dealers profit by obtaining for small buyers terms slightly more favourable than they would otherwise obtain in a market dominated by a few large concerns (see Figure 4.6).

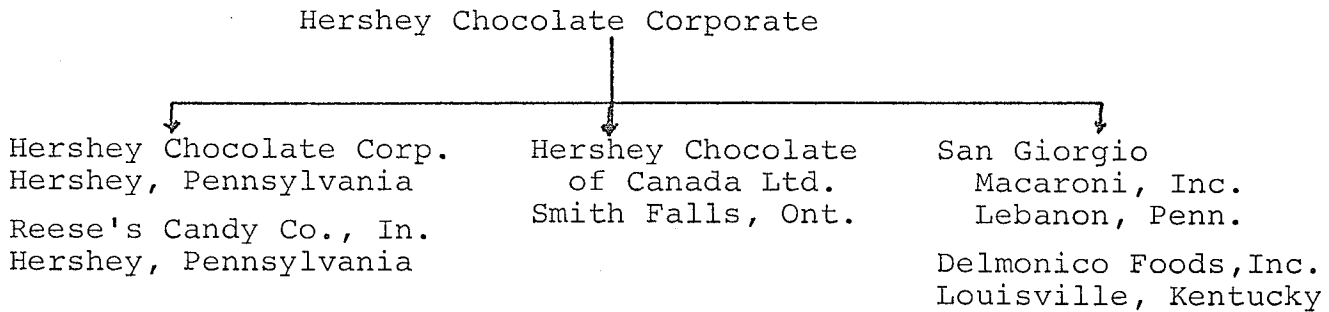
Dealers reduce their risk by hedging their transactions on the terminal market. There is little hedging by manufacturers in the United Kingdom.<sup>24</sup> In New York there is rather more hedging by manufacturers. Besides providing facilities for covering actual transactions, the terminal markets are open to pure speculators who have no interest in the physical cocoa. The volume of transactions on the terminal markets far exceeds the actual tonnage of cocoa changing hands. Thus transactions on the New York terminal market habitually amount to about three times

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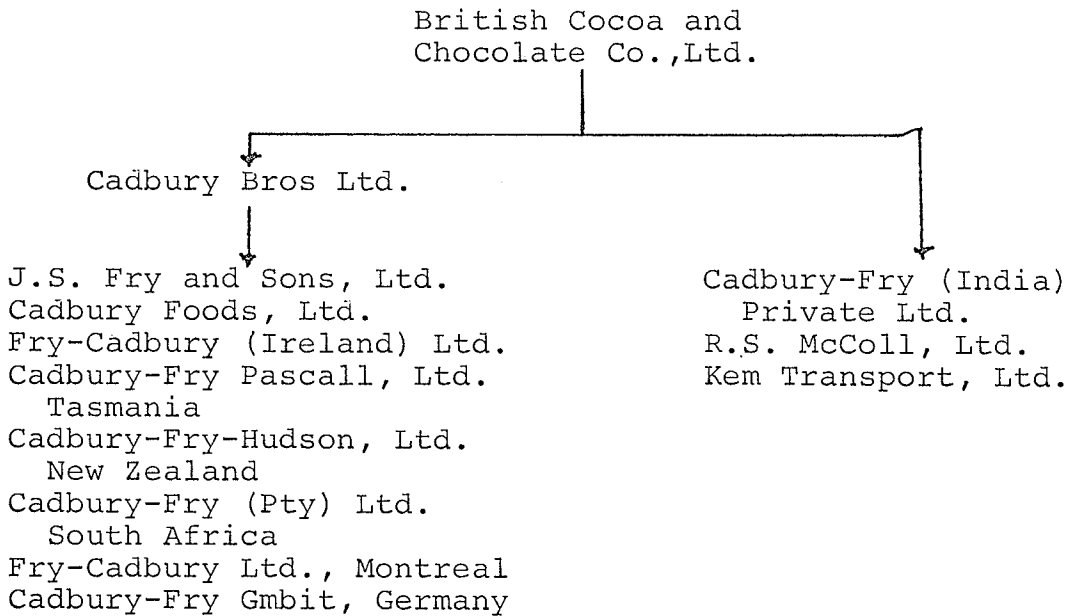
<sup>23</sup>There is no hard-and-fast institutional distinction between brokers and dealers: the same firm may take a fixed commission on certain transactions, while also acting as a dealer.

<sup>24</sup>Hedging of purchases by Cadbury, Fry and Rowntree would, in any case, hardly be practical because of the size of these purchases.

1. Structure of the Hershey Group



2. Structure of the British Chocolate Co., Ltd.



3. Structure of the Nestle Group

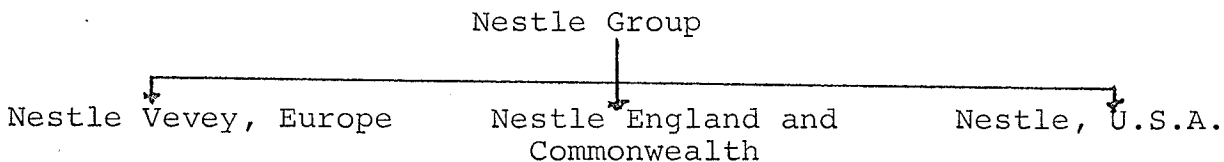


FIGURE 4.6. Concentration in Cocoa Manufacturing.

estimated consumption in the United States, and in certain years they even considerably exceed the total world supply of cocoa.

Day-to-day 'actual' (or 'spot') quotations in the commodity markets may reflect local and short-run factors; hence, the parallel possibility of trading in 'terminal' (or futures) is of significance and it is in futures that most dealings are carried out.

As mentioned earlier, certain large purchasers obtain some supplies from origin markets in producing countries for future delivery. However, with the withdrawal of the marketing agencies of some producing countries from direct operations on the exchanges in consuming countries, and owing to the lack of publicity sometimes surrounding sales in producing countries,<sup>25</sup> it is generally considered that price quotations (on a c.i.f. basis) on the main futures exchange are accurate indicators of the price level at which the bulk of world cocoa transactions take place. Of these exchanges the most important are those of New York and London where world cocoa prices are largely determined, with some effect being exercised from time to

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<sup>25</sup>La Caisse De Stabilisation, "Au Service de la Nation Ivoirienne" (Abidjan, 1971), page 4. See also Nigerian Produce Marketing Co. Ltd., "Nigeria's Produce Marketing Boards" (London: Brown Knight and Truscott Ltd., 1973), pp. 31-32.

time by the exchanges of Hamburg, Amsterdam and Paris.<sup>26</sup>

The futures market may be regarded as a barometer indicating the price of cocoa at various points in time and reflecting informed opinion on pertinent economic factors. Furthermore, the continuous formation of prices has the advantage of lending a certain negotiability to cocoa. However, the existence of futures trading also introduces the possibilities of speculative influence on prices, exaggerating upwards or downwards movements in quotations. Under the more stable conditions of a managed price system, for example an organization of the market, the scope for speculation would probably be reduced. This point will be argued further in detail in Chapter 6.

Excessive speculative participation can be responsible for large price movements, probably beyond the limit

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<sup>26</sup> In October 1964 the UN FAO Sub-Committee on Cocoa Statistics meeting in Rome, agreed that the 'futures' prices for cocoa as defined in Article 26 para (5) of the 1963 Draft International Cocoa Agreement were representative of the actual price of cocoa in international trade. The definition of this representative price involves averaging the quotations for cocoa beans of the nearest three active futures trading months on the New York Cocoa Exchange and the London Terminal Market (see Chapt. 5, below). On the New York Cocoa Exchange, any growth of cocoa from any producing area is admitted. Standard growths representing the bulk of world production are deliverable on futures contract without premium or discounts. Other growths may be delivered at premium or discounts from this price in accordance with rates fixed by the Exchange. On the London Exchange, the futures contract price is based on other growths. On Paris Exchange, opened in early 1963, the basis of contracts is good fermented cocoa, the main crop from the Ivory Coast, Cameroon, Togo, Congo and Gabon. Cocoa of fair fermented quality from the same origins is deliverable at discount.



of economic values based on the fundamental supply and demand situation. The dangers inherent in a market burdened by excessive speculative participation is that it leads to an overbought situation, making the market vulnerable to a steep decline if the bullish potential is not realized. This can eventually lead to "over-shoot" on the down side, or carry futures below expected limits.

Another situation can develop in a commodity like cocoa whereby, for one reason or another, there is a lack of speculative buying interests. As a result, when seasonal hedge pressure from origin is at its height, the speculator who can be normally counted on as a buyer of 50,000 to 75,000 tons of cocoa during the season, is not in the market. This has been found to be the case in the early part of the 1971-72 season.<sup>27</sup> After two consecutive surplus seasons, and preliminary projections of a third surplus, there appeared to be little incentive for speculations to buy cocoa.<sup>28</sup> Thus, the market at times proves very sensitive to hedging, and selling pressure becomes more pronounced. This can lead to prices falling below

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<sup>27</sup>Commodity Research Bureau, Inc., Commodity Year Book 1972, edited by H. Jiler and others, op. cit., p. 16.

<sup>28</sup>Ibid., p. 16.

economic values based on the estimated supply and demand situation. Weymer<sup>29</sup> has demonstrated that price projections based on fundamentals may therefore be distorted by a lack of, or excessive, speculative participation. However, based on the history of cocoa prices and the volatility of the market, one can safely expect at least normal speculative participation in cocoa futures during a season.

#### The Role of Manufacturers and Distributors

As already stated in the earlier chapters cocoa production takes place primarily on small peasant plots in Africa, and on plantations and peasant farms in Brazil. Marketing is in private hands in Brazil, Ivory Coast, and Cameroon, and under Marketing Boards in Ghana and Nigeria.<sup>30</sup> On the supply side, Ghana, Nigeria, Ivory Coast, Brazil, and Cameroon produce almost 80 per cent of world cocoa beans. On the demand side, Gill and Duffus, A. C. Israel, General Cocoa, Paterson-Simons and Ewart Ltd., Cadbury, and Hershey control close to 80 per cent of world trade in "actuals".<sup>31</sup> Manufacturing of cocoa bean products is also

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<sup>29</sup>Weymar, op. cit., pp. 163-187 passim.

<sup>30</sup>J. K. Dietrich and A. D. Gutierrez, op. cit., pp. 93-99.

<sup>31</sup>Wilford J. Eiteman, "Price Determination", Ann Arbor, Bureau of Business Research, Report No. 16, School of Business Administration, University of Michigan, 1949.

highly concentrated as depicted in Figure 4.6 and Table 4.5. Pricing in the industry is therefore determined under a regime of oligopolistic-oligopsonistic competition via the futures market.

Data on the structure of retail prices is sparse, varies from country to country according to the nature of each one's processing and distributive channels, varies over time with changes in cocoa prices, taxes and other costs, and varies for each of the many end-products sold. Table 4.6 depicts two possible typical cases of the structure of the chocolate price in two of Western Europe's major importing countries.

The crucial point demonstrated by Table 4.6, and one of major importance in considering the possibilities of organizing the market for cocoa, is that the costs and margins of the manufacturers, wholesalers, and retailers constitute a very large proportion of the final retail price. In the two examples given such costs and margins amount to nearly 81 and 61 per cent respectively of the final product price.<sup>32</sup> The manufacturers in Germany and

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<sup>32</sup> Available information suggests that the proportion of the cocoa raw materials in the retail price in other developed countries is probably a few percentage points higher than is depicted here. However, since 1960, in a period in which cocoa prices have been sharply down, retail chocolate prices have changed little if at all in the Netherlands, and have been reduced by only some 5 to 10 per cent in Germany: it thus seems likely that the current

TABLE 4.5. Extent of Concentration in the Chocolate and Cocoa Manufacturing Industry.

	Year	Number of manufacturing establishments		Largest Companies	
		Employing 50 persons or more	Employing 1,000 persons or more	Number	Proportion of total value of production or sales (%)
United States	1967	19	2	4	77.0
United Kingdom	1968	30 <sup>a/b/</sup>	-	4	78.2 <sup>c/</sup>
West Germany <sup>d/</sup>	1969	207	16	16	39.2
Netherlands	1961	27 <sup>e/</sup>	-	5	50.0
France	1962	34 <sup>a/</sup>	2 <sup>a/</sup>	6	45.4
Belgium	1961	33 <sup>d/</sup>	0	2	50.0
Italy <sup>d/</sup>	1961	61	3	-	-
Japan	1967	95 <sup>f/</sup>	-	- <sup>g/</sup>	55.5
Spain	1968	19	0	-	-

Sources: U. S.: 1967 Census of Manufactures, U. S. Department of Commerce, Washington, January 1971. U. K.: Report on the Census of Production 1968, HMSO, London, 1971; Cost and Prices of the Chocolate and Sugar Confectionery Industry, Report No. 75, National Board for Prices and Incomes (Cmd. 3694), July 1968. F. R. Germany: Susswaren Taschenbuch, Ausgabe 1970/71, Bundesverband der Deutschen Susswarenindustrie. Netherlands: Statistical Yearbook of the Netherlands 1972 and Jaarveslag 1971, Nederlandse Cacao production vereniging. France: Recensement de l'industrie 1963: Resultats pour 1962, INSEE, Paris, 1967, Belgium: Recensement de l'industrie et du Commerce, 31 decembre 1961, Institut National de Statistique, Bruxelles 1967. Italy: 4e Censimento Generale Dell' Industria e Del Commercio, 16 October 1961, Rome 1966. Spain: Estadistica Industrial de Espana, 1968, Madrid 1971. Le marche du Cafe, du Cacao et des bananes dans les pays de la CEE, serie developpement de l'outre-mer, Bruxelles, 1963.

TABLE 4.5 (continued)

a/Enterprises, not establishments.

b/25 employees or more.

c/1967.

d/Including sugar confectionery industry.

e/1970.

f/20 employees or more.

g/Number not published to avoid disclosure.

TABLE 4.6. Structure of Retail Price of Chocolate<sup>a/</sup> in the Federal Republic of Germany and the Netherlands (in 1960s).

	As % of the retail price			As % of the price of raw cocoa materials		
	Germany	Netherlands A	Netherlands B	Germany	Netherlands A	Netherlands B
1. Raw cocoa materials	12	18	24	100	100	100
2. Other ingredients	3	14	8	26	75	33
3. Total ingredients	15	32	32	126	175	133
4. Manufacturer's processing costs and margins	26	20	20	222	106	84
5. Packaging	6	6	6	51	31	24
6. Transport costs	3	b/	b/	21	b/	b/
7. Tax (10/90)	--	6	6	--	35	27
8. Sales price ex-factory	50	64	64	421	347	267
9. Wholesalers' margin c/	20	11	11	171	58	45
10. Tax (0.75%)	--	(1)	(1)	--	3	2
11. Wholesalers price	70	75	75	592	408	314
12. Turnover tax (4%)	4	--	--	34	--	--
13. Retailers' margin <sup>d/</sup>	26	25	25	222	136	105
14. Retail price	100	100	100	849	544	419

<sup>a/</sup>Source: Etudes Serie development de L'outre-mer, op. cit., pp. 86 and 113.

<sup>b/</sup>Probably included under item 4.

<sup>c/</sup>Represented 41% of the ex-factory price in Germany and 17% in the Netherlands.

<sup>d/</sup>Represented 38% of the wholesale price in Germany and 33% in the Netherlands.

A. "Milk chocolate".

B. "Black chocolate".

the Netherlands alone form 35 and 36 per cent of the retail price in the two countries, while the retailers and wholesalers form a further 46 and 35 per cent respectively.

Between the stage of importation of the raw cocoa beans and the sale of the multitude of chocolate end-products to the consumer, a very large proportion of the final retail price is thus determined. According to available estimates the proportion averages around 80 per cent for all developed countries taken together.<sup>33</sup> Although in certain major consuming countries it is probably substantially higher, this rough illustrative figure is used in the rest of this work. Cocoa beans thus represent an 'agricultural raw material' for processing as much as any non-edible commodity such as cotton or rubber.

From an economic point of view the large importance of these various costs and margins implies that changes in world prices will be reflected in a slight percentage increase in the final retail price. This suggests that increases in the cocoa bean price, if limited, need not necessarily be passed on in a higher price to consumers. However, if such increases would be large and

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weight of the raw cocoa price in the final retail price, at least in these two countries, is even lower than Table 4.6 illustrates.

<sup>33</sup>Cocoa Producers Alliance, Document CPA-AC 261/34 1970, see also UNCTAD Publication TAD/2561(com) 1969.

permanent (as would be the objective in an organization of the market), it seems very unlikely that manufacturers could long delay some rise in the retail price, even if this were only proportional to (say 20 per cent of) the rise in the world cocoa price, since the cost of the raw cocoa is not a small proportion of the manufacturers' selling price, and may be substantial in relation to their processing costs and margins (see lines 1, 4 and 8 of Table 4.6).

The great weight of the processing and distributive functions in the final price, and the large number of successive costs and margins covered by these functions, makes detailed analysis of the retail price of the cocoa bean extremely difficult. The proportion of the final retail price taken by wholesalers and retailers is very significant, but it does not appear appropriate to suggest here that these might be compressed. So far as the manufacturers are concerned, the possibilities for substitution between cocoa materials and other ingredients are large, costs of packing and advertisement are not unimportant, nor probably are profit levels. With respect to all these, the manufacturer has a wide scope for changing the content of his product,<sup>34</sup> the packaging and range of items put before

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<sup>34</sup>There are many ways to accomplish this: by varying the actual cocoa content per unit weight of



the public, as well as the retail price of each. The wide choice of alternatives open to the manufacturer in each given situation renders all generalizations about the structure of the retail price extremely dubious. In Chapter 6, some attempt will be made to give quantitative value to certain possible reactions on the part of manufacturers, but the arbitrary nature of these assumptions must be constantly borne in mind, especially in the very different circumstances of a managed (or controlled) rather than a free market situation.

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chocolate, varying the density of the chocolate covering of various confectionery items, varying the size of the chocolate bar or other confectionery items, varying the total cocoa content of the whole range of confectionery items put before the consumer by varying the range of items, as well as giving different publicity to each etc.

## CHAPTER V

### MONOPOLISTIC PRICING UNDER THE COCOA PRODUCERS ALLIANCE

Considering that attempts to establish an ICA on cocoa have not been very easily taken by producing countries and also bearing in mind that consuming countries view international regulation as a device to benefit producing countries; the question left unanswered is this: why hasn't the Cocoa Producers Alliance (CPA) taken a united stand to control the supply of cocoa and consequently establish monopolistic pricing?

As already pointed out in the preceding chapters, in order to avoid violent fluctuations, to bring stability into the world cocoa market, and to arrive at a price acceptable to both producers and consumers, several international conferences have been held under the auspices of FAO and UNCTAD. A conference in Geneva in 1963 failed to reach agreement, but the main features of that conference are continuously being considered with the view to introduce a price stabilization scheme. These attempts are international in character and all the main producers and consumers of cocoa have been represented at the various conferences.

The failure of the UN Conference on cocoa prices in Geneva in October 1963, when price suggestions of producers and consumers were too far apart, was followed by the establishment of the Cocoa Producers Alliance. This consisted of Ghana, Nigeria, Brazil, Ivory Coast, Cameroon Republic, and Togo. This Alliance tried to do what the conference failed to achieve in Geneva. It fixed export quotas for its members and agreed on a price indicator (26.6 cents per pound) which would govern their market activities. By so doing the Alliance hoped to reduce stocks held by manufacturers and thus compel them to buy. In pursuance of their policy the Alliance members agreed to withhold the 1964/65 crop until prices rose to 26.6 cents per pound.

Unfortunately, the Alliance scheme fell through. The failure can be attributed to a number of reasons:

- (i) the producers were overtaken by record crops in each of the six countries (see Table 5.1, cols. 5 and 6);
- (ii) the Alliance appears to have underestimated stocks held by manufacturers<sup>1</sup> (see Table 5.2);
- (iii) storage facilities in some producing countries

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<sup>1</sup>Consumers (or manufacturers) were skeptical about the eventual success of the agreement and had sufficient supplies to wait out the Alliance (see New York Times, Dec. 7, 1964, p. 55 and Feb. 7, 1965, sec. 3, p. 5).

TABLE 5.1. PRODUCTION\*\* OF RAW COCOA BY ALLIANCE MEMBERS.  
(in thousand long tons\*)

	1959 /60	1960 /61	1961 /62	1962 /63	1963 /64	1964 /65	1965 /66	1966 /67	1967 /68	1968 /69	1969 /70	1970 /71	1971 /72	1972 /73
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Cameroon Republic <sup>a/</sup>	63	73	74	75	84	90	78	85	90	103	108	110	121	102
Ghana <sup>b/</sup>	317	433 <sup>c/</sup>	410	422	436	557	410	376	415	334	409	386	457	420
Ivory Coast	61	93	81	101	97	145	111	147	144	142	178	177	221	180
Nigeria <sup>d/</sup>	155	195	191	176	216	294	182	263	235	189	219	303	251	275
Togo Republic <sup>e/</sup>	9	12	11	11	14	17	15	16	18	18	23	28	29	18
Brazil	198	122	116	111	123	116	170	172	141	163	197	179	164	206
World Total	1039	1173	1124	1158	1216	1482	1205	1333	1333	1220	1419	1481	1546	1486

\*Source: Computed from Gill and Duffus Ltd., Cocoa Statistics, London, December 1972, pp. 8-9.

\*\*Excluding Grade II cocoa beans.

<sup>a/</sup> Includes production in West Cameroon from 1961/62.

<sup>b/</sup> Includes purchases of sub-grade Cocoa.

<sup>c/</sup> Additionally a further 10,000 to 15,000 tons were smuggled into Ivory Coast and Togo. This tonnage is included in the production for these two countries.

<sup>d/</sup> Includes production in the British Cameroon up to 1960/61.

<sup>e/</sup> French Togo prior to 1959/60.

TABLE 5.2. Cocoa Bean stocks (in thousand long tons).

Cocoa Season	Opening Stocks	Closing Stocks	Bean stocks in consuming countries		World Price of beans U.S. cents /lb, f.o.b.	
			Dec. 31	As % of Grindings		
	( - - - thousand tons - - - )					
1959/60	172	274	1960-328	35.3	4.2	26
1960/61	274	418	1961-438	43.1	5.2	21
1961/62	418	422	1962-495	44.6	5.4	21
1962/63	422	424	1963-518	45.3	5.4	21
1963/64	424	451	1964-519	43.9	5.3	22
1964/65	451	592	1965-598	45.2	5.4	15
1965/66	592	414	1966-587	42.7	5.1	17
1966/67	414	369	1967-539	39.4	4.7	23
1967/68	369	299	1968-469	33.6	4.2	27
1968/69	294	169	1969-417	31.4	3.7	34
1969/70	169	238	1970-436	32.7	3.9	32
1970/71	238*	286*	1971	NA**	NA	26
1971/72	286*	287*	1972	NA	NA	22
1972/73	287*	199*	1973	NA	NA	NA

Source: Gill and Duffus Ltd., op. cit., p. 16.

\*Estimates.

\*\*NA - refers to information not available.

were insufficient and the cocoa had to be exported;

- (iv) the economic position of some countries made it necessary for cocoa sales to be made.

While the Alliance was out of the market for three months (January, February and March 1965) they accumulated large stocks of unsold cocoa. Consequently, when they re-entered the market at the end of March 1965, prices collapsed to 15 cents per pound (see Table 5.2, col. 8).

In addition to these two attempts to reach wide agreement on cocoa prices, some producing countries have better agreements with others which involve selling cocoa at government levels. Some of the smaller producers already felt constrained to sell some cocoa quite early in the season, thus breaking the producers' solid front. Lastly, cocoa has no profitable alternative uses. Consideration was given to its use as vegetable oilseed, but this would have earned the producers prices which were only a fraction of those which they could still obtain for cocoa in its conventional form.

