AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY
Batch 66

1. SUBJECT CLASSIFICATION

A. PRIMARY
Food production and nutrition AE10-0000-G732

B. SECONDARY
Agricultural economics--Philippines

2. TITLE AND SUBTITLE
The Philippine coconut industry

3. AUTHOR(S)
Nyberg,A.J.

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1968	259 p.	ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Cornell

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*
(Diss.--Cornell Univ.)

9. ABSTRACT

10. CONTROL NUMBER
PN-AAE-300

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Coconut
Economic analysis
Food industry
International trade
Philippines
Processing

13. PROJECT NUMBER

14. CONTRACT NUMBER
CSD-1815 Res.

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

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THE PHILIPPINE COCONUT INDUSTRY

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University for the Degree of

Doctor of Philosophy

by

Albert John Nyberg

June 1968

VITA

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ACKNOWLEDGEMENTS

The people who contributed to this thesis are so numerous that complete enumeration is prohibitive. Thanks must be expressed to the 1230 Filipino farmers who contributed data to the farm survey, and to the survey enumerators, Misses, Arada, Paje, Cordova, and Labadan, and Messers. Mejia and Calabia. Particular thanks is due Mr. Calabia for his assistance in designing the survey questionnaire and selecting the farm sample.

The kindness, assistance and support of Dr. E. U. Quintana and the Agricultural Economics staff of the U. P. College of Agriculture is gratefully acknowledged. Appreciation is also due Dr. R. Barker, Agricultural Economist, The International Rice Research Institute, under whose guidance the field work was performed. The hospitality of Dr. W. R. N. Nathanael and the staff of the Ceylon Coconut Research Institute is also greatly appreciated.

The assistance of industry personnel was most helpful. Mr. W. Doromal of Lacaran, Davao, Philippines, provided a base for survey operations and permitted the author to familiarize himself with the production process. Mr. E. Waldberger of Granex Corporation (Cargill), Mr. J. Esteva of the Philippine Refining Company (Unilever), and Mr. R. Miller of Procter and Gamble were of considerable help in describing the non-farm portion of the coconut oil industry. Recognition is also given Mr. A. Hewit of Tradax England, Ltd., Mr. R. Smith of Unilever House, and Mr. E. Plesner of the East Asiatic Company for their help in understanding the marketing process.

Professors M. E. Brunk, R. T. Selden, and F. H. Golay reviewed the manuscript and provided constructive criticism. The advice of Professor W. G. Tomek, who served as chairman of the special committee, was invaluable in analyzing, organizing, and presenting the data. Thanks is also expressed to Dr. K. L. Turk, Director, International Agricultural Development, Cornell University, under whose auspices the project was undertaken and financed.

Special appreciation is expressed to Mr. George Hicks of the National Planning Association, who provided continual assistance during the study. Cooperation with Mr. Hicks was so close it is impossible to state the degree to which the author's comments have been influenced by his.

The author is deeply indebted to Mrs. Nancy Brown for her patience, speed, and accuracy in typing the manuscript.

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CHAPTER I

INTRODUCTION

The coconut industry is of major importance to the economy of the Philippines. This importance is manifested in farm income, land area devoted to coconuts, labor force utilized, and foreign exchange earnings. The industry is overwhelmingly agricultural as only 30 percent of the value is attributable to the non-farm sector.[1/]

Approximately 50 percent of the Philippine farms produce coconuts, although only one-fifth are classed as coconut farms. Income from coconut production, comprising 12 percent of farm income, is reasonably well distributed among farmers. The industry earns about one-third of the country's foreign exchange earnings.

Alternatively, about 60 percent of the world's indigenous exports of coconut products originate in the Philippines. Several European countries import a considerable amount of copra from their former colonies under preferential trade agreements. But, despite the preferential trade between the Philippines and the United States, the Philippines exports about 80 percent of the "freely traded" copra and coconut oil.

The Philippine coconut industry has greatly expanded since its commercial inception. But, its growth has predominantly resulted from an increasing demand. Supply has been passive, influenced by weather

1/ George L. Hicks, The Philippine Coconut Industry: Growth and Change, 1900 - 1965, Field Report 17.

and reacting to price, with no conscious effort to shift the supply function. Domestically the industry has not experienced any severe economic difficulties, because of relatively high prices. Consequently, not all the problems of the industry are apparent. The identification of some of these problems is part of the function of this study. The industry has been plagued by low productivity, low quality, and inefficient market performance. Problems, which if solved could contribute substantially to the health of the industry and to the vigor of the economy.

Historically, coconut leasing was by tree numbers rather than per unit land. Consequently, older production areas suffer from excessive tree density, which reduces productivity. Poor management practices have also contributed to the low productivity.

Market efficiency has been retarded by poor transportation facilities. Moreover, the credit financing system, in which various market levels finance the next lower level, has tended to reduce competition by prescribing a defined market channel.

A combination of unstable supply and inelastic demand has created a volatile price for coconut oil. This volatile price, coupled with the high average price, has adversely affected demand. During the 1920's, coconut oil was the lowest priced major oil in the United States. However, by the 1956-65 decade it was the highest priced major oil. Consequently, technology has permitted the replacement of some coconut oil by other less expensive oils.

A virtual knowledge vacuum exists regarding supply response and production change, demand functions and shifts, internal marketing,

international market structure, and price determination. Within this knowledge vacuum, policy enactment has been directed toward symptoms, not problems. The lack of production oriented policy, coupled with the abundance of biological and economic myths that surrounds the industry, has retarded its efficient development.

The inability of the coconut industry to supply a competitively priced oil has caused it to lose markets. While the industry has enjoyed short-run benefits, it has suffered long-run losses. Only an increasing demand, some irreplaceable uses and new uses have permitted the industry to expand.

The consequences of the problems mentioned above are not obvious. The existing situation has permitted expansion but viewed from a normative perspective, the industry has been impeded. If supply shifts would have accompanied the demand shifts, a lower price level could have been maintained. With a competitive price, equilibrium could conceivably be in an elastic portion of the demand curve. Traditionally, demand curves are assumed inelastic at lower prices. However, it is not impossible for the curve to be elastic at low price levels if the commodity has multiple uses.

Objectives

The lack of a recent comprehensive study, upon which to base decisions, projections or policies, prompted this study of the coconut industry. The study undertakes a review of the coconut industry, historically and analytically. Changes in the industry and their causes are evaluated. This thesis contains continuous historical data on the

industry and may serve as a general reference source. The purpose is to determine the position of the Philippine coconut industry in the world fats and oils economy. In addition, future prospects for the industry are considered.

The specific objectives of the study are:

(1) To describe the history of growth of the industry in the Philippines and identify factors influencing growth.

(2) To review the influence of various policies on price and growth, including the influence of tariffs, quotas and monetary decontrol.

(3) To describe the price structure and price performance for copra and coconut products.

(4) To estimate the price elasticity of supply for coconuts for various regions and for the entire country.

(5) To describe the domestic and international market structures.

(6) To estimate the price and income elasticities of demand for copra.

Definitions

The following terms, which require definition, are used in the thesis:

(1) copra - the dried coconut meat.

(a) resecada - a standardized grade of copra, for which price quotations are listed. Deductions are applied to standardize the copra at six percent moisture.

(b) corriente - non-standardized or straight-run copra.

(2) coconut oil - the oil obtained by hydraulically crushing the copra or by chemical solvent extraction.

(3) copra meal/cake - the residue remaining after oil extraction, which contains about 18 percent protein.

(4) desiccated coconut - dehydrated, and shredded or chipped coconut meat, used for baking and confectionery.

(5) tuba - beverage concocted from the coconut palm sap. The sap is acquired by tapping the inflorescence. Fermentation occurs within a few hours, resulting in a mildly intoxicating drink.

(6) tapahan - a copra drier consisting of a lattice framework constructed above a fire pit. Smoke and hot air filters through the copra placed on the lattice, removing the moisture.

Scope of the Thesis

In spite of the importance of the coconut in the Philippines economy, it has been badly neglected in research and study. There has been no written material on the coconut industry from a macro-perspective in the last 30 years. Therefore, the importance of coconuts and their historical development are reviewed in the second chapter. It also contains a description of the coconut palm and a limited review of the literature. (Additional literature, pertaining to specified topics is reviewed in the sections devoted to those topics.) Inadequate records and data prohibit a comprehensive investigation of all the factors contributing to the pre-war growth of the industry. However, factors which assisted post-war expansion in production and exports are analyzed in Chapter III.

Chapter IV contains a discussion of the production of coconuts in the Philippines. This includes a discussion of the heterogeneity in production, productivity, and farm practices as well as the geographical shift in production. Chapter IV also contains the results of a farm survey. Empirical supply equations are presented in Chapter V. The elasticity of coconut hectarage was estimated for the various census regions. An equation for estimating yield was also developed. The two equations can be combined to forecast production.

The domestic marketing pattern is described in Chapter VI. Of considerable importance is the proportion of exports in the form of coconut oil. External forces determine, to a large extent, many of the domestic marketing conditions. Chapter VII contains estimates of demand functions based on United States and European factors. A subgroup of equations was extracted, from the implied but unspecified system of equations, and demand coefficients were estimated.

World market structure, pricing policy, tariffs and trade barriers are examined in Chapter VIII. The ninth chapter evaluates the coconut industry in the Philippine economy and attempts to present guidelines for development. The thesis terminates with a summary and conclusions in Chapter X.

CHAPTER II

THE COCONUT PALM

Importance and Historical Development

The coconut has long been a crop of considerable importance in the humid tropics. The multiple uses of the coconut have made it an invaluable commodity in the subsistance sector. Inasmuch as the coconut is a multi-use commodity it is not surprising that its major use has evolved over time. Food, in the form of fresh fruit and as a vegetable oil, was once the major use and still serves in this capacity in many countries. Later, when Europeans colonized the Asian Tropics, the commercial use of the coconut was a coir fiber rope. This was particularly true of Dutch Ceylon and the Spanish Philippines in the mid-1600's. During the 18th century the primary commercial and domestic use, exclusive of food, was as tuba. Only in the last century has commercial emphasis shifted to the oil component.

Coconut cultivation is reputed to have been in existence by 300 B.C. in Ceylon. Cultivation in the Philippines is younger; however, it is known that Chinese junks engaged in exports prior to the arrival of Magellan in 1521. Commercialization of coconuts occurred almost simultaneously in Ceylon and the Philippines. The Dutch stimulated its cultivation in Ceylon during the 1640-50 era and the manufacture of coir fiber assumed considerable importance. They were soon to export

three million pounds of coir annually. The coir fiber is quite resistant to decay and is not weakened by constant exposure to sea water.

The introduction of coconut oil into Europe occurred in 1750, when a French trader was unable to obtain cargo for his return trip.[1] He allegedly loaded his ship with coconuts as ballast and after arriving in Marseille, convinced a local miller to buy them. Marseille was well established as the center of coconut oil milling throughout the 19th century.

In 1642, an attempt was made to force the commercialization of coconuts in the Philippines when the Spanish Governor General, Don Sebastian Hurtado de Corcuena, issued his ordinances for good government. Ordinance Number 32 stated: "Great care is to be taken to have the Indians plant coconut palms...the chiefs, trees of the number of two hundred...and timavas (peasants) each to the number of one hundred."[2] This forced commercialization was not for increased food production but for subsidiary use. The Spanish used coconut fiber in caulking their galleons and coir fiber for making rope and rigging. The Governor General further demanded the trees be well cared for and implemented his directive by imposing penalties for non-compliance.

Throughout the Spanish period coconut exports were quite small and were primarily in the form of nuts. In 1895 the first copra was exported. The construction of a commercial oil extraction mill in 1906

1/ E. D. Gothwaite, Trade in Philippine Copra and Coconut Oil, Washington, Government Printing Office, 1925.

2/ Emma H. Blair and J. A. Robertson, The Philippine Islands, Vol. 50, pp. 191-211.

initiated a trend in oil exports only to be retarded when the mill was destroyed in 1909. However, commencing in 1913, numerous extraction mills were constructed and coconut oil was again exported. The commercial extraction of oil, made copra cake available for export and was added to the export list in 1913. Desiccated coconut was first exported in 1922 and rapidly became a stable export commodity.

The commercial coconut industry developed concurrently in the Philippines and Indonesia, although Indonesia never developed the desiccated coconut sector. However, the industry developed considerably earlier in Ceylon. Ceylon was exporting coconut oil in commercial quantity by 1878, initiated copra cake export in 1885 and began exporting desiccated coconut in 1891.

The American occupation marked an acceleration of interest in coconuts partially because of the new market but primarily because of fewer trade restrictions permitting France to engage in free copra trade. This period marks the beginning of a rapid increase in copra exports. Another forceful stimulant to the industry was World War I. (Coconut oil is high in glycerin, which is used in explosives.) Prior to 1913 exports had been almost entirely in the form of copra. However, the war also created a shortage in shipping, and oil was extracted for export instead of copra.

The importance of coconuts at the farm level is indicated by its hectarage, its contribution to farm income and by the number of farmers producing coconuts. Currently more than 1.6 million hectares are planted to coconuts, which contributed over 12 percent of total farm income. About 440,000 farmers are classed as coconut farmers, although

well over a million farmers grow coconuts for sale. This commercial agriculture is not concentrated in estates and plantations but consists primarily of small holders.

Historical and Literature Review

Byars[3/] made some interesting observations in 1908 that are still valid today. He mentions that the wealth derived from coconuts is quite well distributed, "so that while none of the people are very rich, none are very poor." The amount of wealth required to make a person "rich" is arbitrary. However, it is obvious that today coconut farmers (both owners or tenants) are in an economically superior position to rice farmers.

Byars describes the most common tenancy arrangement as 50:50 of the gross proceeds, with the tenant bearing the costs of copra manufacture and transportation. Copra manufacture was primarily by tapahan, and considerable oil was manufactured at home from fresh meat. The procedure involves grating, boiling, rolling (oil extraction) and again boiling until the oil and water separates.

Yield per hectare was 10,000-12,000 nuts, but tree density was not mentioned. Byars indicates it required about 4 1/2 nuts to make a kilogram of copra.

In the early part of the century intensive plantings were the rule. This was the result of the customary practice of renting by

3/ A. F. Byars, "Coconuts in Laguna and Tayabas Provinces," The Philippine Agricultural Review, Vol. 1, No. 12, 1908.

tree instead of by area. Hence, concentrations as high as "500 trees to the hectare were not uncommon in old plantations."[4] The average tree concentration was estimated at 200 trees per hectare in 1917.

Throughout the first 30 years of the century, harvesting was recommended by "letting the ripe nuts drop to the ground." This was advocated by most of the earlier writers in all the major producing countries. However, it was never practiced either then or now.

The average yield per tree in 1917 was about 25 nuts implying production of about 5,000 nuts per hectare. On well-managed plantations with "reasonably" spaced plantings, tree yields of 70 nuts were expected.

Webster as well as other early writers made a very inaccurate prediction in saying that tapahan driers will be forced out of business because of higher prices paid for sun dried and machine dried copra. Probably 95 percent of the current copra is tapahan dried.

Many early authors as well as many contemporary farmers believe the coconut does better on the seashore where salt concentrations exist. Copeland[5] effectively discounted this premise, proving physiologically the coconut can tolerate salt but by no means needs it. He indicated the primary need as flowing ground water - hence the prolific production along sandy beaches.

Much of Copeland's work and observations were in Mindanao, which was not then a heavy production area. Cultural practices seem to have changed little since his writing despite their apparent profitability.

4/ P. J. Webster, "The Coconut, Its Culture and Uses," The Philippine Agricultural Review, Vol. XI, No. 1, 1918, p. 21.

5/ Edwin Bingham Copeland, The Coconut, 3rd ed. MacMillan and Co., Ltd. 1931.

In 1917 an experiment was conducted on a Davao plantation to determine the difference in production in cultivated and uncultivated trees. After six years the uncultivated trees were producing an average of about 150 nuts per tree and the cultivated trees had an average production of 250 nuts per tree.

San Ramon, Zamboanga was an area of interest from the viewpoint of plantation production and because of the size of the coconut found there. Tree density in this area was about 100 trees per hectare and the median yield was 88 nuts per tree although yields as high as 200 nuts per tree were obtained. At present a metric ton of copra requires an average of 3210 nuts, although in 1905 only 2800 nuts were required.

Copeland also mentioned a dwarf nut which would yield more than 100 kilograms of copra per tree per year, but states its life span was considerably shorter than the San Ramon variety.

Copeland like all other writers of this period mentions the use of kiln driers, hot air and super heated steam. But contrary to statements of other authors, he states that at that time (1931) it was not profitable to make better copra as it could not be sold at any higher price. This does not differ greatly from the current situation.

The best previous study of the Philippine coconut industry was by Gothwaite.[6] If the dates were changed to the 1960's from the 1920's, his discussion on marketing would still be valid. Then as now criticism is leveled toward alien middlemen. Gothwaite stated that the amount of retail business done by the Chinese was between 75 and 90 percent.

6/ Gothwaite, op. cit., p. 33.

Gothwaite's description of the first transaction of copra movement differs only slightly from current methods. "The farmer drives in from his plantation carrying perhaps a half a dozen sacks of copra on his cart. In town (he) circulates among the merchants seeking the best possible price for his copra. Eventually a bargain is struck and the copra changes hands. Payment is often in cash, often in goods and supplies and more generally in both." The only place where marketing is currently carried out precisely like this is in Northern Cebu. He mentions elsewhere in his book that credit is often advanced to the farmer but he does not describe it in detail.

The merchant (in 1920) who bought the copra followed one of two alternatives. He could ship it by rail or boat to Manila to his wholesaler to whom he was probably in debt for his merchandise. Alternatively the merchant could sell his copra locally to a dealer who would in turn ship it to Manila. On the Southern Islands similar transactions occurred. If the retail merchant was in the interior he would sell either to his wholesaler or to a dealer, both of whom were probably located on the coast.

The final transaction would be to the exporter or mill either in Manila or in one of the other shipping centers.

Another interesting parallel still in evidence relates to the financial transaction: then as now it is either in commodities or cash...cash meaning currency. Credit instruments such as checks simply are not used. If the transaction is ₱20 or ₱2,000, it is still in currency.

Visual inspection and grading was practiced then as now with one exception. Moisture content is currently estimated and the copra is

discounted by an equivalent amount. However, in the 1920's a premium was allegedly paid for sun-dried copra. This premium was about ₱2.00 per short ton.

Gothwaite indicated three ways of copra preparation: (1) sun dried (2) tapahan and (3) artificial drying. He did not describe the latter except to say it was used only on large plantations and the copra was sold direct to the exporter or even to a foreign oil mill. He postulated that the artificially dried copra was superior copra and was more profitable, and hence would increase - at the expense of the tapahan.

If the marketing situation has remained static since Gothwaite's study, then production has certainly retrogressed. He estimated the annual average yield at 62 nuts per tree. He further indicated isolated cases in Davao of 300 to 500 nuts per tree.

A study by Snodgrass[7] provided the most comprehensive study of the industry. The perspective was world wide and indicated that the Philippines was second to India in coconut hectarage and second to the Dutch East Indies in coconut product exports. The outlook for expansion was mixed as only slight expansion could be expected in Ceylon. But considerable potential existed in both the Dutch East Indies and the Philippines. However, the Dutch East Indies was expected to expand in oil palm rather than coconuts, and lack of labor limited the expansion in the Philippines.

Trade patterns in this era indicated monopolies of an intra-empire nature. Two factors contributed to these apparent monopolies. First was

7/ K. Snodgrass, Copra and Coconut Oil, Food Research Institute, Stanford University, 1928.

the merchant marine subsidies the colonial country provided for shipping between the mother country and the colonies. Such subsidies permitted unusually low freight rates. The second factor was the tariff structure on coconut oil. The U.S. had a two cent per pound tariff on coconut oil of non-Philippine origin, thus essentially prohibiting non-Philippine oil from the U.S. market. The European countries did not give tariff preference to their colonies, but, with the exception of the United Kingdom, had sizable tariffs. The effect of these two factors was to create oil extraction industries in the importing countries.

Description of the Coconut Palm

The coconut is a true tropical palm as it thrives best where the temperature is maintained between 22°C and 30°C.[8/] It is limited to an altitude of about 1500 feet in the Philippines. It thrives best with a well distributed rainfall pattern, high humidity, and light winds. Since a long pronounced dry season limits commercial production, Philippine production is found primarily in the areas south of Manila. The tree does not have a tap root so it cannot draw water from more than 2-1/2 feet beneath the soil surface. Coconuts can, of course, be irrigated but if irrigation facilities are established some other crop is probably more profitable. Soils for coconuts should be well drained and friable. Such soils are found along sandy coastal lowlands and around the bases of volcanic mountains. Most of the Philippine hectarage is planted along the coastal lowlands, the exception being in Southern Luzon where substantial inland plantings are found.

8/ See for example, Philippine Agriculture, Vol. 1, edited by L. B. Uichanco, 1959, for a complete discussion of coconut production.

The coconut palm begins to bear fruit from six to eight years after planting. The palm will set flowers about every 30 days, thus providing a continuous crop after the palm has matured. Although the life span of the coconut may approach 80 to 100 years, the average is somewhat less. The harvesting of nuts varies from once each 45 days on good plantations to twice per year in the poorer producing areas.

In the Philippines the worst enemy of the coconut palm is neither disease nor insect, but typhoons. Fortunately, much of Mindanao, the newest coconut area, is not subject to typhoons. A strong wind or typhoon not only blows off the mature and immature nuts but destroys the infloresence as well. Since it requires at least a year from flowering to maturing, a typhoon retards production for at least a year. Other pests are monkeys destroying mature nuts, rats destroying immature nuts, and wild pigs destroying seedlings.

By far the worst disease is a virus, cadang-cadang; it has severely infested the Bicol region of Southern Luzon and the island of Samar. Cadang-cadang manifests itself with a mottling of the leaves, a gradual decline in production and ultimately a dropping of the leaves, leaving a bare trunk standing. Cadang-cadang is not a serious problem in well-kept, well-managed plantations. The other serious disease is coconut bud rot. This disease affects the central bud, prohibiting further growth of the palm.

Insect pests are the Rhinoceros Beetle, a large black beetle which bores a hole into the palm to suck the sap, and the Asiatic palm weevil which sometimes infest the holes bored by the Rhinoceros beetle. These are not major problems.

Planting

Coconuts are planted in two common arrangements and are spaced at various distances. The most common planting arrangement in the older production areas is a square design in which rows, and plants within a row are evenly spaced. The planting arrangement that is recommended to utilize land more efficiently is a triangular design. The rows are closer spaced than the trees within the rows, but the plants are offset to give an equilateral triangle effect between adjacent palms. The individual plants are set in such a manner that each is equidistant from the surrounding six plants.

Planting distance varies from 5 x 5 meters to 10 x 10 meters. A 5 x 5 planting will result in 400 trees per hectare; such heavy plant density is found only in the older farms and probably results from early rental arrangements. The recommended spacing distance of 10 meters, triangularly spaced will give a plant density of about 115 trees per hectare. The 10 meter spacing is more desirable if intercropping is to be practiced. The newly planted areas of Mindanao are predominantly 10 meter triangularly spaced.

When plants are spaced closer than eight meters, productivity per tree declines, as does nut size. Very dense plantings will result in decreased production per hectare. Heavy plant densities create more competition for water and soil nutrients. However, these can be supplied leaving sunlight as the limiting factor.

Harvesting

The length of time required between flowering and maturity is about one year. Although nuts will be ripening in 30 day intervals, harvesting

is rarely practiced that frequently. Harvesting intervals are usually 45-60 days.

There are three harvesting methods: (1) by collecting fully mature nuts which fall from the trees; (2) by climbing the tree and cutting the nuts loose; and (3) by cutting the clusters of nuts with a knife attached to a long bamboo pole, the harvester remaining on the ground. Another method, practiced in Malaya, is by using trained monkeys to climb the palm and pick the ripe nuts.

The first method, of letting the nuts fall when mature has long been recommended but is rarely practiced. The positive aspects of this method are: (1) little harvest labor is required and (2) only mature nuts are acquired. The coconut will fall when it is fully mature and at the stage which will produce maximum oil of superior quality. The objections to this method are: (1) more frequent collecting or gathering of nuts (every 30 days) and (2) keeping a cleaner plantation. While the objections are valid, they appear to be in accord with good farm management practices.

The other two methods are widely used. However, climbing the trees is impractical on large plantations. The primary disadvantage associated with these methods is the tendency to harvest immature nuts. When immature nuts fall they often crack upon striking the ground and copra made from immature nuts is of poor quality.

Copra Production

Copra is manufactured on the farm by three alternative methods, sun dried, tapahan, or kiln dried.

At one time sun drying was considered the most desirable way of drying copra, and because of its white color it presumably received a higher price. There are disadvantages to sun drying copra; it requires considerably more time and labor than other methods and is more subject to fungi attack than is smoked copra. Sun drying copra during inclement weather is very difficult and may become moldy before it is dried. Good sun dried copra does produce higher quality oil that requires less filtration.

The tapahan is the most commonly used method of copra drying. Contrary to popular belief, high quality copra can be produced by this drying method if the fire is well tended and the framework is properly spaced above the firewell. The tapahan is usually an inexpensive structure and it dries copra rather rapidly. Thus, it is the method most preferred by farmers.

Kiln dryers exist but they are not numerous. Drying is rapidly accomplished by forced draft hot air or steam. The copra produced is very clean and of top quality. The disadvantages of kiln driers are high capital outlay and no premium price for the better quality.

CHAPTER III

GROWTH

The initial subsections of this chapter are concerned with domestic growth in coconut production and growth in coconut product exports. Consideration is given to production and export growth in terms of both physical quantity and value. Growth is measured in a time series framework, commencing with 1901 and terminating with 1966. The time period was subdivided to present average annual rates of growth during periods of relatively homogeneous conditions.

A great many factors, both internal and external, have influenced growth in the coconut industry. Detailed analytical explanations of why these changes occurred are not attempted. However, a number of contributory factors are discussed, with emphasis on post World War II changes. Price is discussed in terms of price relatives, price movements, and seasonal prices. In addition, the geographical location of coconut production and regional shifts are described. Lastly, the effects of domestic legislation and policy are reviewed. Growth is interpreted to mean physical expansion and does not imply development or increased efficiency.

Subsections in this chapter cover: (1) growth in domestic production, (2) growth in exports, (3) relative prices of alternative agricultural commodities, and (4) legislation affecting the coconut industry.

Domestic Production

The Act No. 1898 of the First Philippine Legislature provided for quarterly reports on agriculture.[1] However, collection was not implemented until July 1, 1909, but is available in various forms for each succeeding year except 1939 through 1946. The series can best be described by dividing the data into two general time periods, prior to and after World War II.

There are several methods of describing growth in coconuts, although production and value of production are more meaningful measures. The number of nuts produced increased at an annual rate of 5.0 percent between 1910 and 1938 and of 4.7 percent between 1952 and 1966.[2] Therefore, if the war years are omitted, the trend has been essentially constant since 1909-10 (chart 1).

Trend in the price of copra is dealt with in a later section. However, the growth rate in the farm value of coconut production was computed. From 1909 to 1929 the growth in the farm value proceeded at 7.8 percent annually, thus indicating that the price was also increasing (chart 2).

To obtain the "real" value of coconut production, the value data were deflated by a rice price index. An index of the farm price of the

1/ Philippine Agriculture Review, Vol. 1, No. 1, p. 10, January 1911.

2/ Data between 1947 and 1951 are too unreliable to analyze, for these five years the recorded statistics fluctuated violently, indicating changes which are physically impossible for a perennial crop with lagged production.

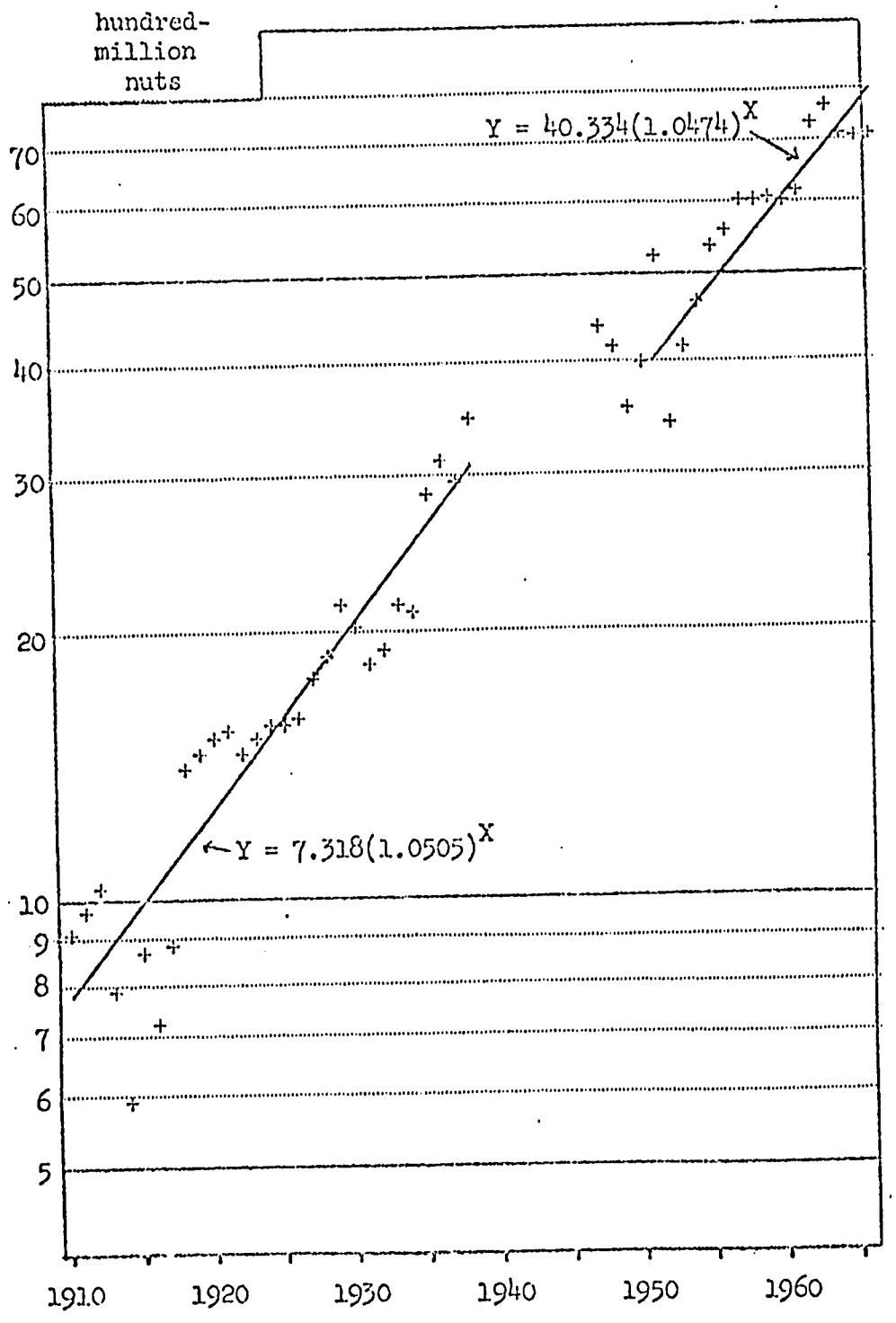

Chart 1: Coconut Production, 1910-66

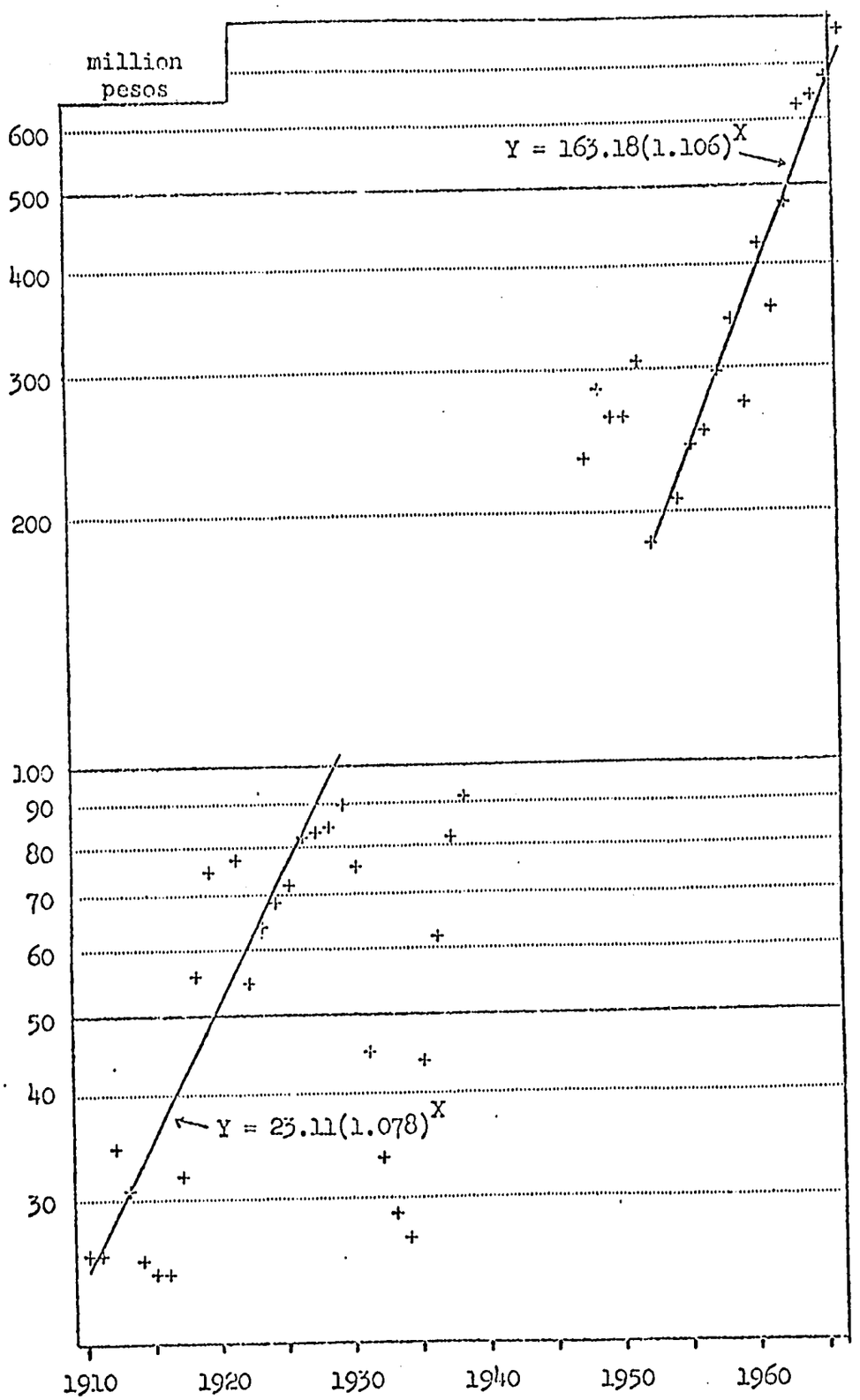

Chart 2: Farm Value of Coconut Production, 1910-66

palay was constructed and divided into the annual copra values. The palay price index was used for two reasons: (1) since palay is the major domestic crop, changes in its price should generally reflect changes in general farm prices or serve as an index of prices received by farmers, and (2) as the major food commodity whose retail price closely parallels the farm price, the palay price index could also serve as a consumer price index. The "real" farm value of coconut production was found to have increased at the annual rate of 4.8 percent between 1909-1928. Since the rates of increase in production and deflated value of production are essentially identical it suggests that the "real" price of copra did not change during the time period.

The erratic price fluctuations of the 1930's prohibits any meaningful trend analysis of crop value during that period. Even the deflated values fluctuated erratically during this period.

For the post-war period, 1952 to 1966, the farm value increased at an annual rate of 10.6 percent. However, when the values were deflated by the palay price index, the annual rate of increase became 6.8 percent.

In considering the components of production, further breakdown of the time periods is required. The period 1910-20 generally reflects a period of high demand and the period 1921-38 represents a period of slack demand and depression. The high growth rates in the first period for hectarage, bearing and non-bearing trees reflect the response to higher prices caused by increased demand. The respective growth rates were 8.1, 6.5, and 9.4 percent, (table 1), whereas growth rates during the latter period were 2.5, 4.2, and 0.9 percent respectively. During the entire period,

nuts per bearing tree remained relatively constant at about 31. While these components of production exhibited diverse growth rates, the consistency in the growth of production is noteworthy. This indicates the nature of the production process, where production is lagged several years behind planting.

Table 1: Growth Rates of Coconut Hectarage, Trees, Productivity, and Value (Selected Time Periods)

	1910-20	1921-38	1949-59	1960-66
		(percent)		
Hectarage	8.1	2.5	0.4	8.3
Bearing trees	6.5	4.2	1.5	7.3
Non-bearing trees	9.4	0.9	0.8	7.6
Nuts/bearing tree			3.1	-3.4
Production	5.0	5.0	4.7**	
Value	7.8*		10.6**	
Deflated value	4.8*		6.2**	

* 1910-29

** 1952-66

Source: Appendix table B1

For the post-war period, two subperiods can also be distinguished, corresponding to the years prior to and after monetary decontrol. This was initiated in April 1960. Between 1949 and 1959 bearing trees increased 1.5 percent per year and non-bearing trees increased 0.8 percent. However, during 1960-66 the growth rates increased to 7.3 and 7.6 percent respectively. The change in the growth rate of hectarage was even more dramatic; 0.4 percent for 1949-59 compared with 8.3 percent for 1960-66. The yield as measured by nuts per bearing tree had a growth rate of 3.1

percent from 1949 to 1959, but had a negative growth rate of 3.4 percent from 1960 to 1966.

Sufficient data were not available to determine the regions of most rapid growth prior to 1960. However, regional growth rates of total trees for 1960-66 are contained in table 2.

Table 2: Growth Rate of Coconut Palms by Region, 1960-66

Region	Growth Rate
	(percent)
Ilocos, Cagayan Valley, and Central Luzon	3.9
Southern Tagalog	0.3
Bicol	6.2
Eastern Visayas	11.5
Western Visayas	7.3
Northern and Eastern Mindanao	6.0
Southern and Western Mindanao	16.2

Source: Appendix table B3

Despite the fact that the primary producing regions had smooth growth rates in tree numbers for the 1960-66 period, only Southern and Western Mindanao displayed steady growth rates for nut production and value of production. These growth rates were 22.2 and 33.5 percent respectively. This region also had the highest productivity; nut production per bearing tree averaged 50 while the average for the Philippines (1960-66) was 41 nuts per bearing tree.

Exports

Inasmuch as coconut product exports did not contribute appreciably to export earnings until about 1900, the trend analysis was limited to exports of this century. The 1901-66 time period was divided into three sub-periods to describe the changes in export and export value growth rates. The time periods are 1901-19, 1920-40, and post World War II. The post World War II growth rates start with 1952 as the initial year; between 1947 and 1951 the data were highly erratic and exhibited no trend.

During the first two decades of the century exports of coconut products, in copra equivalent, increased at an annual rate of 9.0 percent (chart 3). In 1901, the Philippines exported 32,000 tons of copra equivalent and by 1919 it had reached 248,000 tons. (Copra equivalent is derived by dividing coconut oil exports by .63, dividing desiccated exports by .85 and adding them to copra exports. Copra meal is not converted as it is a by-product of oil extraction.) The growth in the value of coconut product exports increased at a much faster rate than the quantity exported, increasing 16.5 percent annually (chart 4 and table 3).

Table 3: Growth Rates of Coconut Product Exports and Export Values (Selected Time Periods)

	1901-19	1920-40	1952-66
		(percent)	
Exports	9.0	5.0	3.7
Export value	16.5	8.0*	4.5

* 1920-1929 only

Source: Appendix table D1

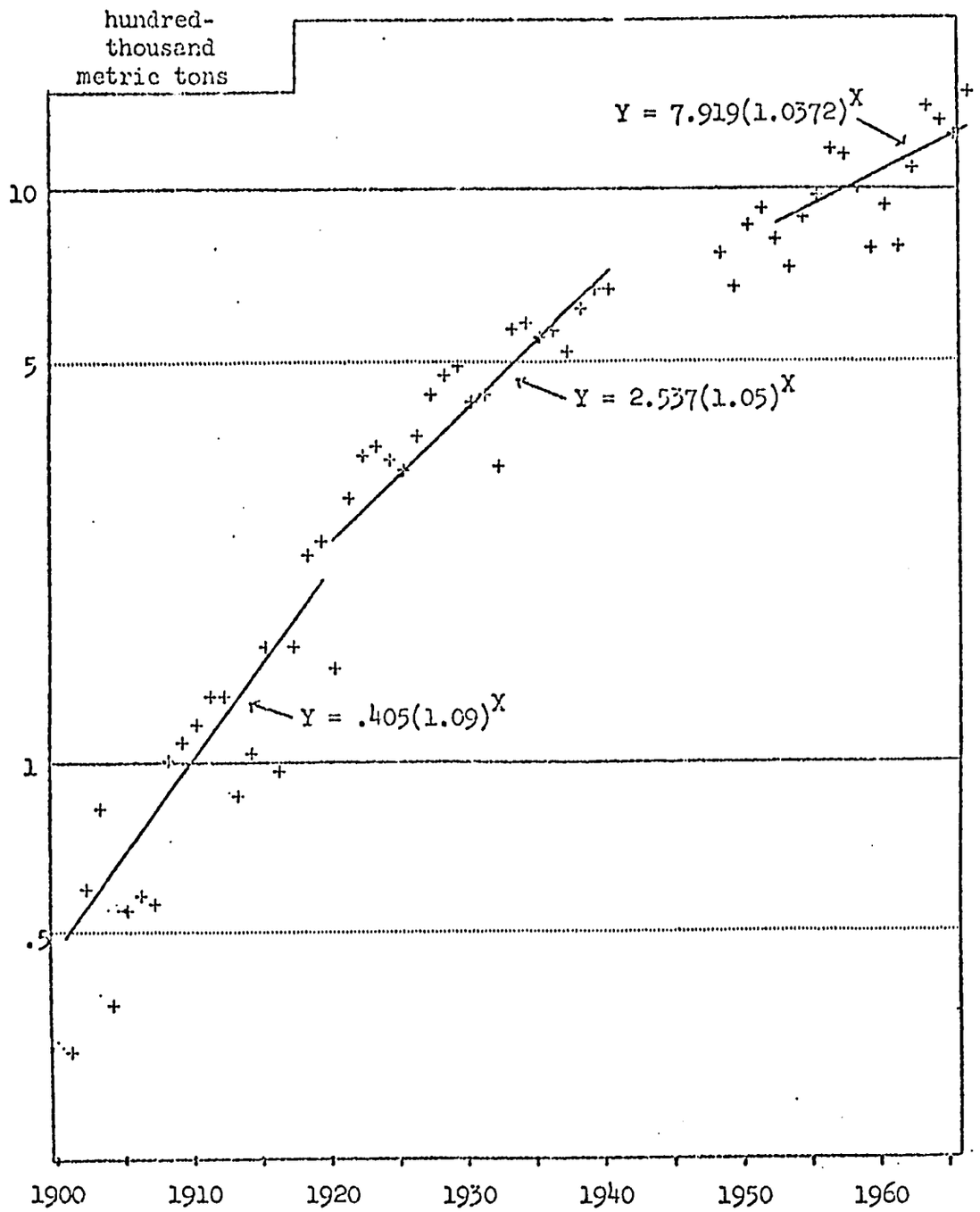

Chart 3: Exports of Coconut Products, in Copra Equivalent, 1901-66

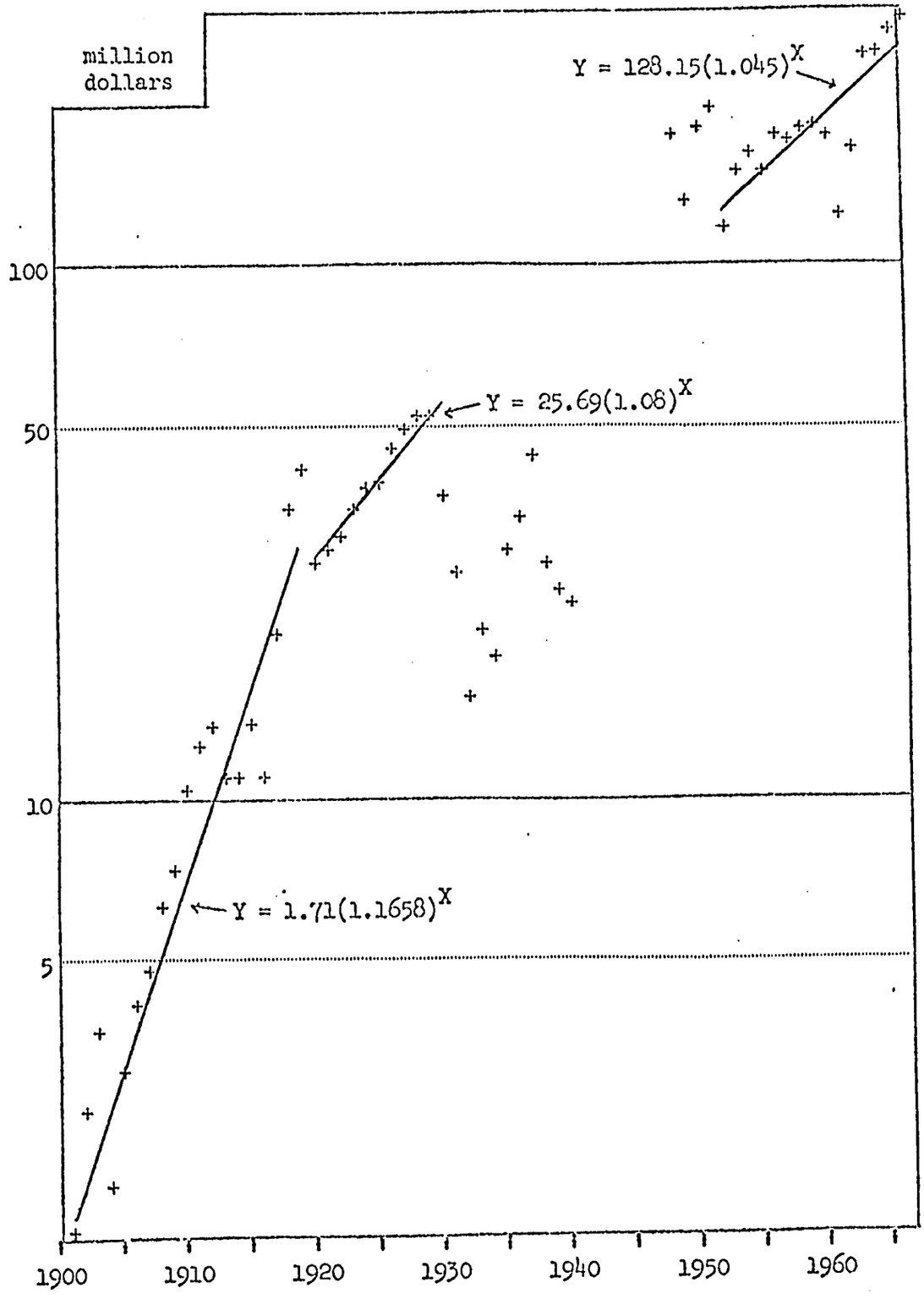

Chart 4: Export Value of Coconut Products, 1901-66

The growth rate of exports declined during the inter-war period to 5.0 percent annually. Exports in copra equivalent reached 685,000 tons by 1940. Only in one year, 1932, did a considerable divergence exist between the actual exports and the computed trend. During the first half of the inter-war period, 1920-29, the value of coconut products increased 8.0 percent annually. However, during the decade of the 1930's, the export value fluctuated violently, exhibiting no trend.

After World War II, copra became and continued to be the primary coconut export. Coconut oil was on the tariff free quota list for United States imports under the Bell Trade Act and the Laurel-Langley Trade Agreements. The United States has an import quota on the quantity of Philippine coconut oil which can enter the country tariff-free. The quota diminishes every three years and will decline to zero by 1974. Any Philippine coconut oil imported in excess of the quota is subject to the one cent per pound tariff. However, limitations imposed by the quota were more apparent than real until 1963, as prior to that date the quota was never filled.

In the immediate post-war years there was considerable fluctuation in both tonnage and value of copra exported. The unfulfilled demand of the war years contributed to the violent movements and it was not until 1952 that the data appear to exhibit a trend.

The data from 1952 to 1965 are also subject to error because of over- and undershipments during the period of monetary control. The full extent of over- and undershipping is unknown but some estimates are made and presented in the following section along with the economic reasons for overshipment.

The composition of coconut product exports and their values changed substantially over the post-war period, and disproportionate growth rates occurred for the components.

While exports in copra equivalent were increasing at the annual rate of 3.7 percent, exports of desiccated coconut kept pace with an identical growth rate. However, the growth rate in the value of desiccated coconut exports of 3.4 percent was somewhat less than that of total export value growth rate of 4.5 percent.

Prior to 1960, coconut oil exports did not experience any growth. However, between 1960 and 1966 the export tonnage of coconut oil increased at the annual rate of 31.7 percent. Accompanying the expansion in coconut oil exports was an increase in the growth rate of copra meal exports of 19.4 percent annually. Concurrent with the export growth, dollar earnings also increased at the respective annual rates of 30.0 and 24.0 percent.

The proportion of export value accounted for by oil exports and copra meal remained relatively constant between 1952 and 1959, at 13 percent and two percent respectively. However, by 1966 coconut oil exports were contributing 25 percent of the export value of coconut products and copra meal was contributing five percent. In the meantime the value of copra exports had declined from about 75 percent to 60 percent.

To estimate either the "real" value of exports or the growth in "real" value, the dollar values were deflated. There were no composite indices available for prewar periods. Therefore, no attempt was made to deflate the prewar data. Of the several indices available for the

post-war period, the import price index was selected as a deflator. This seemed the logical selection as the interest is in the quantity of imports that can be acquired for a given set of exports. The growth rate in "real" value has averaged 2.7 percent annually during the 15 years.

Chart 5 illustrates the post-war increase in the "real" value of coconut product exports.

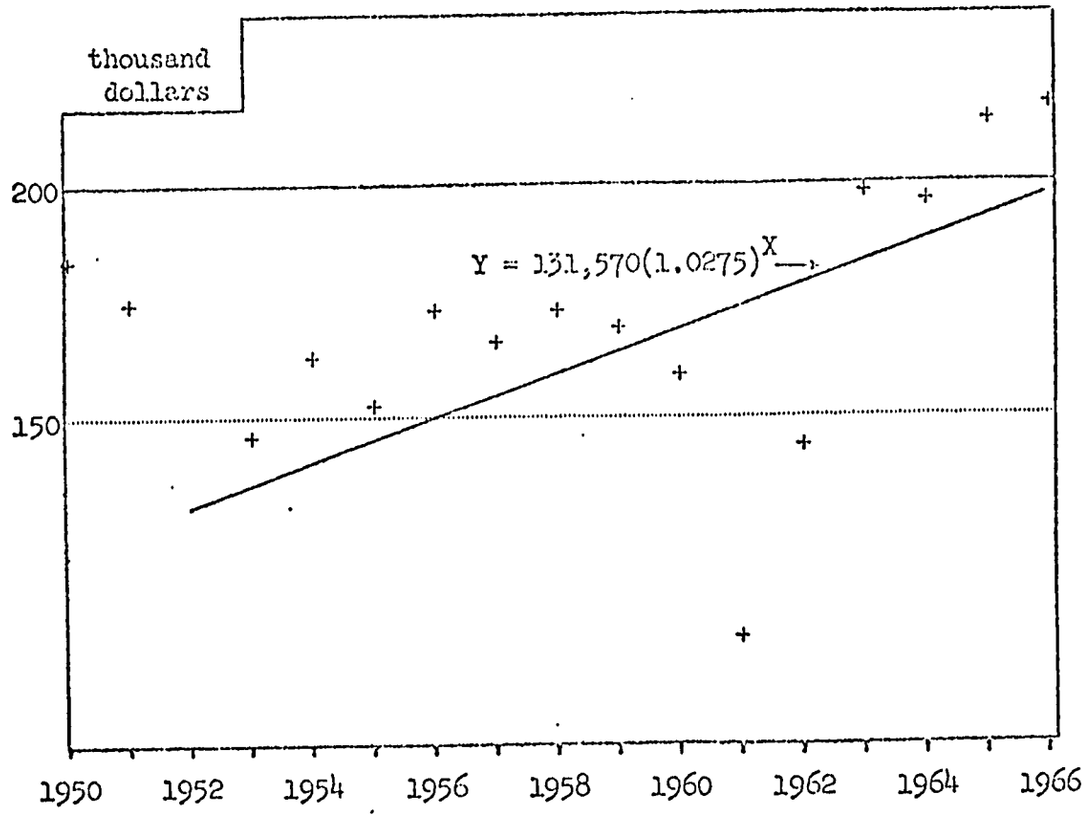

Chart 5: Real Value of Coconut Product Exports, 1952-66

Over- and Undershipping

For a period of years prior to 1963, it was common practice for actual copra exports to exceed the amount stated on the shipping papers. This practice was known as overshipping and was a result of the unrealistic exchange rate policy. The physical nature of shipping apparently prohibited the overshipment of coconut products other than copra. Copra is predominantly exported by chartered vessel, whereas other coconut products are exported via normal shipping conference lines.