#### Interperiod Demand Relationship

An aspect of the economic literature on international trade is that the implications of imperfect competition in international trade and its effects on the

economic growth of LDCS has been ignored in both the applied and theoretical fields. According to H. G. Johnson, "the theory of monopolistic competition has had virtually no impact on the theory of international trade."<sup>2</sup> Paul Samuelson voiced concern on the neglect: "the role of monopolistic and imperfect competition in actual international trade is crucial and may transcend in importance mere transport cost. . . ."<sup>3</sup>

Pincus<sup>4</sup> defines monopolistic pricing to be the reduction of supplies of an internationally traded commodity through a coordinated policy of the producing nations in order to increase the product price and thereby the profits of the producing nations. Behrman in an article on monopolistic pricing,<sup>5</sup> sets out the problems involved in such an endeavour in detail.

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<sup>2</sup>Harry G. Johnson, "International Trade Theory and Monopolistic Competition Theory," Monopolistic Competition Theory: Studies in Impact, ed. R. E. Kuenne (New York: John Wiley and Sons, 1967), p. 203.

<sup>3</sup>Paul Samuelson, "The Transfer Problem and Transport Costs: The Terms of Trade When Impedements are Absent," Economic Journal, LXII, 1952, p. 292 (as quoted by H. G. Johnson, op. cit., p. 203).

<sup>4</sup>John A. Pincus, Commodity Policy and Economic Development (Washington, The Rand Corporation, 1963).

<sup>5</sup>J. R. Behrman, op. cit., pp. 702-719.

An elaboration of conventional theory of monopolistic pricing to recognize the relation of current price to future demand has been suggested by Reder;<sup>6</sup> it may deserve re-emphasis in connection with the present issue.

The monopolistic firm (or group of collusive oligopolists) may be provisionally viewed as dealing with an entire industry demand curve in a succession of time intervals, in each of which it can freely select a price-output combination for the industry. It will thus logically take account of the effect of any current price-output decision on the position of the industry demand curve in future periods. A lower price now may mean a higher (or lower) demand later, and any such anticipated relationship should affect any current pricing policy. If it does, a single long-run industry demand curve cannot be viewed as an independent determinant even of the long-run tendency of price. Such a relation is not given independently of the prices the seller(s) charge at various times during a future time period, but will assume various levels according to the behavior of a series of short-run prices. Reder suggests that instead the seller(s) necessarily refer to a series of short-run demand curves for each of a

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<sup>6</sup>M. W. Reder, "Intertemporal Relations of Demand and Supply Within the Firm," Canadian Journal of Economics and Political Science, VII, February 1941, pp. 25-38, and especially pp. 32-35.



succession of future intervals; these fully replace any long-run demand curve for the purposes of making all output adjustments. It is the price-pattern through time and not a single long-run price which is of importance.

Bain has constructed a simple model<sup>7</sup> in which a single-firm monopolist is conceived of as pricing solely in a current Period I and a future Period II. In this model there is an industry demand curve for each such period and corresponding marginal revenue curves. Monopoly price for the first period in isolation is set to equate the marginal cost of that period to the marginal revenue of that period. But demand in Period II is supposed to depend upon Period I price; for example, the Period II demand curve may shift outward as Period I price falls. Viewing this relation in retrospect from the beginning of the first period, the monopolist may be supposed to adjust Period I price so as to allow maximization of the sum of the profits of the two periods. This procedure may result in setting Period I price below the level for which the marginal cost and marginal revenue of that period are equated, so long as the resulting decrease in Period I profits is more than offset by a resulting increment in Period II profits (appropriately discounted

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<sup>7</sup>Joe S. Bain, "Pricing in Monopoly and Oligopoly", AER, Vol. 39, March 1949, pp. 448-464.

for interest and risk).

Use of the demand-supply technique in such a sequence analysis permits precise formal treatment of the effects of anticipated relations between current price and future demand. To employ the analysis for the purposes of prediction, Bain puts emphasis on determination of sign and value of the cross-elasticity between Period I and Period II quantity for the monopolist

$$\frac{\partial q(t_2)}{\partial P(t_1)} \cdot \frac{P(t_1)}{q(t_2)}$$

It is possible to identify actual cases where this elasticity might be alternatively positive or negative in sign, or zero. Where it is negative and significantly large, a current monopoly price below the current profit-maximizing level can be formally explained; where it is positive and large, current prices above this level could be predicted. This model does not have the monopoly power of doing other than maximize the "long-run" difference between aggregate industry revenue and aggregate production cost, so long as these are measured as capital values of future revenue and cost streams to a time horizon. But it does indicate the rational possibility of deliberate departures from profit maximization for 'short' periods longer than those required to permit every adaptation in scale of firm and plant.

However, in the absence of cost data for cocoa producing countries such procedure and analysis will not be feasible, hence the use of ordinary revenue earnings will be imputed in this analysis.

#### Supply and Demand for Setting Monopolistic Pricing

In respect to establishing a monopolistic price in the world cocoa market, five characteristics of the supply of cocoa seem most important: (1) the concentration of production in a few of the developing countries, (2) the dominance of a relatively few standard grades in international trade, (3) the limited short-run supply response to economic incentives, (4) the substantial long-run supply response to economic incentives, and (5) the existence of government marketing institutions in many of the major producing countries.

Four characteristics of the derived demand for cocoa seem equally important and relevant in respect to establishing a monopolistic price: (1) the concentration of consumption in a few developed nations with oligopolistic chocolate markets, (2) the generally quite inelastic short-run price response of the derived demand function<sup>8</sup> (see Table 5.3, col. 2), (3) sugar and vegetable oil are

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<sup>8</sup>R. C. Amoa, "A Study in Demand: An Analysis of the Cocoa Bean and Cocoa Products Markets of the United States." Unpublished Ph.D. dissertation, Massachusetts Institute of Technology, 1965, pp. 53-55; 62-67; 115; 119; 124; 146; 157.

TABLE 5.3. Percentage Share of Consumption in Bean Equivalents and Elasticities of Demand for Bean Equivalents.<sup>a/</sup>

Country	Consumption of Cocoa Products in Bean Equivalents <sup>b/</sup>				
	% of world total 1960-1964	Elasticity of per capita consumption <sup>c/</sup> with respect to			
		Price of cocoa	Per capita income	Price of sugar	Price of soybean oil
United States	28.5	-0.25	[NA] <sup>d/</sup>	0.08	0.19
Federal Republic of Germany	12.6	-0.18	0.93	[NA]	0.32
United Kingdom	10.4	-0.16	0.71	[NA]	0.40
France	6.1	-0.38	0.68	0.15	0.05
Canada	2.5	-0.19	0.72	-0.12	0.43
Netherlands	2.5	-0.89	0.62	[NA]	0.77
Spain	2.2	-0.24	0.85	[NA]	[NA]
Italy	2.1	-0.21	0.93	[NA]	0.05
Rest of World	33.1	-0.25	[NA]	0.20	-0.74

<sup>a/</sup>Source; J. R. Behrman, op. cit., p. 706.

<sup>b/</sup>Bean equivalents are grindings of beans adjusted for net exports of cocoa butter, cocoa powder, cocoa paste, and chocolate products, as calculated from data in Gill and Duffus.

<sup>c/</sup>Calculated at means from demand regressions (see Appendix B of Behrman, op. cit., p. 715.

<sup>d/</sup>[NA]- refers to information not available.

apparently, on balance, both basically important in manufacturing of chocolate. Behrman's analysis discovered that changes in the price of sugar apparently do not affect substantially the demand for cocoa beans, but for three consuming countries, the estimated cross elasticity of the derived demand with respect to vegetable oil prices is greater than the estimated own-price elasticity. One implication of this result is that monopolistic cocoa prices may result in considerable substitution of vegetable oil for cocoa butter, (4) long-run responses to a monopolistic price are less predictable but presumably are much larger than short-run responses. For many uses of cocoa butter, no satisfactory substitute is currently available because of cocoa butter's property of melting at under the human body temperature.

#### Effect of Monopolistic Pricing by the Alliance in 1964

Within the framework of supply and demand which has been described in Chapter 3 and summarized above it is possible to analyse the potential or hypothetical effect of monopolistic cocoa pricing by the Alliance. In Table 5.4 each row summarizes the implied effects on demand for cocoa beans for consumption and on total revenue of cocoa producers in 1964 had the Alliances' and various proposed cocoa prices prevailed in that year. It must be stated that these are hypothetical effects and before examining

TABLE 5.4. Effects, on Demand for Cocoa by Eight Leading Consuming Countries and on the Resulting Total Revenue of Cocoa Producers of Alternative Cocoa Prices, 1964.a/

A	B	C	D	E	F
Price per pound <sup>b/</sup> (U.S. cents)	Calculated annual demand (for price in col.1) <sup>c/</sup>	Difference between calculated demand and actual demand <sup>d/</sup>	Calculated annual revenue (AB=D) <sup>e/</sup>	Difference between calculated and actual revenue	Percentage change in total revenue from cocoa <sup>f/</sup>
	( In thousands of tons of beans equivalents)	( In thousands of tons of beans equivalents)	( Million 1964 U.S. \$ )	( Million 1964 U.S. \$ )	( Percent )
12.2 <sup>g/</sup>	825.8	+76.3	226	-172	-33.1
20.0 <sup>h/</sup>	779.5	+20.0	343	- 55	-10.6
20.6 <sup>i/</sup>	775.8	+16.3	348	- 50	- 9.6
22.5 <sup>j/</sup>	764.5	+ 5.0	382	- 16	- 3.8
23.0 <sup>k/</sup>	761.5	+ 2.0	390	- 8	- 1.5
23.6 <sup>l/</sup>	757.8	- 1.3	400	2	- 0.4
26.6 <sup>m/</sup>	740.3	-19.3	441	43	8.3
27.0 <sup>n/</sup>	737.3	-22.3	446	48	8.9
29.0 <sup>o/</sup>	725.7	-34.6	471	73	14.0
46.3 <sup>p/</sup>	622.5	-137.0	645	247	47.5
62.7 <sup>q/</sup>	525.5	-234.0	739	341	66.6
74.3 <sup>r/</sup>	456.0	-303.5	758	360	68.3
75.6 <sup>s/</sup>	448.5	-311.5	760	362	69.7
80.0 <sup>t/</sup>	422.5	-337.5	755	357	68.7

TABLE 5.4 (continued)

Source: Adapted from Behrman, op. cit., p. 706.

a/ The eight countries included are U.S., West Germany, U.K., France, Canada, Netherlands, Spain, Italy, Rest of World. The eight countries together accounted for two-thirds of the world consumption of cocoa in 1960-64.

b/ New York spot price of Ghanaian cocoa.

c/ Given 1964 levels of income, population, and prices of sugar and of soybean oil, the aggregate demand schedule for cocoa in thousand tons of bean equivalents for the eight countries is

$$D_t = 898.5 - 5.95 P_t.$$

where  $P_t$  is the spot price of Ghanaian cocoa in New York in 1964 U.S. cents per pound.

d/ The actual grindings in the eight countries of concern (adjusted for trade in cocoa products) totaled  $759.5 \times 10^3$  tons in 1964.

e/ All revenues are calculated at New York prices assuming that all cocoa is sold at such prices.

f/ Change from actual 1964 revenue, under the assumption that exports remain at actual 1964 level. The actual quantity of bean equivalents consumed in 1964 multiplied by the average spot price of Ghanaian cocoa on the New York market equalled \$520 million and was used as the base for the percentages which are given in this column.

g/ July 1965 price, as reported by Gill and Duffus.

h/ Minimum price suggested by consumers at 1963 conference.

i/ February 1965 price

j/ Average price for 1961

k/ January 1965 price

l/ October 1964 price

m/ Producers' Alliance minimum price 1964-65  
(CPA-AC-393)

n/ Minimum price suggested by producers at 1963 conference (CPA-AC-392).

o/ Pincus "monopoly price" op. cit.,, p. 47.

p/ Average price for 1958, Gill and Duffus Cocoa Statistics, London, Sept. 1965.

q/ Average price for 1954, ibid.

r/ July 1965 price, ibid.

s/ Calculated price to maximize gross revenue, obtained by maximizing the product of  $D_t$  and  $P_t$  given the expression for  $D_t$  in note c above.

t/ Arbitrarily chosen price.



them, the assumptions<sup>9</sup> which underlie Table 5.4 must be explicitly stated.

In column A the prices are assumed to be accepted as the prevalent prices for the foreseeable future by the consumers. There is assumed to be no activity by cocoa purchasers, to reduce future cocoa prices. (2) The demand equations for the eight leading consuming countries are assumed to prevail (see Table 5.5). (3) The producers of cocoa are assumed to be operating successfully as discriminating monopolists and selling cocoa at the 1964 prices for the actual 1964 stock additions and for the actual 1964 consumption in the rest of the world.

Under these assumptions, columns five and six of Table 5.4 give the earnings and percentage increases in the revenue from the sale of cocoa which would result from various prices, in comparison with the revenue obtained from the actual 1964 price and sales. If the demand for current consumption in the eight leading consuming countries had been satisfied at the Cocoa Producers' Alliance desired minimum price of 26.6 cents per pound, the implied revenue would have increased by \$43 million or 8.3 per cent. If the demand for current consumption in the eight leading consuming countries had been satisfied

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<sup>9</sup>J. R. Behrman, op. cit., p. 704.

TABLE 5.5. Least Square Estimates of Demand for Cocoa Bean Equivalents for Current Consumption in Leading Consuming Countries, 1948-1964.<sup>a/</sup>

Country	Least-squares estimates (with standard errors in parenthesis)						R <sup>2</sup>
	PC	PS	PV	Y/N	Constant	N	
United States	-0.00127 (0.00038)	0.00241 (0.000212)	0.00177 (0.00054)		0.235 (0.11)		.97
West Germany	-0.00262 (0.0013)		0.0102 (0.0023)	0.569 (0.033)	-0.145 (0.15)		.98
United Kingdom	-0.00295 (0.0021)		0.0160 (0.0042)	0.482 (0.069)	0.0901 (0.18)		.97
France	-0.00355 (0.0012)	0.00110 (0.00064)	0.0105 (0.0021)	0.241 (0.0021)	-0.0031 (0.12)		.96
Canada	-0.000885 (0.000771)	-0.000412 (0.00038)	0.00397 (0.0013)	0.0850 (0.0235)	0.235 (0.217)		.91
Netherlands	-0.0143 (0.0093)		0.0252 (0.014)	0.0486 (0.039)	1.10 (0.99)		.36
Spain <sup>b/</sup>	-0.0328 <sup>b/</sup> (0.029)			0.0457 <sup>b/</sup> (0.0161)	-5.36 <sup>b/</sup> (2.6)	-0.415 <sup>b/</sup> (3.09)	.92
Italy	-0.000307 (0.00023)		0.000391 (0.00037)	0.142 (0.013)	0.029 (0.043)		.93
Rest of World <sup>b/</sup>	-0.174 <sup>b/</sup> (0.15)	0.102 <sup>b/</sup> (0.09)	-0.954 <sup>b/</sup> (2.26)		384.5 <sup>b/</sup> (60.9)		.63

The demand function used for the above estimates took the form,\*

$$(C/N)_t = a_1 + b_1 PC_{t-.5} + b_2 PS_{t-.5} + b_3 PV_{t-.5} + b_4 (Y/N)_t + E_{st}$$

<sup>a/</sup>Source: Behrman, *op. cit.*, p. 717.

where

- C/N is the annual per capita grindings of cocoa beans.  
PC is the wholesale price of cocoa beans.  
PS is the wholesale price of sugar.  
PV is the wholesale price of vegetable oil.  
Y/N is the time series for per capita income in each of the eight leading consuming countries  
E is the disturbance term.

\*The reason for lagging all prices by one half year is that response in chocolate formulas to changes in cocoa prices reputedly require a lag of that length. (See Amoa, R., op. cit., pp. 56, 63-70, 124; Paul Bareaux, Cocoa: A Crop with a Future (London, Cadbury Brothers Ltd., 1953), p. 19; United Nations, FAO, "Cocoa: The Outlook for Production and Consumption, 1970-1972 (Working Party-Prices and Quotas, for UN Cocoa Conference), New York, 1965, mimeo; and also Wickizer, V., op. cit., p. 262.

at the implied revenue-maximizing price of 75.6 cents per pound, the implied revenue would have increased to \$362 million or by 69.7 per cent.

On examination of Table 5.4 the indication is that if the demand for current consumption in the eight leading consuming countries had been satisfied at the Cocoa Producers' Alliance desired minimum price of 26.6 cents per pound (a 13.7 per cent increase over the actual price which prevailed in 1964), only for Ghana and Cameroon Republic would the implied increase in earnings from total exports have been as large as 2 per cent (see Table 5.6, columns 2 and 5 at 26.6 cents per pound). If the demand for current consumption in the eight leading consuming countries had been satisfied at the implied revenue-maximizing price of 75.6 cents a pound (a 211 per cent increase over the actual price which prevailed in 1964), only for Ghana would the implied increase in earnings from total exports have been as large as 20 per cent. Table 5.6 suggests, thus, that substantial increases in cocoa market prices would have resulted in relatively small increases in the command over external resources for the major cocoa producing countries.

The impact of the Alliances' monopolistic pricing in 1963/64 has been clearly demonstrated with respect to changes in the quantity of cocoa beans demanded and in the

TABLE 5.6. Percentage Change in Total Cocoa Earnings in 1964 in Eight Leading Producing Countries Assuming Prevalence of Alternative Prices in the World Market.<sup>a/</sup>

Price/lb in 1964 <sup>b/</sup> U.S. cents per lb.	Ghana	Nigeria	Ivory Coast	Cameroon Republic	Brazil	Ecuador	Dominican Republic	Venezuela
12.2	-22.5	-6.4	-7.1	-9.3	-1.6	-4.2	-2.2	-1.2
20.0	-7.0	-2.0	-2.3	-3.0	-0.5	-1.4	-0.7	-0.4
20.6	-6.3	-1.9	-2.1	-2.7	-0.5	-1.2	-0.6	-0.3
22.5	-2.5	-0.7	-0.8	-1.0	-0.2	-0.5	-0.3	-0.2
23.0	-1.0	-0.3	-0.3	-0.4	-0.1	-0.2	-0.1	-0.1
23.6	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0
26.6	5.5	1.6	1.8	2.4	0.4	1.1	0.6	0.3
27.0	5.9	1.7	1.9	2.5	0.4	1.1	0.6	0.3
29.0	9.2	2.7	3.0	3.9	0.7	1.8	0.9	0.5
46.3	31.7	9.2	10.2	13.4	2.3	6.0	3.1	1.6
62.7	44.0	12.9	14.3	18.7	3.1	8.4	4.4	2.3
74.3	45.2	13.2	14.7	19.2	3.2	8.6	4.5	2.4
75.6	46.0	13.5	15.0	19.6	3.3	8.8	4.7	2.5
80.0	45.4	13.3	14.8	19.3	3.2	8.7	4.6	2.4

Table 5.4 <sup>a/</sup>Calculated from columns one and two in Table 5.5 and column six of

<sup>b/</sup>New York spot price of Ghanaian cocoa. See details in Table 5.4.

revenue of cocoa producing nations. However column three of Table 5.4 casts a very disturbing picture. The column indicates that there may be a problem of disposing of considerable amounts of cocoa if the hypothesized Alliance monopolistic price is above the actual 1964 market price. There are various options open for such disposal and these will be dealt with in Chapter 6.

Finally, one can inquire what would be the effect of various prices on long-run production of cocoa? If marketing boards were effectively to isolate the cocoa producers from the world market price, long-run supplies should be unaffected. If marketing boards were to vary producers' prices with the fluctuations in world prices, however, planting would respond accordingly.<sup>10</sup>

It must be stressed that on the monopolist's side, the concentration of cocoa production in relatively few countries with the eight largest producing countries accounting for almost 86 per cent of world supply should facilitate the strong bargaining power of these producers in the world cocoa market. Also since most of the cocoa traded in the international market is one of a few relatively standard grades, producers need not worry

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<sup>10</sup>The extent to which marketing boards have varied producers' prices with the fluctuations in world prices is a matter of some dispute. See M. J. Bateman, "Cocoa in the Ghanaian Economy", Ph.D. Thesis, MIT, 1965. See also H. Wehner, "Marketing Board Performance in Primary Producing Countries: A Case Study," Economia Internazionale 18:695, November 1965.

about separate pricing for each grade. The short-run cocoa supply response to economic incentives apparently is limited. Behrman's<sup>11</sup> statistical analysis showed no significant short-run response to price in four countries (Ghana, Nigeria, Ivory Coast, and Ecuador) which together accounted for about two-thirds of the world's cocoa supply in the period from 1960 through 1965. The reason for such low short-run response is that in these countries the opportunity cost of long-run deterioration due to short-run neglect of trees is sufficiently high and the marginal cost of harvesting the pods from the existing stock of trees is sufficiently low so that short-run supply has been insensitive to variations in price.<sup>12</sup> Because of this short-run inflexibility, an attempt to maintain a high price for cocoa by limiting the supplies for all or part of the international market might have to be accompanied by considerable storage or nontraditional disposal procedures in order to be successful.

The long-run cocoa supply response to economic incentives is substantial in Ecuador, the Dominican

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<sup>11</sup>J. R. Behrman, op. cit., p. 704.

<sup>12</sup>Merrill J. Bateman, "Aggregate and Regional Supply Function for Ghanaian Cocoa 1946-1962," Journal of Farm Economics, Vol. 47, 1965, pp. 124, 141. See also Robert M. Stern, "The Determinants of Cocoa Supply in West Africa". Paper presented at Seminar on African Primary Products and International Trade. September 20-23, 1964, University of Edinburgh, p. 10.

Republic, and Venezuela. If a monopolistic price were to be established and if therefore, it were desirable to prevent a substantial increase in future supplies due to new plantings, the producers (and potential producers) would have to be isolated from the world market price or planting would have to be restricted by effective regulations.

The above analysis suggests that a monopolistic cocoa pricing agreement by the Alliance in 1963/64 apparently could be utilized to add marginally to the export earnings of the cocoa producing nations, and such marginal additions might provide considerable aid to the process of development. A monopolistic pricing agreement, however, would have been far from a panacea for the economies of the cocoa producing countries. At practically obtainable price levels the benefits would be limited, and the economic and political opportunity costs of negotiating and maintaining an agreement might be substantial. What then is the avenue open for an effective world organization of the cocoa trade. The next chapter will look into such possibility.



## CHAPTER 6

### CONCEPTUAL AND EMPIRICAL ISSUES IN APPLICATION OF A REMUNERATIVE PRICE SCHEME FOR COCOA

This chapter will examine relevant issues relating to remunerative pricing in organizing the world cocoa market under an assumed International Cocoa Council.

The word "remunerative" is used instead of monopoly, to denote a co-operative scheme between producing and consuming countries. However, if cocoa consuming countries refuse to participate in organizing the market the scheme becomes one of monopolistic pricing.

#### Conceptual Application of Remunerative Price Scheme

##### Origins of the Proposals for Remunerative Price Schemes

Compensatory financing has been proposed for primary products by UNCTAD<sup>1</sup> then by Johnson<sup>2</sup> and then by

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<sup>1</sup>UNCTAD Document TD/B/3/Add 2 1964.

<sup>2</sup>Harry G. Johnson, Economic Policies Toward Less Developed Countries (The Brookings Institution, Washington, D. C., 1967), p. 257. See also, David Wall "Opportunities for Developing Countries" in Trade Strategy for Rich and Poor Nations, ed. by Harry G. Johnson (University of Toronto

Friedman<sup>3</sup> and Prebisch.<sup>4</sup> All these have tried to link the price of the exported primary commodity with the price of imported commodities by LDCs. The attempt is to strike a balance between prices of imports and exports. The idea is basically a 'price raising' international commodity agreement.