To export copra during this period, it was necessary to submit a notice to the Central Bank indicating a certain amount of copra was being sold for a specific price. The Central Bank would issue an export permit for the specified quantity and price. The Bureau of Customs would certify the shipment at the time of loading. The Central Bank would pay the exporter the official peso equivalent of the dollar value of the certified exports (after obtaining the usual letters of credit). Prior to 1962, the official exchange rate ranged from ₱2.00 to ₱2.75 = $1.00, whereas the "free" market rate was about ₱4.00 = $1.00. Consequently, there was substantial incentive to by-pass the mandatory money exchange at the official rate.

It was a relatively easy matter to by-pass this transaction in the case of copra exports. Inasmuch as copra was shipped by chartered vessel, additional tonnage could easily be added to the amount requested for export as the freight cost was fixed by the charter. Certification required either complicity or deception of the customs officials. Lastly, the importer must be persuaded to accept additional tonnage. This was a relatively easy task to accomplish and could even be done

without the importer knowing the nature of the scheme. Payment for the additional quantities would not be channeled through the Central Bank but would be deposited in overseas bank accounts or could be sold on the "black market".

Table 4, contains official Philippine exports of copra from 1952 until 1966 and imports of Philippine copra into the various importing countries. Adjustments are made for copra afloat (over year end); however, slight discrepancies would be expected because of shrinkage.

For the first three years listed the discrepancy is minor. However, by 1955 a trend began to develop with an apparent overshipment of 32,000 tons. By 1957, overshipment was 125,000 tons but it declined the following two years. It finally reached its peak in 1961 when overshipments amounted to 337,900 tons or 50 percent of the official exports.

After the devaluation in 1962, which increased the effective exchange rate to ₱3.24 = $1.00, the situation reversed and undershipments occurred. Undershipment is the exporting of less copra than is stated on the official documents.

The success of the previous overshipments permitted a few of the exporters to remain in business despite critically inefficient operations. However, when devaluation occurred they could no longer compete with the efficient exporters. The inefficient exporters then resorted to undershipping or went out of business. Upon receiving a shipment of copra, importers would discover less copra than paid for and would attempt to resolve the conflict. Frequently, the exporter would declare bankruptcy and the importer would be unable to recover his funds. Fortunately the incidence of this activity lasted only two years. However, for each of

Table 4: Philippine Coconut Product Exports and Value, 1952-66

	Copra exported 1/	Copra imported 2/	Coconut product exports 3/	Value of Coconut product exports 4/
	(1000 MT)	(1000 MT)	(1000 MT)	(1000 dollars)
1952	670.8	661.4	835.2	120,206
1953	606.9	601.4	754.0	152,755
1954	763.2	770.1	927.3	165,142
1955	804.8	837.0	1,011.8	157,168
1956	966.3	999.0	1,229.1	180,441
1957	943.0	1,068.6	1,288.2	190,219
1958	811.9	856.5	1,052.7	191,609
1959	681.1	720.3	881.1	192,680
1960	804.4	988.5	1,152.4	209,745
1961	627.5	965.4	1,153.0	170,355
1962	779.4	889.4	1,197.3	184,620
1963	1,032.6	948.7	1,341.4	231,444
1964	910.0	827.3	1,271.2	232,254
1965	883.5	879.9	1,333.7	269,685
1966	1,014.7	924.9	1,502.0	265,026

Sources: 1/ Official Philippine statistics, taken from the Central Bank Statistical Bulletin
2/ A composite of the Official Import Statistics of the various importing countries
3/ Copra imported added to the Official Philippine exports of Coconut Oil and Desiccated Coconut, in copra equivalent
4/ Copra imported multiplied by the implicit export price and added to the Official Export values of Coconut Oil, Desiccated Coconut, and Copra Meal

these two years, 1963 and 1964, undershipment was about 80,000 tons. Furthermore, undershipment was so rampant during the latter months of 1964 that European imports from the Philippines essentially ceased.

The "copra exported" statistic for 1966 is probably an error as other semi-official sources list copra exports at 920,000 tons. Columns three and four of table 4 contain derived data. Their derivations are indicated in the table footnotes. These time series are considerably less volatile than those in charts 3 and 4. However, the computed growth rates are only slightly different from those computed from official statistics (chart 6).

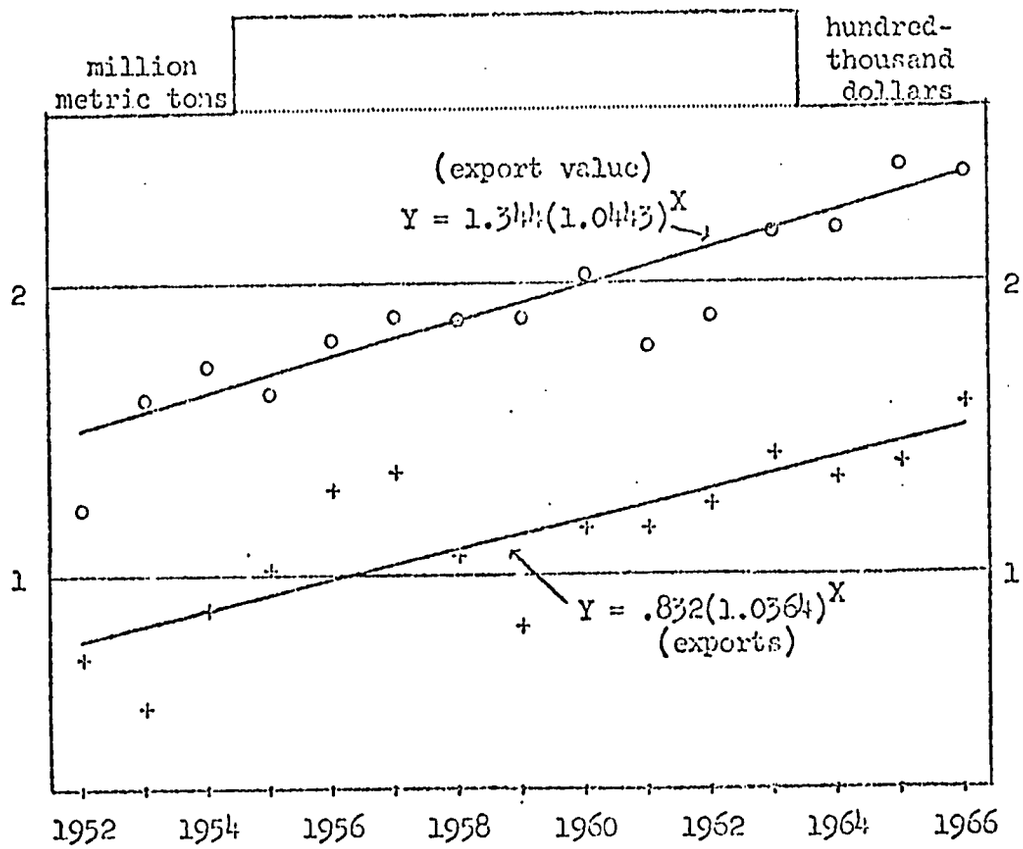

Chart 6: Philippine Coconut Product Exports, 1952-66
(derived from importing country statistics)

The rate of growth for coconut product exports derived from official statistics was 3.7 percent. Whereas, when computed from "actual"

statistics it is 3.6 percent. Similarly, the growth rate of export value changes from 4.5 percent to 4.4 percent when shifting from official to "actual" statistics.

Terms of Trade

The terms of trade, or price relatives, of copra and alternative commodities exhibit extremely large fluctuations over the past half-century. The initial data for terms of trade computation begin with 1912-14 and, with the exception of World War II, are continuously available through 1966.

Computations were divided into three time periods which corresponded to changes in data sources. (Price data are inconsistent between many sources.) The time periods are 1912-14 to 1928, 1929 to 1941, and 1947 to 1966.

Table 5 lists the price per unit and price index of various commodities; copra, abaca, sugar, palay, and corn. The pre-war prices are "prices received in municipal markets" and the post-war prices are Manila wholesale price quotations. Table 6 contains the terms of trade, which were derived by dividing the specific commodity price indices by the copra price index. The following discussion is by time period rather than by commodity.

During the 1912-14 to 1928 time period the price of copra fluctuated considerably. It reached a peak of ₱29.55 per 100 kilograms in 1920, but declined rapidly and closed the period with a price lower than its opening price. The other commodity prices fluctuated in even greater amounts but generally did not fall below the 1912-14 price.

Table 5: Prices and Price Indices of Various Commodities (1912-14 to 1966)

Year	Copra		Abaca		Sugar*		Palay		Corn	
	₱/100 kg	Index	₱/picul	Index	₱/picul	Index	₱/cav	Index	₱/cav	Index
1912-14	17.00	100	13.15	100	5.29	100	2.63	100	3.08	100
1915	10.67	62.7	12.48	94.9	5.41	102.3	2.76	104.9	2.33	175.6
1916	13.38	78.4	17.71	134.7	5.65	106.8	2.68	101.9	2.23	72.4
1917	14.18	83.3	24.99	190.0	6.20	117.2	2.85	108.4	2.79	90.6
1918	14.12	83.0	35.06	266.6	5.79	109.5	3.77	143.3	3.97	128.9
1919	17.19	101.0	27.72	210.8	11.41	215.7	5.58	212.2	6.53	212.0
1920	29.55	173.9	24.16	183.7	22.45	424.4	7.01	266.5	6.91	224.3
1921	15.82	93.0	15.66	119.1	8.90	168.2	3.78	143.7	5.55	180.2
1922	11.98	70.4	10.41	79.2	5.49	106.8	3.22	122.4	4.54	147.4
1923	14.07	82.6	13.16	100.1	9.74	184.1	3.40	129.3	4.10	133.1
1924	14.79	86.9	13.82	105.1	10.69	202.1	4.20	159.7	4.20	136.4
1925	16.50	96.9	22.53	171.3	7.35	138.9	4.20	159.7	4.00	129.9
1926	17.76	104.4	22.84	173.7	5.77	109.1	4.27	162.3	4.70	152.6
1927	15.68	92.1	21.69	164.9	6.76	127.8	4.02	152.8	4.14	134.4
1928	15.74	92.6	19.23	146.2	6.68	126.3	3.67	139.5	3.55	115.2
1929	16.66	100	16.24	100	9.21	100	3.88	100	3.98	100
1930	13.62	81.7	12.21	75.2	8.23	89.4	3.60	92.8	3.90	98.0
1931	7.51	45.1	6.61	40.7	7.79	84.6	2.60	67.1	2.64	66.3
1932	6.44	38.6	3.98	24.5	7.03	76.3	1.89	48.7	1.52	38.2
1933	5.02	30.1	3.70	22.8	5.86	63.6	1.81	46.6	1.74	43.7
1934	4.28	25.7	3.81	23.5	6.75	73.3	1.98	51.0	1.91	48.0
1935	8.88	53.3	3.81	23.5	6.79	73.7	2.02	52.0	2.25	56.5
1936	10.93	65.6	8.25	50.8	7.28	79.0	2.81	72.4	2.47	62.1
1937	13.03	78.2	7.62	46.9	6.39	69.4	2.44	62.9	2.34	58.8
1938	6.01	36.1	8.89	54.7	6.92	75.1	2.61	67.3	2.21	55.5
1939	5.86	35.2	5.08	31.3	6.42	69.7	2.92	75.3	2.32	58.3
1940	3.87	23.2	5.08	31.3	N.A.	N.A.	2.82	72.7	2.37	59.5
1941	7.79	46.7	8.09	49.8	4.81	52.2				

* Mucavado (1912-28), Centrifugal (1929-66).

Table 5: Prices and Price Indices of Various Commodities (1912-14 to 1966) (cont'd)

Year	Copra		Abaca		Sugar*		Palay		Corn	
	₱/100 kg	Index	₱/picul	Index	₱/picul	Index	₱/cav	Index	₱/cav	Index
1947	35.03	112.4	41.00	76.5	13.15	98.5	13.13	100.6	13.07	106.7
1948	51.49	165.2	52.94	98.8	12.40	92.8	13.64	104.5	16.35	133.5
1949	31.15	100	53.54	100	13.35	100	13.05	100	12.24	100
1950	35.98	115.5	53.24	99.4	14.14	105.9	10.02	76.8	9.71	79.3
1951	36.16	116.1	62.66	117.0	13.59	101.8	12.12	92.8	12.25	100.1
1952	24.63	79.1	38.74	72.3	14.25	106.7	11.96	91.6	11.20	91.5
1953	36.62	111.5	38.56	72.0	15.20	113.8	8.62	66.0	8.78	71.7
1954	30.76	98.7	27.46	51.3	14.91	111.7	8.70	66.7	9.55	78.0
1955	27.12	87.2	30.14	56.3	13.82	103.5	9.59	73.5	9.43	77.0
1956	26.02	83.5	36.35	67.9	13.95	104.5	8.82	67.6	9.69	79.2
1957	28.43	91.3	45.16	84.3	14.76	110.6	10.40	79.7	13.48	110.1
1958	37.70	121.0	39.43	73.6	15.28	114.4	11.89	91.1	11.19	91.4
1959	46.66	149.8	58.31	108.9	14.89	111.5	8.54	65.4	9.30	76.0
1960	39.92	128.1	60.17	112.4	16.66	124.8	9.72	74.5	12.48	101.9
1961	38.14	122.4	59.46	111.0	21.03	157.5	11.61	88.9	14.22	116.2
1962	47.31	151.8	57.81	108.0	26.77	200.5	10.84	83.1	11.61	94.8
1963	54.09	173.6	59.47	111.1	35.83	268.4	12.33	94.5	15.53	126.9
1964	56.00	179.8	64.77	121.0	28.63	214.4	14.64	112.2	15.70	128.3
1965	64.25	206.3	59.32	110.8	27.05	202.6	14.19	108.7	20.81	170.0
1966	55.57	178.4	51.77	96.7	32.35	242.3	17.11	131.1	20.52	167.6

Sources: 1912-28 - The Philippine Statistical Bulletin, Vol. 1, No. 1, 1934
1939-41 - Philippine Agricultural Statistics, Vol. 1, 1954
1947-66 - Central Bank of the Philippines, for copra, abaca, and sugar; Bureau of Commerce, for corn (yellow) and palay (Ordinario; Cabanatuan)

Table 6: Terms of Trade* Between Copra And Selected Commodities

Year	Abaca	Sugar	Palay	Corn
1912-14	100	100	100	100
1915	151.3	163.1	167.3	120.6
1916	171.8	136.2	130.0	92.3
1917	228.4	140.9	130.3	108.2
1918	321.2	131.9	172.6	155.3
1919	208.7	213.6	210.1	209.9
1920	105.6	244.0	153.2	129.0
1921	128.1	180.9	154.5	193.8
1922	112.5	151.7	173.9	209.4
1923	121.2	222.9	156.5	161.1
1924	120.9	232.6	183.8	157.0
1925	176.8	143.3	164.8	134.0
1926	166.4	104.5	155.4	146.2
1927	179.0	138.8	165.9	146.0
1928	157.9	136.4	150.6	124.4
1929	100	100	100	100
1930	92.0	109.3	113.5	119.9
1931	90.3	187.7	148.7	147.2
1932	63.4	197.5	126.0	98.8
1933	75.6	211.2	154.8	145.1
1934	91.3	285.3	198.6	186.8
1935	44.0	138.3	97.7	106.1
1936	77.4	120.5	110.4	94.6
1937	60.0	88.7	80.4	75.2
1938	151.8	208.3	186.5	153.9
1939	88.9	198.2	214.0	165.7
1940	134.7	N.A.	313.0	256.4
1941	106.5	111.7	N.A.	N.A.

* Terms of trade is defined as a commodity price index divided by the copra price index.

Table 6: Terms of Trade* Between Copra And Selected Commodities (cont'd)

Year	Abaca	Sugar	Palay	Corn
1947	68.0	87.6	89.5	94.9
1948	59.8	56.1	63.2	80.8
1949	100	100	100	100
1950	86.1	91.7	66.5	68.7
1951	100.8	87.7	80.0	86.2
1952	91.5	135.0	115.9	115.7
1953	61.3	96.8	56.2	61.0
1954	51.9	113.1	67.5	79.0
1955	64.5	118.7	84.3	88.5
1956	81.3	125.1	80.9	94.8
1957	92.4	121.1	87.3	120.7
1958	60.8	94.6	75.3	75.5
1959	72.7	74.4	43.7	50.7
1960	87.7	97.4	58.1	79.6
1961	90.7	128.7	72.7	94.9
1962	71.1	132.0	54.7	62.4
1963	64.0	154.6	54.8	73.1
1964	67.3	119.3	62.4	71.3
1965	53.7	98.2	52.7	82.4
1966	54.2	135.8	73.5	94.0

Record high prices were reached in 1920 except for abaca which reached its high in 1918. The copra index maximum was only 173.9 compared with 266.6 and 424.4 for the other two export crops of abaca and sugar, and 266.5 and 244.3 for palay and corn.

The net result of these price fluctuations was to handicap copra regarding terms of trade. The terms of trade indices indicated that prices received for these alternative crops were relatively higher than the price received for copra.

Comparing this situation with the rapid increase in the production of copra leads to the conclusion that in the early portion of the period copra production must have been extremely profitable. This appears to be substantiated by the fact that coconut hectarage continued to be planted despite the relatively lower return.

The second period 1929 to 1941 is marked primarily by the worldwide depression of the 1930's. During this period prices declined for all commodities but in general the price of export commodities decreased more than domestically consumed commodities (sugar was an exception).

Again the terms of trade changed to the detriment of copra. The period closed with the terms of trade indices for palay and corn, twice as great as in 1929. The terms of trade for abaca and sugar fluctuated considerably but the period closed with little difference in their relative price structure.

The hectarage of coconuts did increase during this period, but apparently the price declined to such a level that profit margins were approaching zero. By 1940 the price of copra was only 13 percent of the 1920 average. The other commodities experienced record low prices in

1932-34 and then had gradual price increases whereas the copra price reached a low in 1934, attained a peak in 1937, and declined to a new low in 1940.

The post-war period has exhibited a generally increasing copra price, a fluctuating abaca price and consistently increasing prices for sugar, palay, and corn. Sugar experienced the largest price increase. The crop years, 1953 to 1956, marked a period of low prices for all the commodities except sugar. Even sugar prices experienced a decline during the period but did not fall below the 1949 base.

Consequently the terms of trade have favored copra over all the other commodities except sugar. Abaca has been particularly disadvantaged and despite recent price increases palay and corn have not attained their 1949 level. The favorable terms of trade have contributed to the substantial increases in coconut hectarage.

Devaluation

Of the factors which have stimulated coconut production and exports during the last six years, decontrol for export earnings is one of the most important. The effect of monetary decontrol was to raise the domestic price of export products, leaving the world price unaffected.

Monetary decontrol was initiated in 1960, passed through a series of five steps finally completed in 1965. Prior to April 25, 1960 all foreign exchange earned through exports had to be exchanged for pesos at the Central Bank at the official rate, of $1.00 = ₱2.00.

The first step toward decontrol was Central Bank Circular 105, effective April 25, 1960. This circular decreed that foreign exchange

earnings would be exchanged for pesos at a combination of "free market" price and "official" rate. Twenty-five percent of the dollars earned would be exchanged at the "free market" rate - which was fixed at ₱3.20 per dollar, and 75 percent at the official rate of ₱2.00 per dollar. The effective rate of exchange was ₱2.30 = $1.00, which was a 15 percent increase in the peso price. The exchange proportions were soon changed to 30 percent at "free market" rates and 70 percent at the official rate. But the "free market" rate was simultaneously lowered to 3.00 pesos per dollar, consequently the effective exchange rate did not change.

Central Bank Circular 117 of November 28, 1960 was the second stage of decontrol. The exchange proportions were changed to 50 percent at "free market" and 50 percent at official rate. The free market rate and official rate was maintained at ₱3.00 and ₱2.00 per dollar, respectively. This combination made the effective exchange rate ₱2.50 = $1.00 a nine percent increase.

The third phase, Central Bank Circular 121, was enacted March 2, 1961. The proportion exchanged at the "free market" rate of ₱3.00 = $1.00 was increased to 75 percent and the proportion exchanged at the official rate declined to 25 percent. This made the effective exchange rate of ₱2.75 per dollar, a 10 percent increase.

The fourth step occurred January 21, 1962 with the enactment of Central Bank Circular 133. The proportion exchanged at the "free market" rate increased to only 80 percent, but the "free market" rate was permitted to actually become free; it jumped to ₱3.65 = $1.00 and soon rose to ₱3.87 per dollar. Twenty percent was still exchanged at the official rate of ₱2.00 per dollar. The effective rate increased 24 percent to ₱3.42 = $1.00.

This "20 percent retention" was maintained until November 6, 1965. Central Bank Circular 210 became effective that date which lifted the 20 percent retention. Foreign exchange receipts were to be redeemed fully at the free market or essentially at ₱3.87 per dollar. This final phase had the effect of raising the peso earnings another 13 percent. The total effect of full decontrol was to increase the peso earnings by approximately 90 percent.

Devaluation was the major factor which influenced the surge in new coconut plantings, commencing in 1960. It was also responsible for the rapid increase in exports of coconut oil and residual oil cake. The 1962 devaluation step eliminated the profitability of copra over-shipment, thus permitting coconut oil to compete in the export market.

Other Domestic Legislation

Apparently the first domestic legislation pertaining specifically to the coconut industry was Commonwealth Act 518. Enacted May 7, 1940, the Act established the National Coconut Corporation (NACOCO). It was desgined to "...establish, keep, maintain, and operate drying plants, copra driers, or coconut centrals ... and to provide facilities for better curing of copra". Thus, its purpose was one of quality improvement and marketing. Lack of success is attributable to initial mismanagement and then to the War which prohibited its operation.

In the post-war period, there have been several Republic Acts relating to the coconut industry. These Acts have one common facet; they have all been ineffective in accomplishing their objective. Nonetheless, they are presented herein as the objectives of the Acts were to stimulate growth and development.

The initial Republic Act relating to the coconut industry was Number 1145, enacted June 17, 1954. This Act created the Philippine Coconut Administration (PHILCOA). The purposes behind the creation of the PHILCOA were noble and their effective implementation would indeed solve some of the industry's problems. The organization had a four-fold purpose. They were (1) to ensure the steady and orderly development of the coconut industry, and to stabilize and strengthen its position in the world market; (2) to promote the effective merchandising of copra, coconut oil, coconut products, and by-products in the domestic and foreign markets so that those who are engaged in the coconut industry will be placed on a basis of economic security; (3) to improve the living conditions of laborers engaged in the coconut industry and the tenancy relations between coconut proprietors and tenants; and (4) to encourage the invention of useful machinery that will hasten the development of the coconut industry.

PHILCOA claims success for the improvement in copra quality which occurred over the years following its establishment. The actual cause of the improvement was purely economical. It became profitable to produce a somewhat better quality than that produced in the early post-war years.

Republic Act 1365, passed on June 18, 1955, required the use of moisture meters by all copra buyers in their first domestic purchase of copra. The intent of this law was to improve the quality of copra that enters trade. The incentive to improve quality was price premiums or deductions depending upon the moisture content of the copra.

The enforcement of this regulation has been essentially nil. It is estimated that less than five percent of the farmers' copra is tested by the moisture meter method. Ocular inspection is the usual method of grading.

Republic Act 1369, also passed on June 18, 1955, appropriated 30 million pesos from the sales of bonds to be used for industrialization. These funds were to be used to finance the manufacture of coconut products, by-products, and tree by-products under the auspices of the PHILCOA. By June 1966, less than two million pesos had been loaned under provisions of this Act.3/

Republic Act 2282, enacted June 19, 1959, appropriated an additional 30 million pesos to be used for financing coconut cooperatives and coconut producers. The Development Bank of the Philippines was to administer the funds and were to be loaned at two percent interest.

The Development Bank of the Philippines has loaned only 5.0 million pesos of these funds.4/ The reason for the lack of total loan commitment in both of the finance programs is unknown. It could stem from stringent loan administration, or lack of borrowing initiative.

Republic Act 4059, of June 18, 1964, created the Philippine Coconut Research Institute. This organization was to conduct research on coconut production. To date, this organization has only developed the administrative structure and has not engaged in biological research.

3/ PHILCOA Annual Report, 1965-66.

4/ Ibid.

Republic Act 4403, passed June 19, 1965, promoted coconut farmers associations and agro-industrial coconut cooperatives as a means of greater farmer income. Such a structure would provide greater marketing control and financial assistance.

Another policy action which has a bearing on the coconut industry is the PHILCOA Coconut Seedling Banks established in 1961. These seedling banks, located at strategic points around the country, were designed to provide seedlings to farmers for replanting old and diseased palms. They have provided only a minor portion of the seedlings planted. The biggest contribution has been in Surigao del Norte where a 1964 typhoon destroyed or damaged about 75 percent of the bearing trees.

The Philippine Tariff Act, RA 1937, enacted June 22, 1957, was to provide protection to the industry. Customs duty were assessed on all coconut imports, at rates of ₱20.00 per 100 kilograms of whole nuts, ₱60.00 per 100 kilograms of processed nuts, and ₱50.00 per 100 kilograms of copra. The Act has been effective in that no legal importation occurs. However, estimates of import smuggling range from 2000 to 3000 metric tons monthly.

Non-Domestic Legislation

Legislation in other countries that affects the Philippines is primarily in the form of quotas and tariffs in the importing countries. However, changes in freight rates have affected the composition of exports. In 1962 the International Shipping Conferences that control ocean freightrates lowered the freight rate for coconut oil.[5/]

5/ Philippine Shipping Conference, Freight Rates.

The rate for coconut oil dropped from $26.50 per ton to $9.00 per ton for Manila-United States West Coast shipments. The conference rate for copra remained constant, but inasmuch as copra is exported by charter vessel, its conference rate is immaterial.

The tariff policy of the European Economic Community and the expiration of the Philippine Trade Agreement Revision Act will affect future growth in the export of Philippine coconut products. However, these topics are discussed in a later section on "Tariffs". Currently the only tariff which has directly affected past growth of the export sector is the United States duty which is levied on non-Philippine copra. This tariff has effectively eliminated all non-Philippine copra from the United States market.

Prior to 1957, the United States imposed a processing tax of three cents per pound on all imported coconut oil. Logically this would affect oil imports (Philippine exports of oil). However, the elimination of the tax in 1957 did not stimulate imports in the form of coconut oil.

CHAPTER IV

PRODUCTION

Philippine coconut production is quite diverse with respect to geographical location, farm size, cultural practices, productivity and production costs. This diversity and its implications for change are described in the following paragraphs. The chapter is designed to provide sufficient background for the succeeding chapter on supply analysis.

Coconuts are of substantial importance to the agricultural economy of several Philippine Provinces. The importance of coconuts to these areas is discussed, using several economic measures.

The location of coconut production has shifted over time into areas of less intensive agriculture. Thus, coconuts appear to be more important in the frontier areas, although they are not exclusively a frontier crop. The significance of this shift is examined in terms of future production and productivity.

The chapter also contains the results of a farm survey on the location of new coconut plantings. In addition, past and current farm management practices, farm sizes, and tenure arrangements are presented. The cost of production is discussed and production cost budgets are developed.

Production Location

Coconut production is widely scattered throughout the Philippine archipelago. Historically, commercial production has been concentrated in a narrow band originating in the Provinces of Quezon and Laguna and has gradually extended into the Bicol Peninsula and the Eastern Visayan Islands. Currently, expansion is occurring primarily on the Island of Mindanao.

Quezon province has long been considered the premier coconut producing province, which it is, as measured by the traditional methods. It produces more nuts than any other province and until recently was first in coconut hectarage. Inasmuch as Quezon is a large province it would be expected to be a big producer.

To make a more equitable comparison of the importance of coconuts to the individual provinces, the proportion of farm land planted to coconuts was computed from 1960 census data. The intensity of coconut hectarage is indicated in figure 1. Quezon province is still of major importance. However, Misamis Occidental ranks first with 65 percent of the farm land planted to coconuts. The country average is 17 percent of the crop area planted to coconuts.

Another measure, which is perhaps even more appropriate for determining the importance of coconuts to the provincial economy, is "contribution to the value of farm production." While the value of farm production is unavailable, the value of crop production is obtainable. Coconuts contribute 24 percent of the total crop value, exceeded only by the contribution of palay. This measure also shows that coconuts are very important to Quezon province, as coconuts contributed 75 percent of the crop value.

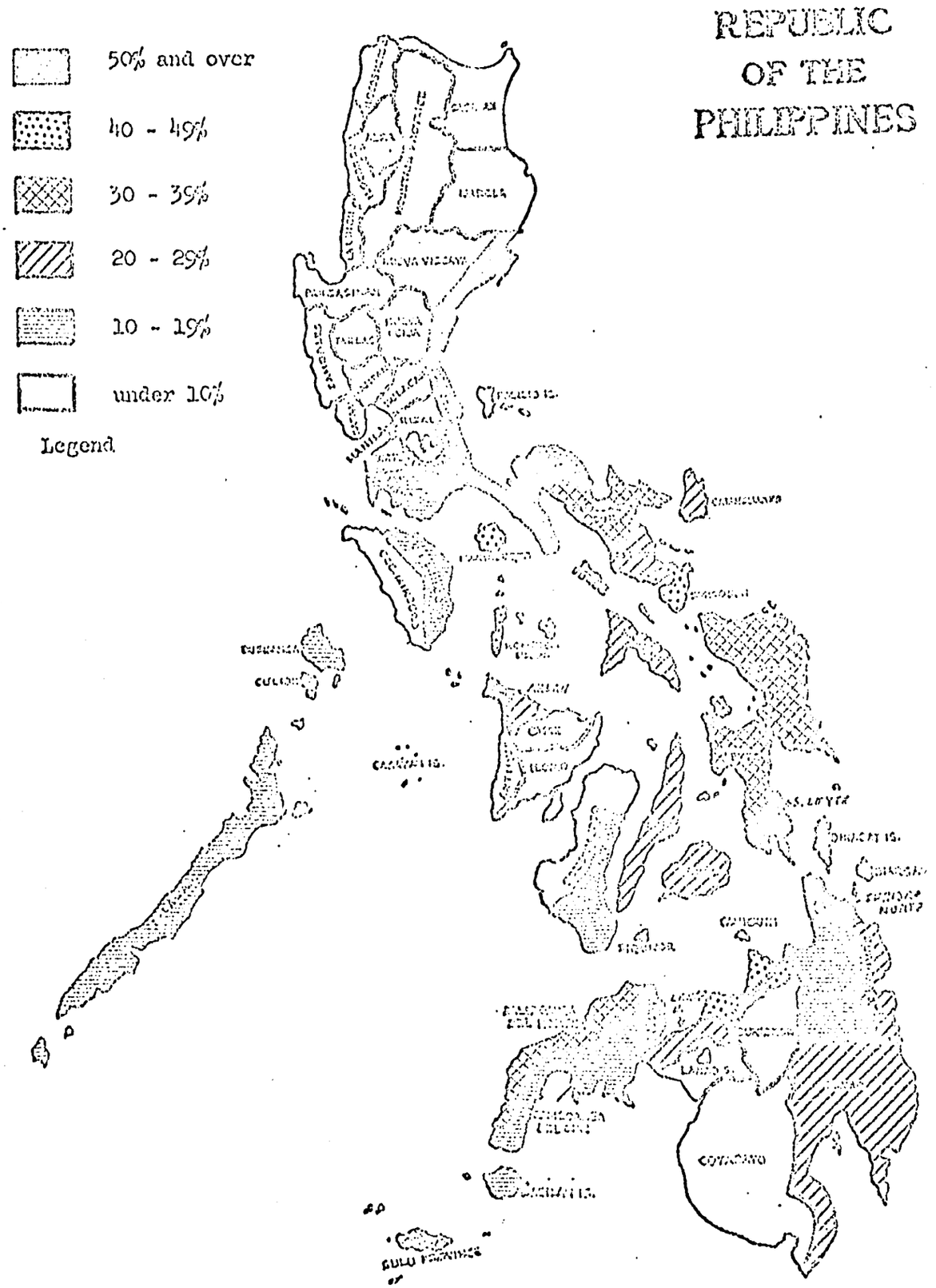

Figure 1: Proportion of Farm Land Planted to Coconuts (1960)

The previous two measures denote the importance of coconuts to the province but do not reflect the contribution of the province to the coconut industry. Nut production by province is indicated in figure 2. Quezon, Samar, Leyte, and Davao are the leading provinces, each producing over 200 million nuts annually. The figure readily shows the area of low production north of Manila in the Ilocos, Cagayan Valley, and Central Luzon regions.

Productivity is of major importance to the individuals engaged in production and consequently is considered separately. The most useful yield measure which can be determined is nuts per bearing hectare. Nuts per bearing hectare, by province, is indicated in figure 3. Productivity in the Mindanao provinces, except Bukidnon, is quite high. Other provinces having high average yields are Sulu, Bohol, Cebu, Quezon, and Batangas. These data cannot be readily translated into copra per hectare because of the aforementioned variety difference associated with various regions.

These charts also illustrate the effect of the different meteorological conditions of the Philippines. The mountainous Ilocos region presents too severe temperature extremes for optimal production. Likewise, the Cagayan Valley and Central Luzon regions have a dry season that is too pronounced for good production. Most of Mindanao has moderate temperatures and rainfall with only slight seasonal differences. Eastern Visayas has desirable climatic conditions but unfortunately lies within the typhoon belt, which often devastates the coconut crop.

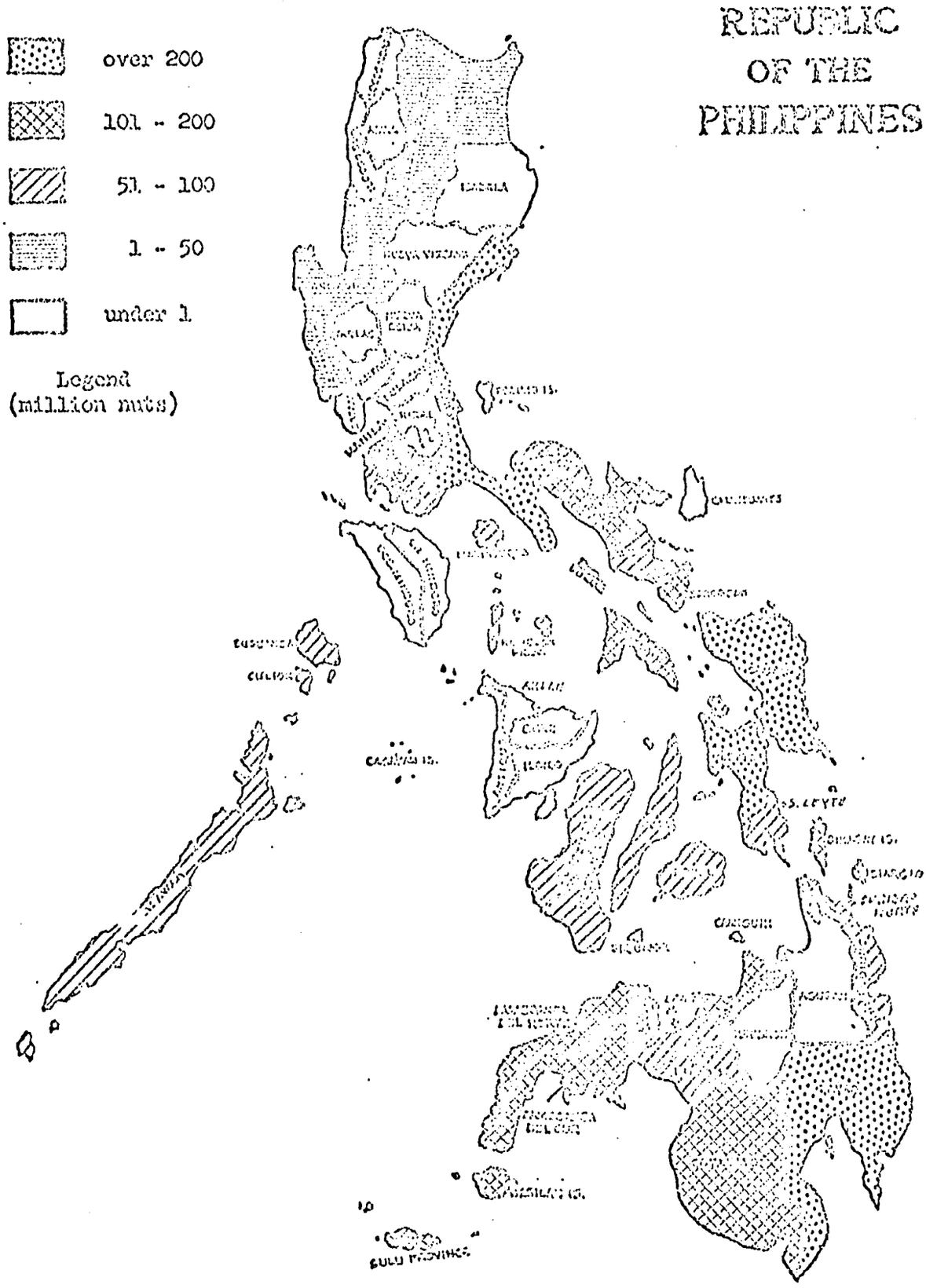

Figure 2: Coconut Production (1960)

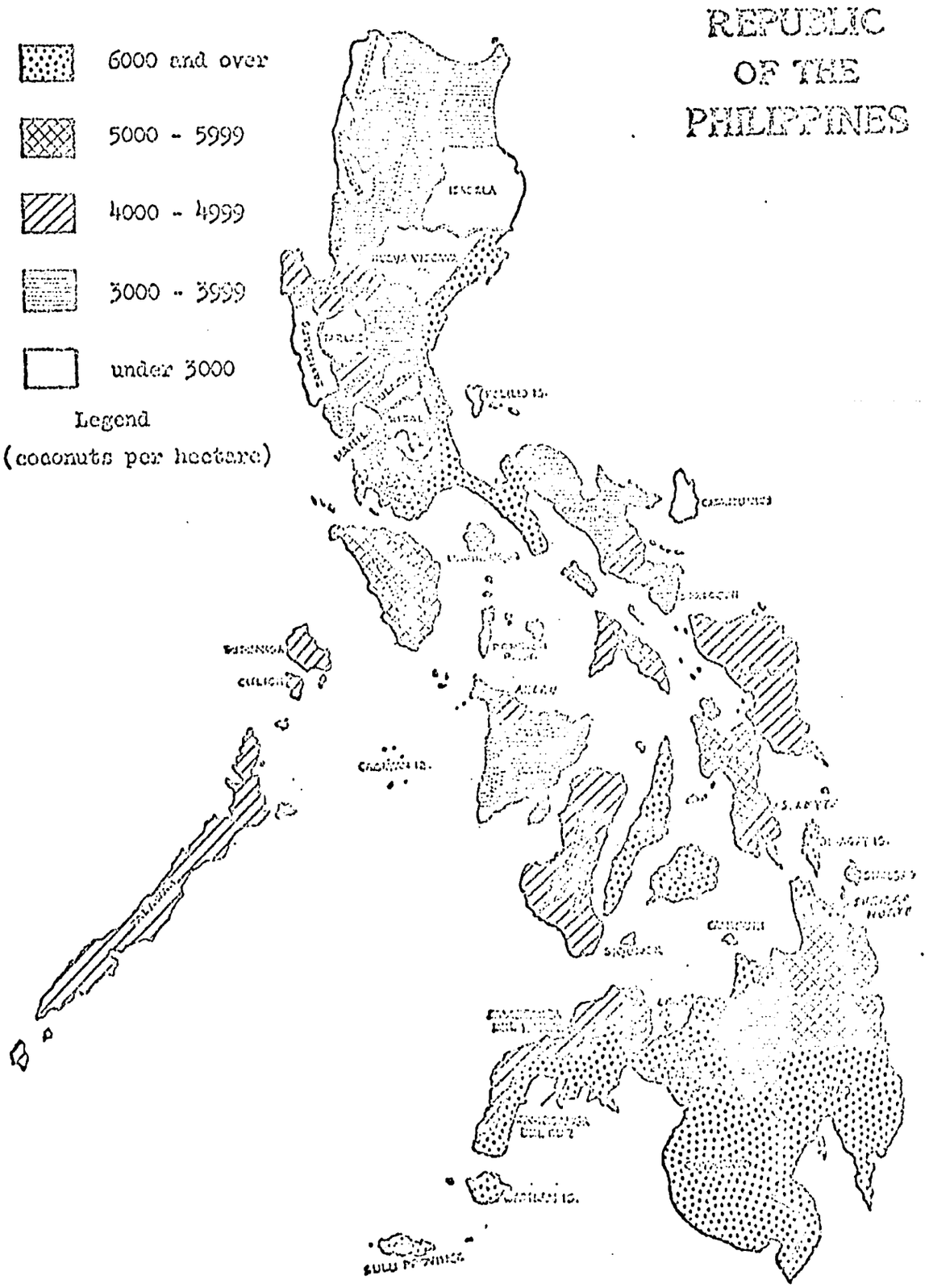

Figure 3: Coconut Yield per Hectare of Bearing Trees (1960)

Geographical Shift

Since the first agricultural census in 1903, there has been a gradual shift in the distribution of coconut production. In terms of hectarage and production, the two Mindanao regions have increased rather dramatically, while the Bicol region has remained static. Southern Tagalog, Eastern Visayas, and Western Visayas have experienced declines in their share of production and hectarage. The decline in the Western Visayas has been rather severe. Southern and Western Mindanao produced only 2.0 percent of the total nut supply in 1902-03 but this had increased to 18.5 percent in 1959-60 (table 7). A similar pattern existed for coconut hectarage. The proportion of hectarage in the Southern and Western Mindanao region increased from 2.8 percent in 1902-03 to 18.8 percent in 1959-60 (table 8). Meanwhile, the Western Visayas region experienced a decline in its share of production from 15.5 percent to 7.2 percent, during the same interval.

Mindanao regions will undoubtedly continue to increase their shares of production as the proportion of bearing trees in Southern and Western Mindanao was only 48.5 percent (in 1960) compared with a national average of 60 percent and 63.5 percent in the Southern Tagalog region. As the tables indicate, the shift to Mindanao is evidenced by each successive census. The reason for the shifts appear to be relatively straightforward - Mindanao is an area with substantial lands suitable to coconuts. In addition, some abaca and corn have been replaced by coconuts. Conversely coconuts have met severe competition from sugar in the Western Visayas, although hectarage has increased in absolute terms.

Table 7: Distribution of Coconut Production by Region and Census Years

Region	1902-03	1917-18	1938-39	1947-48	1959-60
			(Thousand nuts)		
Southern Tagalog	53,213 (22.5)	434,221 (35.7)	817,856 (35.5)	894,233 (28.0)	1,114,159 (23.1)
Bicol	30,646 (13.0)	170,550 (14.0)	348,636 (15.1)	479,423 (15.0)	622,411 (12.9)
Eastern Visayas	70,144 (30.0)	306,647 (25.1)	386,012 (16.7)	639,174 (19.8)	993,596 (20.5)
Western Visayas	36,304 (15.5)	104,826 (8.5)	178,715 (7.7)	274,583 (8.6)	351,334 (7.3)
N and E Mindanao	10,965 (4.7)	138,600 (11.3)	306,988 (13.3)	453,314 (14.2)	801,880 (16.6)
S and W Mindanao	4,642 (2.0)	26,187 (21.4)	231,397 (10.0)	414,076 (12.9)	893,880 (18.4)
Total	235,568 (100)	1,219,948 (100)	2,303,078 (100)	3,194,399 (100)	4,830,945 (100)

Table 8: Distribution of Coconut Hectarage by Region and Census Years

Region	1902-03	1917-18	1938-39	1947-48	1959-60
Southern Tagalog	66,138 (44.6)	141,268 (35.2)	271,968 (25.9)	183,156 (21.3)	268,867 (17.8)
Bicol	21,037 (14.1)	61,325 (15.3)	196,323 (18.6)	164,446 (19.1)	279,531 (18.6)
Eastern Visayas	27,811 (18.7)	74,331 (18.6)	211,659 (20.1)	184,904 (21.5)	316,265 (21.1)
Western Visayas	19,014 (12.8)	50,462 (13.1)	103,266 (9.8)	86,490 (10.0)	119,330 (7.9)
N and E Mindanao	9,059 (6.1)	41,397 (10.3)	121,999 (11.6)	118,722 (13.8)	212,413 (14.2)
S and W Mindanao	3,128 (2.1)	17,748 (4.4)	124,520 (11.8)	103,527 (12.0)	282,506 (18.8)
Total	148,245 (100)	399,859 (100)	1,051,214 (100)	859,696 (100)	1,497,004 (100)

Sources: Censuses of Agriculture of the Philippines

It is often stated that coconuts are a "frontier crop" (requires little labor, much land, and results in low returns per hectare). Thus the shift to Mindanao with sufficient land, where low returns are permissible. This argument is invalid as returns per hectare can be and frequently are quite high. Coconut gross returns per hectare are greater than any other major Philippine crop except sugar cane and tobacco, and net returns may exceed these two crops in certain instances (tobacco and coconuts are not competitive crops, geographically).

Changes in coconut hectarage, production, and yield present an interesting diversion from typical crop changes. Of the various regions of the country in which coconut palms are being planted, the most rapid growth rate is occurring in the most productive region.

One usually assumes that the better land is planted first with further planting occurring on the marginal lands. However, in the case of Philippine coconuts, the more productive lands are frontier areas which have not been fully exploited whereas the traditional coconut lands are not as productive, but have been extensively planted.

Most of the productivity increase since World War II has resulted from the increased proportion of plantings being made in Mindanao. Technology, in the form of improved management has contributed only slightly to the productivity increase.

Usually productivity is expected to increase through time because of technologic innovation. And usually when crop area expands, average yield declines, due to the utilization of marginal lands. This then is unique among commodity hectarage expansion, since increased hectarage has occurred simultaneously with increased productivity.

Productivity measures such as nuts per bearing tree and copra per bearing hectare are not available for the 1902-03 census. However, these data can be computed for the remaining census years and are presented below.

The most striking factor in table 9, on nuts per bearing tree, is the dramatic increase in the average yield per tree in Southern and Western Mindanao. In 1917-18 the average tree yield was 21 nuts, but by 1959-60 it had more than doubled to 52 nuts. Meanwhile, the national average yield increased from 32 nuts per tree to only 41.2 nuts. This apparent trend is mitigated somewhat by a declining tree density. Most of the early plantings were too dense for optimal productivity. More recent plantings are less dense resulting in both more nuts per tree and per hectare. But the proportional increase in production per hectare has been less than the increase in production per tree.

Table 9: Nuts Per Bearing Tree by Region and Census Year

Region	1917-18	1938-39	1947-48	1959-60
Southern Tagalog	30	27	36	38
Bicol	29	25	29	32
Eastern Visayas	39	25	35	39
Western Visayas	25	22	33	37
N and E Mindanao	40	36	44	50
S and W Mindanao	21	36	48	52
Total	32	27	36	41

Sources: Censuses of Agriculture of the Philippines

The table also indicates the wide disparity in productivity between regions. However, all regions have experienced a gradual increase in yield per tree. In 1960 the Bicol region had an average of 34 nuts per tree, or only 65 percent of the yield per tree in Southern and Western Mindanao.

Copra production per hectare is a function of several factors; nuts per bearing tree, percent of trees bearing, tree density, nuts required per unit of copra, and percent of nuts used for copra. Sufficient data were available to compute copra production per hectare for three of the last four agricultural censuses (table 10). Copra production was estimated for 1959-60 and is highly inconsistent. It cannot be compared with other years nor can it be accepted as reflecting actual productivity.

Table 10: Copra Production per Bearing Hectare by Region and Census Year

Region	1917-18	1938-39	1947-48	1959-60 1/
		(kilograms)		
Southern Tagalog	1110	817	1289	1887
Bicol	551	704	878	1221
Eastern Visayas	1207	781	1077	953
Western Visayas	409	627	914	821
N and E Mindanao	1195	1136	1158	1124
S and W Mindanao	265	930	1267	1017
Philippines	935	795	1087	1268

Sources: Censuses of Agriculture of the Philippines

1/ Copra production was not obtained in the 1960 Agricultural Census. The data used were the DANR estimate.

The data for the individual census years do not necessarily reveal trends but may reflect the climatic conditions of particular years. Despite this limitation, certain trends appear to exist. With the exception of Northern and Eastern Mindanao, all the regions have experienced yield increases. Southern and Western Mindanao has experienced the largest productivity increase of about 1000 kilograms per hectare, whereas Northern and Eastern Mindanao has maintained a static yield of about 1150 kilograms per hectare.

The high copra production value for the Southern Tagalog region in 1959-60, reflects an unusually favorable year. The region had not previously nor subsequently experienced such high productivity.

Estimates of copra production per bearing hectare for 1960 - 1966 are presented in the appendix. Seven years of data are insufficient to project accurate trends. However, a declining productivity in the Southern Tagalog region and an increasing productivity in the Southern and Western Mindanao region are apparent.

Coconut Farm Size

Coconut farm sizes vary from the very small, less than one hectare, to quite large, well over 1000 hectares. However, most of the farms are family sized units, with approximately 60 percent of the farms being from two to ten hectares in size, and these farms occupy about 55 percent of the coconut hectarage. The mean size coconut farm is 4.5 hectares and the modal group is 2.0-4.9 hectares. It is impossible to state a specific size as the optimum size family unit. However, the

study by Quintana, et al, indicated the larger farms made more optimal use of labor.[1/]

Farm size distribution among the provinces is also quite varied. In general the farms in the Southern Tagalog, Bicol, and Eastern Visayas regions are smaller than those in the Mindanao regions. Most of the large plantations are found in Mindanao. There are exceptions and occasionally a large plantation is found in Southern Luzon, surrounded by small holdings.

One important difference between the small holdings of Southern Luzon and Eastern Visayas is the tenure system. Share crop tenancy in the Eastern Visayas regions is uncommon, as most holdings are owner operated. The reverse more accurately reflects the situation in Southern Tagalog and Bicol.

A desirable equity shift has occurred in coconut farm holdings since 1948. The proportion of farms smaller than one hectare and the proportion of the hectarage in these farms was reduced by about one-half between the census periods. The shift in farm numbers and sizes is indicated in table 11.

An almost identical shift has occurred in the upper class interval of 50 hectares and over. Both the proportion of these farms and the proportion of the hectarage in these farms declined by about 50 percent between censuses. This shift is desirable from the viewpoint of equity but undesirable from the perspective of productivity, as the larger farms usually obtain higher yields.

1/ E. U. Quintana, B. N. de Los Reyes, and J. M. Marasigan, "Farm Business Management of Coconut Farms," The Philippine Agriculturist, Vol. XLII, Nos. 8-9, Jan. - Feb. 1959.

Table 11: Farms and Coconut Hectarage by Farm Size

Farm size	1948 Farms	1948 Hectarage	1960 Farms	1960 Hectarage
	(percent)			
Under 1 ha	16.4	1.7	7.7	0.9
1.0- 1.9	22.9	6.6	23.9	6.7
2.0- 4.9	36.4	23.6	40.5	26.7
5.0- 9.9	15.1	20.7	18.5	27.4
10.0-19.9	6.4	18.3	7.7	20.8
20.0-49.9	2.3	13.5	1.5	9.3
50 and over	0.5	15.6	0.2	8.2
Total	100.0	100.0	100.0	100.0

Sources: Censuses of Agriculture, 1948 and 1960

1966 Farm Survey

An abundance of historical production data is available. However, a critical set of data for supply estimation is not available. In order to estimate a long-run supply function, data on new plantings must be obtained or an adequate proxy variable must be found. As data on new plantings were not available and since "non-bearing tree" data could not be tested for reliability as a proxy, a survey was undertaken to acquire data on new tree plantings.

The objectives of the survey were to locate the source of new plantings geographically, by farm size, tenure, the year planted, and to determine what crops coconuts were replacing. Data on farm management and marketing practices were also obtained. The survey was conducted in June, July and August of 1966.

Sample Selection

The survey was limited to the primary coconut producing provinces and concentrated in municipalities which were of major importance to the coconut industries. Thus, the criterion for selecting areas for inclusion in the sample was "the importance of coconuts." The source of the information determining importance was the 1960 Agricultural Census. Unfortunately, determining the importance of a province in the production of a crop depends upon the measure used to describe importance.

The 12 leading provinces, measured in terms of commercial nut production, were selected as the sample provinces. These provinces were based on the 1948 boundaries to permit growth estimates. Therefore, Zamboanga del Norte and del Sur were considered one province as were Surigao del Norte and del Sur and Leyte and Southern Leyte. In addition to these three provincial areas Camarines Sur, Cotabato, Davao, Laguna, Misamis Occidental, Misamis Oriental, Quezon, Samar, and Sorsogon were included. Cebu was added because of its importance in the marketing system.

Later difficulties caused two replacements. Albay replaced Camarines Sur and Agusan replaced Misamis Oriental. Table 12 contains data on the provinces included in the survey.

After selecting the provinces to be included, two or three sample municipalities were selected; first on the basis of coconut production or growth, secondly, on geographic distribution within the province and thirdly on accessibility. (Two selected municipalities were not surveyed because of their inaccessibility and were subsequently replaced.) Further sub-sampling were performed by selecting two or three barrios

Table 12: Provinces Selected and Interviewed in Coconut Farm Survey

	Coconut hectares	Trees Total (000)	Trees Bearing (000)	Commercial Nut production (000)
Agusan	16,120	1,946	1,060	48,317
Albay	35,152	4,380	2,773	91,468
Camarines Sur*	89,036	11,424	5,193	130,834
Cebu	35,741	4,861	3,266	103,233
Cotabato	63,118	7,610	3,690	189,406
Davao	95,350	12,381	5,020	268,162
Laguna	39,088	5,295	4,510	182,230
Leyte	78,881	9,785	5,186	229,325
S. Leyte	28,850	3,592	2,244	86,510
Misamis Occidental	40,495	4,590	3,226	147,577
Misamis Oriental*	57,963	7,118	4,894	248,025
Quezon	141,714	24,616	17,735	634,846
Samar	143,211	19,620	11,827	424,365
Sorsogon	50,289	6,106	4,292	127,801
Surigao Norte	40,729	5,107	2,933	142,504
Surigao Sur	25,770	3,121	1,618	79,131
Zamboanga Norte	42,436	4,692	2,586	100,432
Zamboanga Sur	53,921	6,584	3,379	180,385

Source: Philippines (Republic), Department of Commerce, Census of Agriculture, Summary 1960

* Selected but not interviewed

within the municipality. This selection was assisted by the municipal officials who indicated the most important barrios in terms of coconut production. Barrios selected were geographically dispersed; ease of access was not a criterion at this level.