During the early part of June 1973 thirty African states hammered out a common approach to the negotiations with the European Economic Community (EEC); the most important aspect of which was a refusal to grant tariff concessions to EEC goods.

Refusal of such concessions came not only from some of the associates of the EEC in the Caribbean and the Pacific, but also the independent African states. While for various reasons<sup>5</sup> their outcome remains open to doubt,

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Press, Toronto, 1971), Part II, see especially, discussion on Five UNCTAD Proposals, pp. 52-70.

<sup>3</sup>Irving S. Friedman, "The Developing Countries in the Past Twenty-Years" in World Development, ed. by Denys Munby (Washington, Corpus Publication, 1969), pp. 147-172.

<sup>4</sup>Paul Prebisch, Change and Development--Latin America's Great Task (New York, Praeger Publishers, 1970), Chapter 3.

<sup>5</sup>The associates of the EEC under the Yaounde Convention were Francophone, while the newly qualified associates are largely from the British Commonwealth. In the past this division has run deep resulting in an uncertain common approach to the highly complicated negotiations.

the negotiations have brought applications of the remunerative pricing concept under serious consideration. Earlier in the year the European Commission (EC) produced a preliminary set of proposals for the negotiations. Included was a proposal for the stabilization of export receipts from certain primary products--sugar, groundnuts, groundnut oil, cotton, cocoa, coffee, bananas and copper. The suggested means of achieving such stabilization is through remunerative pricing (i.e., by fixing a reference price) for a specific quantity of each of the commodities for each country that produced it. The remunerative price is to be based on an average of world prices over the previous five years. The proposal provides that if a shortfall occurs between the actual value of the exports and the reference value this is to be made up by a transfer of financial resources from the Community to the country concerned. This credit is designed to guarantee a minimum amount to the actual producing countries and also to enable them to increase their productivity and, where necessary, to diversify.

A major aim of this EC proposal is to reduce the impact of fluctuations in the world prices for these primary products. The fluctuations in price have on numerous occasions been extremely wide. Copper, for example, has fluctuated from \$1,800 a ton in 1970 to a

low of around \$1,000 a ton in 1972 and in mid-1973 was more than \$2,000 a ton. Not surprisingly this makes for problems in planning and investing for development.

The need has long been recognized for a world-scale solution to the price fluctuations and their adverse effects on producing countries earnings and development. Apart from the work being done by UNCTAD,<sup>6</sup> the International Monetary Fund (IMF) operates a scheme of remunerative pricing to help in these circumstances. However, the European Commission, while accepting in principle that a world solution would be desirable, makes the point that ICAS have proved difficult or impossible to operate effectively. This is certainly true, as is shown by the review of such agreements in chapter 2 above. In particular the International Coffee Board has nearly broken up on several occasions and at their last meeting no progress was made toward fixing the next quotas. It has taken fifteen years for discussions to reach the point where an International Cocoa Agreement has almost been signed (in January 1973) and even then the United States, which consumes about twenty-five per cent of the world's cocoa, has opted out.<sup>7</sup>

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<sup>6</sup>Gerald M. Meier, Leading Issues in Economic Development (Oxford University Press, Oxford, 1970), p. 516.

<sup>7</sup>C. Sanger, "Commodity Agreements" in Cooperation Canada, published by CIDA Sept/October 1973, pp. 16-17.

It is on the basis of this sort of activity that the European Commission has come to the conclusion that regional agreements are likely to be more productive and useful. However, a number of criticisms can be made against such ICAS, whether regional or international. Regional agreements are, by definition, discriminatory. The Commission's proposals will insure only the associated countries against world price fluctuations; but other developing countries in Latin America and Asia produce the same primary products. In addition such regional arrangements might well inhibit interest in attempts to make international agreements as the interested countries would have duty-free entry to most of their markets; and it is not impossible that the EEC countries might feel they were already doing enough without entering into wider commitments.

Furthermore, there are disagreements among economists over whether countries dependent upon such primary products are in fact more subject to fluctuations than elsewhere; and there is dispute as to the effects of the fluctuations as well.<sup>8</sup> It is arguable that the state

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<sup>8</sup>Ragnar Nurkse, "Trade Fluctuations and Buffer Policies of Low-Income Countries," at Symposium on The Quest for a Stabilization Policy in Primary Producing Countries, Kyklos, Vol. XI, 1958, Fasc. 2, pp. 139-265. See also J. Tinbergen, "International Co-ordination of Stabilization and Development Policies", in Kyklos, Vol.

of the internal economy depends far more on other factors than export earnings and if this is the case such remunerative schemes are not important.

There is a doubt whether the proposal will, in fact, help production. As the reference price will be fixed for a given period there would be incentive to allow resources for a certain crop which had a reference price to be diverted to another crop which had no reference price for that country. The gain would be twofold--the reference price would continue to be made up for the stipulated period; and the export of the converted crop would be an added bonus over the same period. The obvious way of avoiding this would be making the credits available at commercial rates as suggested by Gilkes,<sup>9</sup> but then the scheme becomes very similar to the present IMF scheme.

All this is not to decry the Commission's proposals. They will obviously be the basis for a long and hard bargaining at which the whole concept of commodity

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XII, 1959, Fasc. 3, pp. 269-401; Emile Benoit, "Purchasing Guarantees as a Means of Reducing Instability of Commodity Export Proceeds of Underdeveloped Countries", in Kyklos, Vol. XII, 1959, Fasc. 3, pp. 300-305; C. N. Vakil and P. R. Brahmanand, "Price Stabilization Versus Fiscal Stabilization", in Kyklos, Vol. XII, 1959, Fasc. 3, pp. 329-340; see also M. A. G. van Meerhaeghe, International Economic Institutions (The Camelot Press, London, 1971), Chapter 3.

<sup>9</sup> Patrick Gilkes, Approaches to EEC, in the Toronto Globe and Mail, Friday, July 27, 1973, p. 7.

agreements and their value needs to be examined with great care.

#### The Concept of a Remunerative Price

The concept of remunerative price has alternative interpretations. International discussion on the concept has yet to define what precise relationship between exports and imports is to be maintained at a remunerative level. UNCTAD discussion on the subject is not clear at all. However, one possibility is that the ratio of prices (or unit values) of exports be held at remunerative level in relation to the prices (or unit values) of essential imports. Another and prima facie more valid approach, would be for the ratio of total export earnings (i.e., price times volume) to be held in a remunerative relationship to the prices (or unit values) of essential imports. The distinction between these two approaches is important, particularly when one examines the concept of remunerative price for a single commodity, since in the one case it is implicit that price alone can be acted on, while, in the other, action affecting both price and volume can be recommended. When analyzing the effects of liberalization of trade (which can effect the volume at least as much as the price of exports), it is the second of these approaches which must be the basic objective of discussion. Volume as well as price, i.e., earnings rather than price alone,

therefore becomes relevant to the remunerative concept.

Action through price and/or the volume of exports could thus be component parts of any organization of the world cocoa market. Direct action could be taken on the volume of exports, for example through export quota systems, stockpiling, diversion to non-traditional uses, and even destruction, all of which could conceivably be linked, through some automatic, or negotiating mechanism, to changes in the costs of essential imports. "Organization of market" is thus a very general term which can be interpreted as being any scheme or series of schemes to maintain or raise the real value (however defined) of the export earnings of cocoa-producing countries.<sup>10</sup>

In the absence of any specific policy guidance, it is assumed for the purposes of this study that, though an upward movement in export earnings to remunerative levels is the ultimate objective of most if not all commodity schemes, it is on price and volume that attention must be concentrated. Comparison of the role of cocoa prices and prices of essential imports is shown in Appendix A. On the basis of the available statistics, and defining the essential imports of consuming countries as total imports, it seems clear that historically the real purchasing power

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<sup>10</sup> A. I. MacBean, op. cit., pp. 328-329.



of cocoa has not been greatly affected by changes in import prices. Partly as a result of this analysis, it is assumed here that, whatever the scheme, and however it is linked to the concept of real import purchasing power, it will have to work through, or be based fairly directly on, movements of the actual world prices for cocoa.

#### The Price Quotation to be Used

The following analysis will be generally made in terms of a world price for cocoa. It is important to note that no such single world price exists, although the cocoa quotations of, for example, the New York, London, Hamburg, Paris and Amsterdam markets probably constitute a more representative small group of price series than is available for many other commodities. Taken together, these markets cover a large portion of world imports of cocoa, although their quotations do not of course always move in exactly parallel fashion. In any organization of the world cocoa market, a representative 'world price' would necessarily have to be fixed on, especially insofar as the organization was to act directly through the price level, and be linked to other price or unit value series.

The problem of a representative price arose when the draft for the abortive 1966 Agreement for Cocoa was being drawn up. Nonetheless, for the purpose of an agreement, it was at that time decided that any reference to

price should be to,

an average taken daily and converted to pounds sterling per long ton at the official currency rate of the quotations for cocoa beans of the nearest three active futures trading months on the New York Cocoa Exchange at noon and the London Terminal Market at closing time, or whichever of the two quotations is available.<sup>11</sup>

Furthermore in the Producers' Alliance Agreement, which became effective at the beginning of the 1964/65 season, the same method was used when referring to the "indicator price" below which cocoa was not to be sold. The problem of fixing on a 'world price' is thus not a crucial one for cocoa, and it appears permissible to analyse in terms of a single world import price in the remainder of this study.

#### Theoretical Effects for Production of a Rise in the World Price

The interest in considering the implications that arise in the world cocoa price is to learn what would happen if this price were manipulated in some remunerative pricing scheme. Starting from an assumed equilibrium situation, what will be the likely implications of a rise in the world price? Generally speaking, cocoa production is responsive to price changes mainly in the long run through resulting changes in the price policies of Marketing

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<sup>11</sup>UNCTAD Document, "Draft International Cocoa Agreement", TD/Cocoa, 1/12 (New York, November 15, 1967), p. 32.

Boards and Caisses de Stabilisation.<sup>12</sup> In the past, periods of high prices have generally been followed by the Boards and Caisses inducing a good deal of new planting. Higher prices paid by the Boards and Caisses have led to increases in current output by encouraging spraying and other practices, but their main effect has been to stimulate new plantings which come into bearing only some years later. Once the new trees begin to produce, however, their output tends to continue increasing, even if prices then fall.

Low prices tend to discourage new planting, but the existing trees continue to bear, and their yields may even rise.<sup>13</sup> For when low prices are paid by the Boards and the Caisses, these seldom induce growers to go to the expense of uprooting trees which are still yielding and of planting some other crop instead: it is always possible

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<sup>12</sup>Robert M. Stern, op. cit., p. 10. M. J. Bateman, "Aggregate and Regional Supply Functions for Ghanaian Cocoa, 1946-1962," op. cit., pp. 384-401.

<sup>13</sup>Peter Ady, "Trends in Cocoa Production," Oxford University Institute of Economic and Stat. Bul. 11:389-404, 1949. P. T. Bauer, and F. W. Paish, "The Reduction of Fluctuations in the Incomes of Primary Products," The Economic Journal (Dec. 1952), pp. 750-780. P. T. Bauer and F. W. Paish, "The Reduction of Fluctuations in the Incomes of Primary Producers Further Considered," Economic Journal, Dec. 1954, pp. 704-729. See also Edwin R. Dean, "Economic Analysis and African Responses to Price," Journal of Farm Economics, Vol. 47, 1965, pp. 402-409.

that prices may recover, and there are usually some returns even when prices are low.

Production thus responds only weakly in the short term to price changes. However the crucial point in the context of an organization of the market is that, however inadequately, it does respond to some extent, and especially more so in the long-run. One essential conclusion with regard to any raising of prices to "remunerative" levels thus follows: if excessive increases in production and export supplies are to be avoided, particularly in the long-run, means will have to be found of isolating the cocoa farmer from the increase in world prices (however their prices should not be so low to discourage such increases in output as the market can absorb). The rise in prices may only accrue to the governments of cocoa-producing countries for development and diversification purposes. Happily, the existence of Marketing Board and Caisse de Stabilization mechanisms over a large proportion of world cocoa production makes such an isolation possible. In producing countries without such mechanisms, some (e.g., fiscal) means would have to be found to ensure the isolation. This separation of the cocoa farmer from the effects of any increase in prices to remunerative levels will be found to be equally acceptable to the final consumer at the other end of the market (as analysed

in the paragraphs below), though, as will be seen, it is probably less likely to be a practical possibility.

Theoretical Effects of a Rise in the  
World Price on Consumption

The proportion of the final retail price represented by the import cost of the raw cocoa beans is small (see Table 4.6 above). Further, the price elasticity of demand for the raw cocoa beans for grinding (i.e., the manufacturer's demand for current consumption plus stocks) and the price elasticity of demand at the final retail level tend to be substantially below unity.<sup>14</sup>

The effects of the low proportion of the value of the beans in the final product and the relatively low price elasticities of demand have combined in the past to make the reactions of consumption to upward changes in import prices relatively weak.<sup>15</sup>

The proportion of the price taken by the manufacturing and distribution processes is so large that the elasticities of demand for grindings which can be calculated for the past are not necessarily valid for the future, unless it can be assumed that the pricing and stock policies of the manufacturers will remain the same.

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<sup>14</sup>J. R. Behrman, op. cit., p. 704.

<sup>15</sup>The important qualification needs however to be entered that, *prima facie*, price elasticities of demand will tend to be higher both in the very short-run of a few months and in the longer-run.

Such an assumption is unlikely to be valid because manufacturers would face more uncertainty in a market 'controlled' for 'remunerative' price objectives than under the present "free" market in which inventory management is more crucial to minimize vulnerability to adverse price changes.

Hence, what might happen to the retail price of chocolate and chocolate products, given a permanent and managed increase in the import price of raw cocoa beans, depends to a large extent on how the manufacturers in the importing countries adjust to the new situation. Hitherto, manufacturers have followed a fairly consistent policy of stable retail prices, while absorbing the world price fluctuation themselves by either increasing or decreasing the size of the chocolate bar. However, this situation is expected to change in the 70's as demonstrated in Chapter 4. If an organization of the market were now to raise prices to a high and permanent level, their precise reaction can only be conjectured.

It seems likely that, initially, for a fairly short transitional period, the manufacturers would hold off the market so as to evaluate the success of the new scheme. Needless to say, such an attitude could put considerable pressure on any organization of the market, and should not be underestimated.

The short-term reaction would be followed by

different responses depending on the actual level of the 'remunerative' price compared with the recent past, and means used for reaching it, and the extent to which the current price has had to be raised to reach the new level.

Considering past experience, and given that the new price was visualized to be permanent, some rise in retail prices and some decrease in the cocoa content of chocolate products, i.e., some increase in substitution of other ingredients, etc., must be assumed eventually to occur; both of these imply some decrease in consumption. Certainly these are not the only alternatives, other alternatives are open to a limited extent: e.g., downwards adjustment of profit margins, alteration of packaging and publicity policies etc., but whether these could be the only reactions of manufacturers in the following period to a permanent rise in price is doubtful indeed.

Two other more general developments, which are difficult to be precise about, could take place. The industry, faced with a managed price at a higher level, might further intensify its use of cheaper substitutes which could, at least in part, be substituted for cocoa in a wide range of chocolate products. Further, with the world price stable and a futures market non-existent, or at least dormant, manufacturers might find the holding of

stocks at anything like present levels an unnecessary cost.<sup>16</sup> Should the stock-holding function gradually devolve on the producers this would constitute an additional cost to them, nonetheless it could also have considerable impact with regard to stabilization, if properly handled.

The ideal for an effective organization of the market at the retail, as well as the producer level, is that movements in the cocoa import price are completely isolated from both the farmer and the final consumer. This ideal may be a practicable possibility at the producer end, as has been noted, but it does not appear realistic to treat it as possible at the retail end. However weak the numerical elasticities of production and consumption with respect to price, it seems reasonable to assume, for any future permanent rise in the import price level, that some reaction will take place, especially in the long run. If this condition of excess supply should

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<sup>16</sup> Experience so far under the International Coffee Agreement points to this kind of trend. For example, while roastings in the United States have remained relatively stable, coffee stocks held in the United States at end of October 1965 were about half the level of the beginning of the year, and well below the average of the past four years. With the price of coffee stabilized under the Agreement, and thus the risks of sudden price rises and the prospects for speculative profits eliminated, it seems that the roasters are content to operate on a much more short-term, 'hand-to-mouth' basis, though the special circumstances of the previous period, when an International Agreement was being expected by the trade, should also be kept in mind.



develop, i.e., if consumption should begin increasingly to lag behind production, as a result of applying a remunerative price for cocoa, corrective measures would be necessitated.<sup>17</sup>

Quantitative Effects on Consumption  
of Raising the World Price to  
Remunerative Level

An attempt will now be made in this section to estimate some potential numerical impacts on consumption as a consequence of movements in the international cocoa price. Despite the fact that the analysis is based entirely on a very limited range of assumptions, it indicates the fairly restricted limits beyond which the process of raising the international price without associated measures to control production and/or export volumes would appear to be self defeating. One assumption throughout the analysis is that the existence of government marketing boards or a history of government control of cocoa exports in almost all the major producing countries is favourable to the establishment of an effective international commodity agreement in that institutions are available for the control of supplies in

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<sup>17</sup>Such corrective measures worth mentioning include: production control, stockpiling, diversion of supplies to non-traditional markets, destruction and development of new markets. Further discussions of these measures are presented in section (c) of this chapter.

individual countries and for the isolation of cocoa farmers from the world market.<sup>18</sup>

Manufacturers' policies will largely determine the effect which changes in the world cocoa price will have on the final consumption of chocolate and chocolate products. Direct demand for beans in the short-run can be numerically expressed by a coefficient measuring the price elasticity of the manufacturers' demand for beans for grinding plus stocks. The effect of a change in the import price of cocoa bean on retail price (as to whether retail price will change or not) will partly depend on the extent and prospective duration of the change in import prices, and partly on whether manufacturers decide to alter the cocoa content of their final products by substituting more or less of other ingredients, to change the size or weight of the final product and/or to accept different profit and distribution margins. There will be partly technical and consumer-taste limits to the possibilities of substitution, public relations limits to the

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<sup>18</sup>For the basis of assuming that marketing boards and other mechanisms are able totally to isolate the producer from the effect of the rise in the world price see chapter 5 of this study and also Organization for European Economic Cooperation, The Main Products of the Overseas Territories: Cocoa (Paris; 1956), pp. 26-30, 72-73, 88-89; John A. Pincus, Commodity Policy and Economic Development, op. cit., pp. 17, 27.

changes in weights and contents, and financial and accounting limits to the changes in margins, though some of these limits will probably be fairly wide. If and when alterations eventually do take place in the retail price, these will then induce responses from the final consumer, which can be measured quantitatively by the price elasticity of the demand for chocolate products at the retail stage. These responses will consequently have a lagged impact on manufacturers' demand for grindings; the effect on imports, however, will also depend on the changes that have taken place in the relative amounts of other ingredients used in the new range of final products.

Information on what might be the actual values of these various possible reactions is very sparse indeed; they undoubtedly vary from country to country as well as from manufacturer to manufacturer, and at different price levels. An attempt to give some overall quantitative values to each of them will now be made.

Price Elasticities of Demand for  
Raw Cocoa for Grinding

The two approaches frequently used in estimating the cocoa bean price elasticities of demand are (1) the response of grindings to changes in cocoa bean prices for selected countries and (2) the response of grindings in selected countries to annual changes in

prices of cocoa beans. A modified version of Weymar's model<sup>19</sup> yields an estimate of price elasticity for

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<sup>19</sup>Weymar, *op. cit.*, pp. 96-102. The model uses linear approximations to show that the equation for quarterly consumption takes the form (see his Appendix 5B for a discussion):

$$\ell_n Q_T^M = a + b_1 \sum_{i=1}^{n+2} c_i P_{3T+1-i} + b_2 Y_T^M + b_3 T \quad \dots (1)$$

Where

- $Q^M$  = aggregate quarterly per capita cocoa consumption  
 $Y^M$  = aggregate quarterly per capita real income (\$ thousand per person)  
 $P$  = monthly average real cocoa price  
 $T$  = time, in quarters (3T means three separate monthly consumptions in each quarter)  
 $c_i$  = lag coefficient

The above equation yields

$$-0.0113 \sum c_i P_{3T+1-i} + 1.036 Y_T^M - 0.00144 T + c_T \dots (2)$$

(0.0015) (1.731) (0.00400)

$$R^2 = 0.968$$

Given the format  $\ell_n Q = a + bP \quad \dots (3)$

and using the above results, price elasticity can be computed this way:

$$E = \frac{dQ}{dP} \cdot \frac{P}{Q} = bP \quad \dots (4)$$

Yields

This gives

$$E_P = bP \quad E_P = (-0.0113)(\bar{P})$$

Where  $\bar{P}$  is the average postwar price (P) in equation (1). For 1956-70 interval the  $\bar{P}$  is 30.97 cents per pound hence giving the average price elasticity of demand estimate

$$\begin{aligned} &= (-0.0113)(30.97) \\ &= -0.3499 \\ &= -0.35. \end{aligned}$$

aggregate per capita consumption of -0.35. This is consistent with earlier FAO findings.<sup>20</sup> FAO used the volume of grindings per capita, adjusted for seasonal variation in the case of the quarterly figures for its dependent variable. Time, and, where applicable, the volume of trade in cocoa products, were additional independent variables. In any event the results of both approaches were consistent in that the price elasticities were found to lie between -0.2 and -0.5 in all cases, i.e., a change in the price of beans of, say, 10 per cent may be expected to be associated with a change in manufacturers' demand in the opposite direction of 2 to 5 per cent; the mid-way figure of 3.5 per cent derived from Weymar will be used in the section below. Behrman's model<sup>21</sup> also produced estimates which lie between 2 and 4 per cent.

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<sup>20</sup>See FAO, *The Cocoa Situation: Recent Developments and the Outlook for Production and Demand* (Rome 1967), p. 12. The FAO estimates of the cocoa bean price elasticities of demand in various countries are:

United States	-.35	United Kingdom	-.27
Belgium	-.26	Australia	-.35
France	-.35	Denmark	-.49
Netherlands	-.41	Germany	-.49
		Sweden	-.35

<sup>21</sup>J. R. Behrman, *op. cit.* Behrman's demand function takes the form

$$\left(\frac{C}{N}\right)_t = A_0 = A_1 PC_{t-\frac{1}{2}} + A_2 PS_{t-\frac{1}{2}} + A_3 PS_{t-\frac{1}{2}} + A_4 \left(\frac{Y}{N}\right)_t + U_{s_t}$$

Manufacturers Reaction to a  
Rise in the Import Price

Considering the producing countries in isolation, the ideal consequence for them of a rise in the import price would certainly be for no upward movement to occur in the retail price. If this were actually so, however, the import price could logically be raised ad infinitum without any consequent impact on consumption. Certainly there will be some stage in the upward movement of raw beans prices at which manufacturers feel it necessary to raise the final retail price. For present purposes it is assumed that some limited rearrangement of ingredients, sizes and weights, some narrowing of margins, and some increased efficiency of production and distribution will occur on the part of the manufacturers. A further assumption is made in that approximately the first 15 per cent of changes in import prices will not induce manufacturers to change the retail price (see Table 4.1, line 4; though this change would in practice depend on the level of prices from which movements started). It is also assumed that for each 10 per cent increase in the import price the manufacturers reduce the cocoa content of their final products by 2 per cent.<sup>22</sup>

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<sup>22</sup>Personal interviews with four manufacturers from three different countries indicate that an increase of about

With the above increases of 15 per cent in the import price, and with beans contributing a 20 per cent proportion of the final price, each change in the world price will lead to a change in the retail price proportionate to the cocoa content of the final product. In this estimation, it is assumed that prices of all other ingredients remain constant.<sup>23</sup>

Price Elasticity of Demand  
at Retail Level

Studies on price elasticity of demand at the final retail level in industrialized countries have been conducted by the FAO. However, estimation of the price elasticity of demand at this level presents difficulties. Apart from the serious inadequacy of data on prices of chocolate products there is also the problem of lack of uniformity of data on these prices due to the wide range of qualities and types of cocoa and chocolate products offered

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15 per cent in cocoa price will not affect their margin much. They also indicated that this is the reason why they insisted during the initial stages for 15 per cent increase in price (taking the trend of the past 5 years) as ceiling for the cocoa agreement. Instead of increasing the price of the final product manufacturers prefer to reduce the cocoa content of the final product and thereby maintain the price.

<sup>23</sup>These figures are derived through personal interviews with manufacturers in different consuming countries. It is therefore expected that in negotiating for a remunerative price it will be open to the industry to determine values which would be acceptable to all participating countries.

for sale. The first estimates of the price elasticity of final demand were calculated by using the simple sum of production and net imports of chocolate products regardless of their cocoa content as the dependent variable, with price and consumer income as the explanatory variables. The correlation coefficients for four of the countries analysed ranged from 0.94 to 0.99 and for the fifth the coefficient was 0.74. The analysis indicated that the repercussions of price changes at the final consumer level are greater and in some countries much greater than at the manufacturing level. Bearing in mind the qualifications which the approach described above entails,<sup>24</sup> the price elasticities at the consumer level thus estimated ranged between -0.5 and -1.2 for the different countries; that is a 10 per cent change in the price of chocolate products is associated with a change in demand in the opposite direction of 5 to 12 per cent.

A more recent and comprehensive study by UNCTAD<sup>25</sup> obtained values which range between -0.2 and -0.25 for

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<sup>24</sup>FAO, *Agricultural Commodities--Projections for 1970* (Rome, 1962), Annex C, p. 39; and FAO, *The Cocoa Situation: Recent Developments and the Outlook for Production and Demand* (Rome, 1961), p. 12.

<sup>25</sup>United Nations Conference on Trade and Development, "The International Commodity Trade", TD/B/AC.213, January 3, 1969, p. 29.



the USA and Switzerland, and -1.0 for Italy and Japan, with a weighted average of about -0.3, i.e., each 10 per cent change in prices at the retail level might be expected to induce a change in consumption in the opposite direction of some 3 per cent. This value applies to countries making up some 85 per cent of current world consumption. A price elasticity (of around -1.0) is assumed for the remaining countries, which would give a world price elasticity of demand for cocoa products of around -0.4.<sup>26</sup>

Population and Income Effects  
Independent of Price

Current UN estimates<sup>27</sup> indicate that, for the developed countries making up some 85 per cent of world cocoa consumption, population growth in the next ten years is likely to proceed at about 1.1 per cent per annum. In the developing countries, representing about 15 per cent of the world market, population growth will be nearly twice as fast, at about 2.1 per cent per annum. Weighting these two sets of figures together,<sup>28</sup> a future population

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<sup>26</sup>This value is derived by weighting

$$\frac{85(-0.3) + 15(-0.1)}{100} = \frac{-40.5}{100} = -0.405.$$

<sup>27</sup>Ibid., p. 30.

<sup>28</sup>The weighting is derived as follows:

$$\text{weighted average} = \frac{\sum WM}{\sum W}$$

growth effect on cocoa consumption of some 1.25 per cent per year can be assumed.

Though knowledge of detailed analysis of the possible effect of future income growth on demand for cocoa is important, it must be emphasized that, for present purposes, a GNP growth rate of four per cent per capita is assumed<sup>29</sup> for the world at large. Income elasticity values of 0.2 for the developed 85 per cent of cocoa consuming countries and 0.8 for the less developed 15 per cent are assumed, averaging into a global income elasticity of demand of about 0.3.<sup>30</sup> Consequently future demand for

$$\begin{aligned} &= \frac{85 (1.1) + 15 (2.1)}{100} \\ &= 1.25 \end{aligned}$$

where

W = weights  
M = numbers to be averaged.

<sup>29</sup>J. J. Kaplan, The Challenge of Foreign Aid. Policies, Problems, and Possibilities (New York, 1967), pp. 63-67. See also International Finance Corporation General Policies of the IFC (rev. ed., Washington, 1970), p. 36.

<sup>30</sup>Using the formula of footnote 29 above. The global income elasticity is derived as follows

$$\frac{85(0.2) + 15(0.8)}{100} = 2.9$$

using modified version of Weymar's model (see footnote 19) yields income elasticity of:

$$E_y = (1.036) (\bar{Y})$$

where  $\bar{Y}$  is the average value for consumption expenditure (Y) in equation (1) of footnote 20. For 1956-70 interval the  $\bar{Y}$  is 0.288. Hence

cocoa as a result of income growth per head is thus assumed to be around 1.2 per cent per annum, giving a total population and income effect of about 2.5 per cent per annum. This may be a conservative estimate, since it does not take into account the possible development of new markets for cocoa, including particular radical changes in consumption levels in Eastern Europe. Again it would appear to be adequate for present illustrative purposes.

In sum the following assumptions are made:

- The short-run price elasticity of manufacturers' demand is -0.35.

- The long-run cocoa content of final products decreases by 2% for each 10% rise in import price.

- The long-run retail price will remain constant up to a 15% rise in import price; thereafter each 10% rise induces a rise in retail prices proportionate to the value of the cocoa content of the final product.

- Price elasticity of final demand is -0.4.

- Population and income effects on final demand is +2.5% per year. All these values are shown in Table 6.1.

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$$E_Y = (1.036)(0.288)$$

$$= 0.298.$$

The value 0.3 will be used in the rest of the analysis.

TABLE 6.1. Impacts of Price Changes

	Increase in Import Price of		
	0%	10%	20%
<u>Short-run</u>	(.....percentage change...)		
1. Change in manufacturers' demand	0	-3.5	-7.0
<u>Long-run</u>			
2. Change in cocoa content of final products	0	-2.0	-4.0
3. Cocoa content of "new" final product by value (for each 10% increase in price cocoa content decrease by 2%)	(20%)	(19.6%)	(19.2%)
4. Change in retail price for "new" product (no change up to a 15% rise in import price)	0	0	+3.84
5. Change in volume of consumption of "new" final product due to retail price change:	0	0	-1.54
6. Change in consumption due to income and population effects	+2.5	+2.5	+2.5
7. Short-run change in volume of exports <sup>a/</sup> (same as 1)	0	-3.5	-7.0
8. Short-run change in value of exports (= 7 + price change)	0	+6.15	+11.6
9. Long-run change in volume of exports (2 + 5 + 6)	+2.5	+0.5	-3.04
10. Long-run change in value of exports (9 + price change) <sup>b/</sup>	+2.5	+10.55	+16.35

a/ Assuming no income and population effects in short run.

b/ Price change also applies to 9.

Estimates of Quantitative  
Effects on Consumption

It is now possible to explore the possible quantitative impacts on consumption of changes in the import price with the use of the assumptions made in the preceding sections. However, a further note concerning time-periods is required. Short-term and long-run price and income elasticities vary for almost all products and certainly for cocoa. They also change at different levels of income and price and for different magnitudes of change in price. The assumptions made are thus extremely limited for simplicity of exposition, and, it should be reiterated are for illustrative purposes only. In addition all the changes shown are assumed to take place from an equilibrium situation of demand, supply and prices, which as has been pointed out earlier, is in fact rarely the case on the cocoa market. (Further disequilibrium situation analysis is carried on in chapter 7).

On the basis of the assumptions an attempt will now be made to work through three cases: those of changes in the import price of 10 and 20 per cent respectively, and that of an 'equilibrium' year with unchanged import prices of cocoa beans.

Independently of other considerations, the higher the import price is raised (by whatever means), the higher will be the absolute rise in cocoa earnings, it should

however be mentioned that the values shown in Table 6.2 are slightly higher (by a few percentage points) than those which emerge from a less static method of calculation (see section (c) of this chapter and data shown in Appendix B, C and D). There are 'decreasing returns'.<sup>31</sup>

Increases in export earnings would have to be accompanied by a fall in consumption. It is therefore pertinent to note that, even with the assumption that upward movements in world price are totally isolated from the cocoa farmer, the likely reaction of manufacturers, and, the resultant reaction of consumers, to anything more than a moderate increase in price will lead to a decrease in consumption in the long-run and consequently in the volume of exports. The implication of this is that, from any given year in which a remunerative price scheme is introduced, and in which production is assumed to be advancing at an 'equilibrium' rate, certain proportions of world export availabilities would have to be permanently isolated from the market or otherwise disposed of yearly, if heavy pressures threatening the remunerative scheme were not soon to build up.

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<sup>31</sup>For example a difference of 25 percentage points (33%) between raising the price by 75 and by 100 per cent results in an increase in long-term earnings of only 8 percentage points (18%).

TABLE 6.2. Effects on Volume and Value of Cocoa Exports in One Year of Selected Changes in Import Price.

<u>Percentage Rise In Import Price</u>	(Data Rounded)								
	0	5	10	20	25	30	50	75	100
<u>Consequent Percentage Change in Export Volume</u>									
in short-run <sup>a/</sup> :	0	-1.8	-3.5	-7	-8.8	-10.5	-17.5	-26.3	-35
in longer-run:	+2.5	+1.5	+0.5	-3	-4.4	-5.8	-11.1	-17.6	-23.9
<u>Consequent Percentage Change in Export Value<sup>b/</sup></u>									
in short-run <sup>a/</sup> :	0	+3.2	+6.2	+11.6	+14.1	+16.4	+23.8	+29.1	+30
in longer-run:	+2.5	+6.6	+10.6	+16.3	+19.5	+22.5	+33.4	+44.2	+52.2

<sup>a/</sup> Assuming no population and income effects in short-run.

<sup>b/</sup> c.i.f. port of importation; insurance and freight assumed to remain a constant proportion of the c.i.f. value.

Obviously if a situation of disequilibrium is to be avoided, the magnitude to which prices of cocoa can be raised is limited. Consumption should not be depressed below a rate of change equal to that to which it is possible to hold production (or export supplies). In Table 6.2, column 3 shows that, if supply can be controlled to a growth rate of about 0.5 per cent per annum in the long-run, instead of the assumed equilibrium rate of 2.5 per cent per annum, the amount of the remunerative price increase should not exceed 10 per cent, if, in the absence of isolation or other disposal action, burdensome surpluses are not to emerge.

The corollary to the above is that if a remunerative price level which would reduce the rate of change of consumption below that of production is deemed politically desirable, then the remunerative price scheme would have to contain or be associated with: (a) provisions to hold back production, (b) provisions to divert to new uses, destroy or stockpile given annual quantities of the commodity, including the necessary financial means, and/or (c) provisions to develop new markets, possibly at a lower differential price. Beyond a certain fairly early limit, therefore, a remunerative price scheme could not be adopted in isolation, but would have to be associated with other measures, including possibly some of the classic provisions



of an international commodity agreement or arrangement. The financial resources to carry through any agreed scheme would have to be an assured and integral part of the arrangement developed.

Quantitative Effects on Export Earnings  
of Raising the World Cocoa Price

Until 1971/72 a 'normal', 'equilibrium' season in the mid-1960's as reported by Gill and Duffus<sup>32</sup> were as follows:

World production and consumption:	1.25 million tons
World exports and imports:	1.05 million tons
Unit value of exports:	\$510 per ton <sup>33</sup>
Total export earnings:	\$535 million

If the 1971/72 and 1972/73 seasons see the market move to a level of 15 per cent above that of the 1960's, as is the current expectation,<sup>34</sup> a normal year in which production and consumption are almost in balance might be approximately as follows in the first half of the 1970's,

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<sup>32</sup>Gill and Duffus Ltd., Cocoa Market Report, Supl. 065, 1973, p. 15.

<sup>33</sup>Equivalent to 23 cents/lb. In 1968-71 spot Ghana on New York average 23.1 cents/lb; Spot Bahia 23.4 cents; Spot Ghana on London 23.3 cents or 187/- per cwt. Twenty-three cents was the compromise price level put forward by the Chairman at the closing stages of the abortive UN Conference of 1963.

<sup>34</sup>Gill and Duffus Ltd., Cocoa Market Report, December 1973.

assuming the 'equilibrium' price level of the first half of the period:

World production and consumption:	1.45 million tons <sup>35</sup>
World exports and imports:	1.25 million tons
Unit value of exports (as above):	\$510 per ton
Total export earnings:	\$637.5 million

From the above projected equilibrium situation, export earnings could be expected, on the equilibrium assumption to rise by 2.5 per cent in the following year, i.e., by about \$15.96 million (2.5 per cent of 1.25 million tons at \$510 per ton) to \$653.46 million (0.0313 + 1.25 = 1.2813 million tons at \$510 per ton), and so on year by year (see column 1 of Appendix C).

Assume now that a remunerative price scheme is implemented raising prices by 30 per cent (i.e., 30 per cent of \$510 = \$153.0) to \$663 per ton (i.e., \$510 + \$153). According to the previous assumptions, the crucial element in such a scheme's longer-run success will be the withdrawal from the market of a quantity equal to about 8.3% of the equilibrium level of world exports per year (see Table 6.2, column 6;  $8.3 = 5.8 + 2.5$ ).<sup>36</sup> There will

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<sup>35</sup>World production in 1971/72 and 1972/73 (forecast) averaged 1.45 million tons.

<sup>36</sup>Detailed data on a wider range of possible price increases is given in Appendix C.

moreover be the more adverse short-run effect of manufacturers' initial responses as depicted in Table 6.2: this is assumed to last for six months.<sup>37</sup> The development of export earnings on the equilibrium assumption (Model 1 - Free Market) and on the assumption of a 30 per cent price increase (Model 2 - Controlled Market) over a period of 5 years will now be examined, assuming also a sudden transition after a half year from the "short-run" to the longer-run" in Model 2.

Model 1 - Free Market

(Equilibrium development of the market at 2.5 per cent per year)

Year	Exports	Price	Earnings
1	1,281,300 tons	at \$510 per ton	\$653,463,000
2	1,313,332.5 tons	at \$510 per ton	\$669,799,575
3	1,346,165.8 tons	at \$510 per ton	\$686,544,558
4	1,379,820 tons	at \$510 per ton	\$703,708,200
5	1,414,315.5 tons	at \$510 per ton	\$721,300,905
Gross	6,734,933.8 tons		\$3,434,816,238
Annual Average	1,346,986.8 tons	at \$510 per ton	\$686,963,268

<sup>37</sup> Response in chocolate formulas to changes in cocoa prices reputedly require a lag of six months. See R. Amoa, op. cit., pp. 56, 63-70, 124.

Model 2 - Controlled Market

(Renumerative price increase of 30%; isolation 8.3% of export supplies each year)

Year	Exports	Price	Earnings
1	1,160,857.8 <sup>a/</sup> tons	at \$663 per ton	\$769,648,721.4
2	1,204,325.9 tons	at \$663 per ton	\$798,468,071.7
3	1,234,434.0 tons	at \$663 per ton	\$818,429,742.0
4	1,265,294.9 tons	at \$663 per ton	\$838,890,518.7
5	1,296,927.3 tons	at \$663 per ton	\$859,862,799.9
Gross	6,161,839.9 tons		\$4,085,299,853.7
Annual Average	1,232,368.0 tons	at \$663 per ton	\$817,059,984.0

Now, assuming that there are no restraints on production itself, the quantities to be isolated each year from the market would be as follows:

Year 1	120,442.2 tons	Cummulative total: 120,442.2 ton
2	109,006.6 tons	229,448.8
3	111,731.8 tons	341,180.6
4	114,525.1 tons	455,705.7
5	117,388.2 tons	573,093.9

From the above calculations, over the five year period, under all the assumptions made, a gain of about \$130 million per year (19 per cent above the average earnings

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<sup>a/</sup> Isolation of 9.4 per cent of world supplies in first year; i.e., the resultant of short-run and longer-run effects for 6 months each (see Table 6.2).

of the equilibrium case 1) could accrue from the world market following the implementation of a price increase of 30 per cent and assuming that this could be maintained by isolating 8.3 per cent of export supplies from the world market each year, by the fifth year, a cumulative quantity equal to as much as 44 per cent of possible world market sales ( $\frac{573,093.9}{1,296,927.3} \times 100$ ) would exist. The rising proportion of world exports which would have to be isolated under alternative remunerative price increases is further illustrated in detail in the last line of Appendix B.

The problem facing the Cocoa Council (or CPA if consuming countries refuse to participate) would be what to do with the quantities which had to be isolated from the world market. A number of possible means of disposal can be listed along with other assumptions about their possible numerical values. The quantities might never come into existence, especially in the later years of the remunerative price scheme, because of measures to decrease production (assuming zero direct costs in foreign exchange). They might be destroyed (small costs of transport and disposal though none in foreign exchange), they might be diverted to non-traditional uses (at an assumed price of \$25 per ton), stockpiled (at a cost of \$20 per ton<sup>38</sup> per

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<sup>38</sup>This is based on the contribution charged on

year), or they might be sold to new markets in developing countries or countries in the Soviet block (at an assumed price 50 per cent of the new remunerative level).

It is possible, however, to use a combination of these various disposal approaches. It must be stressed that if on the other hand the quantities to be isolated are left merely to pile up and impede the market, the scheme will be doomed to fail.

Under the various disposal assumptions made above, the additional earnings or loss in earnings is shown in Table 6.3. By the fifth year, under the assumptions made above, a further gain of over \$47 million to a loss of over \$11 million might be additional to the extra earnings of about \$139 million ( $\$859,862,799.9 - \$721,300,905 = \$138,561,894.9$ ) from the remunerative price scheme in the world market proper. On average for the five years, a sum between \$38 million gain and a loss of about \$7 million might be additional to the basic annual gain in earnings of \$130 million ( $\$817,059,984.0 - \$686,963,247.6 = \$130,096,736.4$ ). For the five-year period, the total gains from a controlled market would be about \$698 million above the free market (see Table 6.4).

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cocoa on first export by a member at one U. S. cent per pound of cocoa beans to finance the buffer stock.

TABLE 6.3. Additional Costs or Earnings Under Various Disposal Methods for the Isolated 8.3 Per Cent of World Exports

Year	Quantities (in thousand tons)	Destroyed or not Produced <sup>a/</sup> (. . . . . \$ million . . . . .)	Diverted	Stockpiled <sup>b/</sup> (. . . . . \$ million . . . . .)	To new markets @ \$332/ton	Combination of methods <sup>c/</sup>
1	120	-	2.4	-2	39.8	10
2	109	-	2.2	-4.6	36.2	9.1
3	112	-	2.2	-6.8	37.2	9.3
4	115	-	2.3	-9.1	38.2	9.6
5	117	-	2.3	-11.5	38.8	9.7
Yearly Average	115	-	2.3	-6.8	38.0	9.5
Cumulative Total	573	-	11.4	-11.5	190.2	47.7

<sup>a/</sup>An alternative assumption could have been a minus cost (of about \$60 million per year) for the exchange earnings foregone (at the lower price) on the quantities destroyed or not produced.

<sup>b/</sup>Indicates cumulative costs.

<sup>c/</sup>Assuming 25 per cent destroyed or not produced, 25 per cent diverted, 25 per cent stockpiled, 25 per cent to new markets.

TABLE 6.4. Yearly World Earnings: Free Market  
Compared with Controlled Market

Year	A Free Market	B Controlled Market	C Earnings from Isolation Using Combination Method
1	\$653,463,000	\$769,648,721	\$10,000,000
2	669,799,575	798,468,072	9,100,000
3	686,544,558	818,429,742	9,300,000
4	703,708,200	838,890,519	9,600,000
5	721,300,905	859,862,800	9,700,000
Total	\$3,434,816,238	\$4,085,299,854	\$47,700,000
Net for Controlled Market			
B + C		\$4,132,999,854	
Net Gains from Stabi- lization			
Net B - Total A		\$698,183,616	



Relating the percentage values of Table 6.2 to dynamic data for prices and earnings allows a further series of conclusions to be made. The increase in export earnings which is achievable by withdrawing a specific quantity from the world market and thus raising price is substantial.

The additional earnings or costs involved in withdrawing the necessary quantities from the market, as well as the precise means by which the isolation is implemented, would be an important though not crucial element in the overall computation of gains, but the fact of isolation would be a key element in the success of the whole scheme. The importance of this element would develop in the later years of the market organization when larger quantities requiring isolation would, in the absence of production regulation, have accumulated.

Using their percentage shares in world exports as shown below (Table 6.5), the total gain from the world market, assumed to be \$130 million per year,<sup>39</sup> might accrue as indicated below to the major cocoa exporters. The values below would be estimates of each country's possible gain from a scheme raising prices by 30 per cent.

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<sup>39</sup>This value excludes possible earnings from disposal operations (see Table 6.5).

TABLE 6.5. Basic Percentage Market Share,  
1962/63 to 1971/72\*

Country	Average Export	
	Thousand Tons	Percentage of Market Share
Ghana	535.4	41
Nigeria	235.0	18
Ivory Coast	117.5	9
Brazil	91.4	7
Cameroon	91.4	7
Ecuador	39.2	3
Dominican Republic	26.1	2
Togo	13.1	1
Costa Rica	13.1	1
Rest of World	143.6	11
TOTAL	1,305.8	100

\*In both the 1968 and 1972 Draft Cocoa Agreements the market share of each producing country is based on its highest production for the past eight years in determining basic quotas. Average export shares are used in this analysis for illustrative purposes in order to derive export earnings.

Data used for computation are from Gill and Duffus Ltd., Cocoa Reports (various issues, 1960/61 to 1971/72, London).

Country	Earning
Ghana	\$53 million
Nigeria	23 million
Ivory Coast	12 million
Cameroon Republic	9 million
Brazil	9 million
Ecuador	4 million
Dominican Republic	2 million
Costa Rica	1 million
Togo	1 million
Rest of the World	16 million

A wider range of possible earnings under different remunerative price increases is given in Appendix D.

The data set in Appendix D which demonstrates distribution of gains under alternative increases in price and export earnings, seems to beg the question whether net additional financial transfers of these orders of magnitude to each country would not be a more efficient and acceptable means of "assistance" than that entailed in holding back the growth of consumption of cocoa through the possible complex negotiation of an organization of the market (see for example, the type of schemes outlined briefly under International Deficiency Payment Scheme, and the International Compensatory Financing Mechanism).

The isolation of given quantities from the market--how large or small depending on the precise elasticity of manufacturers' and consumers' response--can again be seen to be an important factor on which the success or failure of the scheme hinges. Furthermore, production increases must be restrained if other means of disposal such as

diversion or the development of new markets are not in prospect. It will be insufficient simply to isolate the cocoa farmer from the upward movement in world prices, as has been assumed throughout this analysis: what may well become necessary are some active restraints on the rate of production growth. A proportion of the additional earnings could possibly be earmarked for measures to regulate production and diversify the economy. Insofar as such regulation was successfully carried through, or some other disposal methods successfully worked out, it could then become less necessary in certain circumstances to isolate the cocoa farmer totally from price fluctuations, though the dangers of any premature raising of price to the farmer would have to be strongly emphasized. Stockpiling has been suggested in this analysis as a possible disposal means, but this cannot be seen as a permanent long-run solution to the problem of isolating supplies.

An organization of the market will thus certainly require political agreement on the necessity of disposing of large tonnages of cocoa outside the world market proper, but equally important will be a thorough examination, based on more reliable statistics and information than is currently available, of the means and costs of various alternative methods of carrying such isolation through.