Selection of the sampling units down to the farm level had been based on the importance of coconuts. However, the lack of resources prohibited the selection of farmers on this basis, except in areas where production was concentrated in a few large holdings; then selected interviewing of the plantations was conducted. But farmer interviewing was primarily on an availability basis, comprising at least 20 percent of the farm households in the barrios. The sample consisted of 1,230 farms in 12 provinces, about 0.4 percent of the total farms in these provinces.

Farm Survey Results

While the farm survey was not intended as a farm management study, certain questions were asked regarding farm practices. These questions related to practices such as intercropping (i.e., planting a food or cash crop between the coconut palms), frequency of clearing the plantation, incidence of cover cropping (i.e., planting a low growing crop prevents erosion and helps control weeds - usually a legume or grass), incidence of grazing livestock, and of fertilizing the coconuts. A question was also asked regarding the frequency of plowing the plantation, but positive responses were so infrequent that essentially no plowing occurs except that relating to the intercrops such as corn and palay.

A frequency distribution of the proportion of farms performing these various management functions are arrayed by province in table 13.

The average number of times operators cleared their plantations was 1.8 times per year. The average ranged from less than 1.5 times in Laguna and Zamboanga to almost three times per year in Davao. Clearing refers to the cutting down of weeds and removal of undergrowth and trash.

Table 13: Management Functions Performed on Coconut Farms, by Province

Province	Farms	Frequency of clearing plantation	Intercrop	Cover crop	Graze livestock	Fertilizer
		(average)	(%)	(%)	(%)	(%)
Laguna	277	1.43	84.0	6.5	11.9	7.9
Quezon	158	1.61	38.6	9.5	19.0	1.9
Bicol	182	2.31	74.8	24.7	24.7	1.6
Samar	192	2.29	72.4	1.5	22.9	0
Leyte	124	1.65	79.1	.8	2.4	.8
Cebu	118	1.58	74.6	0	28.0	.8
Agusan	16	2.18	68.7	43.7	43.7	6.2
Davao	40	2.94	55.0	22.5	45.0	30.3
Cotabato	35	1.77	65.8	22.8	60.0	31.4
Misamis Occ.	55	1.67	36.3	43.7	29.1	10.9
Zamboanga	33	1.45	36.3	36.3	48.5	9.1
Total	1,230	1.84	68.6	11.5	21.6	5.3

The intercropping of coconuts was a very common occurrence; 68 percent of the operators practiced it. Usually only a portion of the coconut land was intercropped, the exceptions being in the small farms where occasionally the entire plantation would be intercropped. Misamis Occidental and Zamboanga farmers practiced the least amount of intercropping, only one third of the farms intercropped. Whereas 84 percent of the Laguna farmers practiced intercropping. Bananas were the most common intercrop, and corn was the second most popular. Palay, abaca, coffee, lanzones, and root crops (camote, cassava, gabi) were also important in some provinces. Intercropping followed a barrio pattern; if bananas were intercropped

on one farm in a barrio, they would be found on most of the other farms as well. The following list indicates the common intercrops in the provinces, in order of importance.

Laguna	-	bananas, lanzones, santol
Quezon	-	bananas, palay
Bicol	-	bananas, palay, abaca
Samar	-	bananas, root crops
Leyte	-	abaca, corn, bananas
Cebu	-	bananas, corn
Agusan	-	bananas, corn
Davao	-	corn, bananas
Cotabato	-	corn
Misamis Occidental	-	bananas
Zamboanga	-	coffee

There were three common leguminous cover crops in use, centrosema, calapogonium, and kudzu. In addition to these, camote was occasionally used as a cover crop. The incidence of cover crop usage ranged from zero on Cebu to about one-third in the Mindanao provinces, and as high as 43 percent by Agusan and Misamis Occidental farmers. The overall average was 11.5 percent.

About 21 percent of the farmers grazed livestock on a portion of the plantation. This usually referred to a portion which was not intercropped. Grazing livestock was assumed to mean two or more head of carabao, horses, or cattle. Leyte had the smallest proportion of farms grazing cattle, only two percent. Whereas about 60 percent of the Cotabato farms grazed cattle. These values are highly correlated with farm size, as will be shown later.

With few exceptions the incidence of planting cover crops and grazing livestock were correlated with each other. Thirty-six percent of the farmers that planted cover crops also grazed livestock (table 14). This ranged from zero percent in Cebu and Leyte to as high as 89 percent in Davao.

Table 14: Proportion of Farms Having Cover Crops that Also Grazed Livestock

Province	Percent	Province	Percent
Laguna	33	Agusan	57
Quezon	6	Davao	89
Bicol	18	Cotabato	75
Samar	33	Misamis Occidental	34
Leyte	0	Zamboanga	83
Cebu	0	Total	36

Fertilization was not commonly practiced by coconut farmers in any province. Fertilizer is recommended for coconuts in all the growing areas, usually in a nitrogen-potash mix. However, in some areas only the nitrogen component is required. Thus, where leguminous cover crops are planted, the fertilizer requirement is less. Fertilizer responses are obviously present and very dramatic in the older production areas. Unfortunately the use of fertilizer is concentrated in the new production areas as was indicated in the preceeding table. Fertilizer use ranged from zero percent in Samar to 31 percent in Cotabato. Again the usage was more a function of farm size rather than province although the two are intercorrelated. Overall, fertilizer was used by 5.3 percent of the farmers.

The same management functions were also tabulated by farm size and as such are more meaningful than the geographic tabulation. The tabulations are contained in table 15.

Table 15: Management Functions Performed on Coconut Farms by Farm Size

Farm Size	Farms	Frequency of clearing plantation	Intercrop	Cover crop	Graze livestock	Fertilizer
		(average)	(%)	(%)	(%)	(%)
Under 2	293	1.73	63.6	5.4	10.9	2.4
2.0- 4.9	473	1.87	65.2	9.3	16.6	2.5
5.0- 9.9	236	1.86	78.5	11.0	25.2	2.5
10.0-19.9	105	1.92	77.2	14.3	39.0	7.6
20.0-49.9	62	1.76	59.7	22.6	43.5	12.9
50 and over	61	1.85	73.8	44.3	52.4	36.1
Total	1,230	1.84	68.6	11.5	21.6	5.3

The average number of times the plantation was cleared, varied less when tabulated by farm size, with the values being only slightly different from the mean value of 1.84. No progressive changes occurred as farm size increased, the fluctuations were random.

Intercropping was practiced on both large and small farms with no real significant difference in the proportion of farmers engaging in the practice. Intercropping is usually practiced on a small scale regardless of farm size - that is only a small amount of land is devoted to intercropping. Thus, the proportion of coconut land intercropped on small holdings will be greater than on large plantations, but the incidence of

occurrence is relatively constant. This finding generally concurred with previous studies by Ilag,[2] and Robertson and Bratton.[3] The crop used as the intercrop is not related to farm size.

The proportion of farmers that plant cover crops does increase as farm size increases. Only five percent of the farmers having less than two hectares planted cover crops. However, 44 percent of the farms of 50 hectares or more had cover crops.

A similar pattern existed for the proportion of farmers grazing livestock beneath the coconut trees. Only 10 percent of the smallest farm sizes grazed livestock but as farm sizes increased the proportion of farmers grazing livestock also increased, reaching 52 percent in the over 50 hectares farm size. The small farmers often grazed only a few carabaos; whereas the larger plantations often had well stocked cattle farms.

The number of farmers who planted cover crops and also grazed livestock increased substantially as farm size increased. Table 16 indicates the increasing proportions, from 11 percent on farms under two hectares to 73 percent on farms of 50 hectares or more.

The proportion of farmers who fertilized the coconuts also increased as farm size increased. The range was from 2.4 percent on the under two-hectare farms to 36 percent on the large plantations.

2/ Leodegario M. Ilag, Farm Management and Cultural Practices, Costs, and Returns of Coconut Farms in Camarines Sur, U.P. College of Agriculture, unpublished thesis or

3/ L. S. Robertson and C. A. Bratton, "Investment and Income of 107 Tenant Farmers in San Pablo City," Philippine Agriculturist, Vol. 38, Nos. 4 - 5, 1954.

Table 16: Proportion of Farms Having Cover Crops that also Graze Livestock, by Farm Size

Farm Size (ha.)	Percent
Under 2	11
2.0- 4.9	20
5.0- 9.9	27
10.0-19.9	57
20.0-49.9	62
50 or more	73
Total	36

The reasons for the correlation of the incidence of cover cropping, grazing livestock, and fertilizing with farm size is caused primarily by the availability of capital. All three of these management functions require capital outlay and the small farmer often does not have sufficient capital to invest in these practices even though it may be profitable.

Statistical Analysis

The primary purpose of the farm survey was to obtain information on trees planted during the previous 10 years. This information was obtained and subjected to an analysis of variance. The factors for the three-fold analysis of variance were farm size, geographical location, and time. The observations were the 1230 farms that were surveyed and the variable was "new plantings." In addition to testing for significant differences between factor means, the four interaction combinations were also tested.

The data did not fit the precise conditions assumed by the analysis of variance model. The data within cells were not normally distributed, primarily because of the high incidence of observations in which the variable was zero. Neither was the condition of homoscedasticity fulfilled as unequal variances within cells were common. Disproportionate subclass numbers within factor categories caused the analysis of variance to be non-orthogonal. Thus, the addition theorem for sums of squares is invalid as the sum of the component sums of squares was greater than the calculated total sum of squares.[4] Two cells had no observations as no farms of that particular size, within certain Provinces had been selected in the sample. Proportional sampling within farm sizes and provinces was intended but not always accomplished. Thus, it is obvious the data fell short of the theoretical statistical model. (Certain transformations could be performed to reduce the unequal variances but would not affect the non-normality.)

The theoretical framework and the analysis are indicated in tables 17 and 18. The model upon which the analysis is based is,

$$Y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + (\alpha\beta)_{ij} + (\alpha\gamma)_{ik} + (\beta\gamma)_{jk} + (\alpha\beta\gamma)_{ijk} + \delta_{ijk} .$$

Where, Y = the observation in cell (ijk), the actual number of trees planted,

μ = the overall mean, the mean number of trees planted per farm,

α = the deviation from the mean associated with provinces,

β = the deviation from the mean associated with farm size,

4/ The statistical appendix contains a discussion of the "addition theorem."

Table 17: Theoretical Three- fold Analysis of Variance

Source	df	Sum of Squares	Expected Mean Square
Province	(p-1)	$\Sigma(P_i^2/syn)-C$	$\sigma^2 + S_{ni}\alpha_i^2/(p-1)$
Farm Size	(s-1)	$\Sigma(S_j^2/pyn)-C$	$\sigma^2 + S_{nj}\beta_j^2/(s-1)$
Year	(y-1)	$\Sigma(Y_k^2/psn)-C$	$\sigma^2 + S_{nk}\gamma_k^2/(y-1)$
P x S	(p-1)(s-1)	$\Sigma\Sigma((P_iS_j)^2/yn)-C-SS_p-SS_s$	$\sigma^2 + S_{nij}(\alpha\beta)_{ij}^2/(p-1)(s-1)$
P x Y	(p-1)(y-1)	$\Sigma\Sigma((P_iY_k)^2/sn)-C-SS_p-SS_y$	$\sigma^2 + S_{nik}(\alpha\gamma)_{ik}^2/(p-1)(y-1)$
S x Y	(s-1)(y-1)	$\Sigma\Sigma((S_jY_k)^2/pn)-C-SS_s-SS_y$	$\sigma^2 + S_{njk}(\beta\gamma)_{jk}^2/(s-1)(y-1)$
P x S x Y	(p-1)(s-1)(y-1)	$\Sigma\Sigma\Sigma((P_iS_jY_k)^2/n)-C-SS_p-SS_s-SS_y$	$\sigma^2 + S_{nijk}(\alpha\beta\gamma)_{ijk}^2/(p-1)(s-1)(y-1)$
Error	psy(n-1)	$\Sigma\Sigma\Sigma\Sigma(X_{ijkn}^2) - \Sigma\Sigma\Sigma((P_iS_jY_k)^2/n)$	σ^2
TOTAL	psyn - 1	$\Sigma\Sigma\Sigma\Sigma(X_{ijkn}^2) - C$	

$C = (\Sigma\Sigma\Sigma\Sigma X_{ijkn})^2/psyn$

p = number of provinces

s = number of farm size categories

y = number of years

n = number of observations per cell

Table 18: Analysis of Variance of New Tree Plantings by Province, Farm Size, and Years

Source	df	SS			MS	F
Province	10	241,204,867 - C	=	199,542,572	19,954,257	40.7**
Farm Size	5	453,955,973 - C	=	412,293,679	83,458,735	168.3**
Year	9	51,409,939 - C	=	9,747,644	1,083,071	2.2
P X S	50	676,800,766 - C - SS_p - SS_s	=	23,302,220	466,044	.9
P X Y	90	404,907,799 - C - SS_p - SS_y	=	153,955,288	1,710,614	3.5**
S X Y	45	559,158,524 - C - SS_s - SS_y	=	95,454,906	2,121,220	4.3**
P X S X Y	450	1,244,075,825 - C - SS_p - SS_s - SS_y	=	580,829,635	1,290,732	2.6**
Error	11640	7,217,789,525 - 1,244,075,825	=	5,973,713,700	489,776	
TOTAL	12299	7,217,789,525 - C	=	7,176,127,230		

C = 41,662,295

γ = the deviation from the mean associated with year,

δ = a random error term, with mean zero,

$\Sigma\alpha_i = 0, \quad \Sigma\beta_j = 0, \quad \Sigma\gamma_k = 0,$

$i = 1, \ldots, p; \quad j = 1, \ldots, s; \quad k = 1, \ldots, y.$

The hypotheses tested were:

$H_o : \alpha_i = 0, \ \beta_j = 0, \ \text{and} \ \gamma_k = 0$ against

$H_{alt} : \alpha_i \neq 0, \ \beta_j \neq 0, \ \text{and} \ \gamma_k \neq 0.$

The null hypotheses stated that provinces, farm sizes, and years had no effect on new tree plantings. The alternate hypotheses were anticipated.

Inasmuch as the hypotheses for main factors assumed zero effects, the hypotheses for interaction of these factors also assumed zero effects. There was no "a priori" reason to expect interaction effects.

Statistically significant differences do exist between the mean "new plantings" of the various farm sizes and of the various geographic locations (table 18). All the interaction terms except "Province X Farm Size" contained interaction effects.

The analysis permitted two primary conclusions: (1) the average number of new trees planted varied on different farm sizes and (2) the average number of trees planted differed between provinces. Upon determining significant differences between means within these factors, it became desirable to test which means within the factors were significantly different from each other. The Scheffé[5/] test was deemed appropriate

5/ Henry Scheffé, The Analysis of Variance, pp. 33-40, Wiley, 1959. The computation procedure for the test statistic is contained in the Statistical Appendix.

and used in testing the data. The Scheffé test permits the use of "F" values in determining significant differences, yet does not depend upon the conditions of normality and homoscedasticity. Furthermore, the test is easily adapted for use where unequal observations per cell are prevalent. Consequently, it was an acceptable measure for testing differences between individual means.

The Scheffé test was used to test the following hypotheses:

H_o: $\alpha_i = 0$ and

$\beta_j = 0$.

The alternate sets of hypotheses were:

$\alpha_1 \neq \alpha_2, \alpha_3, \ldots, \alpha_p$	and	$\beta_1 \neq \beta_2, \ldots, \beta_s$
$\alpha_2 \neq \alpha_3, \alpha_4, \ldots, \alpha_p$		$\beta_2 \neq \beta_3, \ldots, \beta_s$
$\vdots$		$\vdots$
$\alpha_{p-1} \neq \alpha_p$		$\beta_{s-1} \neq \beta_s$.

Tables 19 and 20 were constructed to indicate which farm sizes and geographic locations had significantly different average numbers of new tree plantings. The numbers in the body of table 19 indicate the difference in the average number of trees planted per farm between the various farm sizes. The numbers in parentheses are the test statistics, which indicate the maximum permissible difference between means to conclude no difference exists. The heavy line separates significantly different means (five percent significance level) from the non-significantly different means.

Farms less than two hectares did not have new tree plantings significantly different from zero. However, all other farm sizes had new tree plantings that were both significantly different from zero and

Table 19: Differences in Average Numbers of New Tree Plantings by Farm Size

	$\bar{X}_{.j}$	$\bar{X}_j - 0$	$\bar{X}_j - \bar{X}_1$	$\bar{X}_j - \bar{X}_2$	$\bar{X}_j - \bar{X}_3$	$\bar{X}_j - \bar{X}_4$	$\bar{X}_j - \bar{X}_5$
(Over 50 ha) $\bar{X}_{.6}$.	8547	8547 (94)	8527 (103)	8457 (100)	8354 (105)	8131 (118)	7626 (132)
(20.0-49.9) $\bar{X}_{.5}$.	921	921 (93)	901 (103)	832 (99)	729 (105)	505 (117)	
(10.0-19.9) $\bar{X}_{.4}$.	416	416 (72)	396 (83)	327 (79)	225 (86)		
(5.0- 9.9) $\bar{X}_{.3}$.	192	192 (48)	172 (64)	103 (58)			
(2.0- 4.9) $\bar{X}_{.2}$.	89	89 (34)	69 (55)				
(Under 2 ha) $\bar{X}_{.1}$.	20	20 (45)					

significantly different from each other. With increasing farm sizes, the average number of new plantings increased significantly. This does not imply that the larger farms contributed more new plantings, as the frequency of farm size is not indicated.

The results confirm what would be expected. Very small farms have, in most instances, been fully planted, leaving no space available for additional plantings. In larger farm sizes, more vacant space exists on which new plantings can be made, and in some instances the farm size expands to acquire vacant land. The upper class interval, "farms over 50 hectares," is highly skewed. However, the average number of new plantings during the past ten years, 8,500, indicate an average of about 85 hectares must have been available for planting to coconuts.

Table 20 is constructed in the same manner as table 19, except that the values in the table body are the differences in average new plantings per farm between provinces. The test statistics are again in parentheses. Results are interpreted in a similar fashion.

All of the provinces had plantings significantly different from zero. Farms in Davao and the Zamboangas have experienced substantial new plantings averaging 6,500 and 4,188 trees per farm for the respective provinces over the last 10 years. Cotabato farms have also planted a substantial number of new trees during the time period involved, requiring an average of 15 additional hectares per farm for the new plantings.

The data for Agusan and Cebu suggest that sizable new plantings were also made in these two provinces. However, the data are misleading for these two provinces. The high mean values are the result of non-proportional sub-sampling. The sample of farms surveyed included all the farms over 50 hectares in Agusan and Cebu. Thus, these two cells were highly overweighted. Realistic means for the two provinces' farms would be 150 trees for Agusan and 75 trees for Cebu.

The province of Laguna was more intensely surveyed than any other province, resulting from the pretesting of the survey questionnaire in Laguna. Consequently, the large number of farms in the Laguna sample produces unique results. The average number of new plantings in Laguna is slightly greater (but not significantly) than new plantings in Misamis Occidental. However, new plantings in Laguna are significantly less than new plantings in Samar and Bicol, but new plantings in Misamis Occidental are not significantly different from those in Samar and Bicol.

Table 20: Differences in Average Number of New Tree Plantings by Province

		$\bar{X}_i$..	$\bar{X}_i$-0	$\bar{X}_i-\bar{X}_7$	$\bar{X}_i-\bar{X}_6$	$\bar{X}_i-\bar{X}_1$	$\bar{X}_i-\bar{X}_2$	$\bar{X}_i-\bar{X}_5$	$\bar{X}_i-\bar{X}_3$	$\bar{X}_i-\bar{X}_4$	$\bar{X}_i-\bar{X}_8$	$\bar{X}_i-\bar{X}_{10}$	$\bar{X}_i-\bar{X}_9$
Davao	$\bar{X}_{11}$	6500	6500 (133)	6388 (172)	6371 (197)	6352 (160)	6258 (167)	6257 (165)	6240 (164)	6070 (173)	5542 (280)	4973 (219)	2312 (222)
Zamboango	$\bar{X}_9$	4188	4188 (164)	4076 (185)	4059 (208)	4040 (174)	3946 (181)	3945 (179)	3930 (178)	3758 (186)	3230 (288)	2661 (229)	
Cotabato	$\bar{X}_{10}$	1527	1527 (160)	1415 (181)	1398 (205)	1379 (169)	1285 (176)	1284 (174)	1269 (174)	997 (182)	569 (285)		
Agusan	$\bar{X}_8$	958	958 (236)	846 (251)	829 (269)	810 (245)	716 (248)	715 (246)	700 (246)	528 (252)			
Cebu	$\bar{X}_4$	420	430 (87)	318 (121)	301 (154)	282 (104)	188 (115)	187 (112)	172 (110)				
Samar	$\bar{X}_3$	258	258 (68)	146 (109)	129 (144)	110 (89)	16 (102)	15 (100)					
Bicol	$\bar{X}_5$	243	243 (70)	131 (110)	114 (145)	95 (90)	1 (102)						
Quezon	$\bar{X}_2$	242	242 (75)	130 (115)	113 (148)	94 (94)							
Laguna	$\bar{X}_1$	148	148 (57)	36 (102)	19 (139)								
Misamis	$\bar{X}_6$	129	129 (127)	17 (133)									
Leyte	$\bar{X}_7$	112	112 (85)										

These results are consistent with the statistical procedure as the size of the test statistic varies inversely with the square root of the sub-sample sizes.

The third factor in the analysis of variance was years, which the "F" test indicated was not significant at the five percent level. Despite the lack of significance in the "F" test, the data were subjected to the Scheffe' test for contrasts between means. It was expected that significant differences would exist between individual means even though significance was not detected with the "F" test. This possibility exists because the "F" test, as mentioned earlier, tests the hypothesis that all means are equal, whereas the Scheffe' test compares the means with each other.

The only significant difference between means was when average annual plantings prior to monetary decontrol was compared with the average after decontrol was initiated. Thus, the annual mean for the years 1957 to 1959 was compared with the annual mean for the years 1960 to 1966. The values were significantly different at the 10 percent level.

The "F" tests performed in the analysis of variance indicated three significant interactions. While the interactions appeared to be statistically significant, the non-orthogonal nature of the analysis creates doubts as to their actual significance. Since the interaction terms were not of particular economic interest further tests for significance were not conducted.

Budgeting

The determination of a single cost of production for coconuts is essentially impossible because of large variances in land values, wages

and variable costs related to yield variation. Several studies have been conducted on the cost of production during the last 15 years, and these studies have shown that labor units required remained relatively static, both over time and between geographic areas.[6]

These studies have dealt with positive or empirical cost analyses with the primary distinction occurring between cash and non-cash costs. In trying to derive normative values for budgeting, cash and non-cash cost distinctions are of little value as it is impossible to establish a norm for hired labor versus unpaid labor. However, the data can be transformed into standard costs of operation, and fixed and variable costs can be budgeted. Furthermore, since many of the variable cost operations are performed by hired labor and is paid by units handled (i.e., nuts) rather than paid a wage, the variable costs are relatively easily estimated.

Fixed costs are land, interest, depreciation, taxes, and maintenance labor. The maintenance labor could be assumed to be variable as this labor would not have to be exerted but since such labor performance is independent of yield, it is classed as a fixed cost.

The variable costs are essentially labor costs for harvesting, assembling, husking, and copra making. The costs vary directly with the nut output and are often paid on a per thousand nut or per 100 kilograms of copra basis. Even when the basis is a labor wage, the cost still varies with output. The final variable cost is copra transportation.

6/ See for example, G. C. Eala, S. G. Dolar, and L. M. Ilag, "Farm Management and Cultural Practices on Coconut Farms in the Philippines," unpublished manuscript, Philippine Coconut Administration, 1962.

The cost components and their method of determination and magnitude are indicated in table 21.

The primary cost component is land, and its determination is based upon the alternative return of invested capital. Since the maximum bank interest rate is 6 1/2 percent for time deposits, this was used as the cost determinant. The value of the land will of course vary greatly among different geographic areas. Of the primary coconut areas, the land value is highest in the Southern Tagalog region. The foregoing would apply to owner-operated coconut lands. On tenant operated plantations, land cost may be a variable cost as rental is often on the basis of production.

The interest, depreciation, and tax costs are arbitrary and while minor, have large variations. The investment in tools and equipment is usually small, limited to simple devices for harvesting, husking and meat removal and a tapahan for smoke drying the copra; thus interest and depreciation are small. The tax item is also quite variable and often represents the only cash outlay for fixed cost. These costs are derived from actual costs and cost estimates of several previous studies.

Proper maintenance of coconuts appears to require about eight man-days per hectare. This involves the removal of fronds and clearance of weeds and rubbish from the plantation area. The cost of this labor will fluctuate between regions, depending upon the common wage rate.

In previous studies, the cost of harvesting through copra making has been determined on a per hectare basis. While such is useful, it is illogical as the cost per hectare is directly dependent upon the yield per hectare. Therefore, when previous studies of labor requirements are

Table 21: Components of Copra Production Cost

Component	Cost Estimate
Fixed cost per hectare	
Land	6 1/2 % of land value
Interest	₱2.
Depreciation	₱2.
Taxes	₱3.
Maintenance	8 man-days
Variable cost per 1,000 nuts	
Harvest	1-1 1/2 man-days
Assemble	1 man-day
Husk	1-1 1/2 man-days
Copra making	2 1/2 man-days
Transportation (per 100 kg copra)	₱0.20

recalculated on a per 1,000 nut basis rather than a per hectare basis, the variability becomes considerably less. The cost still fluctuates depending upon the wage. The labor requirements per 1,000 nuts are 1 to 1 1/2 man-days for harvesting, the lower value for harvesting with a bamboo pole and the high value for climbing the trees; one man-day for gathering and assembling the nuts; 1 to 1 1/2 man-days for husking; and 2 1/2 man-days for making copra. Often some animal labor is used in assembling the nuts but the cost of such is minor and is disregarded here.

These labor requirements can be converted to "100 kilograms of copra" basis by converting nuts to copra at the rate of 4.5 nuts/kg copra for Laguna variety and 3.5 nuts/kg copra for San Ramon variety.

The wage rate can be multiplied by the above labor requirements to determine cost, but in most regions, when labor is hired to perform these functions, it is paid on a piece rate basis rather than a wage rate.