This conclusion leads in to the following section on the means by which an organization of the market for cocoa might be achieved.

Possible Means of Achieving a  
Remunerative Price for Cocoa

The precise means whereby the cocoa market is organized so as to raise prices to remunerative levels will, if ever realized, be the result of a political negotiating process. The discussion of technical possibilities can thus be only a preliminary to negotiation.

International commodity agreements are, in sum, beset with many problems and difficulties.<sup>40</sup> Even if they can be successfully negotiated their implementation produces various inefficiencies--in both market mechanisms and distribution of "aid". Estimates of cash gains which might accrue to developing countries from the several possible commodity arrangements according to Harry Johnson are all below \$1,000 million, some being substantially less.<sup>41</sup> While \$1,000 million is not an insignificant sum, it would not go much more than a very small way

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<sup>40</sup>Boris C. Swerling, "Buffer Stock and Commodity Problems," Economic Journal, Vol. 63, 1953, pp. 778-190; and W. E. Schmidt, "The Case Against Commodity Agreements" in Foreign Agricultural Trade, ed. Robert L. Tontz (Iowa State University Press, Ames, 1966), pp. 365-380.

<sup>41</sup>Harry G. Johnson, "Economic Policies Toward Less Developed Countries," op. cit., p. 257.

towards meeting the foreign exchange requirements of developing countries. As Pincus has put it:

The dominant conclusion which emerges from investigating all these aspects of international commodity trends and policies is that the South [LDCS in Africa and Latin America] must look primarily to Northern prosperity [EEC and UK] as a source of export growth, and not to the UNCTAD policies (for commodity trade arrangements). Should the effect of these policies be substantial, they are unlikely to be adopted; measures that are likely to be adopted are also likely to be unimportant as sources of increased capital or trade. Policies to increase or stabilize commodity earnings cannot proceed much faster than Northern willingness to act on the broader problem of developing country growth.<sup>42</sup>

Despite their limited possibilities developing countries will continue to press for international arrangements for primary products. For trade in these commodities is to them crucially important and (to them) is an obvious source of their difficulties. The idea of solving everything through the right arrangement over prices is, moreover, appealing in its simplicity. As a background to any eventual technical discussions, this section touches on some possible means which could be considered with respect to remunerative pricing for cocoa. It is not intended to provide an exhaustive list, which, in the final analysis, as has been indicated above, could cover virtually every proposal ever put forward for regulating an international commodity market.

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<sup>42</sup>John Pincus, Trade, Aid and Development, op. cit., p. 294.

The means listed below might be regarded as a basis for future consideration should the Cocoa Council decide to explore all means of achieving a remunerative price. Any examination of possible means will have to be related to the reaction of participating countries to the draft International Cocoa Agreement submitted to the UN in January 1973. This is because the decisions of the UN Cocoa Conference might in fact amount to an organization of the cocoa market, though such an organization will probably fall short of linking the cocoa price to an index of essential imports in any way. The following list of possible means must therefore be regarded as a hypothetical listing which may be taken into consideration by the Cocoa Conference, and which is likely to be rendered somewhat academic by the decisions of the Conference.

The level of price regarded as remunerative might be negotiated on the basis of a number of different criteria (e.g., through Johnson's formulae automatically linking it to an index of essential imports,<sup>43</sup> or through a pure negotiating and bargaining process). The price target once fixed could be maintained in a number of different ways. The various measures listed below could also of course be used in alternative combinations. Stockpiling for example cannot really be considered in

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<sup>43</sup> Harry G. Johnson and others, Trade Strategy for Rich and Poor Nations, op. cit., pp. 62-63.

isolation, but is of basic importance as a support for other techniques (e.g., export quotas and production controls). Similarly, it is possible to envisage a scheme whereby cocoa diverted to non-traditional uses at a low price attracts a compensatory financing payment which to some extent makes good the price loss.

International Deficiency Payment Scheme might be one of the simplest forms of organization to operate and one of the most acceptable from the producing countries' viewpoint. Briefly, there would be no regulation of the market as such, price being free to find its own level in relation to supply and demand pressures, and thus perform its theoretical long-term allocative functions. The difference between world prices and the negotiated remunerative price level would then be made up by financial transfers on a government-to-government basis. The country-by-country basis on which the finance was provided and the allocation of disbursement would certainly have to be negotiated, possibly in separate form by the importers among themselves, and by the exporters among themselves. Safeguards would be required against the creation of artificial gluts leading to lower prices and thus higher deficiency transfers; some production or export regulation would undoubtedly be necessary. No financial transfers would take place when the world price equalled or exceeded



the remunerative level.

An International Compensatory Financing Mechanism

would be a variant of the deficiency payments method. A large literature already exists on this subject<sup>44</sup> and much expert international discussion has already taken place. Unfortunately several important points remain unclarified: e.g., are the resources to be used for compensation of shortfalls in export earnings to be provided wholly or partly by developed countries? Is there to be a "revolving fund" approach, or are fresh injections of resources into the system to be implicit in its structure?

The compensatory financing approach involves no intervention, but takes short-term variations in prices and earnings as given and seeks to compensate for shortfalls from an agreed "norm".

Export Price Arrangement. Such an arrangement consists in a commitment by substantially all producing

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<sup>44</sup>See for example: Gerald M. Meier, op. cit., pp. 488-489 and 562-567; Paul Prebisch, "Toward a New Trade Policy for Development" reprinted in Reshaping the World Economy, ed. by John A. Pincus (Prentice-Hall, New Jersey, 1968), pp. 124-125; UN Secretariat Document "A Development Insurance Fund for Single Commodities", E/CN.13/45, CCP 62/11, Feb. 1962; Alasdair I. MacBean, op. cit., chap. 13, passim; International Monetary Finance Report, "Compensatory Financial Measures to Offset Fluctuations in the Export Income of Primary Producing Countries," E/CN.13/58, March 1963.

countries to permit no exports at prices below an agreed minimum, though this scheme may not necessarily require the agreement or co-operation of consuming countries. Such price agreements can, in theory, be relatively easy to negotiate and can also preserve some aspects of competition on international markets. An extreme form of such an arrangement was tried unsuccessfully by the Cocoa Producers' Alliance in early 1965 when the producers chose to hold off the market altogether (see chapter 5). The principal problems remain those of enforcement, the pressure from non-co-operating exporters, and, in the longer-run, the maintenance of supply in line with export possibilities.

A multilateral long-term contract consists of an exchange of commitments between producers and consumers on prices and quantities to be traded. Producers undertake to sell, on request, to the importers, specified quantities at no more than the maximum price, while consumers undertake to buy, on the exporters request, specified quantities at no less than a minimum price. The effect on producers' earnings will depend under this scheme on the level of the negotiated price range and on the share of the market covered by the reciprocal commitments. This control mechanism is exemplified by the Wheat Agreement of 1962.<sup>45</sup>

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<sup>45</sup>International Wheat Agreement of 1962, supra note 56.

There can be considerable problems of enforcement under this system; it can be virtually nullified, by the non-co-operation of certain exporting countries, and the need to maintain production in line with export possibilities is again a very real one. If the contract was a strong one which took care of these possible drawbacks, a remunerative price level could be maintained by this means.

There are certain advantages worth noting with this scheme. It more or less assures producers of a tolerable income and assures consumers that they can obtain a quantity of the commodity at reasonable prices. The scheme thus moderates fluctuations in income of both producing and consuming countries. At the same time, since part of world trade is left free, prices attained outside the quantities controlled by the agreement can serve as a guide for re-negotiation of the agreement floor and ceiling prices. In principle the scheme appears to achieve moderation of income fluctuations while preserving the allocative function of a free price.

A technical drawback stems from the risk that the residual free market may be made much more unstable as a result of the controlled share of the market. Johnson<sup>46</sup>

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<sup>46</sup>H. G. Johnson, "The De-Stabilizing Effect of International Commodity Agreement on the Prices of Primary Products," Economic Journal (November 1950), p. 626.

argues that in the absence of other national or international intervention, an agreement which fixes maximum and minimum prices for a part only of the total volume of a commodity traded is likely to give rise to more violent fluctuations than would otherwise occur. Consequently, the advantage of guaranteed maximum buying prices or minimum selling prices on that part of the transactions covered by the agreement will to a greater or lesser extent be offset by higher buying or lower selling prices on those transactions which fall outside the agreement.

Johnson's criticism applies equally to any control scheme of ICA which does not cover all of the traded commodity. As MacBean puts it, its theoretical validity is unchallengeable, but its empirical significance is probably minor as long as the area under the agreement is much larger than the part of the market left free.<sup>47</sup> The

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<sup>47</sup> If demand and supply reach equilibrium above the "ceiling price of the agreement, consumers satisfy a large part of their demand at the ceiling price. As opposed to buying at the equilibrium price, this represents a saving of real income equal to the quota times the difference between the equilibrium price and the ceiling price. Depending on consumers' income elasticity of demand for the commodity, their residual demand may be increased, thus pushing the residual free market price above the over-all market equilibrium price. If the commodity were by any chance an "inferior good", this income effect would actually be stabilizing. Since the proportion of income spent on one commodity in the main consuming countries is generally very small and the income elasticity of demand very low, the total effect on demand is likely to be negligible. An analogous argument exists for sales at the floor price

weighted average of the controlled price and the free price will then almost certainly show greater stability than would average prices in the absence of the agreement.

Export Taxes and Import Levies. In the case of export taxes, the earnings received by the producing country can be raised either by the producing country simply levying an additional tax at the export stage, possibly raising the world price, or, in the case of import levies (or internal taxes), by the consuming country levying additional taxes at the import or consumption stage, the revenue from which is then returned to the producing country under certain agreed conditions.

However, such schemes may restrict exports from the producing countries in two ways: increased prices reduce total consumption and domestic consumption of cocoa is substituted for imports. It is difficult to assess the value of expanded export income which would accrue to cocoa producing countries under such a scheme. One observer,<sup>48</sup> however, has put the figure at \$2,000 million, equivalent to an increase of about 15 per cent of earnings from agricultural exports. Johnson has estimated that such

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and also for effects on supply elasticities." A. I. MacBean, Export Instability and Economic Development, op. cit., p. 277.

<sup>48</sup>D. Gale Johnson, "Agriculture and Foreign Economic Policy," Journal of Farm Economics, Dec. 1964, pp. 922 and 923.

schemes for sugar alone would result in a minimum increase of \$897 million in the value of sugar imports into the developed countries and in addition would have released some \$482 million worth of resources which could be used for development.<sup>49</sup>

The return of revenue from import levies or internal taxes to producing countries would presumably require international agreements of some kind. It would be important that the import levies or taxes paid over should be additional to the current total of aid from the consuming to the producing countries. Accompanying measures of supply restriction may well need to be associated with these taxes or levies if the price paid by consumers is to be maintained at a permanently higher level.

Export Quota. Typical of direct action on supply is the classic export quota type of commodity agreement, designed to maintain price at a given level, or within a given range, by restricting the supply reaching international markets. The Cocoa Conference of 1963 had this form of draft agreement before it, as did the 1966 and 1972 draft agreements (see Appendix E). Enforcement poses a problem for this type of agreement, as does the role of

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<sup>49</sup> Harry G. Johnson, Economic Policies Toward Less Developed Countries, op. cit., p. 257.

non-co-operating countries. Also of concern is the long-term maintenance of production in line with export possibilities and the periodic reallocation of quotas in a dynamic world. However, the International Coffee Agreement has so far worked well along these lines. Indeed, its recent incorporation of a mechanism linking quota adjustment to movements in an agreed indicator price,<sup>50</sup> constitutes a significant feature. This experience could be extremely relevant if an export quota system had at some future time to be merged with an organization of the market which took into account movements in prices of essential imports.

The earlier analysis has shown that direct action on price will almost inevitably, sooner or later, induce divergent movements of supply and demand even for what appears to be so suitable a crop as cocoa. Given the typical characteristics of the production of cocoa, a key factor in the long-term success of any organization of markets is thus likely to be some regulation of supply. Such regulation might at first act through exports alone, but it is highly likely that, in the longer-run, means will also have to be found to manage production. Similarly,

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<sup>50</sup> If the indicator price moves outside a certain range, and stays there for 15 consecutive marketing days, quotas are reduced or increased accordingly.

production cannot, for example, long continue to grow more rapidly than export possibilities if an export quota is in force, and being enforced, without losses to the producing countries. Production regulation may thus become an essential at some stage.

Production Regulation. In the long-run some regard must be paid to changes in relative productivity and costs in different producing countries. How to control production is a far more difficult question to which there is obviously no general answer. Cocoa plantings might have to be reduced or at least controlled. Expenditures on pesticides, spraying, advisory services etc. might well have to be reduced, and, given a positive elasticity of response by producers, prices paid by Marketing Boards etc. might have to be lowered.<sup>51</sup> The political, social and technical difficulties in controlling cocoa production, largely farmed by individual peasants, are very large, but failure to do so would certainly compromise any remunerative price system.

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<sup>51</sup>Reduction in prices paid to farmers by Marketing Boards with the objective of reducing production might not work. Though there is no empirical evidence to substantiate this, some writers have noted a strong tendency for some cocoa producers to expand their farms and increase plantings and consequently output if price falls. This action is taken purely because these farmers want to maintain their yearly income from the proceeds of cocoa.



Destruction of crops is an alternative should production regulation fail. Destruction is however widely recognized as immoral, as well as entailing costs of collection and disposal which, if not in foreign exchange, still constitute economic waste. Nonetheless, in certain circumstances, and whether or not it is morally acceptable, destruction could certainly remove excess supplies from the market and assist in raising and/or maintaining prices.

Much more preferable to destruction of excess supplies would be diversion to non-traditional uses, which should not be beyond the international community to organize, given the existence of excess supplies. For example, at the beginning of an organization of the market for remunerative prices or later as a result of any failure to regulate production sufficiently, the diversion scheme could be used. Cocoa fat has a value on the world fats and oils market which would represent some return to producing countries, though far below that for chocolate products. The possibilities of non-traditional uses are meagre, but at least they represent some advance on destruction as a means of disposal. Diversion could moreover be an important element in maintaining an organization of the markets' scheme, whatever the financial returns involved, if ready to be put into temporary effect at some stage of excess production, such as occurred in 1964/65

season.

At any prices higher than those obtainable for cocoa in the fats and oils market, a still more favourable solution to an excess supply problem would be that of diversion to new markets, should these be available. A two-, or three-price, scheme could be envisaged under which excess supplies at various levels of prices below the remunerative one could be diverted to countries which have not in the past been significant buyers. As with diversion to non-traditional uses, a crucial element in this form of diversion would be the assured isolation of the excess supplies from the world market itself. Without such an assurance, the whole remunerative price scheme might collapse if re-sales of low priced supplies become available in any quantity. The major opportunity for developing such non-traditional markets currently appears to lie in the Eastern European region. Increased cocoa consumption in Eastern Europe and elsewhere might well be stimulated by sales at lower prices, though how far such a form of diversion as part of remunerative price organization of markets would be acceptable to other major consuming countries is open to question.

Stockpiling by an international agency, as defined by Swerling, applies when raw commodities are stockpiled because of falling price, only to be resold when the

commodity price recovers.<sup>52</sup> Among professional economists whose endorsement has loaned prestige to recommending stockpiling as a device for damping the short-term price fluctuations that plague international markets will be found such names as Colin Clark, J. B. Condliffe, J. K. Galbraith, E. S. Mason, Hla Myint and W. W. Riefler.<sup>53</sup>

The distinction between strategic stockpiling and commercial buffer-stocks is by no means easy to draw. One of the basic problems in arriving at any international agreement is the question of "where" the commodity is to be stockpiled. Stores of cotton, wheat, sugar, cocoa, along with the scarcer industrial raw materials and many other commodities, are, under appropriate conditions, clearly strategic goods. The question of their location is an important one, only in part to be decided by availability of warehouse facilities. Cocoa stockpiled in Ghana would be of little help to Canada in an emergency, likewise wheat stockpiled in Australia. Since producing countries do not consume the cocoa beans they produce, the closer stocks lie to these producing countries, or the longer sea voyage necessary between present warehouse and

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<sup>52</sup>E. C. Sterling, "Buffer Stocks and Commodity Problems," Economic Journal, December, 1953, p. 778.

<sup>53</sup>For reviewed literature see M. K. Bennett, et al., International Commodity Stockpiling as an Economic Stabilizer (Stanford, 1949), pp. 178-89.

ultimate destination, the more influence is exerted by non-commercial considerations. Fortunately cocoa beans cannot be economically stockpiled in producing countries due to the effect of tropical temperature.

Stockpiling thus could be regarded as a means of regulating supply to raise price to remunerative levels. It would however be essentially a temporary method, to be employed, for example, to offset fluctuations caused by climatic variations which, as has been explained earlier, are a typical feature. However in this short-term role, stockholding could be of invaluable use, preventing short-term pressures on the remunerative price from getting out of hand. The question of the financing of the stocks would be an important consideration in any scheme using this system. On a longer-term view, it is theoretically possible to visualize buffer stock operations for stabilizing cocoa price within a given range, assuming sufficient resources in funds and kind and a successful regulation of production. It is, however, difficult to perceive how such operations could be used to increase exporters' real earnings without repeated storage subsidies, nor is it easy to discern how they could be combined with any two-price system which might be required. Nonetheless the buffer stock scheme is the most widely advocated measure

for stabilizing commodity markets.<sup>54</sup> In principle the scheme interferes as little as possible with the free workings of the price mechanism as an allocative influence on producers and consumers. However, when it does interfere it does so minimally, avoiding such distasteful features as destruction of crops or restriction of output. The main difficulty is the cost of operating the scheme which the Cocoa Council must seek to minimize. If the price of cocoa rises above the upper limit, the Cocoa Council can sell the cocoa from its stocks at the ceiling price, and so long as its stocks last, the price can be held at or below the ceiling. The effectiveness of the scheme in reducing fluctuations in cocoa prices will depend on the size of the gap between the ceiling and the floor price and the ability of the Council to defend these.

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<sup>54</sup> Advocates include almost all the international agencies concerned with this field, e.g., GATT Trends in International Trade, 1958; U. N. Department of Economic and Social Affairs, National and International Measures for Full Employment, 1949; U. N. Commodity Trade and Economic Development, 1953; and an impressive list of economists, among them: Hla Myint, W. W. Rieflex, and Sir Roy Harrod. See also E. S. Mason, Controlling World Trade: Cartels and Commodity Agreements (New York: McGraw-Hill, 1946); J. M. Keynes, "The Policy of Government Storage of Foodstuffs and Raw Materials", Economic Journal, September 1938; J. M. Keynes, "The Objective of International Price Stability", Economic Journal, June-September 1943; B. C. Swerling, "Buffer Stocks and International Monetary Problems", Economic Journal, December 1953 and B. C. Swerling, "Problems of International Commodity Stabilization", American Economic Review, May 1963, p. 778.

International buffer stock is prima facie the most appealing and superior tool to achieve objectives with respect to remunerative pricing. However, the cost and risk involved in operating a buffer stock is crucial. The prospects of creating international funds to buy the stocks may not seem hopeful unless cocoa consuming countries (especially U.S.A.) show enthusiastic support to finance them. Other forms of measures of achieving a remunerative price for cocoa have rather less evident virtue in relation to the chosen objective of moderating fluctuations without disturbing long-run equilibrium, for they interfere more directly with supply and demand. Ideal is least cost or optimal stabilization policy over alternative time periods. Issues involved in the minimization of the cost of operating a buffer stock by the Cocoa Council are explored in chapter 7.

## CHAPTER 7

### OPTIMAL STABILIZATION POLICY FOR A REMUNERATIVE PRICE SCHEME FOR COCOA

At any negotiations the producers will want a high price, the consumers a low price, the manufacturers a stable price and the speculators will want to know which way prices are going to move. The actual remunerative price will have to be negotiated.

Cocoa prices are matters of great concern to both producers and consumers. The producer must receive a price for cocoa which not only covers the cost of production, but also provides an incentive to produce more to meet increased demands. The manufacturer must be able to buy his raw material at a price which will enable him to produce and sell cocoa and chocolate at a reasonable profit. Consequently the expression 'a price which is fair to both producer and consumer' can be very misleading if not meaningless. Unfortunately it is extremely difficult to state a single price<sup>1</sup> which will completely fit

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<sup>1</sup>Gerda Blau, "International Commodity Agreements and Policies" (FAO, Comm. Pol. Studies 16, Special Studies Programme No. 1, Rome, 1964). See also J. E. Meade, "International Commodity Agreements", Lloyd Bank Rev., July 1964.

this description because costs of production vary considerably in different cocoa-growing areas. To fix a price based upon low-cost production would not be acceptable to producers whose costs are much higher. Since remunerative pricing is not based upon production costs, this problem is avoided.

A mere establishment of remunerative price does not ensure price or supply stability. As shown in chapter 6 various mechanisms for isolating surplus cocoa beans from the market must be used. Nevertheless not all adjustment paths are equally desirable, raising the question, what, if anything should the Cocoa Council do in order to try to influence the transition to equilibrium. The objective is not to make specific recommendations for the conduct of the Cocoa Council but to illustrate a technique. The exact details of a mechanism are not essential to show how the technique can help to guide decision makers.

Buffer stock is a superior tool to achieve the objectives with respect to remunerative price. However, this does not mean that the issues arising from operational problems in management of buffer stock are insignificant.

These issues are essentially one of minimizing cost of a given price stability scheme or minimizing the time horizon. These issues are explored in this chapter.



This chapter deals specifically with the following; the theoretical considerations and limitations of the optimal stabilization policies, an application of a linear model of a deterministic market, and Cocoa Council's intervention in such a market. Costs of intervention by the Cocoa Council are considered and an optimal policy with the Council trading in cocoa is determined.

There are many models that could be chosen to analyze the stabilization policy but a rather simple linear model is selected for convenience.

#### Theoretical Approaches and Limitations of Optimal Stabilization

By using a downward sloping demand curve,<sup>2</sup> Frederick Waugh showed that consumers gain more from a price fall than they lose from an equal price rise. Apparently, Waugh was so convinced of the results of his static partial analyses that he advised against "the 'ever-normal granary' program in the United States, and the proposed 'buffer stocks' of staple food to stabilize international food prices after the war."<sup>3</sup>

A similar conclusion was arrived at seventeen years later on the supply side. Walter Oi using a positively sloped supply curve and assuming producers to be price-takers,

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<sup>2</sup>Frederick V. Waugh, "Does the Consumer Benefit from Price Instability?" Quarterly Journal of Economics, LVIII (August 1944), pp. 602-14.

<sup>3</sup>Ibid., p. 609.

concluded that "price instability is a virtue rather than a vice,"<sup>4</sup> thus producers gain from price instability and lose from price stabilization. These two studies considered the welfare of one group only, ignoring the effects on the other.

The static models of Waugh and Oi came under more scrutiny when the perfect competition theory assumptions under their models were relaxed. Tisdell, assuming a world of uncertainty, showed that if output is pre-planned--a lagged price response--then a producer will gain more from fixed price than under varying price, albeit with the same average.<sup>5</sup> Zucker on the other hand showed that if a constant elasticity of supply is assumed and if revenues are stabilized rather than prices, then producers gain since fluctuating prices may require additional costs to manage output optimally.<sup>6</sup>

The recent work by Tisdell and Zucker, compelled Waugh to modify his conclusions of twenty years back:

Price instability, in itself appears to be neither a virtue nor a vice, neither good nor bad, neither harmful nor beneficial. It depends upon the level at

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<sup>4</sup>Walter Oi, "The Desirability of Price Instability Under Perfect Competition," Econometrica, 29 (January 1961), p. 63.