The final variable cost "transportation" is an arbitrary average, selected from previous studies. Such a value will depend upon the nearness to market. Hence, in areas close to principal highways the cost may be negligible whereas it may be as much as ₱10.00 per 100 kilograms of copra in more remote areas. This cost will vary more within areas than among areas.

Hypothetical cost analyses are contained in table 22 for four coconut producing regions. The conditions are realistic, but are not samples, and do not represent averages for the regions.

The wage rates which were used to obtain the cost values were different among regions and between tasks performed. The wages used are listed in table 23.

Conversion of nuts to copra was made at the rate of 4 1/2 nuts per kilo of copra in the Southern Tagalog and Bicol region and 3 1/2 nuts per kilo of copra in the Visayan and Mindanao regions. These two geographic separations generally mark the location of Laguna and San Ramon varieties.

The analysis can be completed by establishing a copra price. With an assumed price of ₱42.00 per 100 kilograms of copra the net returns for the various hypothetical situations were determined (table 24).

Various prices and various yields can be budgeted to determine net returns per hectare. For example, consider two extremes, one a poorly managed and low production farm in Quezon province in which the yield

Table 22: Budget Cost per Hectare for Coconut Production

Item	Region			
	S. Tagalog	Bicol	E. Visayas	Mindanao
Land value	2,500	1,500	1,000	1,200
Production (nuts)	5,000	3,500	4,000	6,000
Fixed cost				
Land	₱165.00	₱ 97.50	₱ 65.00	₱ 78.00
Interest	2.00	2.00	2.00	2.00
Depreciation	3.00	3.00	3.00	3.00
Tax	4.00	2.00	2.00	3.00
Maintenance	16.00	12.00	12.00	16.00
Sub-total	₱190.00	₱116.50	₱ 84.00	₱102.00
Variable cost				
Harvest	₱ 20.00	₱ 10.50	₱ 20.00	₱103.00
Assemble	12.50	8.50		
Husk	15.00	10.50	12.00	
Copra Making	25.00	17.50	20.00	
Transportation	2.20	1.60	4.60	8.60
Sub-total	₱ 74.70	₱ 48.60	₱ 56.60	₱111.60
GRAND TOTAL	₱264.70	₱165.10	₱140.60	₱213.60

Table 23: Wage Rates by Region and Task

	Region			
	S. Tagalog	Bicol	E. Visayas	Mindanao
	pesos/day	pesos/day	pesos/ 1000 nuts	pesos/100 kg copra
Harvest	₱4.00	₱3.00	₱5.00	
Assemble	2.50	2.50		₱6.00
Husk	3.00	3.00	3.00	
Copra making	2.00	2.00	5.00	

Table 24: Net Returns per Hectare of Coconuts (₱42.00/100 kg)

	Region			
	S. Tagalog	Bicol	E. Visayas	Mindanao
Production (nuts)	5,000	3,500	4,000	6,000
Gross copra value	₱467.00	₱326.00	₱480.00	₱720.00
Production cost	264.70	165.10	140.60	213.60
Net returns	₱202.30	₱160.00	₱339.40	₱506.40

is 2,000 nuts per hectare. Under such conditions a net loss of ₱33.00 per hectare would be incurred. Alternatively, consider a well-managed Zamboanga plantation which yields 9,000 nuts per hectare. To obtain such a yield, probably ₱80.00 worth of fertilizer per hectare would be used, but net returns would be ₱728.00 per hectare. Furthermore, if the average copra price of 1965 was used, ₱64.25 per 100 kg the net returns would be ₱1,292.00, per hectare for the Zamboanga farm.

The budget omitted fertilizer in the cost items because fertilizer is used very infrequently, and did not warrant inclusion in the cost analysis. The cost budget also assumes the coconuts are not intercropped nor are livestock grazing the plantation. Under either of these conditions, the cost would be reduced by a sharing of the land cost and a reduction in the maintenance cost. Where land values are high, intercropping has substantial relevance.

Summary

Coconut production in the Philippines is a multi-faceted enterprise. Production is widely scattered throughout the provinces. However, new plantings are predominantly located in the Southern provinces.

Farm sizes range from under one hectare to well over 1000 hectares with the larger plantations located primarily in Mindanao. The average farm size is about 4.5 hectares. Tenure relationships vary considerably between regions. In Southern Luzon, small plantations are frequently tenant operated, whereas in the Visayan regions small owner operated plantations are common. The large plantations of Mindanao employ hired labor, exclusive of share tenancy.

Productivity is as highly varied as are the various management practices. Fertilization is rarely practiced except on large plantations. Small portions of the plantations are frequently intercropped, usually with a food crop for household use. Cover cropping with accompanying livestock grazing is practiced on the larger plantations, particularly in Mindanao.

Production inputs are insufficient to result in optimal productivity, as the average capital inputs return considerably more than their cost. Coconut production is quite profitable under most conditions. Under price conditions prevailing since 1965, production would have to decline to about 500 kilograms of copra per hectare before a loss would be incurred. Variable production costs would be covered until the price declined to about ₱10.00 per 100 kilograms of copra.

CHAPTER V

SUPPLY ANALYSIS

The preceeding chapter dealt with the location of production and various management practices for coconuts in the Philippines. Such a description is useful in understanding the regional production of coconuts. However, a qualitative description is of little value in forecasting production. Therefore, a quantitative forecasting model was developed for the major coconut regions.

Developing an empirical supply function from official statistics is a dubious undertaking. The official sample surveys are designed to accurately reflect the situation of the two primary food crops, rice and corn. Unfortunately if the samples are properly weighted for corn and rice, they are automatically improperly weighted for coconuts. (Rice and coconuts are not competing crops, regionally. Therefore, a sample survey from a major rice producing region is heavily weighted, resulting in an overestimate of coconuts. Conversely, a sample in a minor rice producing region is weighted lightly, resulting in an understatement of coconuts.) Furthermore, since World War II, three different government offices have been responsible for the collection of agricultural data, and four sampling designs have been used.

Considerable statistical data on coconut production have been published since 1955. Such measures as production, value of production, hectarage, trees, bearing trees and production utilization are readily

available on a regional basis. However, prior to 1960, much of these data are of no real value as they were generated internally rather than derived from farm survey data.

The data concerning trees, bearing trees, and hectares all bear constant relationships to each other prior to 1960. A hectare was assumed to contain 150 trees of which 77.1 percent were bearing trees.

Despite the data problems, a supply analysis was attempted. The analyses used trees as the production unit rather than hectares since the former is assumed to be more accurate. Both hectarage and tree numbers were requested in the sample surveys, and inasmuch as most coconuts are grown on small holdings, it is probable that tree numbers are more accurately known than hectarage. The published statistics understate the values for both hectarage and trees as the sample surveys exclude palms growing in home lots and along roadsides.

An indication of the error is evidenced when the Department of Agriculture and Natural Resources (DANR) statistics of 1960 are compared with the 1960 census of agriculture. The DANR values for hectarage and total trees are substantially smaller than the census values. Bearing trees are similar from both sources. But despite the DANR understatement of area and trees, total nut production appears to be overstated. Theoretically the census statistics should reflect greater accuracy as a larger sample is surveyed - one-third of all farms under 10 hectares and all farms over 10 hectares. However, the nut production reported by the census would just be sufficient to cover coconut product exports for the year, thus leaving nothing for domestic consumption.

Since it is obvious that errors exist in both sets of data, no adjustment of the raw data was attempted.

The lagged nature of production after planting, prohibited the computation of a direct production response. A recursive model was necessary to reflect the hypotheses. It was hypothesized that planned production was a function of a set of predetermined variables. Static productivity was implicitly assumed in the function of anticipated production. Inasmuch as productivity is not static, it was further hypothesized that yield was a function of various exogenous variables. Most of these variables, while exogenous, are not known in advance of actual production. This limits its use as a forecasting device.

Forecasting Tree Numbers

The first step in the supply analysis was to derive a function that reflected anticipated production. Trees or newly planted trees were presumed to reflect anticipated production. Furthermore, since tree numbers rarely decline, the annual incremental change was the major concern. Thus a first difference analysis seemed appropriate.

Unfortunately the regional data did not lend itself to first difference analysis. The radical changes in tree numbers that appear in the data are highly suspect. After determining that a first difference analysis did not fit the data, a distributed lag model was used. The two models are not greatly different, the primary difference being that the first difference model forces a coefficient of "one" for the lagged variable.

The relationship estimated was $X_1 = f(X_2, X_3)$

where X_1 = tree numbers in millions, at time 't',

X_2 = expected price of copra, pesos per 100 kilograms,

X_3 = tree numbers in millions, at time 't-1'.

The price used in the analyses was an expected price, P*. The expected price was assumed to be the average price of the two previous years,

$$P^* = \frac{P_{t-1} + P_{t-2}}{2}.$$ 1/

The disparity in production and productivity described in Chapter IV, indicated that regional analyses were necessary for meaningful interpretation. Consequently, the six primary producing regions were analyzed separately, although an aggregate function was also derived. The data are annual time series for the years 1950-66.

The functional relationship was derived in both arithmetic and power form, with essentially identical results. The coefficients for both forms are indicated, by region, in table 25.

Logic suggests that the arithmetic function may more accurately reflect the true relationship among the variables. However, the power function is included for ease of interpretation. The standard errors of the estimated parameters are contained in parentheses beneath the respective coefficients. The Durbin-Watson test suggests that serial correlation in the residuals is non-existent.2/

The equations representing the Southern Tagalog and Bicol regions are poor in the sense that the multiple coefficients of determination

1/ See the appendix for justification of the distributed lag model and necessary assumptions.

2/ The Durbin-Watson test is very weak in functions which involve a lagged dependent variable. However, it is still frequently used.

Table 25: Regional Supply Functions of Philippine Coconut Palms (1953-66)

Region		Constant	Price coefficient	Tree coefficient	Coefficient of determination	Standard error of the estimate	Durbin-Watson Statistic
Southern Tagalog	(a)	45.42	.256** (.122)	-.077 (.312)	.426	2.41	2.34
	(b)	42.11	.150** (.006)	-.09 (.300)	.451	5%	2.44
Bicol	(a)	10.56	.213* (.147)	.493* (.300)	.502	3.77	1.57
	(b)	2.92	.152 (.133)	.547** (.289)	.435	13%	1.51
Eastern Visayas	(a)	- 1.94	.966** (.434)	.411* (.282)	.837	4.72	1.99
	(b)	1.02	.618** (.281)	.446* (.258)	.801	14%	1.85
Western Visayas	(a)	5.53	.117** (.009)	.434* (.259)	.831	1.12	1.65
	(b)	2.11	.239** (.118)	.416** (.219)	.848	6%	1.80
N and E Mindanao	(a)	- .43	.228* (.159)	.842** (.176)	.925	2.25	2.37
	(b)	.91	.263* (.154)	.780** (.157)	.941	8%	2.14
S and W Mindanao	(a)	- 4.45	.601** (.251)	.520** (.264)	.931	2.38	2.30
	(b)	.52	.621** (.242)	.563** (.214)	.935	9%	2.32
Philippines	(a)	31.17	2.03 ** (.691)	.570** (.178)	.970	5.98	1.41
	(b)	4.09	.299** (.074)	.549** (.131)	.975	2.8%	1.70
Philippines 1925-35	(a)	22.97	-.189 (.323)	.826** (.238)	.971	1.65	2.67
	(b)	1.38	-.0008 (.024)	.936** (.168)	.973	1.5%	2.68

(a) Arithmetic function
(b) Logarithmic function - coefficients are converted to real numbers

** Significant at 5% level
* Significant at 10% level

are small. Further, the negative coefficient for the lagged variable in the Southern Tagalog region was particularly unexpected and unexplainable. The small coefficients of determination imply that a small proportion of the change in tree numbers is attributable to price change or previous tree numbers. Perhaps the "poor" relationship may be explained by the fact that both of these regions are old production regions and are so completely saturated with palms that price levels are immaterial, at least as long as relative prices don't justify alternatives.

The remaining regions and the Philippines as a whole are reasonably well described by the functions. The coefficients of determination and the standard errors of estimate both reflect good fit.

The difference in the effect of price on new plantings between regions is particularly interesting. The price coefficients indicate new plantings in the Eastern Visayas and Southern and Western Mindanao regions are quite responsive to price. Whereas Western Visayas and Northern and Eastern Mindanao responded only slightly to price increases. The coefficients of the functions indicate that the price elasticity of planned production for the two pairs of regions to be .62 and .26 respectively. The price elasticity for the Philippines as a whole was .30.

Less variation was evidenced in the coefficient for trees at time, t-1. The coefficient for the power equations ranged from .43 for Western Visayas to .78 for Northern and Eastern Visayas, (excluding Southern Tagalog).

The interpretation of results may be limited by the fact that

during the period under review, prices perpetually increased. Consequently, if a price decline occurs, the function may be inapplicable.

To determine what has happened under declining price conditions, the country data for the period 1925-34 were analyzed. This period is the only one in which prices declined for several consecutive years. It cannot be assumed that these two periods are directly comparable as conditions other than price have obviously changed. Nonetheless the negative coefficient of the price variable suggests that plantings continued to increase even when price declined continuously for nine years. The coefficient was not significant, however.

The nature of the distributed lag function permits adjustment coefficients and long-run price elasticities of supply to be derived. The coefficient of adjustment (or elasticity, if in log form) is derived by subtracting the coefficient of the lagged variable from one. Long-run price elasticities are derived by dividing the short-run price elasticity by the elasticity of adjustment.

Table 26 contains the two price elasticities and the adjustment elasticity for the logarithmic function and at the mean values of the arithmetic function.

The negative coefficient of the lagged variable in the Southern Tagalog region prohibits the derivation of a meaningful elasticity of adjustment. In general the elasticity values are similar regardless of the form of the function. Bicol elasticities are an exception - as might be expected because of the poor fit of the equations.

Eastern Visayas and the two Mindanao regions have long-run price elasticities greater than one. Since these regions , particularly

Table 26: Price and Adjustment Elasticities for Coconut Palms by Region, 1953-66

Region		Short-run price e	Long-run price e	Elasticity of adjustment
Southern Tagalog	(a)	.14	N.A.	N.A.
	(b)	.15	N.A.	N.A.
Bicol	(a)	.24	.52	.46
	(b)	.15	.34	.45
Eastern Visayas	(a)	.66	1.08	.61
	(b)	.62	1.11	.58
Western Visayas	(a)	.25	.43	.58
	(b)	.29	.49	.58
N and E Mindanao	(a)	.22	1.00	.22
	(b)	.26	1.20	.22
S and W Mindanao	(a)	.70	1.35	.52
	(b)	.62	1.43	.43
Philippines	(a)	.29	.63	.46
	(b)	.30	.66	.45

(a) Arithmetic function - elasticities are computed at the mean values
(b) Logarithmic function
N.A. - not appropriate

Eastern Visayas and Southern and Western Mindanao, have experienced quite large growth rates this is not unexpected.

The period for a 95 percent adjustment can be computed by solving for "N" in the equation $(1 - \gamma)^N \leq .05$, where γ = elasticity of adjustment.[3/] This adjustment period is two to four years for the various regions.

3/ The algebraic derivation of the coefficient of adjustment, γ, can be found in Nerlove's explanation of the distributed lag models in the May 1958, Journal of Farm Economics.

A considerable amount of commonality is evident in the elasticities for the various regions. In general the elasticities of adjustment are about .5, which results in long-run price elasticities double the size of their short-run price elasticity. The exception to the generalization is the Northern and Eastern Mindanao region which has an elasticity of adjustment of .22, creating a long-run price elasticity about four times greater than the short-run elasticity.

The various coefficients for the Philippines' arithmetic supply function is interpreted as follows. A one unit increase in the expected price of copra will result in two million more trees planted. However, these two million trees represent only 46 percent of the change that will occur if the expected price is realized. Consequently, it would require three years before the total effects of the price change were completed. The total effect of the price change would be about 4.4 million new trees planted. Thus the price elasticity in the short-run is about .29, and .63 in the long-run.

While the coefficients of the power function are easier to understand, the arithmetic function is probably more appropriate for forecasting. It is unlikely that tree numbers can continue to grow geometrically.

Forecasting Yield

The second portion of the supply analysis was the derivation of a yield function. Several factors were assumed to affect yield. However, statistics for many of these factors were not available. It was hypothesized that yield was a function of the age of the trees,

fertilizer use, rainfall, and management practices.

Age of the trees could be derived if an accurate and lengthy time series were available. However, with reliable data being limited to only a few years, an age distribution could not be analyzed. While fertilizer is used sparingly, there is no doubt that it greatly affects the yield of individual plantations. Its use may have affected the aggregate yield, however, data on fertilizer use were not available. Lastly, the incidence of various farm management practices is unknown and cannot be correlated with yield.

Rainfall data are available for various stations throughout the Philippines. However, the geographic distribution of rainfall varies widely and the selection of a particular station's data may not reflect the rainfall for its census region. Visual inspection of the monthly rainfall distribution led to the conclusion that wet season rainfall was adequate, but might be a limiting factor during the dry season. Therefore, wet season rainfall was disregarded and dry season rainfall was used in the analysis.

Additional observations indicated that typhoons also affected the yield. Consequently typhoons were included in the analysis by using a zero-one variable as a qualitative measure of their occurrence or non-occurrence. Considerable judgment had to be exercised to declare a typhoon as destructive. For example, a typhoon may have passed through a particular "area of responsibility" but may have skirted the coconut producing locations; the effect being heavy rainfall in the producing areas without any accompanying wind damage.

Another factor considered, but disregarded after preliminary

investigation, was the current price of copra. Conceivably, high prices may stimulate the manufacture of copra from immature nuts or they may cause fertilization or other desirable management practices to be initiated. Thus, price might act as a proxy variable for some other factor(s) which were not available or measurable. Inasmuch as price was not correlated with yield it was omitted from the analysis.

Yield is measurable in several ways, but the analysis used nuts per bearing tree as the yield variable as it was probably more accurate than other measures. Copra per unit of land is perhaps a more meaningful yield measure but it is not available nor can it be accurately derived. The analysis was of nuts per bearing tree as a function of dry season rainfall and typhoons.

The yield data are on a crop year basis, terminating on June 30. The typhoon data are current year typhoons as they normally occur during the early part of the crop year. The dry season rainfall occurs during the final portion of the crop year and rainfall during the season does not materially affect current yield. Consequently, the rainfall variable refers to rainfall during the dry season of the previous crop year.

The relationship was computed using logarithmic, arithmetic, first differences, and combinations of these functional forms. The function selected as most accurately reflecting the relationship was a logarithmic-semi-logarithmic combination. The algebraic form of the function was:

$$Y = aR^{b_1}b_2^{T} \qquad \text{or}$$

$$\log Y = \log a + b_1(\log R) + T(\log b_2),$$

where Y = yield in nuts per bearing tree, at time "t",

R = dry season rainfall in inches, during time "t-1",

T = typhoons, at time "t".

The function was computed for the six major producing regions and are listed in table 27.

Table 27: Regional Yield Functions of Bearing Coconut Palms, by Region, 1958-66

Region	Constant	Rainfall coefficient	Typhoon coefficient	Coefficient of determination	Standard error of estimate
					(percent)
Southern Tagalog	33.8	.096 (.226)	.642*	.37	13.1
Bicol	42.4	-.014 (.071)	.958*	.30	4.3
Eastern Visayas	11.3	.333 (.494)	.829*	.59	13.7
Western Visayas	23.7	.235 (.155)	.720**	.64	13.0
N and E Mindanao	48.0	.007 (.294)	.816	.25	21.9
S and W Mindanao	16.8	.312 (.150)		.46	12.2
Philippines	39.7	.033 (.138)	.883**	.46	8.2

** Significant at 5 percent level
* Significant at 10 percent level

The interpretations of the coefficients are somewhat unusual. The rainfall coefficient indicates the proportional change in yield expected if a one percent change in rainfall occurs. The typhoon coefficient indicates the proportional decline in yield that will result if a typhoon occurs.

The yield equation for the Philippines is interpreted as follows:

A one percent increase in dry season rainfall will cause yield to increase by .03 percent. If a typhoon occurs, the yield will be reduced to 88.3 percent of the "normal" yield. If a typhoon does not occur the exponent for the typhoon coefficient is zero. Thus, the typhoon factor becomes one, having no mathematical effect on the equation.

There was no "a priori" knowledge to suggest the magnitude of the rainfall coefficients. However, they were expected to be positive. Therefore, the negative coefficient for the Bicol region is opposite to that expected. The typhoon coefficients, when converted to real numbers, were expected to fall between zero and one.

The standard errors of the rainfall coefficients are in parenthesis below their respective coefficients. Very few of the coefficients were significantly different from zero. Inasmuch as the typhoon coefficients were converted to real numbers their standard errors are not listed. However, the asterisks accompanying the coefficients indicate the significance of the logarithm value, prior to converting.

Analyses of variance were performed on the regression equations to determine if they were significant measures of variation in the dependent variable. The equations for the regions of Eastern Visayas, Western Visayas, and Southern and Western Mindanao, and for the Philippines were statistically significant at the five percent level. The equation for Southern Tagalog was significant at the 10 percent level. The equations for the remaining regions were not significant.

Typhoons do not occur in the Southern and Western Mindanao region. Therefore, the yield equation contained only the dry season rainfall variable.

Probably the most contributing factor which was omitted from the analysis, was the age of the trees. The effect of this omission is greatest in the older regions such as Southern Tagalog.

Summary

Supply equations derived for forecasting tree numbers and yield were quite poor for the Southern Tagalog and Bicol regions.

The yield functions, for all regions, had large standard errors of the estimate. Nonetheless, the analyses of variance indicated the regression equations were significant in explaining changes in yield. However, it is apparent that the previous years' yield would frequently be as accurate an estimate of yield as would result from the forecasting equation.

The supply equations were used to estimate the 1966 tree numbers and production. The aggregate function for the Philippines indicated that 252 million trees should have existed in 1966. However, the sum of the individual region functions forecasted 248 million trees. The published statistics indicated that 247.7 million trees existed in 1966. When yield was estimated and nut production derived, the aggregate function forecast 7,356 million nuts. The sum of the regional forecasts was similar with 7,348 million nuts. Published statistics list total 1966 production at 7,089 million nuts. Thus, the nut estimate was about 3.7 percent higher than the actual amount.

Using the regional equations to forecast 1967 tree numbers, a total of 261.7 million trees is obtained. Such a number is probably too high; however an annual increase of 14 million trees is possible.

CHAPTER VI

DOMESTIC MARKETING AND PRICING

Within the domestic economy, the marketing of coconuts does not exhibit a well-defined structure or market organization. Instead there are several structures operating simultaneously, often with certain transfer levels omitted or bypassed. Transfer levels are reasonably well distinguished, and vertical integration in a physical sense does not exist in the industry. However, the financing system and lending practices often produce results much like a vertically integrated commodity market system.

There are five basic marketing levels in the coconut industry starting at the farm level and working up to the domestic processing or exporting firm. While the physical transfer and ownership transfer are well defined, the functions and location of the various levels are poorly defined.

The pricing procedure is reasonably well structured and price margins are relatively consistent. Seasonal prices follow distinct patterns and price leadership is well established. Price leadership is a function of end use rather than by firm.

Historically, prices of the various coconut products have not been correlated. However, post-war price relationships between coconut products have been relatively stable. Price movements are highly parallel between the various levels.

The following discussion describes the structures and their geographic distribution. The marketing channels within the structures and the functions of the buyers within the channels are also discussed. The discussion on pricing includes price leadership, seasonal prices, and methods of pricing. In addition, a limited analysis is performed on price movements and marketing margins. The Chapter terminates with a description of the structure of the exporters of coconut products and the geographic structure in terms of customs ports.

Market Structures

While there are about 440,000 coconut farms in the country, the number of farms that produce some coconuts is well over one million.[1/] This is the beginning level of the market structure, essentially one million individual suppliers (see figure 4).

As indicated in figure 4, there are approximately 10,000 barrio buyers, about 3,000 licensed municipal buyers and perhaps 1,500 unlicensed buyers.[2/] The barrio and town buyers are defined as buyers operating in a barrio or town and are usually financed from a higher level in the structure. The barrio buyer usually does not have a bodega (warehouse) except in seashore barrios where the copra is picked up by coastal vessel. They usually, but not always, sell their copra immediately and expect to obtain a profit either in the margin between buying

1/ Philippines (Republic), Bureau of the Census and Statistics, Census of the Philippines, Vol. III, Agriculture, 1960.

2/ Economic Research Department, PHILCOA, mimeograph of March 25, 1964.

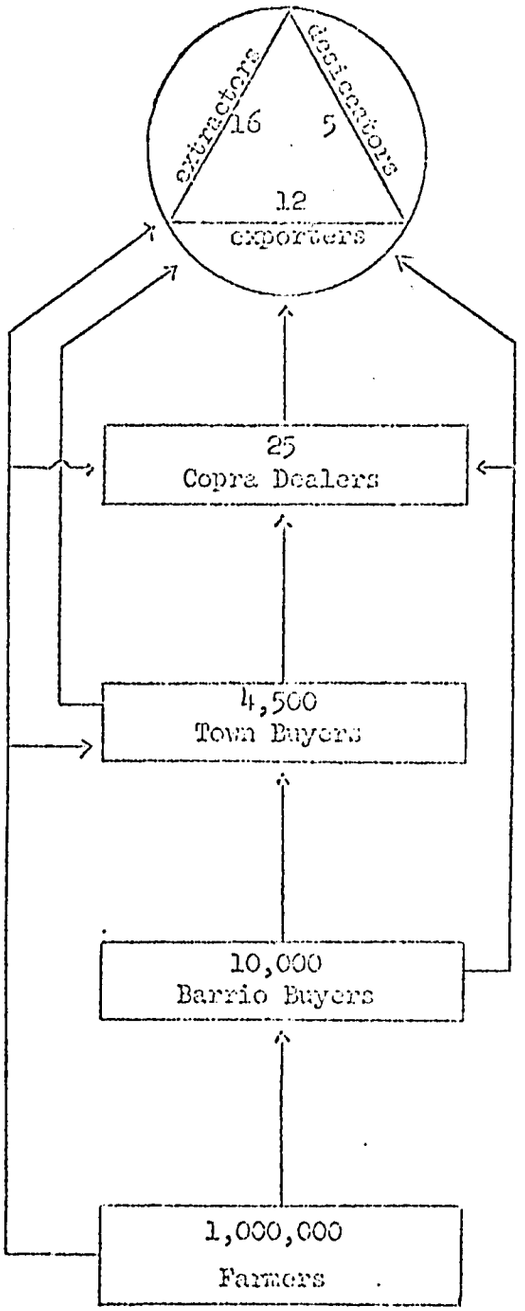

Figure 4: Flow Diagram of Coconut and Copra Marketing

and selling price or a commission in some instances. FACOMAS (Farmers' Marketing Cooperative Associations) are an exception to the definition but are considered as town buyers.

At the barrio level, farmers sell their copra in two different ways: (1) to the highest bidder and (2) to their regular buyers. The second method is far more important in terms of volume, although disadvantageous to the farmer.

In the first instance the farmer will assemble his copra alongside a road or in some instances in the market and will simply sell to the individual who offers the highest price, or when a "favorable" price is offered.

In the second instance, farmers who sell to regular buyers seldom receive top prices for their copra as they are usually (not always) indebted to the buyer through previously extended credit in either cash or commodities. In such situations, price or weight is often shaded. However, the seller has little alternative because of the selling commitment made at the time credit was extended. The result is similar to a vertically integrated structure.

Copra from the barrio farmer or barrio buyer changes hands when it reaches the town proper (poblacion); unless a town buyer has purchased the copra at the barrio. The sacked copra is transported to the town in jeepneys, trucks, or boats with a flat fee charged per kilo of copra transported. Ownership of the copra is rarely assumed by the transporter - except where the copra owner has his own boat, etc. It is usually to the advantage of the farmer to maintain ownership to the town level, assuming all transportation costs, as the price at this level will more than cover

the transportation cost. This suggests, not an imperfect market structure, but an imperfect transportation system. Quintana also noted the high transportation cost.[3/]

There are about 25 copra dealers located in the terminal markets.[4/] The copra dealers have bodegas and often engage in speculation when the price is expected to increase. They may maintain ownership for as long as a month. The function of the dealer is primarily to aggregate copra into larger quantities than the town buyer, adding time and place utility to the coprawhich is sold to exporters and processors. Normally copra dealers do not have outside financing in the form of cash advances from exporters or processors, but rely on their own capital.

The final market level is comprised of exporters and processors (oil millers and dessicators). The exporters usually have offices in the international markets such as London and New York and are promptly notified of market conditions. There are about 26 copra exporters located in 37 different ports and operating 84 terminal warehouses.[5/] The number of functional exporters has declined in recent years and only 12 actually exported copra in the first quarter of 1967.

There are 21 domestic processors, 16 of which are oil millers (five of the millers also export copra) and five are desiccators.[6/]

3/ V. U. Quintana and C. E. Cabrera, "Marketing of Copra and Financing of Coconut Farms," unpublished manuscript, 1960.

4/ PHILCOA, op. cit.

5/ Standards Department, PHILCOA, List of Copra Exporters, 1966.

6/ Statistical Services Staff, PHILCOA, mimeograph of April 14, 1964, revised January 1967.

The oil millers operate 18 extracting plants in 14 different locations and the desiccating firms operate six processing plants in six locations.

From the preceeding description of the various levels in the market structure, it is obvious that situations exist for potential monopsonies or oligopsonies. The potential monopsonies are in Dagupan City, Pangasinan, where a domestic oil miller is located; Jolo, Sulu and Marinduque where single copra exporters are located. However, the easy access to Manila from Pangasinan, and the coastal shipments of copra from Jolo to Zamboanga and from Marinduque to Cebu prohibit the realization of the monopsony power.

The concentration, size and number of the exporters and processors is such that an oligopsony situation is evident. The four largest copra exporters purchase about 70 percent of the copra that is exported. Three are vertically integrated in the sense that they finance their suppliers which is in turn funneled down the marketing chain to the farmer. Thus, the exporter's or processor's money is used to finance the farmer. Such financing, of course, insures a supply of copra or nuts.

The large copra dealers are located in areas where substantial copra is exported, primarily Cebu, Davao, and Zamboanga. They function as competitors to the exporters (although they sell to the exporters) since they compete for the available copra.

At the town buyer and barrio buyer levels some monopsony positions exist. Again the potential competitive threat makes the position more apparent than real. The exceptions to this are the mountainous regions of Laguna, Samar and Surigao where inadequate transportation networks probably prohibit effective competition.

Substantial concern has been expressed regarding alien control of the marketing system. The copra producers are primarily Filipino, as would be expected, and about 87 percent of the barrio buyers are Filipino. The remaining barrio buyers are Chinese.

At the town level the Filipinos still constitute 65 percent of the buyers but Chinese buyers comprise 34 percent. The remaining one percent are Spaniards and Americans. The copra dealers in the terminal markets are predominantly Chinese. Some of these dealers are former exporters who were unable to compete successfully at that level.

Filipinos control only a small portion of the export trade. Data for 1965 indicate Filipinos comprised only 23 percent of the exporters, and exported 19 percent of the export volume (table 28). Whereas Chinese and American exporters exported 44 and 32 percent respectively of total export volume.

Table 28: Copra Exporters by Nationality and Volume of Exports, 1965

Nationality	Number of exporters	Percent of exporters	Percent of export volume
Chinese	14	54	44
American	4	15	32
Filipino	6	23	19
Spanish	2	8	5
TOTAL	26	100	100

Source: Standards Department, PHILCOA, 1965 mimeograph

The same situation exists for desiccators and oil millers. Desiccating is completely controlled by Americans and Chinese without any Filipinos. The bulk of the oil extracting is also by American and Chinese firms. Only two Filipino-owned firms are engaged in oil extraction, and neither export oil; extraction is only for domestic consumption.

Geographic Marketing Structures

Geographically, the Philippines has to be divided into several regions to describe the generally prevailing market structure. Six distinctive structural systems, in separated locations, were covered in the 1966 survey and are described below.

Manila, Laguna, and Quezon comprise an area where several processors exist as well as numerous copra exporters on the Eastern coast of Quezon. Most, if not all, of these final domestic markets finance their suppliers, which in turn finance their suppliers until ultimately the farmer receives credit. The pattern of marketing in this area is from farmer to barrio buyer or town buyer to exporter or processor. The large copra dealer does not exist and hence is by-passed. There are numerous farmers, most having small hectarages, and many of them tenant operated.

In the Bicol region the pattern is similar except the barrio buyer is usually present. The copra dealer is absent and the final market is usually exporters, as only one processor is located within the area. Financing of suppliers is practiced and the farmers are small and numerous.

Samar, Surigao and Agusan are substantially different, as very little copra is exported directly from ports of these provinces. Most of the copra is shipped to Cebu to dealers and exporters. In Samar and Surigao

the town buyer is often by-passed as copra is frequently shipped from a seashore barrio direct to a dealer. In these provinces, coastal vessels are either owned or act as agents for the large dealers. In Agusan, the copra passes through the hands of barrio buyers to town buyers who in turn sell to the Cebu dealers and exporters. Farmers are numerous and farms are small, but the farm is usually owner operated as opposed to the numerous tenant operations of Bicol and Southern Tagalog regions.

Leyte has five exporters located in the port of Tacloban. The pattern of marketing is relatively standard, passing from the farmer to the barrio buyer to town buyer to exporter. Farmers are primarily small owner operators and are financed through the marketing chain, indirectly by the exporters.

Cebu as a separate geographic location is unique as eight exporters, several dealers, and one oil extractor are located there, but coconut production is small on a relatively few farms. Few barrio buyers exist as most of the local production is sold direct to the town buyer. Most of the copra marketed in the province is produced on other islands and is directed through Cebu by the large dealers who have financed the outlying production.

Most of Mindanao, notably Davao, Cotabato, Misamis Occidental and Zamboanga, has a substantially different pattern of marketing. This is the region in which several large plantations exist, consequently all of the middlemen are by-passed in many instances as the copra goes direct from plantation to exporter. All of the other marketing levels exist to handle copra from small holdings, but it is rare that the copra will pass through all three middlemen before it reaches the exporter. The

price at the export level is higher in Davao than at any other terminal market, suggesting that competition is more severe in Davao than any other location.

Domestic Prices

A thorough discussion of historical prices is difficult because of the number of discontinuous price series which exist. In instances where the series overlap, the statistics listed are often of different magnitude.

Obtaining an accurate "price received by farmers" prior to the war was impossible. Prices were listed as "prices in municipal markets", but this rarely reflected the amount received by farmers. Manila wholesale prices for the various coconut products are available for pre-World War II and are listed in the appendix to indicate relative magnitude and price change.

Prior to 1920, the prices listed are for corriente grade whereas later prices are for resecada. In general, copra prices were quite high during the early years, and certainly this high price contributed to the expansion of production. Wholesale oil prices were quoted in 1913 at very favorable rates. The oil/copra price ratio rarely fell below 2 : 1, despite excess oil capacity during the early years.

After World War I, prices generally diminished during the 1920's. With the depression of the early 1930's the price of copra, oil, and other export commodities dropped much more than food crops. Prices recuperated somewhat in the mid-1930's only to drop to new lows during 1938-40. In 1940 copra and coconut oil reached their minimum price of ₱3.87 per 100 kilograms and ₱0.09 per kilogram, respectively.

Copra meal prices fluctuated considerably over the pre-war period, but its price was not related to the price of other coconut commodities. Copra meal was simply a limited use by-product of oil extraction. Consequently, copra meal prices ranged from ₱0.09 to ₱0.48 per kilogram.

Desiccated coconut entered the market in 1922 and also demanded a very favorable price relative to both copra and coconut oil. The lowest price was ₱0.18 per kilogram in 1940 which was almost four times greater than an equivalent amount of copra.

For farmers, the copra price is the relevant price as that is the product price which determines how much he will receive. Some farmers sell whole coconuts to desiccating firms, but the price they receive is dependent upon the copra price, not the value of desiccated coconut. To insure a supply of desiccating nuts, they are purchased at a slightly higher price than is paid for an equivalent amount of copra.

Marketing Margins

The margin between the buying and selling price of a particular marketing firm may be quite large. This is particularly true where substantial transportation is required to move the copra to the next level. Inland surface transportation is quite difficult in some of the more remote areas and consequently is quite costly. However, the margins appear to reflect only the added service costs plus nominal profits.

Table 29 and chart 7 contain copra price data by crop years for various levels. One of the farm prices and the export price series are implicit prices, derived by dividing value by quantity. The wholesale price and the other farm price are price quotations for the resecada grade copra. The quoted price is rarely paid as only a small portion of copra is assumed to be of resecada quality.

Table 29: Copra Prices

Year	Export[1/] Price ₱/100kg	Manila[2/] Price ₱/100kg	Farm[3/4/] Price ₱/100kg	Farm[2/] Price ₱/100kg
1948	52.74	51.49	36.96	
1949	33.90	31.15	31.35	
1950	39.01	35.98	27.06	
1951	39.51	36.16	39.15	
1952	27.03	24.63	19.53	
1953	38.33	36.62	25.00	
1954	34.08	30.76	19.15	
1955	29.49	27.12	19.14	
1956	27.75	26.02	19.67	
1957	27.98	28.43	19.83	21.00
1958	34.26	37.70	23.67	28.00
1959	40.54	46.66	21.24	37.02
1960	40.03	39.92	34.08	31.70
1961	38.36	38.14	27.43	30.16
1962	49.56	47.31	30.60	36.72
1963	57.19	54.09	36.93	43.18
1964	60.20	56.00	40.00	43.28
1965	67.90	64.25	43.37	51.85
1966	64.89	55.57	50.50	

1/ Computed from export quantity and value

2/ Resecada basis, quotation

3/ Computed from farm production of copra and copra value

4/ Date refers to crop year ending June 30

Sources: Philippines (Republic), Department of Agriculture and Natural Resources, Bureau of Agricultural Economics, Philippine Agricultural Statistics, Vol. I, 1954.

_____, _____, _____, Crop and Livestock Survey, 1954-66

_____, _____, _____, Prices Received by Farmers, 1957-65

Central Bank, Statistical Bulletin, 1949-66.

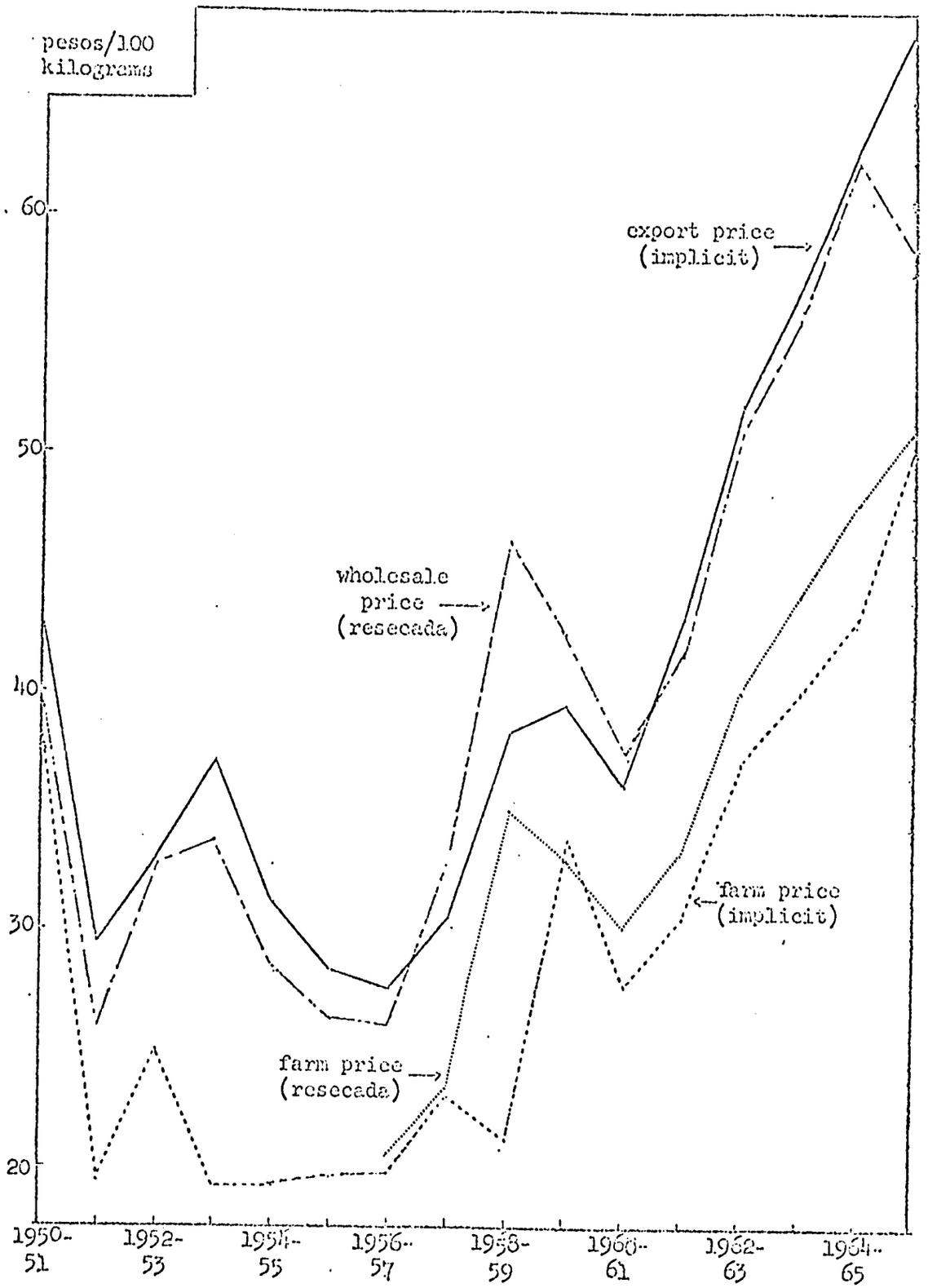

Chart 7: Copra Prices at Various Domestic Levels, crop year 1951-66

The two rescecada copra price quotations exhibit a high degree of parallelism. Similarly, the two implicit prices also follow similar paths, except for a drastic divergence for the 1958-59 crop year.

Numerous methods exist for determining the nature of the relationship between two variables. In this situation, the nature of the margin and its magnitude was of interest. To test the hypothesis of a constant percentage margin, the export price of copra was regressed against the farm price in logarithmic form.[7] The beta coefficient derived was .944. Inasmuch as the coefficient was not significantly different from 1.0, the hypothesis of a constant percentage margin was assumed to be valid. Had the coefficient been precisely 1.0 the constant term would have indicated the magnitude of the margin. Since a slight discrepancy existed, the relative magnitude of farm price was expressed as a percent of the export price. The annual data were summed, averaged and a standard deviation computed. Farm price was found to average 72.2 percent of the export price for the 1958-66 period. The standard deviation was seven percentage points.

To test that the margin was indeed a constant percentage rather than a constant absolute amount, the export price of copra was again regressed against the farm price in arithmetic form. If the regression coefficient was not significantly different from 1.0, a constant margin could be assumed. If the coefficient was precisely 1.0, the constant term would indicate the magnitude of the marketing margin. The beta coefficient derived was .687, significantly different from 1.0.

7/ The estimated equation is $Y = .89\ X^{.944}$.

A similar analysis was performed on the two price quotations for resecada copra. The Manila wholesale price was regressed against the farm price quotation for resecada copra in both logarithmic and arithmetic form. In the logarithmic form the regression coefficient was 1.10, which was not significantly different from 1.0. The analysis indicated that the farm price quotation was 78 percent of the wholesale price quotation. The standard deviation was 2.4 percentage points.

The implicit price data were compared with similar data from 1929-37. The regression again produced a coefficient not significantly different from 1.0. The farm price was found to be 81.5 percent of the export price with a standard deviation of 3.9 percentage points. The general conclusion from the comparisons is that current domestic marketing margins comprise a slightly larger proportion of the export price than was true during the 1930's. The increase in the implicit marketing margin has been about 10 percentage points.

A graphic analysis of monthly prices are presented in Chart 8. Unfortunately, actual or implicit prices are not available on a monthly basis. Therefore, the analysis is of resecada copra price quotations at wholesale and farm level. The monthly price series indicates that changes in farm prices lag about one month behind those in the wholesale price.

The farm price was somewhat more stable than the wholesale price. The farm price did not fully share in the peak prices, nor did it experience the complete effect of wholesale price declines.

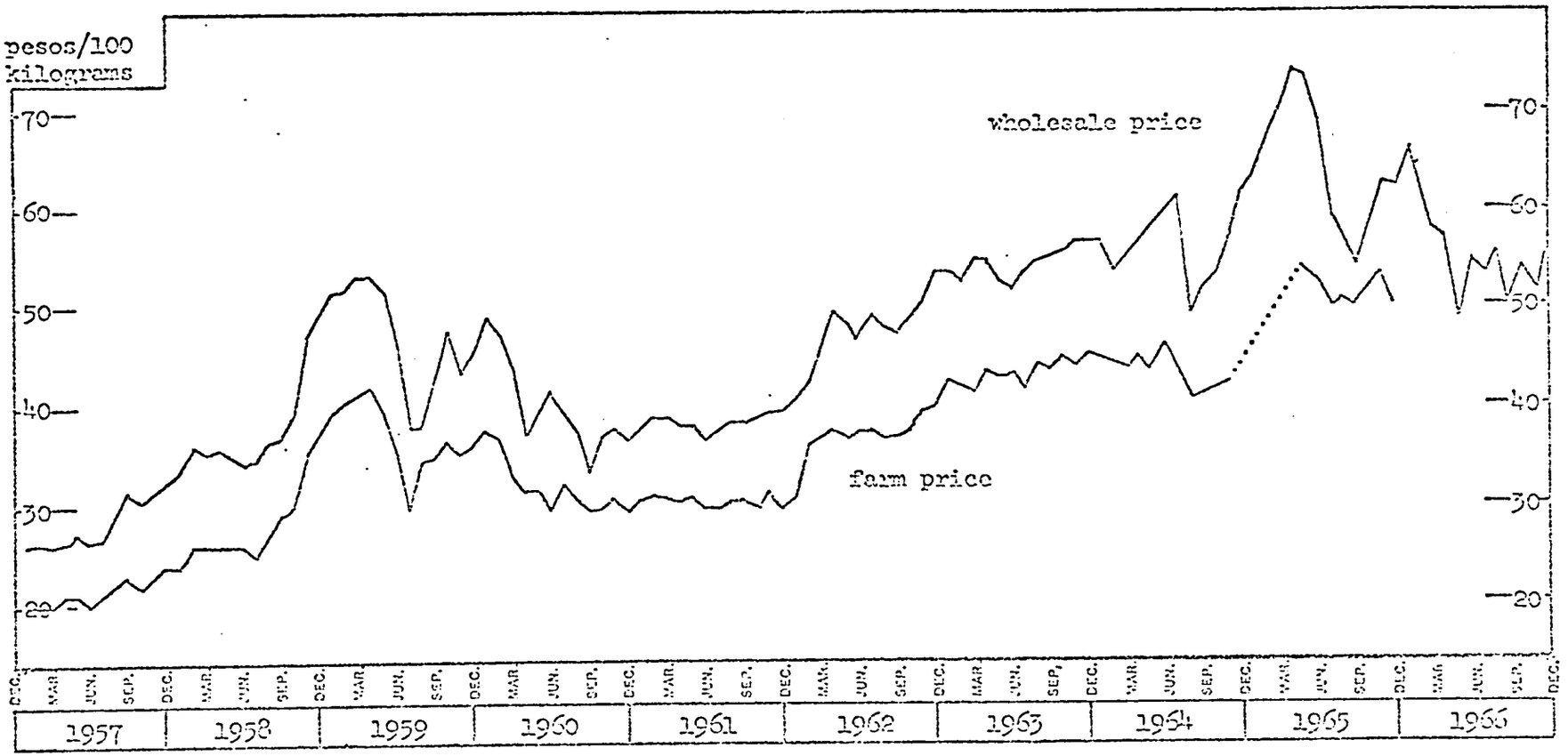

Chart 8: Philippine Price Quotations for Resecada Copra, Monthly 1957 - 1966

Seasonal Prices

Manila wholesale copra prices are available by month, extending back to 1919. Consequently the price series was sub-divided into three periods and seasonal indices were derived. The time periods were 1919-29, 1929-41, and 1949-66. The indices derived are contained in table 30 and displayed graphically in chart 9.

Table 30: Wholesale Price Index of Copra (selected time periods)

Month	1919-29	1929-41	1949-66
January	104.2	108.3	106.6
February	100.1	105.4	106.2
March	102.2	106.6	105.5
April	101.5	104.7	103.3
May	100.0	98.1	99.3
June	96.7	95.3	96.2
July	99.0	93.9	93.7
August	98.3	92.7	92.4
September	97.9	95.2	93.8
October	98.5	99.8	98.0
November	100.2	97.8	102.3
December	101.4	102.2	102.7

Sources: Computed from data found in
(1) Statistical Bulletin of the Philippine Islands (1922-29).
(2) Philippine Agricultural Statistics, Vol. I (1954).
(3) Central Bank, Statistical Bulletin (1949-66).

The seasonal pattern for 1919-29 was highly erratic but did not have as wide extreme values as the later years. May through October were the months of below average prices.

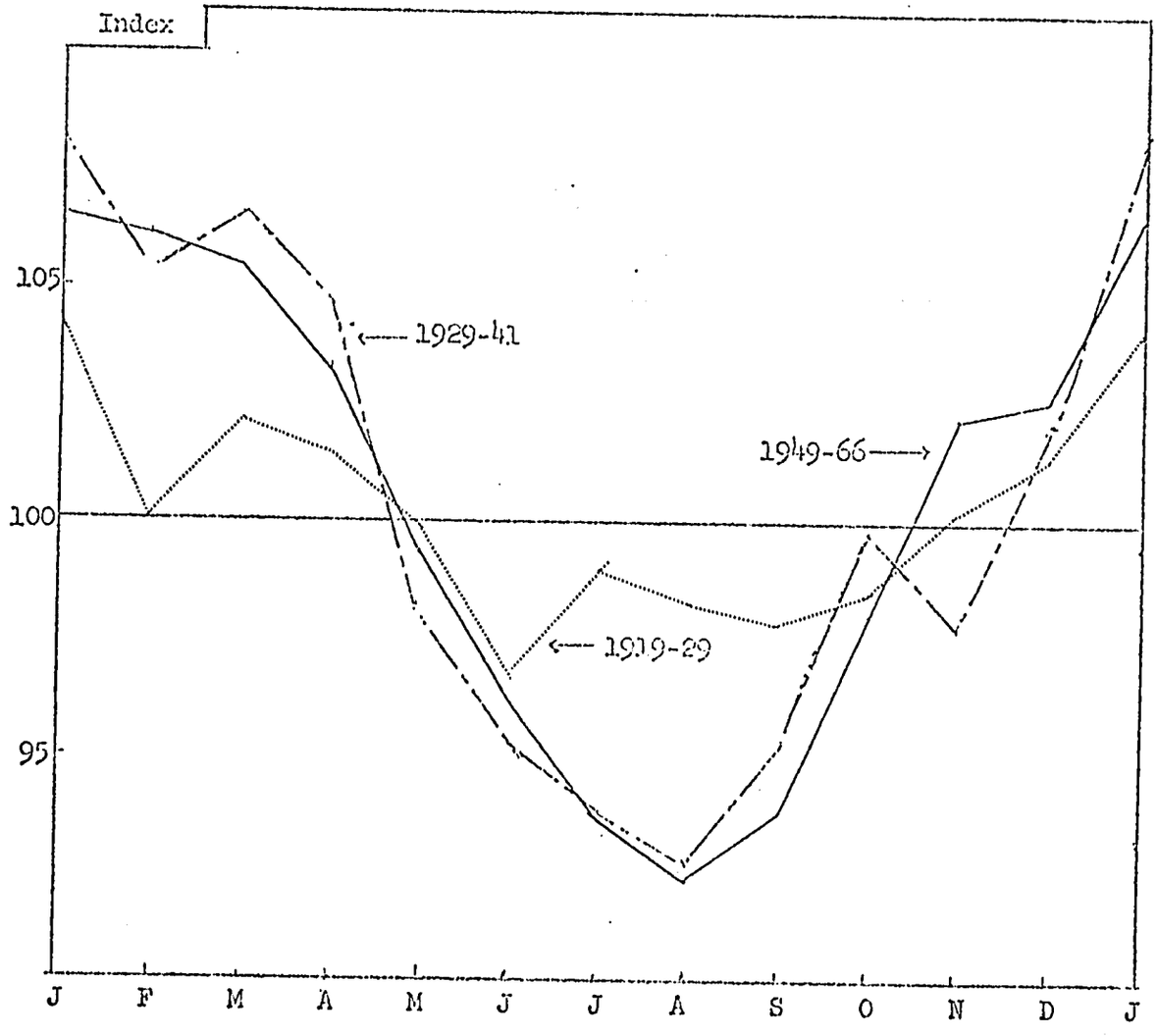

Chart 9: Seasonal Index of the Manila Wholesale Price of Copra

The index for 1949-66 is similar to the one in 1929-41. The seasonal high for the 1949-66 index was in January with 106.6 and the seasonal low of 92.4 occurred in August. Both indices fell below average in May. The 1949-66 index rose above the average in November whereas

the 1921-41 index did not rise above the average until December. The 1929-41 index was slightly more erratic than the 1949-66 index which was quite smooth and regular.

The seasonal price pattern is associated with the production pattern. Coconuts are harvested throughout the year, but harvest during the rainy season months is greater than during the dry season. The rainy season usually lasts from June through November. Thus, the low price index values generally conform to the rainy season months.