<sup>5</sup>Clem Tisdell, "Uncertainty, Instability, Expected Profit," Econometrica, 31 (January 1963), pp. 243-48.

<sup>6</sup>Albert Zucker, "On the Desirability of Price Instability," Econometrica, 33 (April 1965), pp. 437-41.

which it is stabilized and whether one is concerned with the welfare of the consumer or producer.<sup>7</sup>

Thus, more than twenty years have passed and we are still saddled with the problem of determining whether price instability is a vice or virtue.

In light of the mystery surrounding the implications of export instability in general, Benton Massell's article on "Price Stabilization and Welfare"<sup>8</sup> is most welcome since it attempts to integrate the theoretical work on the subject so far. Massell intergrates the two analyses and shows that when both producers and consumers are taken into account simultaneously, the total effect of price variability is a reduction in welfare, so that stability is, in fact, desirable.

Massell's model deviates from the static partial model, which has hitherto been used by Waugh, Oi and others, in that both consumers and producers are represented in the model. Hence results of such a partial-static model must be taken seriously since it represents equilibrium analysis in a market situation. One of Massell's contributions to the discussion is to point out that Waugh and Oi's results cannot hold simultaneously. However, in order to build a

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<sup>7</sup>Frederick V. Waugh, "Consumer Aspects of Price Instability," Econometrica, 34 (April 1966), p. 508.

<sup>8</sup>B. F. Massell, "Price Stabilization and Welfare," Quarterly Journal of Economics (May 1969), pp. 284-98.

model which represents both consumers and producers and which is mathematically manageable, Massell had to make some key simplifying assumptions--trade-offs between real market situations and the needs of statistical model building--and in so doing some reality was lost.

The analysis of short-run market adjustments has been extensively studied since Ezekiel's early paper on the cobweb theorem<sup>9</sup> appeared over 40 years ago. Most of the subsequent work has been descriptive in nature, being devoted to investigating the behavior of prices in the adjustment process. The determination of stability conditions under a variety of hypotheses, particularly with respect to the formation of expectations, has been examined in the works of Nerlove,<sup>10</sup> Muth,<sup>11</sup> Turnovsky,<sup>12</sup> and Pashigian.<sup>13</sup>

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<sup>9</sup>M. Ezekiel, "The Cobweb Theorem," Quarterly Journal of Economics, Vol. 52, February 1933.

<sup>10</sup>M. Nerlove, "Adaptive Expectations and Cobweb Phenomena," Quarterly Journal of Economics, Vol. 72, May 1958.

<sup>11</sup>J. F. Muth, "Rational Expectations and the Theory of Price Movements," Econometrica, Vol. 29, July 1961.

<sup>12</sup>S. J. Turnovsky, "Stochastic Stability of Short-run Market Equilibrium Under Variations in Supply," Quarterly Journal of Economics, Vol. 82, November 1968. See also S. J. Turnovsky, "Optimal Stabilization in a Market with Lagged Supply," Economic Record, March 1973, pp. 31-49.

<sup>13</sup>B. P. Pashigian, "Rational Expectations and the Cobweb Theory," Journal of Political Economy, Vol. 78, March-April 1970.

The comments on Waugh, Oi and Massell's models are restricted. The usefulness of their analysis to the policy makers of the Cocoa Council faced with problems of export instability is limited.

By building a buffer stock type model which includes both consumers and producers, unlike the Waugh and Oi models, Massell concluded that "price stabilization, brought about by a buffer stock, provides a net gain to producers and consumers taken together."<sup>14</sup> Massell, however, pointed out that the results should be viewed in terms of his assumptions. As a result of trade-off between real market situations and statistical model building, Massell's model ended up being a centralized decision making market model: "A buffer stock is set up, with a buying and selling price equal to a constant thereby establishing the market price at this level."<sup>15</sup> Thus, the buffer stock authority is the sole middleman--the single intermediary between sellers, farmers, and the consumers. This is an unrealistic assumption in a buffer stock model. The virtue of a buffer stock model over other stabilization schemes is that it interferes minimally in the workings of the price system, thus ensuring that stabilization measures lead to price movements along the long run equilibrium trend of

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<sup>14</sup>B. F. Massell, op. cit., p. 297.

<sup>15</sup>Ibid., p. 288.

demand and supply. These results can only be arrived at if an optimal price range is maintained above which the buffer stock authority sells to the market if he has stocks available, or below which he buys from the market if he has funds available. Secondly, Massell's assumption of costless storage, and hence costless distribution of the buffer stock operations is unrealistic. Thus the model lacks sufficient resemblance to a real market situation because of these assumptions and can serve at best as a forerunner of more refined models.

All these works mentioned above deal with the desirability of having "an international institution" to stabilize the remunerative price, thus ignoring the role that such an international institution should play along the transitional path. As long as the market is initially well away from equilibrium or slow to adjust, this is undoubtedly an important aspect of organizing the cocoa market. Furthermore, in view of the well-known result that even with conventionally sloped demand and supply curves the lagged adjustment in supply can easily create an unstable market, it can even be more important, since in that case unless the Cocoa Council takes some action along the transitional path equilibrium will never be reached.

Assuming that welfare in the market can be adequately measured by the sum of consumers' plus

producers' surplus it should be possible to incorporate this in Massell's model to analyze in detail the nature of the costs incurred while the supply and demand are not at equilibrium. A simple linear model under deterministic market is chosen to demonstrate this point.

### Deterministic Market

The general short-run linear model of a single market, using discrete time can be described by:

$$D_t = A + aP_t \quad \dots \dots \dots (1a)$$

$$S_t = B + bP_{t-1} \quad \dots \dots \dots (1b)$$

$$D_t = S_t \quad \dots \dots \dots (1c)$$

Equation (1a) implies that demand is determined by the current price level and it can be regarded as the linearized form of a demand curve where consumers are assumed to respond to the current price ( $P_t$ ), where "A" and "a" are parameters. Equation (1b) asserts that supply depends upon the previous period's price ( $P_{t-1}$ ). One reason for introducing this lag is that producers respond to anticipated prices which they expect to equal the previous period's price ( $P_{t-1}$ ). Again "B" and "b" are parameters. Finally, equation (1c) describes the market-clearing condition assumed to prevail each period, implying that no producer is left with unsold stocks and no consumer with an unsatisfied demand.

Equations (1) yield about the simplest possible linear model of price adjustment. However, this model serves the main objectives in this illustrative study. More complicated lag structures, reflecting more sophisticated expectational hypotheses, can be introduced into the model. Although such modifications do not alter anything conceptually, they render explicit solution more difficult.

The market is in equilibrium only if

$$\bar{D} = A + a\bar{P} \quad \dots \dots \dots (2a)$$

$$\bar{S} = B + b\bar{P} \quad \dots \dots \dots (2b)$$

$$\bar{D} = \bar{S} \quad \dots \dots \dots (2c)$$

where  $\bar{D}$ ,  $\bar{S}$  and  $\bar{P}$  are all equilibrium magnitudes; hence equilibrium price becomes

$$\begin{aligned} A + a\bar{P} &= B + b\bar{P} \\ \bar{P}(b-a) &= A - B \\ \bar{P} &= \frac{(A - B)}{(b - a)} \quad \dots \dots \dots (3) \end{aligned}$$

Lower case-deviation from equilibrium equations are obtained by subtraction<sup>16</sup> and described by

$$d_t = ap_t \quad \dots \dots \dots (4a)$$

$$s_t = bp_{t-1} \quad \dots \dots \dots (4b)$$

$$d_t = s_t \quad \dots \dots \dots (4c)$$

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<sup>16</sup>Where

$$\begin{aligned} d_t &= D_t - \bar{D} \\ &= A + aP_t - A - a\bar{P} \\ &= a(P_t - \bar{P}) \\ &= ap_t \end{aligned}$$

$$\begin{aligned} s_t &= S_t - \bar{S} \\ &= B + bP_{t-1} - B - b\bar{P} \\ &= b(P_{t-1} - \bar{P}) \\ &= bp_{t-1} \end{aligned}$$



With the elimination of  $d_t$  and  $s_t$  it is realized that the short-run price dynamics are described by the equation<sup>17</sup>

$$p_t = \alpha b p_{t-1} \dots \dots \dots (5)$$

where  $\alpha = \frac{1}{a}$ . Thus, the standard result is obtained that this market will be stable if and only if

$$-1 < \alpha b < 1 \text{ (or } |\alpha b| < 1) \dots \dots \dots (6)$$

If the demand and supply curves have their usual slopes (so that  $\alpha < 0$ ,  $b > 0$ ) the path will necessarily involve oscillations, giving rise to instances of the well-known 'cobweb' phenomenon. In some said instances the market will be unstable; this will happen if the demand curve is inelastic and the supply curve is very elastic.

#### Cocoa Council's Intervention

Because of the long-run nature of the remunerative price scheme and the associated buffer stock mechanism in this model, it is necessary to treat the supply and demand curves as long-run. Hence they differ from the ordinary demand and supply concepts, but the same basic attributes of the short-run model presented above still applies. This makes the supply and demand schedules in this model differ from the ordinary supply and demand concepts, because the buffer stock mechanism adjusts for any shifts in these schedules.

For reasons which will be discussed presently, as

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<sup>17</sup>  $d_t = s_t$                        $p_t = \frac{1}{a} b p_{t-1}$   
 $a p_t = b p_{t-1}$                    $p_t = \alpha b p_{t-1}$

long as the market is not in long-run equilibrium, the participants in the market will suffer welfare losses. Hence the purpose of the Cocoa Council's intervention in the cocoa market is to try to minimize the social costs incurred while the market is in a state of disequilibrium.

In order to try to influence the market, there are two important kinds of policies that the Council may utilize. These are (a) policy intervention where the Council seeks to support the equilibrium price by trading in the market and (b) policy intervention where the Council controls the market by continually trading in the commodity. First, it is logical to visualize the Council<sup>18</sup> operating in the market like any other participant, buying or selling cocoa as it deems appropriate. Denoting the level of the Council's activity by " $f_t$ ", a positive value for " $f_t$ " will be interpreted to mean that the Council is adding to the supply (or equivalently is reducing demand); a negative " $f_t$ " means that it is reducing the supply (or alternatively is adding to demand). It must be noted however, that in either case these adjustments to supply or demand could be induced through changes in quotas assigned to the producing countries rather than through direct trading by the Council. For example, if the Council

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<sup>18</sup>The United Nations Cocoa Council itself need not participate in the market directly but a buffer stock manager may be assigned this duty. However he should take his instructions from the Council.

wishes to see an increase in supply it may legally obligate (with appropriate remuneration) producing countries to supply the additional quantity by increasing their quotas. Moreover, as will be indicated, either of these forms of the Council's participation is formally equivalent to indirect intervention.

Now taking the Cocoa Council's controlled supply into account, total supply is given by

$$s_t = bp_{t-1} + f_t \quad . . . . . (4b')$$

hence with short-run market clearing, the price dynamics are now given by

$$p_t = \alpha bp_{t-1} + \alpha f_t \quad . . . . . (5')$$

The introduction of the decision variable  $f_t$  assures a short-run market clearing situation.

Nonetheless, the following alternative form of the Council's intervention must be considered. The Council may be assumed to know the demand and supply curves and therefore the equilibrium price (which turns out to be the remunerative price). Hence, it could adopt the policy of revealing to the market participants this equilibrium price, at which all trading must occur, at the same time announcing that the Council is willing to buy or sell any quantity that is required to maintain that equilibrium. Certainly if there were no lags in supply, so that both demand for and supply of cocoa depended upon the current

price, this would be the optimal policy. In this circumstance, by making the above offer, the Council would succeed in instantaneously equating private demand and supply at the equilibrium price and, in fact, would find that it would not need to trade at all. The problem would be trivially solved and equilibrium would be immediately established at zero cost.

Nevertheless, with the supply lag present, this fortunate situation does not exist. In this case, the Council will have to trade the commodity for one period. To visualize this, assume that initially at the start of period one, the prevailing price (expressed as a deviation from equilibrium) is  $p_0$ . In period one the Council announces the equilibrium price (zero) and in accordance with its offer has to sell a quantity

$$f_1 = -bp_0$$

in order to sustain it. In period two, producers now supply on the basis of period one's price (i.e., the equilibrium price) and since this continues to be the Council-enforced price which prevails during that period and upon which consumers base their demand, it is immediately seen that private demand and supply are brought into equilibrium and no further Council intervention is required. However, as will be demonstrated below, provided the two forms of the Council's control have the same fixed costs,

then with one exception this procedure is never optimal and will always be more costly than if the Council continually trades in the commodity.

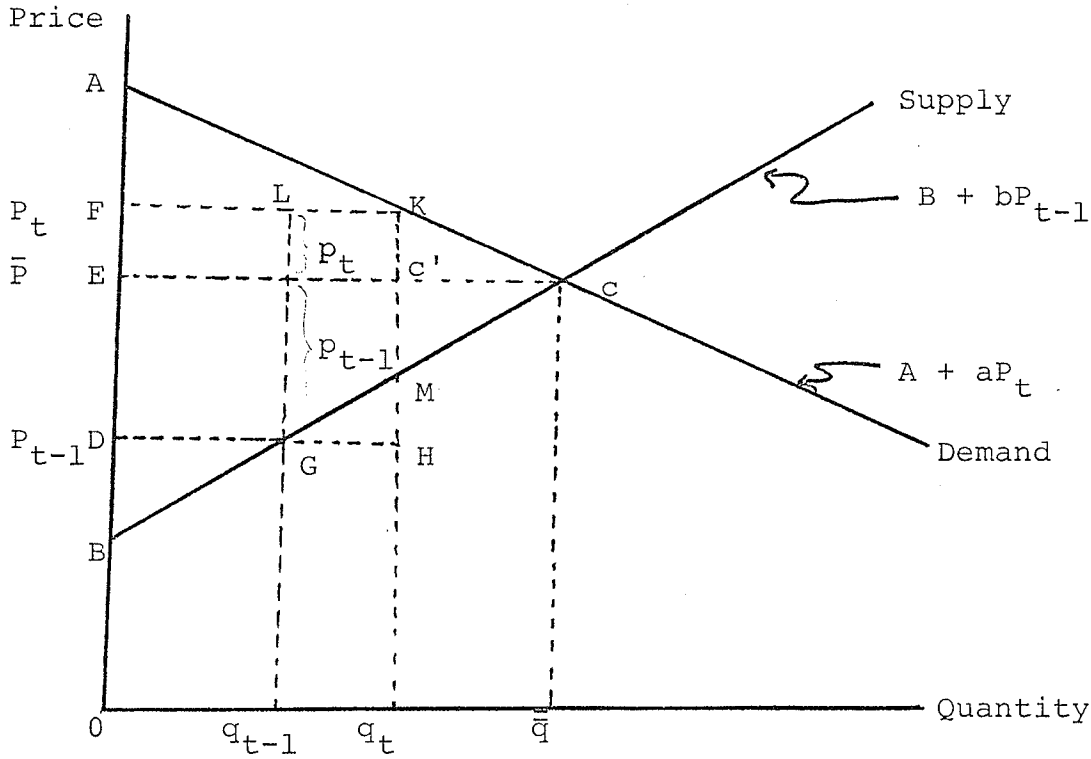
### Social Cost

Now the social costs incurred during the transition to equilibrium will be elaborated. To do this, it is necessary to comment that welfare can be adequately measured by the sum of consumers' and producers' surpluses and it can be shown that at any short-run transitional equilibrium, the participants in the market are suffering a loss relative to the long-run equilibrium.<sup>20</sup> According to precedent<sup>21</sup> we hereby define consumers' surplus as the triangle AEC, and the producers' surplus as the other triangle BEC in Figure 7.1. Thus at equilibrium the sum

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<sup>20</sup> Needless to mention that the use of consumers' and producers' surplus as a welfare measure has a long tradition. The conditions under which they are reliable measures of welfare are rather special and have been discussed at length in the works of O. Eckstein, Water-Resource Development, Harvard University Press, Cambridge, Mass., 1958. Chapter 2; A. Maass, M. N. Hufschmidt, R. Dorfman, H. A. Thomas, S. A. Marglin and G. M. Fair, Design of Water-Resource Systems, Harvard University Press, Cambridge, Mass., 1962. Chapter 2, and R. N. McKean, Efficiency in Government Through System Analysis, Wiley, New York, 1958, Part 3. Basically what is required is that the marginal utility of income must be constant and the same for all individuals, that all markets are perfect, and that there are no externalities.

<sup>21</sup> Abba P. Lerner, "The Concept of Monopoly and the Measurement of Monopoly Power." Reprinted in Readings in Microeconomics, ed. by William Breit and Harold M. Hochman



Consumers' and Producers' Surplus and Welfare Loss

FIGURE 7.1

of consumers' and producers' surplus is given by the triangle ABC. Consider now period  $t$  for example. Assume that the initial price at the start of the period,  $P_{t-1}$ , is given by OD and that during period  $t$  the Council supplies a quantity  $f_t = GH$  yielding a market-clearing price for that period,  $P_t$ , measured by OF. The consumers' surplus earned in this case is measured by the triangle AFK. Similarly the producers' surplus earned by producing

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(Holt, Rinehart and Winston, Inc., New York, 1971), pp. 209, 210. See also Armen A. Alchian, "Utility and Consumers' Surplus," *ibid.*, pp. 57-76.

countries is the area BGLF. In addition, if the additional Council supply is achieved by means of some kind of directive, whereby the Council enforces the producing countries to supply this additional quantity, then the producing countries obtain an additional producers' surplus of GMKL. Alternatively, if the Council actually supplies the cocoa directly itself from its buffer stock, it earns the producers' surplus which it can build as a fund and later redistribute to the participants. The Council, for example, may decide to compensate the producing countries for the lost revenue they suffer due to the reduction in price resulting from the increased supply from the Councils' stock. In either case the sum of the consumers' and producers' surplus is measured by the area ABMK, so that during period t there is a welfare loss KMC. It can be easily shown<sup>22</sup> that the area of this triangle equals

$$\begin{aligned}
 {}^{22}\text{Area} &= \frac{1}{2} \text{ base } \times \text{ alt.} \\
 &= \frac{1}{2} (\text{KM} \cdot \text{c}'\text{c}) \\
 &= \frac{1}{2} \frac{\text{KC}'}{\text{c}'\text{c}} (\text{c}'\text{c})^2 + \frac{1}{2} \frac{\text{c}'\text{M}}{\text{c}'\text{c}} (\text{c}'\text{c})^2 \\
 \frac{\text{KC}'}{\text{c}'\text{c}} &= a \quad \text{similarly } \frac{\text{c}'\text{M}}{\text{c}'\text{c}} = b
 \end{aligned}$$

$$\begin{aligned}
 \therefore \frac{\text{KC}'}{\text{c}'\text{c}} (\text{c}'\text{c})^2 + \frac{\text{c}'\text{M}}{\text{c}'\text{c}} (\text{c}'\text{c})^2 &= \frac{1}{2} (-a) (\text{c}'\text{c})^2 + \frac{1}{2} b (\text{c}'\text{c})^2 \\
 &= \frac{1}{2} (b-a) (\text{c}'\text{c})^2
 \end{aligned}$$

$$\text{but } a = \frac{\text{KC}'}{\text{c}'\text{c}} = \frac{P_t}{\text{c}'\text{c}}$$

$$\frac{1}{2} (b-a) \frac{1}{a} p_t^2$$

Thus, it follows that the short-run disequilibrium does impose a welfare loss on the market which is proportional to the square of the deviation in price from equilibrium.

#### Costs of Intervention by the Cocoa Council

At the same time, intervention by the Cocoa Council is also costly. If the Council enters the market as a buyer, there is the obvious opportunity cost of the funds used by the Council to make the purchase and it is reasonable to suppose that these too involve an increasing marginal cost. Alternatively, if the Council enters the market as a seller, it will incur direct costs, the marginal costs of which are likely to be increasing. However, since the Council is expected to exercise its control through UN legislation, it seems reasonable to presume that any legislative and administrative costs associated with implementing the policy are also likely to be associated with increasing marginal costs, although these may also have an overhead component. Finally,

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$$c'c = \frac{p_t}{a}$$

$$\frac{KC'}{c'c} (c'c)^2 + \frac{c'M}{c'c} (c'c)^2 = \frac{1}{2} (b-a) \frac{1}{a} p_t^2 \quad \text{QED}$$

For alternate proof see Appendix G.



certain policies which oblige participants to adjust their behaviour may also impose costs upon the Council if it is necessary to compensate these participants.

Granting that the marginal costs of the Council's control increase at an approximately constant rate, then the costs of disequilibrium, and the Council's intervention incurred during period  $t$ , can be represented by the quadratic function

$$mp_t^2 + nf_t^2 \quad . . . . . (7)$$

where  $m$ ,  $n$  denote the respective rates at which the marginal costs increase. The Council may decide to minimize either the costs or choose to minimize the price fluctuations occurring along the transitional path. As the function shows, both  $p$  and  $f$  cannot be minimized without constraint. The former can be minimized subject to given levels of the latter, and vice versa. In operations based on this function, it may be appropriate for the Council to attempt various combinations of the two variables at various times, depending on circumstances and preferences of the Council's members.

If the Council resolves to minimize the total costs over an infinite time horizon then the Council's objective is this: given the system (5'), to choose  $f_t$  so as to minimize

$$\text{Costs} = \sum_{t=1}^{\infty} \left[ mp_t^2 + nf_t^2 \right] \quad . . . . . (8)$$

Though consideration is given to upper limit as shown in Appendix G, time discounting is ignored in this analysis for a possible refinement as is the stochastic side.

Determination of Optimal Policy  
Where the Council Trades in Cocoa

Now consider the situation where the Council controls the market by continually trading in the commodity. The alternative policy has been discussed whereby the Council seeks to support the equilibrium. This policy turns out to be a special case of direct trading. The formal optimization problem confronting the policy makers of the Council is to choose  $f_t$  so as to

$$\min \sum_{t=1}^{\infty} [mp_t^2 + nf_t^2] \dots \dots \dots (8)$$

$$\text{subject to } p_t = \alpha p_{t-1} + \alpha f_t \dots \dots \dots (5')$$

This becomes a problem in control theory<sup>23</sup> and, as demonstrated in Appendix G (see equations 10 and 11 of Appendix G), the optimal Council policy  $f_t$  is given by the feedback solution

$$f_t = - \left[ \frac{k\alpha^2 b}{n + \alpha^2 k} \right] p_{t-1} \dots \dots \dots (9)$$

where  $k$  is the unique positive solution to the quadratic equation

$$m - k + \frac{kn\alpha^2 b^2}{k\alpha^2 + n} = 0 \dots \dots \dots (10)$$

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<sup>23</sup>M. Athans and P. L. Falb, Optimal Control: An Introduction to the Theory and Its Application (New York: McGraw-Hill, 1966), Chapter 9.

or

$$k - m = \frac{k n \alpha^2 b^2}{k \alpha^2 + n}$$

writing (9) in the form<sup>24</sup>

$$f_t = \phi p_{t-1} \dots \dots \dots (11)$$

equations (10) and (11) indicate that the optimal Council supply is proportional to the deviation of the previous period's price from equilibrium, so that once equilibrium is established the buffer stock manager of the Council should cease his trading activity.<sup>25</sup> It is a particularly convenient form for the Cocoa Council policy-makers since it will enable them to determine their current policy  $f_t$  on the basis of the immediate past state of the system as described by  $p_{t-1}$ . The magnitude  $\phi$  measures the intensity with which the Council should respond to any deviation in the market price from equilibrium. If the demand and supply curves have their usual slopes ( $\alpha < 0$ ,  $b > 0$ ), then

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<sup>24</sup>Note that the optimal policy can also be expressed explicitly in terms of time. Substituting for  $f_t = \phi p_{t-1}$  in equation (5'), the difference equation describing price movements becomes

$$p_t = \alpha(b + \phi)p_{t-1}$$

solving this to obtain

$$p_t = p_0 [\alpha(b + \phi)]^t$$

where  $p_0$  is the initial value, implying that

$$f_t = p_0 [\phi \alpha(b + \phi)]^{t-1}$$

<sup>25</sup>Although it is assumed that all parameters  $\alpha$ ,  $b$ ,  $m$ ,  $n$  are constant through time, this assumption can be relaxed. If these parameters are free to change through

$\phi < 0$ , so that if the prevailing price is below the equilibrium (i.e.,  $p_{t-1} < 0$ ), the optimal policy for the Council is to supply a positive quantity of cocoa, proportional to the disequilibrium. As indicated in Figure 7.1,  $p_{t-1} < 0$  implies that at that price OD, demand exceeds supply and thus by increasing supply the Council is able to diminish the resulting price change as well as reduce the loss in surplus for period  $t$ .

There are further issues needing discussion in connection with the optimal policy. First, it is important to examine the stability properties of the market when the optimal policy is adopted. By substituting for  $f_t$  from (9), it is found that the corresponding optimal path of prices is given by the difference equation

$$p_t = \frac{\alpha b n}{\alpha^2 k + n} p_{t-1} \dots \dots \dots (12)$$

where  $k$  satisfies (10). This path is stable if and only if

$$-[n + \alpha^2 k] < \alpha b n < n + \alpha^2 k \dots \dots \dots (13)$$

and by substituting the solution for  $k$  obtained from (10), it can be verified that these inequalities are satisfied for all values of  $\alpha$  and  $b$ , provided that either one of the two cost parameters  $m$  or  $n$  is strictly positive. Hence,

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time, a proportional policy such as (9), (10) is still obtained, although the proportionality factor,  $\phi$ , is now no longer constant and therefore becomes much more difficult to obtain (see Appendix G, last four equations) for the general formula.

irrespective of the slopes of the demand and supply curves, if the Council follows the optimal policy given by (9), then the market will always be stable. Consequently, by following such a policy, the Council can always convert an unstable market into a stable one.<sup>26</sup> Moreover, if demand and supply curves have their usual slopes ( $\alpha < 0$ ,  $b > 0$ ), then from (12) the optimal path will always involve an oscillatory approach to equilibrium.

Now consider the alternative policy proposed earlier where the Council reveals to all participants the equilibrium price and announces that it will trade whatever quantities are necessary to support that equilibrium. That is not a very likely policy for the Council to adopt but it is worth analysing as a possible alternative. Assuming an initial price of  $p_0$ , then as already indicated, this policy requires the Council to sell (or buy) a quantity

$$f_1 = -bp_0 \quad \dots \dots \dots (14)$$

in the first period. This will bring the system into equilibrium at the end of that period, after which no

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<sup>26</sup>If the Council adopts some arbitrary proportional policy,  $f_t = \lambda p_{t-1}$  where  $\lambda = \phi$ , the adjustment path will be stable if and only if

$$-1 < \alpha(b + \lambda) < 1$$

Thus even if the Council correctly selects  $\lambda < 0$  it may induce instability into an otherwise stable market if it intervenes too intensively.

further Council action is required. The total social costs of using this policy to bring the system to equilibrium equals

$$nb^2 p_0^2 + D \dots \dots \dots (15)$$

where D represents the overhead costs associated with this alternative policy. Similarly, the social costs of applying the policy (9) to equilibrate the market are given by

$$(k - m) p_0^2 + C \dots \dots \dots (16)$$

Hence, policy (9) will be preferable provided

$$(k - m)p_0^2 + C < nb^2 p_0^2 + D \dots \dots \dots (17)$$

By substituting from equation (10) for k inequality (17)

will be met if and only if

$$-\frac{b^2 n^2 p_0^2}{n + \alpha^2 k} + C - D < 0 \dots \dots \dots (18)$$

Assume that the fixed costs are the same. In this case inequality (18) will in general be met, so that the optimal policy (9) will be better than the alternative just proposed. The exception is if  $n = 0$  when they become equally desirable. However, substituting  $n = 0$  in (12) and (9) implies

$$p_1 = 0$$

and

$$f_1 = -bp_0$$

so that in this case the optimal policy given by (9) is the alternative policy (14) and the market is driven to

equilibrium in one period.

Assuming the marginal cost of the Council's intervention ( $n$ ) is 100 per cent, and given the equation for marginal cost of disequilibrium ( $m$ ) where  $a$  and  $b$  are assigned values of  $-5.95$  and  $0.44$  respectively (for  $\frac{1}{2}(b - a) \frac{1}{a}$ ), column 2 of Table 7.1 shows the level of the Council's intervention at each period. Columns 3, 4 and 5 show the level of the Council's influence at different magnitudes of deviation from equilibrium. The Council intervenes vigorously in the initial year but gradually withdraws as the market moves to equilibrium. For a deviation of a magnitude of 40 per cent the Council intervenes at a level of  $-0.21335453$  during the first period but in the seventh period its intervention is almost zero. Thus for this particular situation the Council ceases its trading activity immediately when equilibrium is established. The Council's activity at the initial period of  $-0.21335453$  indicates that it is reducing supply (or alternatively is adding to demand) the value of which is proportional to the deviation of the previous period's price from equilibrium.

Table 7.2 demonstrates that there is a corresponding decrease in price deviation minimization when the Council's level of intervention is given. Table 7.2 indicates that if price is at disequilibrium (e.g.,  $+ 40$  or

TABLE 7.1. Values Resulting from Optimal Stabilization Policies (Selected).

Initial $P_n$	Minimization of			
	Cocoa Council intervention	Cocoa Council intervention	Price Fluctuation	Cocoa Council intervention
	(1)	(2)	(3)	(4)
$t-1$	40	20	40	40
$n$	100	100	100	500
$f_t$	-0.21335453	-0.10667723	-0.24395227	-0.04309136
$f_{t+1}$	0.01560055	0.00780027	0.01780651	0.00318168
$f_{t+2}$	-0.00114072	-0.00057036	-0.00129973	-0.00023492
$f_{t+3}$	0.00008341	0.00004170	0.00009487	0.00001735
$f_{t+4}$	-0.00000610	-0.00000305	-0.00000692	-0.00000128
$f_{t+5}$	0.00000045	0.00000022	0.00000051	0.00000009
$f_{t+6}$	-0.00000003	-0.00000002	-0.00000004	-0.00000001



TABLE 7.2. Values Resulting from Optimal Stabilization Policies

Initial $P_{t-1}$ $n$	Minimization of							
	40		20		40		40	
	100		100		100		500	
	$f_{ti}$ Cocoa Council Intervention	$P_{ti}$ Resulting Deviation	$f_{ti}$ Cocoa Council Intervention	$P_{ti}$ Resulting Deviation	$f_{ti}$ Price Fluctuation	$P_{ti}$ Resulting Deviation	Cocoa Council Intervention	Resulting Deviation
$f_t$	-0.21335453	-2.92481327	-0.11667723	-1.46240616	-0.24395227	-2.91967106	-0.04309136	-2.95342922
$f_{t+1}$	0.01560055	0.21386319	0.00780027	0.10693157	0.01780651	0.21311200	0.00318168	0.21806854
$f_{t+2}$	-0.00114072	-0.01563774	-0.00057036	-0.00781887	-0.00129973	-0.01555542	-0.00023492	-0.01610124
$f_{t+3}$	0.00098341	0.00114344	0.00004170	0.00057172	0.00009487	0.00113542	0.00001735	0.00118885
$f_{t+4}$	-0.00000610	-0.00008361	-0.00000305	-0.00004180	-0.00000692	-0.00008288	-0.00000128	-0.00008778
$f_{t+5}$	0.00000045	0.00000611	0.00000022	0.00000306	0.00000051	0.00000605	0.00000009	0.00000648
$f_{t+5}$	-0.00000003	-0.00000045	-0.00000002	-0.00000022	-0.00000004	-0.00000044	-0.00000001	-0.00000048
$f_{t+6}$	0.00000000	0.00000003	0.00000000	0.00000002	0.00000000	0.00000003	0.00000000	0.00000004

+ 20) and if the Council proposes policy to revert to equilibrium the following will be the general results:

(1) for greater values of deviation (c.f. 40 and 20) the initial Council intervention is greater as given by the values  $-0.21335453$  and  $-0.10667723$  in Columns 2 and 4 respectively.

(2) time required to get to equilibrium is not dependent significantly on amount of disequilibrium.

(3) minimization of price fluctuations (see Column 6) results in greater initial Council intervention than minimization of government influence as demonstrated by Columns 2 and 6. For the same magnitude of deviation and the same marginal cost of intervention, the level of minimization of Council's influence will initially be  $-0.21335453$  while minimization of price fluctuation will be at a level of  $-0.24395227$ .

(4) increased marginal costs of Council's intervention results in (a) reduced initial Council intervention and (b) no change in amount of time to derive equilibrium market. This is shown in Columns 2 and 8 where  $n$  values of 100 and 500 are assumed for Columns 2 and 8 respectively.

(5) disequilibrium in either direction (e.g., 40 above or 40 below equilibrium) does not change the above four results.

Two general observations concerning the formulation

of the optimal policy should be made. Firstly, a welfare criteria has been adopted based on consumers' and producers' surpluses. Apart from the assumptions mentioned in footnote 20, these measures assume that resources can be shifted costlessly from one use to another. This in fact may not be so for cocoa in different countries and the revision in plans resulting from the variation in prices occurring during transition to equilibrium may indeed impose substantial adjustment costs on both producers and consumers. In this case a plausible alternative welfare objective may be to minimize the price fluctuations occurring along the transitional path, so that instead of (8) one minimizes the objective function

$$\sum_{t=1}^{\infty} \left[ m(\Delta p_t)^2 + n f_t^2 \right] + C \dots \dots \dots (8')$$

This turns out to yield essentially similar optimal policies. Specifically the concern now is to determine

$$f_t = - \left[ \frac{\alpha[m(\alpha b - 1) + k\alpha b]}{n + \alpha^2(m + k)} \right] P_{t-1} \dots \dots \dots (9')$$

where now

$$-k + \frac{n[(\alpha b - 1)^2 m + \alpha^2 b k] + \alpha^2 m k}{n + \alpha^2(m + k)} = 0 \dots \dots \dots (10')$$

Stability again is assured, and the only difference worth noting is that the transitional path may now be monotonic if  $n/m$  is sufficiently small.

Secondly, the foregoing analysis assumes that the Cocoa Council knows the equilibrium price exactly (of course this price may be negotiably arrived at through remunerative pricing). In practice, the Council's information may be imperfect and one way of incorporating this is to assume that the parameters are stochastic. Alternatively, even within a deterministic framework, the Council's belief concerning the true equilibrium may be incorrect. If the Council continually seeks to drive the market to some disequilibrium price level then its actions will impose social costs. Needless to say this would represent gross ineptitude on the part of the Cocoa Council and would be unlikely to occur. More reasonably the Council would be likely to learn over time that its initial information was incorrect, thereby causing it to revise its estimate of true equilibrium. In this case the errors committed during the learning process would involve social costs and would have to be taken into account in assessing the desirability of the Council's intervention. Presumably if they were sufficiently high, the Council's control would cease to be justified.

## CHAPTER 8

### SUMMARY AND CONCLUSIONS

Cocoa is produced in developing countries only. It has no immediate close substitutes in the short-run and it faces an inelastic demand. This commodity is, *prima facie*, suitable for the introduction of a market organization scheme to increase export earnings through action on price mechanisms.

The effects of the institution of discriminatory monopolistic pricing by the Cocoa Producers Alliance in 1964 were detrimental. Such an agreement would have resulted in marginal, although possibly important, additions to the leading cocoa producing countries' command over external resources if mechanisms were also considered to take care of stock accumulation or surplus disposal problems, and if cocoa farmers were effectively isolated from the world market to check the substantial increases of long-run supplies. However Chapter 6 and Appendixes B, C, D and E show that with a careful understanding of and application of economic principles, significant, though by no means fully proportional, increases in earnings could be realized from increases in price.

It had become increasingly realized and recognized, however, that price had two important functions to perform in a commodity market. The more traditional, "classic" view of price is in its allocative role: regulating supply and demand, i.e., ensuring a balanced allocation of resources, both on the supply and the demand side, to clear the market.<sup>1</sup> More recently, partly in view of the plight of the developing countries, increased emphasis has been given to the income role of price, i.e., as one of the principal determinants of the level of income or export earnings received. Market organization would represent an attempt to act, through this second role of price, on the level of earnings. In doing so, however, it may more or less seriously disturb the first, allocative role, and a successful organization of markets must therefore be so conceived that substantial disequilibrium between supply and demand, i.e., in the allocation of resources, does not result.<sup>2</sup>

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<sup>1</sup>Of course this is not to claim that the allocative function of price is by any means always performed satisfactorily, especially in primary commodity markets.

<sup>2</sup>The question is of course begged whether there may not be better ways of assisting the cocoa producing countries than acting through the income role of price and tying the cocoa price very closely to a concept of the purchasing power of essential imports: for example, by straight compensatory transfers based in some way on changes in the relationships between exports and imports!

On the producer side, what is required in the context of the cocoa market to avoid such disequilibrium is that the cocoa farmer be absolutely isolated from the rises in the world import price which will be the characteristic feature of any organisation of the market. A tendency for the increase in price or export earnings to be reflected in higher prices to farmers, and therefore, in the longer-run, increased plantings and production, would be detrimental to the success of any market organization unless other rigorous control mechanisms were in force. Fortunately, the Marketing Boards and other institutional means by which cocoa is procured and exported make such isolation a practical possibility.

A more difficult aspect of the market organization would be the need for cocoa producing countries to demonstrate, before the inception of any scheme of market organization, that they are able to regulate production effectively, i.e., that, independently of the inevitable fluctuations caused by annual climatic conditions, they are able to keep production in line with export possibilities plus any disposal outlets (destruction, diversion to new uses or new markets, etc.) which might be clearly available and assured. This condition is probably still a practical possibility, though the economic, social and political difficulties of regulating a peasant-grown

tropical tree-crop are well known; the technical and statistical difficulties in differentiating between fluctuations and basic trends on a commodity market in any given year are very substantial; and the ability of the international community, or the producers alone, to organize effective disposal outlets for cocoa surpluses has yet to be demonstrated. Production regulation of a restrictive character in some form or another will be a basic requirement for virtually all types of cocoa market organization; yet it must be recognized that to control production is a difficult and complex undertaking. In the long-run, it means shifting land and farmers out of cocoa production. Thus, however export receipts from cocoa are increased, mechanisms should be found for ensuring that producing countries will create alternative employment for resources now in cocoa, e.g., through a development plan and possibly financed by some part of the accrued addition in export receipts. Since economic development through diversification is probably the only long-run method of controlling supplies, producing countries must have a strong interest in the use of funds in this way.

An initial step towards demonstrating the ability of exporting countries to regulate production might well be the allocation of greatly increased means by the international community to investigate thoroughly the reactions



of cocoa farmers to changes in market conditions, and to gather much improved statistics on cocoa tree numbers, ages, productivity, etc.

Characteristically, cocoa (both price and quantities) is subject to large yearly fluctuations. Accordingly any actual market organization would in all probability, have to be introduced in an unstable situation. The means to be used for organizing the market, and the price level to be arrived at, might well however differ considerably according to whether the market was in a falling or rising phase. Nonetheless with linear demand and supply functions and a supply lag, chapter 7 analyses a simple operational policy determining how the Cocoa Council (or the Cocoa Producers Alliance) could attempt to bring the market into equilibrium at minimum cost. If the market is deterministic, the optimal policy requires the Cocoa Council to trade a quantity which is proportional to the deviation of the preceeding period's price from equilibrium. Such a policy will ensure that the market will always be stable, so that the Cocoa Council can convert an unstable market into a stable one. With conventional demand and supply curves and a criterion based on consumers' and producers' surplus the transitional path will oscillate temporarily until equilibrium is reached.

This policy is preferable to the alternative where the Cocoa Council offers to buy or sell whatever quantities are necessary to support the true equilibrium.

A related problem concerns any eventual links with a price index of essential imports. Aside from problems of negotiation and definition, it is possible for supply and demand in the cocoa market to be in balance, with price at a "remunerative" level, when a movement in prices of essential imports (for reasons quite unconnected with cocoa) require an upward movement in the cocoa price, leading to a new imbalance, and adjustments to offset the new de-stabilization.

Finally, still on the producer side, the success of an organization of the market for cocoa might also be heavily dependent on the capacity of producing countries to hold stocks, either in their own countries or abroad. Such stockholding capacity should probably be regarded as a basic requirement. Its function would be to iron out much at least of the inevitable yearly fluctuations in production. It could also offset the possible tendency of manufacturers, in the face of a permanently high price-level, to allow the stockholding role in the market, at present performed by them, to devolve on others to a much greater extent than is currently the case.

So far as the manufacturing sector is concerned, a

large proportion of the price of the final cocoa product is taken by processing and distribution costs. The variety of possible reactions on the part of manufacturers to given changes in price, thus making this segment of the market the most important and the most difficult to analyze. The role played by the manufacturer is crucial, but the information on his precise reactions to given price changes, etc., is very sparse. The price elasticity of demand for cocoa appears to be fairly low. However, it is not so low that all upward movements in world cocoa prices would be absorbed by the manufacturers, or, in a broader sense, the consuming countries, and neither the price nor the cocoa content of the final products would remain unaltered. In fact, it seems likely that, faced with a rise in the world price of cocoa, i.e., a relative cheapening of all other ingredients and costs entering the price of the final product, manufacturers would at least decrease the volume of cocoa utilized in a wide range of their final products. Past policy in most consuming countries has been for no changes in retail prices to be immediately made; however, if the new and higher price level was seen to be permanent, as would in fact be the objective of any organization of the market, it seems unlikely that a rise in retail prices to consumers would or could be long delayed. In view of the sparsity of detailed information, it might well be necessary

to look into the whole issue much more closely, e.g., to analyse the exact way in which manufacturers adjust the pattern of their inputs and production in the face of price changes, and to attempt to compute precise elasticities of demand for actual use and for stock operations. This latter distinction could become important if a once-and-for-all increase in price was followed by much greater stability than before. For the time being, however, it must be concluded that there appear to be no immediately available practical means of influencing manufacturers' policies with regard to their cocoa utilization or retail pricing policies. If this is accepted, then the manufacturers' role must be largely taken as given, and other measures suggested elsewhere for action on other elements in the market evolved.

The cocoa consumer does not react strongly to changes in retail prices. Such reaction, plus decreases in manufacturers' utilization of cocoa, are estimated (see chapter 6) to be of such magnitude that some fall-off in the "normal" rate of consumption increase appears very likely to occur. Consequently, even if cocoa farmers are totally isolated from world price changes, the possibilities of a growing disequilibrium between production and consumption developing from the demand side are large, and, insofar as new disposal outlets outside the existing world

market are not available, the need for different efficient means of regulating production can again be seen to be basic.

The difficulties of analyzing manufacturers' reactions are compounded by the fact that what is known is based entirely on past experience in a "free" and fluctuating market. How manufacturers will in fact react to a managed market with the world price supported at a permanently higher level is unknown. Much would depend undoubtedly on the precise market circumstances at the inception of any "remunerative" price scheme, and the extent of the actual rise in price which was negotiated. Any doubts about the eventual success of the scheme could well lead to a temporary refusal to purchase by the manufacturers, lasting at least as long as their stocks permitted. Longer-term reactions would, however, probably take the form, at least inter alia, of a lower utilization of cocoa per unit of final output, a higher price to consumers (depending on the extent of the remunerative price rise), and a much more intensive search for and development of substitutes than occurred in the previous brief disequilibrium periods of very high prices. Moreover, what is known of consumer price elasticities of demand is largely based on observations of relatively small short-term movements in price. These negative elasticities of

response are certainly likely to be larger over the long-term than the short, greater at higher price levels than at lower, and greater for bigger price changes than consumers have been accustomed to in the past.

The optimal stabilization policies which would necessitate an institution such as the Cocoa Council would involve costs. There are administrative and legislative costs incurred with setting up the appropriate machinery, there may also be various opportunity costs incurred, hence in deciding its policies the Council must weigh these costs against the costs involved in market disequilibrium. The higher the costs the less the Council should intervene.

With uncertainties on both the manufacturing and consumer sides, but the likelihood that the rate of increase in consumption is at the least likely to be slowed below that of production by the introduction of a remunerative price scheme, two basic desiderata for the successful functioning of an organization of the market for cocoa can be stated. Firstly, means of regulating supply coming on to the market over the long-term to keep it in line with the lower if not negative rate of growth of export outlets (excluding development of new markets, new uses, etc.) are absolutely essential, and should be demonstrably available before the scheme is set in

operation, if it is not to be destined to almost certain failure from the start. Insofar as the option of such means will require the co-operation and financial assistance of consuming countries, the need for an international approach to the problem is essential. However, insofar as the regulation of supplies can be effected through action by the producing countries themselves, this necessary condition for a remunerative price scheme could be implemented without recourse to international action on the part of consumers. Of course since it could be demonstrated that the financial benefits of such action by producers alone would far outweigh the costs, in view of the elasticities of response involved, it could be argued that such regulation, if possible, is in fact a simpler and more direct way of acting on cocoa prices than through a complex international scheme requiring long multilateral negotiation and compromise before final agreement.

Secondly, the fluctuations inherent in cocoa production for climatic reasons alone make it essential for a series of flexible and assured short-term weapons to be at hand to prevent temporary surpluses or deficits menacing the whole scheme. Among such means, development of new uses or new markets, stockpiling, destruction, etc. have been listed but for efficient optimal stability the Cocoa Council intervention scheme would be the recommended course

of action.

Except for hypothetical illustrations, this study has avoided any examination of what actual price or actual means might be optimal in an organization of the market for cocoa. For these there can be no a priori rules; there are problems of the base-period to be chosen, and of differing redistributive effects; in the last analysis, if an organization of the cocoa market is to become a reality, the price and method of implementation will be established undoubtedly by negotiation.



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APPENDICES

APPENDIX A

THE ESTIMATE OF 'REAL PURCHASING POWER' OF COCOA

The table below represents two basic attempts to compute the real purchasing power of cocoa exports based on data for a group of countries (Ghana, Nigeria, Brazil, Cameroon and Ecuador) representing some 75 per cent of world cocoa exports in 1970-72. Data for total imports are taken for the present purpose to define 'essential imports'. Unit values of imports of the five countries are weighted (a) by each country's total cocoa exports, and (b) by each country's total imports. Two unit value indices of imports (1968 = 100) were derived as follows:

	(a)	(b)
1964	103.9	113.8
1965	100.4	105.7
1966	102.1	106.5
1967	102.8	106.4
1968	100.0	100.0
1969	99.2	95.0
1970	102.7	99.5
1971	103.2	102.6
1972	102.1	107.6
1973	102.6	109.2

Source: (a) Data for computation from FAO: Commodity Year Book (1963/72 issues); (b) IMF: Annual Report (1970/71 issues); (a) Gill and Duffus, Cocoa (1963/72 issues). All 1973 figures are estimates from Merrill, Lynch, Pierce Fenner and others, Cocoa Statistics. All values derived by following computational method of UNCTAD Publication "Cocoa", General TD/B/AC 2./3, New York: UNCTACT, 1966.

If unit values of world cocoa exports are now deflated by the above two import unit value series, a measure of the real purchasing power of cocoa exports (in 1968 prices is obtained. Viz.:

	Unit values of cocoa exports \$ per ton	Real purchasing power of cocoa exports (in 1968 prices) \$ per ton	
		(a)	(b)
1964	1,070	1,030	940
1965	818	815	774
1966	581	569	546
1967	563	548	529
1968	845	845	845
1969	739	745	778
1970	594	578	597
1971	474	459	462
1972	453	444	421
1973	486	474	445
<hr/>			
Average 1964-1973	662	651	634
<hr/>			
Average 1964-1968	775	761	727
<hr/>			
Average 1969-1973	549	540	541
<hr/>			

These figures show that deflation by an index of imports has little effect on the current value figures. For example, for 1964-73 as a whole, the average difference between the current and the 'real' series lies between \$28 million and \$11 million according to which deflator is used, a deviation of only some 4.2 per cent and 1.7 per cent respectively from the current value average. On the basis



of these figures, it might be concluded that adjustment for change in import prices would historically, have contributed only little to the solution of the export earnings problems of the cocoa countries. Their problem remains that of a stable 'remunerative' price for cocoa per se.

APPENDIX B

QUANTITIES TO BE ISOLATED FROM THE MARKET<sup>a/</sup>  
 UNDER VARIOUS REMUNERATIVE PRICE ASSUMPTIONS

1. <u>Remunerative Price Rise (in %)</u>	0	5	10	20	25	30	50	75	100
2. <u>% of export availabilities to be isolated each year</u> <sup>b/</sup>									
(i) Year 1	-	1.4	2.8	6.3	7.9	9.4	15.6	23.2	30.7
(ii) Years 2-5	-	1.0	2.2	5.5	6.9	8.3	13.6	20.1	26.4
3. <u>Quantities to be isolated (000 tons)</u>									
Year 1	-	18	36	81	101	120	200	297	393
Year 2	-	13	26	72	91	109	179	264	347
Year 3	-	13	27	74	93	112	183	271	355
Year 4	-	14	28	76	95	115	188	277	364
Year 5	-	14	28	78	98	117	192	284	374
4. <u>Cumulative Total</u>	-	72	145	381	478	573	942	1393	1833
5. <u>As % of world export demand in fifth year</u>	-	5	10	28	36	44	77	123	176

a/ Or not in fact produced.

b/ On the assumptions of Table 6.2. For Year 1, six months of short-term reaction and six months of long-run reaction are assumed. The percentage values shown (those of Table 6.2 minus 2.5%) are applied to the data for world exports on the equilibrium assumption shown in Column 1, Appendix C, to obtain the quantities to be isolated.

## APPENDIX C

WORLD EXPORT EARNINGS UNDER VARIOUS REMUNERATIVE PRICE ASSUMPTIONS  
AND ASSUMING THE NECESSARY QUANTITIES ISOLATED FROM THE MARKET

1.	<u>Remunerative price rise (in %)</u>	0	5	10	20	25	30	50	75	100
2.	<u>Assumed price (\$/ton)</u>	510	535.5	561	612	637.5	663	763	892.5	1020
3.	<u>World exports<sup>a/</sup> (million tons)</u>									
	Year 0	1.25								
	Year 1	1.28	1.26	1.25	1.20	1.18	1.16	1.08	0.98	0.89
	Year 2	1.31	1.30	1.29	1.24	1.22	1.20	1.13	1.05	0.97
	Year 3	1.35	1.33	1.32	1.27	1.25	1.23	1.16	1.08	0.99
	Year 4	1.38	1.37	1.35	1.30	1.29	1.27	1.19	1.10	1.02
	Year 5	1.42	1.40	1.39	1.34	1.31	1.30	1.22	1.13	1.04
4.	<u>Annual Average (Years 1-5)</u>	1.35	1.33	1.32	1.27	1.25	1.23	1.16	1.07	0.98
5.	<u>As % of Year 0 (Col. 1)</u>	108	107	105	102	100	99	93	85	78
6.	<u>Export Earnings (\$ million)</u>									
	Year 0	637.5								
	Year 1	653.46	676	698	734	752	770	827	878	906
	Year 2	670.92	696	722	759	779	798	868	936	985
	Year 3	687.38	714	740	778	799	818	890	959	1011
	Year 4	704.84	731	758	798	819	839	912	984	1036
	Year 5	722.30	750	778	818	837	861	936	1009	1062
7.	<u>Annual Average (Years 1-5)</u>	687	714	739	778	797	817	887	953	1000
8.	<u>As % of Equilibrium Case (Col. 1)</u>	100	104	108	113	116	119	129	139	146

<sup>a/</sup>Exports in the equilibrium case (Col. 1) less quantities to be isolated (see Appendix B).

APPENDIX D

DISTRIBUTION OF EXPORT EARNINGS BY COUNTRIES ON BASIS OF SHARES<sup>a/</sup>  
 OF WORLD EXPORT VOLUME (5 YEARS) AND ASSUMING  
 NO EARNINGS FROM THE QUANTITIES TO BE ISOLATED

1. <u>Remunerative Price</u> <u>Rise (in %)</u>	0	5	10	20	25	30	50	75	100
2. <u>Average Annual</u> <u>Earnings (Years 1-5)</u> <u>(\$ million)</u>	687	714	739	778	797	817	887	953	100
Ghana	282	293	303	319	327	335	364	391	410
Nigeria	124	129	133	140	143	147	160	172	180
Ivory Coast	62	64	67	70	72	74	80	86	90
Brazil	48	50	52	54	56	57	62	67	70
Cameroon	48	50	52	54	56	57	62	67	70
Ecuador	21	21	22	23	24	25	27	29	30
Dominican Rep.	14	14	15	16	16	16	18	19	20
Togo	7	7	7	8	8	8	9	10	10
Costa Rica	7	7	7	8	8	8	9	10	10
Others	74	79	81	86	87	90	96	102	110
3. <u>Annual Gain in</u> <u>Earnings over</u> <u>Equilibrium Case</u> <u>(\$ million)</u>	-	27	52	91	110	130	200	266	313

APPENDIX D (continued)

Ghana	-	11	21	37	45	53	82	109	128
Nigeria	-	5	9	16	19	23	36	48	56
Ivory Coast	-	2	5	8	10	12	18	24	28
Brazil	-	2	4	6	8	9	14	19	22
Cameroon	-	2	4	6	8	9	14	19	22
Ecuador	-	-	1	2	3	4	6	8	9
Dominican Rep.	-	-	1	2	2	2	4	5	6
Togo	-	-	-	1	1	1	2	3	3
Costa Rica	-	-	-	1	1	1	2	3	3
Others	-	5	7	12	13	16	22	28	36

a/ Ghana	41%	Brazil	7%	Dominican Rep.	2%	
Nigeria	18%	Cameroon	7%	Togo	1%	Others 11%
Ivory Coast	9%	Equador	3%	Costa Rica	1%	

APPENDIX E

BASIC QUOTAS 1964/65 TO 1971/72

Exporting Countries	Production (in thousands of tons)	Basic Quotas (Percentages)
Ghana	580.9	36.7
Nigeria	307.8	19.5
Ivory Coast	224.0	14.2
Brazil	200.6	12.7
Cameroon	126.0	8.0
Dominican Republic	47.0	3.0
Equatorial Guinea	38.7	2.4
Togo	28.0	1.8
Mexico	27.0	1.7
TOTAL	1580.0	100.0

Note: Calculated for the first quota year on the basis of the highest annual production figure during the past years beginning with and including the 1964/65 crop year.

Data used for computation is from Gill and Duffus Ltd., Cocoa Market Reports (various issues, 1964/65 to 1971/72, London).

APPENDIX F

ALTERNATIVE PROOF OF WELFARE LOSS FORMULA

The following alternative proof is given to show that the area of triangle KMC is equal to  $\frac{1}{2}(b-a)\frac{1}{a} p_t^2$

At equilibrium  $A + a\bar{q} = B + b\bar{q}$

$$\bar{q} = \frac{B - A}{a - b}$$

$$P_t = A + aq_t$$

$$q_t = \frac{P_t - A}{a}$$

$$\text{AREA KMC} = \int_{x=q_t}^{x=\bar{q}} (y_1 - y_2) dx = \int_{\frac{P_t - A}{a}}^{\frac{B - A}{a - b}} [aX + A - bX - B] dx$$

$$= \int \left[ (a-b) + (A-B) \right] dx = (a-b) \frac{x^2}{2} + (A-B) x \left| \begin{array}{l} \frac{B-A}{a-b} \\ \frac{P_t - A}{a} \end{array} \right.$$

$$= \left[ \frac{(a-b)}{2} \left[ \frac{B-A}{a-b} \right]^2 + (A-B) \left( \frac{B-A}{a-b} \right) \right] - \left[ \frac{(a-b)}{2} \left( \frac{P_t - A}{a} \right)^2 + A-B \left( \frac{P_t - A}{a} \right) \right]$$

$$= \left[ \frac{(a-b)}{2} \left( \frac{B-A}{a-b} \right) \left( \frac{B-a}{a-b} \right) + (A-B) \left( \frac{B-A}{a-b} \right) \right] - \left[ \frac{(a-b)}{2} \left( \frac{P_t - A}{a} \right)^2 + A-B \left( \frac{P_t - A}{a} \right) \right]$$

$$= \left[ \frac{(a-b)(B-A)^2}{2(a-b)^2} + \frac{(A-B)(B-A)}{a-b} \right] - \left[ \frac{a-b}{2} \left( \frac{P_t - A}{a} \right)^2 + (A-B) \left( \frac{P_t - A}{a} \right) \right]$$

$$\text{But } P_t = a \frac{B-A}{a-b} + P_t$$

$$= \left[ \frac{(a-b)(B-A)^2 + 2(a-b)(A-B)(B-A)}{2(a-b)^2} \right] - \left[ \frac{a-b}{2} \left[ a \frac{B-A}{a-b} + P_t \right]^2 \right. \\ \left. + (A-B) \left( a \frac{B-A}{a-b} + P_t \right) \right]$$

$$= \left[ a-b \frac{[(B-A)^2 + 2(A-B)(B-A)]}{2(a-b)^2} \right] - \left[ \frac{a-b}{2} \left( \frac{B-A}{a-b} + \frac{P_t}{a} \right)^2 \right. \\ \left. + (A-B) \left( \frac{B-A}{a-b} + \frac{P_t}{a} \right) \right]$$

$$= \left[ \frac{(B-A)(B-A) + 2(A-B)(B-A)}{2(a-b)} \right] - \left[ \frac{a-b}{2} \left\{ \left( \frac{B-A}{a-b} \right)^2 + 2 \left( \frac{B-A}{a-b} \right) \right. \right. \\ \left. \left. \frac{P_t}{a} + \frac{P_t^2}{a^2} \right\} + \left\{ \frac{(A-B)(B-A)}{a-b} + \frac{(A-B)}{a} \right\} P_t \right]$$

$$= \left[ \frac{(B^2 - 2AB + A^2 + 2Ab - 2A^2 - 2b^2)}{2(a-b)} + 2AB \right] - \left[ \frac{(B-A)^2}{2(a-b)} \right. \\ \left. + (B-A) \frac{P_t}{a} + \left( \frac{a-b}{2} \right) \frac{P_t^2}{a^2} - \frac{(B-A)^2}{(a-b)} + (A-B) \frac{P_t}{a} \right]$$

$$= \left[ \frac{-B^2 + 2AB - A^2}{2(a-b)} \right] - \left[ \frac{(B-A)^2}{2(a-b)} + (B-A) \frac{P_t}{a} + \left( \frac{a-b}{2} \right) \frac{P_t^2}{a^2} \right. \\ \left. - \frac{(B-A)^2}{(a-b)} + (A-B) \frac{P_t}{a} \right]$$



$$= \left[ -\frac{(B-A)^2}{2(a-b)} \right] - \left[ \frac{(B-A)^2}{2(a-b)} + (B-A) \frac{p_t}{a} + \frac{(a-b)}{2} \frac{p_t^2}{a^2} - \frac{(B-A)^2}{a-b} + A-B \frac{p_t}{a} \right]$$

$$= -\frac{(B-A)^2}{2(a-b)} - \left[ \frac{(B-A)^2}{2(a-b)} - (A-B) \frac{p_t}{a} + \left(\frac{a-b}{2}\right) \frac{p_t^2}{a^2} + (A-B) \frac{p_t}{a} - \frac{(B-A)^2}{a-b} \right]$$

$$= -\frac{(B-A)^2}{2(a-b)} - \left[ -\frac{(B-A)^2}{a(a-b)} + \frac{(a-b)}{2} \frac{p_t^2}{a^2} \right]$$

$$= \frac{(B-A)^2}{2(a-b)} + \frac{(B-A)^2}{2(a-b)} - \frac{a-b}{2} \left( \frac{p_t^2}{a^2} \right)$$

$$= -\frac{a-b}{2} \frac{p_t^2}{a^2}$$

$$= -\frac{1}{2} (a-b) \left(\frac{1}{a}\right)^2 p_t^2$$

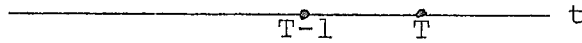
$$= \frac{1}{2} (b-a) \frac{1}{a^2} p_t^2$$

APPENDIX G

THE CASE OF FINITE UPPER LIMIT T

In order to demonstrate the existence of the feed-back solution it is necessary to consider the case of the finite upper limit.

Consider a one-stage process commencing at T-1



$$\text{Cost}_1 = \min \sum_{t=1}^{T-1} [(mp_t^2 + nf_t^2) + C] \dots \dots \dots (1)$$

$$= \min (mp_{T-1}^2 + nf_{T-1}^2) \dots \dots \dots (2)$$

Given the system  $p_{T-1} = \alpha bp_{T-2} + \alpha f_{T-1}$

$$\therefore \text{Cost}_1 = \min \left\{ m(\alpha^2 b^2 p_{T-2}^2 + 2\alpha^2 bp_{T-2} f_{T-1} + \alpha^2 f_{T-1}^2) + nf_{T-1}^2 \right\} \dots \dots \dots (3)$$

Find  $f_{T-1}$  in terms of  $p_{T-2}$

$$\min \left\{ m(\alpha^2 b^2 p_{T-2}^2 + 2\alpha^2 bp_{T-2} f_{T-1} + \alpha^2 f_{T-1}^2) + nf_{T-1}^2 \right\}$$

$$\Rightarrow 0 = \frac{\partial(\text{Cost}_1)}{\partial f_{T-1}} = 2m\alpha^2 bp_{T-2} + 2(m\alpha^2 + n) f_{T-1}$$

$$f_{T-1} = - \frac{m\alpha^2 b p_{T-2}}{m\alpha^2 + n}$$

$$\begin{aligned} \text{and } \therefore \text{cost}_1 &= m \left( \alpha b p_{T-2} - \frac{m\alpha^3 b p_{T-2}}{m\alpha^2 + n} \right)^2 + n \left( \frac{m\alpha^2 b p_{T-2}}{m\alpha^2 + n} \right)^2 \\ &= p_{T-2}^2 \left\{ m \left( \frac{(m\alpha^2 + n) b - m\alpha^3 b}{m\alpha^2 + n} \right)^2 + n \left( \frac{m\alpha^2 b}{m\alpha^2 + n} \right)^2 \right\} \\ &= \frac{b^2 p_{T-2}^2}{(m\alpha^2 + n)^2} \left\{ m \left( \frac{(m\alpha^2 + n) \alpha b - m\alpha^3 b}{m\alpha^2 + n} \right)^2 + n (m\alpha^2)^2 \right\} \\ &= \frac{b^2 p_{T-2}^2}{(m\alpha^2 + n)^2} \left\{ mn^2 \alpha^2 + nm^2 \alpha^4 \right\} \\ &= \frac{\alpha^2 m n b^2 p_{T-2}^2}{(m\alpha^2 + n)^2} (m + n) = \frac{\alpha^2 b^2 m n (m + n)}{(m\alpha^2 + n)^2} p_{T-2}^2 \quad (4) \end{aligned}$$

Thus  $f_{T-1}$  is proportional to  $p_{T-2}^2$  and

$\text{Cost}_1$  is proportional to  $p_{T-2}^2$

Now assume

$$f_{T-1} = \beta p_{T-2}$$

$$\text{Cost}_1 = \gamma p_{T-2}^2$$

$$\begin{aligned} \text{Then } \text{Cost}_1 &= \min (m p_{T-1}^2 + n f_{T-1}^2) = \min \left( m \left[ \alpha b p_{T-2} + \alpha \beta p_{T-2} \right]^2 \right. \\ &\quad \left. + n \beta^2 p_{T-2}^2 \right) \quad \beta \text{ unknown. } \dots (5) \end{aligned}$$

$$= \min_{(\text{wrt } \beta)} \left[ m\alpha^2 p_{T-2}^2 (b + \beta)^2 + n\beta^2 p_{T-2}^2 \right]$$

$$= \min_{\beta} p_{T-2}^2 \left[ m\alpha^2 (b + \beta)^2 + n\beta^2 \right]$$

$$0 = \frac{d}{d\beta} = 2m\alpha^2 (b + \beta) + 2n\beta$$

$$= m\alpha^2 b + m\alpha^2 \beta + n\beta$$

$$= m\alpha^2 b + \beta(m\alpha^2 + n)$$

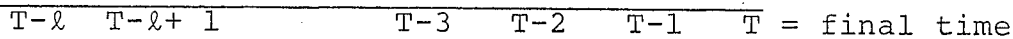
$$\beta^* = - \frac{m\alpha^2 b}{m\alpha^2 + n}$$

← can call this  $\beta_1$  for a one stage process.

Then  $\gamma = m\alpha^2 (b + \beta^*)^2 + n\beta^{*2}$  . . . . . (6)

Now generalize

Instead of considering a one-stage process starting at  $t = T-1$ , consider an  $\ell$ -stage process starting at  $t = T-\ell$



minimum cost is here  $Cost_{\ell}$ .

Now derive a recursion formula relating  $Cost_{\ell}$  to  $Cost_{\ell-1}$

and sum a relation between  $\beta$  and  $\beta_{\ell-1}$ .

$$Cost_{\ell} = \min_{t=T-\ell} \sum_{t=T-\ell}^{T-1} (mp_t^2 + nf_t^2) \quad . . . . . (7)$$

$$= \min_{\text{over } f_{T-\ell}} \left\{ mp_{T-\ell}^2 + nf_{T-\ell}^2 + \underbrace{\min_{T-\ell+1}^{T-1} (mp_t^2 + nf_t^2)}_{\text{recognize as Cost}_{\ell-1}} \right\}$$

$$= \min_{\text{over } f_{T-\ell}} \left\{ mp_{T-\ell}^2 + nf_{T-1}^2 + \text{Cost}_{\ell-1} \right\}$$

Now assume certain forms i.e., that  $\text{Cost}_{\ell} = \gamma_{\ell} p_{T-\ell-1}^2$

and that  $f_{T-\ell} = \beta p_{T-\ell-1}$

$$\therefore \text{Cost}_{\ell} = \min_{\text{over } f_{T-\ell}} \left\{ m(\alpha \beta p_{T-\ell-1} + \alpha \beta_{\ell} p_{T-\ell-1})^2 + n \beta_{\ell}^2 p_{T-\ell-1}^2 + \text{Cost}_{\ell-1} \right\} \dots \dots \dots (8)$$

Can express  $\text{Cost}_{\ell-1}$  in above in terms of  $p_{T-\ell-1}$

equal to  $\gamma_{\ell-1} p_{T-\ell}^2$

express in terms of  $p_{T-\ell-1}$

$$\therefore \text{Cost}_{\ell} = \min_{\text{over } \beta_{\ell}} \left\{ m \alpha^2 p_{T-\ell-1}^2 (b + \beta_{\ell})^2 + n \beta_{\ell}^2 p_{T-\ell-1}^2 + \gamma_{\ell-1} (\alpha \beta p_{T-\ell-1} + \alpha \beta_{\ell} p_{T-\ell-1})^2 \right\}$$

$$= \min_{\beta_{\ell}} \left\{ (m + \gamma_{\ell-1}) \alpha^2 (b + \beta_{\ell})^2 + n \beta_{\ell}^2 \right\} p_{T-\ell-1}^2$$

Set  $\frac{d}{d\beta_\ell} = 0$  for min:  $0 = (m + \gamma_{\ell-1})\alpha^2(b + \beta_\ell)^2 + n\beta_\ell$

$$\beta_\ell = (m + \gamma_{\ell-1})\alpha^2 b + \left[ (m + \gamma_{\ell-1})\alpha^2 + n \right] \beta_\ell$$

$$\beta = - \frac{(m + \gamma_{\ell-1})\alpha^2 b}{(m + \gamma_{\ell-1})\alpha^2 + n}$$

Put into  $\text{Cost}_\ell$  to obtain recursions for  $\gamma$ :

$$\text{Cost}_\ell = \gamma_\ell p_{T-\ell-1}^2 = p_{T-\ell-1}^2 \left\{ (m + \gamma_{\ell-1})\alpha^2 \left( \frac{(m + \gamma_{\ell-1})\alpha^2 b + nb - (m + \gamma_{\ell-1})\alpha^2 b}{(m + \gamma_{\ell-1})\alpha^2 + n} \right)^2 + n \left( \frac{(m + \gamma_{\ell-1})\alpha^2 b}{(m + \gamma_{\ell-1})\alpha^2 + n} \right)^2 \right\}$$

..... (9)

i.e.,  $\gamma_\ell = n(m + \gamma_{\ell-1})\alpha^2 b^2 \left\{ \frac{n^2 + n(m + \gamma_{\ell-1})^2}{(m + \gamma_{\ell-1})\alpha^2 + n} \right\}$

$$\gamma_\ell = \frac{(m + \gamma_{\ell-1})n\alpha^2 b^2}{(m + \gamma_{\ell-1})\alpha^2 + n}$$

Start with  $\ell = 1$

$$\gamma_{\ell-1} \triangleq 0$$

Then find  $\beta_1, \gamma_1$

Find all  $\gamma_i$  from  $\gamma$  recursion. Each

$\beta$  then specified.

Now take limit as  $\ell \longrightarrow \infty$

Then  $\gamma_\ell \longrightarrow \gamma_{\ell-1} \triangleq \gamma$

define  $k \triangleq m + \gamma$

$$\gamma = \frac{(m + \gamma) n \alpha^2 b^2}{(m + \gamma) \alpha^2 + n}$$

$$\gamma (m + \gamma) \alpha^2 + \frac{\gamma n}{(m + \gamma)} = (m + \gamma) n \alpha^2 b$$

and 
$$\beta = - \frac{(m + \gamma) \alpha^2 b}{(m + \gamma) \alpha^2 + n}$$

then 
$$\beta = - \frac{k \alpha^2 b}{k \alpha^2 + n} \quad (\text{agrees with equation 9 in Chapter 7}) \dots \dots \dots (10)$$

use this definition of  $k$  in  $\gamma$ -equation:

$$\gamma = \frac{(m + \gamma) n \alpha^2 b^2}{(m + \gamma) \alpha^2 + n}$$

to obtain

$$k - m = \frac{k n \alpha^2 b^2}{k \alpha^2 + n} \quad (\text{this agrees with equation 10 in Chapter 7}) \dots \dots \dots (11)$$

i.e., Given  $k \triangleq m + \gamma$

$$\gamma \left( \alpha^2 + \frac{n}{m + \gamma} \right) = n \alpha^2 b^2$$

$$\gamma \left( \alpha^2 + \frac{n}{k} \right) = n \alpha^2 b^2$$

$$\gamma = \frac{n \alpha^2 b^2}{\alpha^2 + \frac{n}{k}}$$

$$\gamma = \frac{k n \alpha^2 b^2}{k \alpha^2 + n}$$

but  $k = \underline{\underline{\Delta}} m + \gamma$

$\therefore \gamma = k - m$

$$k - m = \frac{kn\alpha^2 b^2}{k\alpha^2 + n}$$

Q.E.D.