Pricing Procedures

Pricing procedures are not as varied as market structures. The price at a particular level usually depends upon the price at the next highest level. Most of the exporters and processors receive daily cables from the world copra markets of London and New York, informing them of the current price and the market situation or apparent trend. They then base their buying price on the potential selling price. The town buyer will base his buying price on the price he can obtain from the exporter.

The price that the typical exporter is paying for copra is not consistent for all of the suppliers. The quoted price is the price which will be given to the town buyers. Large plantations which consistently sell to the exporter frequently get a price higher than the quotation. Conversely, a small farmer delivering less than a ton would get less than the quoted price. If a dealer had a considerable quantity to sell and the exporter needed it to complete a shipment, the exporter would probably pay a premium above the quoted price.

Another factor, the copra grade, will also influence the price of copra at all levels. The standard grade of copra is "resecada", although six other grades exist. Moisture content is essentially the only determinant of the grade. Resecada is assumed to contain six percent moisture and as such will neither shrink nor gain weight in storage or transit. Legally all copra must be sold on this basis with appropriate deductions for excess moisture or lower grades.

However, in practice, most of the copra is sold on a "corriente" basis in which moisture is neither estimated nor deducted. But the price offered is substantially less than the "resecada" price. The net result is often a lower price than the true worth of the copra. The moisture meter law (discussed elsewhere) was enacted to assure fair pricing but implementation has not been effective.

Increasing use is being made of contracts for future delivery. The desiccating firms and some of the oil millers have long used contracts as a means of insuring a supply of coconuts or copra, but recently copra exporters have also resorted to this method. The desiccators acquire their nuts by short-term contract for delivery in six to 10 days. (In addition they will finance the operations of the contract.)

The oil millers and recently the exporters contract for copra delivery in 20 to 30 days and usually will not extend credit unless the copra is physically present (in the suppliers warehouse) and available for delivery. Firms which do not provide credit usually have to offer a slightly higher price for copra.

Within the oligopsony framework, price leadership would be expected and does occur. Where processors are located, they take the leadership

in establishing the price level. Desiccators pay the highest price for raw material. Thus their effect is predominant in Laguna and Quezon. The oil millers control the price in Manila and exert significant influence in Cebu, Davao, and Ozamis City.

Among the copra exporters, Granexport is the price leader and exerts the dominant influence where there are no processors. Two factors contributed to the price leadership position of Granexport. The firm is the newest in the export field and it does not engage in extending credit. The combination of these two factors, no credit service and being new, necessitated a slightly higher price to divert copra from other firms. In locations where there are no processors and Granexport is also absent, the price leader usually becomes the exporter who most needs copra to fulfill export commitments.

Exportation

The Philippines has 38 principal loading ports, from which copra is exported.[8/] However, 10 to 12 ports handle the bulk of the exported copra. Numerous minor ports exist, from which copra is transshipped by inter-island vessels to the major ports.

Where modern docking and handling equipment are available, copra will be placed in large "tote boxes," which have trap doors in the bottom. These boxes will be placed on trucks at the bodega and filled with two to three tons of copra (filling is accomplished by using tractor scoop-lift equipment). Upon arrival at the dock the freighter's

8/ Standards Department, PHILCOA, Ports of Loading; 1964, 1965, 1966.

winch equipment will lift the "tote" box, swing it to the hold and spring the trap door, dropping the copra into the hold. A small crawler type tractor is often placed in the hold to level the copra.

If modern handling equipment is unavailable at the bodega, the copra is bagged and trucked to the dock. They are then hoisted aboard the ship in slings, and emptied into the hold. Where inadequate docking facilities exist the bagged copra is barged out to the freighter anchorage and hoisted aboard.

The ten major copra loading ports of 1965 were: Cebu City, Cebu; Davao City, Davao; Tacloban City, Leyte: Siain, Quezon; Zamboanga City, Zamboanga del Sur; Dumaguete City, Negros Oriental; Cagayan de Oro, Misamis Occidental; Dipolog, Zamboanga del Norte; Masbate, Masbate; and Cotabato City, Cotabato.9/ (All the major ports are listed in the appendix.). The map in figure 5 indicates the location of these major ports and illustrates their geographic dispersion. As the map indicates, the major ports are well distributed. Thus, copra does not have to be transhipped great distances for export; Palawan is an exception as it has no nearby ports. Interior land transportation is frequently more difficult than inter-island shipments.

Cebu is the most important port in terms of loadings. This inaccurately reflects the importance of Cebu as a production area. A major portion of the loadings at Cebu reflect transhipments from Bohol, Southern Leyte, Samar, and Northern Mindanao. Loadings at other ports reflect only minor

9/ Philippine Coconut Administration, Standards Department, mimeograph of August 11, 1965.

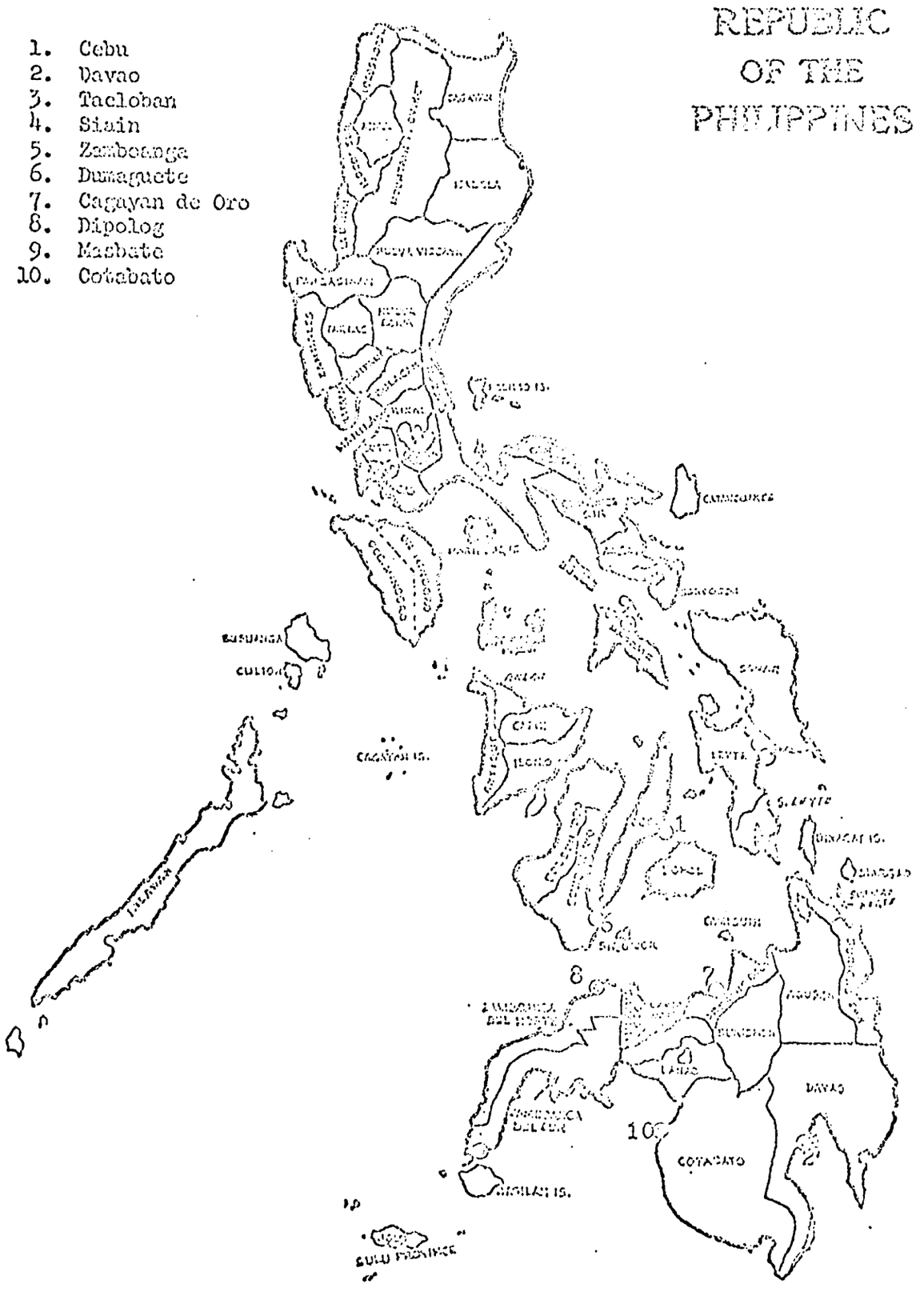

Figure 5: Ten Leading Copra Export Ports of the Philippines (1965)

transshipments; most will come from nearby production. Very infrequently is copra shipped from Manila. However, when such does occur, it represents transshipments.

Shift in Export Ports

It is interesting to note the shift in the importance of various ports. In the early 1900's most of the production was in Southern Luzon and as Manila was the large commercial center it was also the predominant port for copra export. During these years 95 percent of the copra exported was loaded at Manila. The fact that Manila was the only port with adequate facilities contributed to this situation.

By the mid 1920's, Cebu had emerged as the major export center for several reasons.[10/] (1) The center of production had shifted southward, (2) Cebu was closer to the United States by two days sailing time, (3) Cebu was centrally located in the inter-island shipping lanes, and (4) the inter-island shipping rates were very high, even higher than the international rates. In 1922 the inter-island freight rate for a long ton of copra from Cebu to Manila was $7.00 but was only $6.00 from Manila or Cebu to San Francisco. The rise in the importance of Cebu and other ports as export centers was accompanied by a decline in the importance of Manila.

Cebu still exports the largest volume of copra. However, the proportion of exports at Cebu have declined in the post-war period. The

10/ Gothwaite, op. cit., pp. 24-30.

ports of Davao and Zamboanga have incurred substantial export increases. This would be expected as Mindanao has been the scene of substantial production increases.

Table 31 indicates the post-war shift in copra exports from ports in the various regions. (Ports located in the various regions are listed in the appendix.)

Table 31: Copra Exported by Region

Region	1950	1955	1960	1965
I - Manila	44,636	55,452	40,300	14,160
II - Southern Tagalog	36,156	68,159	87,200	56,701
III - Bicol	86,308	138,704	68,325	96,127
IV - E. Visayas	66,634	50,847	65,050	90,800
V - W. Visayas	264,969	290,725	299,438	202,795
VI - N. Mindanao	66,898	90,914	148,069	134,500
VII - S. Mindanao	125,621	117,846	127,994	250,564
Total	691,222	814,145	836,376	845,647

Source: Data compiled by the Statistical Services Staff, PHILCOA.

CHAPTER VII

DEMAND FOR PHILIPPINE COCONUT PRODUCTS

The chapter on supply presented half of the price determination picture. A supply function presents only the potential quantities supplied under various conditions. To determine a schedule of potential prices, demand must also be considered. This chapter attempts to determine demand functions for the major coconut oil consuming centers of the United States and Europe. The analysis is not exclusive of forecasting, but is primarily designed to derive elasticity coefficients.

A demand and price analysis for coconut oil presents more than the usual problems. Inasmuch as this study is concerned with production and trade of the Republic of the Philippines the demand for Philippine exports is the center of interest. Furthermore, since the Philippines is the world's major exporter of coconut products, and is essentially engaged in free market transactions, unencumbered by trading alliances such as those existing between European countries and their former colonies, the analysis should logically focus on the Philippine export level.

However, the demand for the Philippine export is a derived demand based on the consumer centers. It will later be shown that the price for Philippine copra and coconut oil are closely related, regardless of the location. Therefore, a price analysis using one of the world market centers will define the price in the remaining world markets.

Obviously, the price for Philippine copra is influenced by the non-Philippine copra entering trade, but their prices are usually not jointly determined as much non-Philippine copra has preferential sales.

The following analyses are based on the assumption that world trade, rather than world production, is the price determining factor.

Export Demand for Coconut Oil and Copra

Coconut oil, per se, cannot be considered in a vacuum, but must be viewed as one of many oils vying for various uses. Coconut oil is an important component of a group of oils known as lauric oils. Within the lauric group, a high degree of substitution exists because of their similar chemical and physical properties. These oils are highly saturated, short chain and have high melting points. Coconut oil comprises approximately three-fourths of the exports of lauries.

Coconut oil comprises only 14 percent of the fats and oils trade, thus suggesting its price may be influenced more by other exported oils than by its own exports. Complicating the price and demand structure are the fats and oils traded which are by-products or joint products of some other primary product. Oils derived from soybeans, cottonseed, and corn and the animal fats of lard and tallow are by-products of soybean meal, cotton fiber, starch, bacon and ham, and beef, respectively. These by-products approximate 40 percent of the indigenous exports of fats and oils.

It would then appear, superficially at least, that coconut oil might be a vegetable oil which would substitute freely with the various fats and oils. However, closer inspection reveals that only limited substitution can and does occur (coconut oil and palm kernal oil are both lauric oils and are essentially perfect substitutes).

In this light, coconut oil may then be better regarded as a complimentary oil, rather than a supplemental product. As such, coconut oil (or lauric acid oils) are essentially irreplaceable. In the manufacture of soap, oils from three groups are used: lauric acid (quick lathering), slow lathering and soft oils. Coconut oil is the principal quick lathering oil and tallow is the principal slow lathering oil. The relative importance of these two fats in soap manufacture has not altered during the last half century. The proportion has been one part coconut oil to three parts tallow plus one part soft oil. This usage ratio has prevailed despite the "tallow/coconut oil" price ratio ranging from 1:1 to 1:4. (During the war years of 1942-45, substantially less coconut oil was used, resulting in the "no-lather" soap).

Coconut oil was once the primary component of margarine, but now contributes a negligible amount toward margarine manufacture. During the late 1920's and early 1930's as much as 75 percent of the total fats and oils used in margarine was coconut oil. The high melting point for coconut oil made it an ideal oil for a commodity such as margarine. However, when coconut oil became unavailable during the war, manufacturers found they could produce a margarine with superior spreading characteristics from chemically hydrogenated soft oils. The use of coconut oil in shortening has never been large, limited to one or two percent of the total fats and oils. For cooking purposes, coconut oil is inferior as it tends to foam and spatter. Consequently, its use in shortening and cooking oils is quite limited.

For speciality food products, coconut oil is ideal and essentially irreplaceable. Confectionery, biscuits and crackers require smooth non-greasy coatings which will readily melt in the mouth, and fillings which

will remain stable over long periods. The chemical and physical nature of coconut oil fulfills these specifications admirably. Coconut oil is a solid at normal room temperatures but a liquid at body temperature. Furthermore it is a highly saturated, short-chain oil, and will not turn rancid, thus facilitating long storage or shelf life. This latter characteristic has resulted in an additional recent use -- filled milk. The replacing of butterfat with a fully saturated fat permits storage of the milk for long periods without rancidity occurring.

Although coconut oil is a minor oil compared to soybean or cottonseed oil, it has its own niche for which it cannot be readily substituted. Interrelations exist between coconut oil and other vegetable and animal oils, but the uses of coconut oil are so numerous that quantitatively determining the substitutability between individual oils is difficult.

The non-substitutability of lauric oils was inferred by a graphic comparison of the oil prices. The underlying hypothesis was that close substitute oils would have prices which paralleled each other over time. This premise was based on the assumption that even if a particular oil was in abnormally short or excess supply its price would be held in check, relative to its substitutes, by utilizing more of the lower priced oil, thereby tending to equate the two prices. It was further postulated that non-substitutable oil prices would fluctuate relative to each other.

The United States price of four common vegetable oils were plotted for a 17-year period, commencing with 1950 (Chart 10a). The oil prices used were coconut, groundnut, cottonseed and soybean. Cottonseed and soybean oil prices fluctuated in rough parallel fashion indicating some substitutability. However, none of the oil prices approximated the movements of

coconut oil prices. Frequently, coconut oil prices moved in a direction opposite of the other oils. The price of coconut oil relative to soybean oil ranged from an identical price to double the soybean oil price. There was no statistical correlation between coconut oil and alternate oil usage, which is not surprising.

Similar graphs were constructed for five major vegetable oil prices in Europe (Chart 10b). Prices of coconut, groundnut, palm kernal, soybean, and palm oils were the prices compared.

Palm kernal oil price closely paralleled the price of coconut oil, as expected. This substantiated other claims that the two oils were perfect substitutes. The disparity between coconut oil price and prices of the remaining oils was not as great as existed for U.S. prices, but consistent parallel changes were not observed.

Occasionally the price of groundnut oil would parallel coconut oil price. However, other years would find the two prices moving in opposite direction. Of particular interest was the fact that these two oil prices paralleled each other only when a narrow margin separated them. If a wide margin existed the prices seemed to be either converging or diverging. This then lends credence to the theory that the oils are partially substitutable but within a limited range.

The hypothesis was further tested by deriving the linear correlation coefficients between coconuts oil and the other major vegetable oils (table 32). The coefficients further substantiated the non-substitution hypothesis.

The correlation coefficients of United States oil prices were quite low. The highest coefficient was .32 for groundnut oil-coconut oil. The lowest coefficient was .21 for cottonseed oil-coconut oil.

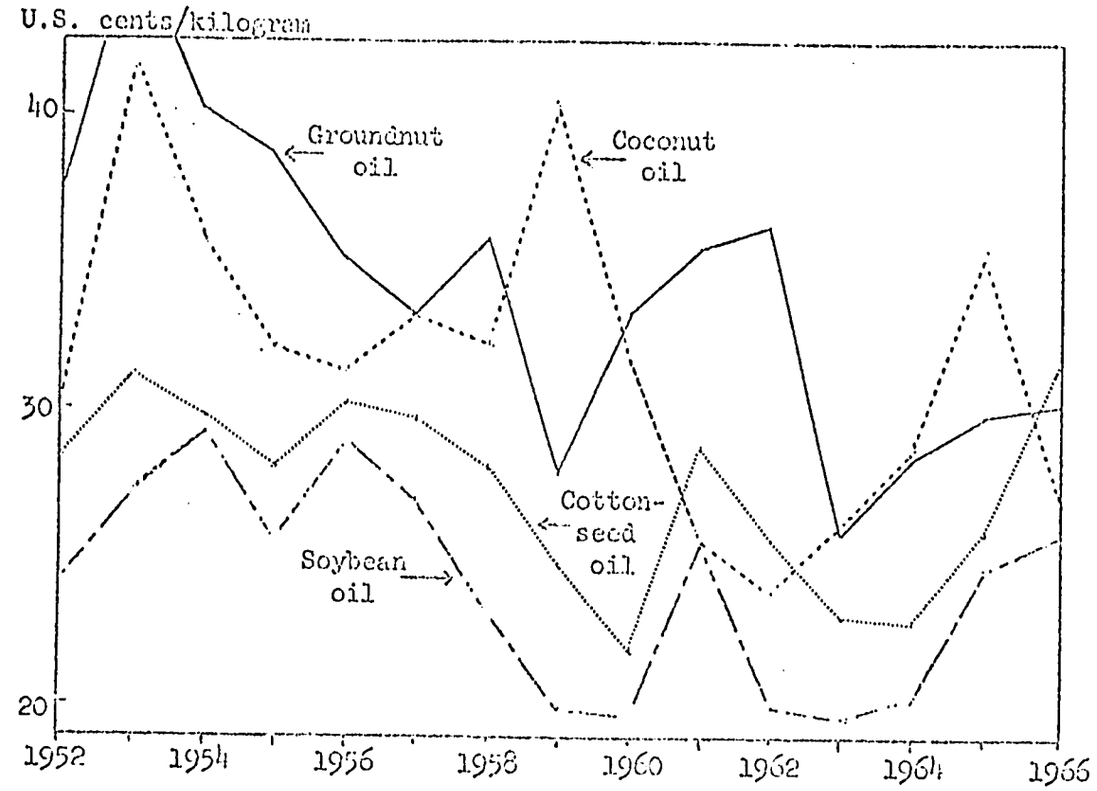

Chart 10a: United States Vegetable Oil Prices, 1952-66

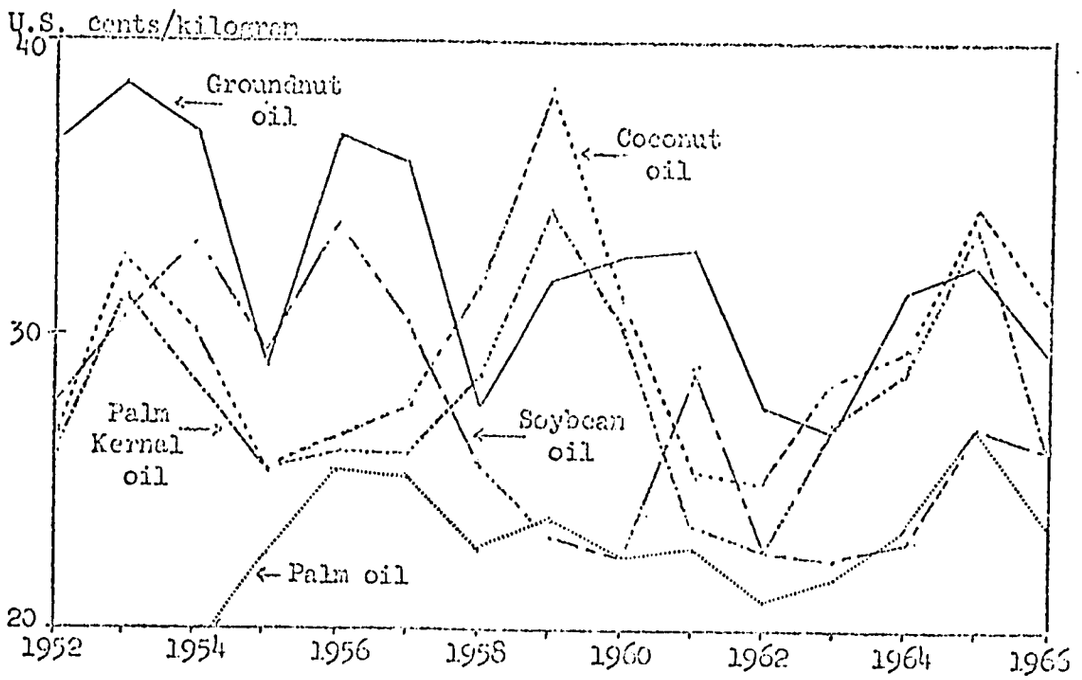

Chart 10b: European Vegetable Oil Prices, 1952-66

Table 32: Correlation Coefficients between Prices of Coconut Oil and Alternative Oils in the United States and Europe

	Palm Kernal	Palm	Soybean	Groundnut	Cotton-seed
U.S. Prices	N.A.	N.A.	.28	.32	.21
European Prices	.94	.04	-.23	.16	N.A.

N.A. = not applicable

The correlation coefficients for European oil prices were also quite low, except for the palm kernal-coconut oil coefficient, which was .94. This coefficient was expected to be quite high, again reflecting the substitutability of the two oils. The remaining correlations ranged from .16 for the gouundnut oil-coconut oil coefficient to -.23 for the soybean oil-coconut oil coefficient.

These correlations were of prices and do not <u>necessarily</u> preclude substitution of the oils, but they do infer non-substitutability.

The preliminary analysis indicated a high correlation between palm kernal oil and coconut oil. Furthermore, the price of palm kernal oil appeared to be influenced more by quantities of coconut oil than by quantities of palm kernal oil. This was a result of two factors. First, the industrial users of vegetable oils recognize the oils as perfect substitutes. Secondly, the production and export of palm kernal oil is small relative to coconut oil.

Subsequent analyses combined the two oils into the common category of lauric oils. Prices used in the analyses were of coconut oil as it was more reflective of lauric exports.

Demand equation estimates were attempted for the two major consuming centers, Europe and the United States. The European demand does not include all the European countries but only those 13 countries included in the European Economic Community and the European Free Trade Association.[1/] Insufficient data precluded the remaining European countries.

Despite the limited substitution inferred, between lauric and non-lauric oils, it was hypothesized that the tremendous amount of soybean production and utilization in the United States would influence the consumption of lauric oils. It was further hypothesized that the European demand would be influenced by soybean and groundnut consumption.

Lauric oils in Europe are primarily used in edible products, consequently would be influenced by other major edible oils. Groundnut oil is the major oil consumed in Europe, and soybean oil ranks third - just behind lauric oils. Fish oil has rapidly become important, but only in the last three years.

After some initial graphic analyses the assumption was made that total world exports of lauric oils was the influential factor in price determination in the given markets. Quantity utilized in the market area is usually assumed to be the predominant factor in price determination, but lauric oils do not fit the typical production-consumption patterns.

Notation used in describing the following demand relationships and empirical analyses are:

1/ Countries in the EEC are: Belgium, France, Germany, Italy, Luxemborg, and the Netherlands. The EFTA consists of Austria, Denmark, Norway, Sweden, Switzerland, Portugal, and the United Kingdom.

Variables:

P = price in U.S. cents per kilogram; wholesale price, west coast, U.S.; and import price, European ports

I = per capita income in dollars; disposable income for the U.S.; national income for Europe

Q = quantity in 1000 metric tons of oil equivalent.

Superscripts:

c = coconut oil

s = soybeans

g = groundnuts

l = lauric oils.

Subscripts:

x = exports

u = United States

e = Europe

r = rest of world.

Structural demand functions based on the above hypotheses are

$$Q_u^l = f\,(P_u^c,\ I_u,\ P_u^g),$$

and

$$Q_e^l = f\,(P_e^c,\ I_e,\ P_e^s,\ P_e^g).$$

However, P_u^c and P_e^c are jointly determined with quantities of lauric oils used in each region. Furthermore, the prices of soybean oil and groundnut oil are functions of their quantities plus various other factors. Thus, the two functions are obviously only a portion of a large system of equations. Consequently, to make the system or sub-system manageable,

quantities utilized were substituted for the United States and European prices of soybean oil and the European price of groundnut oil. This substitution prohibits the computation of cross price elasticities between oils but permits estimation of the remaining coefficients.

The demand functions are of the following forms:

$$Q_u^l = f\,(P_u^c,\ I_u,\ Q_u^s),$$

and

$$Q_e^l = f\,(P_e^c,\ I_e,\ Q_e^s,\ Q_e^g).$$

The system of equations also must contain the identity that the exports to individual regions equals total world exports. That is,

$$Q_x^l = Q_u^l + Q_e^l + Q_r^l .$$

The quantities for other oils (Q_u^s, Q_e^s, and Q_e^g), the income variables (I_u and I_e), and the world exports of lauric oils (Q_x^l) are treated as predetermined variables in the system. The prices of coconut oil (P_u^c and P_e^c) and the quantities of lauric oils used in individual regions (Q_u^l, Q_e^l, and Q_r^l) are assumed to be endogenous variables.

The two behavorial equations in the sub-system are over-identified. Consequently, the two-stage least squares technique was used for estimating the structural coefficients.

Most procedures designed to derive "true" elasticities express price and income variables in constant dollar terms. As a first approximation, the analysis conformed to this procedure. There was no "a priori" knowledge that suggested either an arithmetic or logarithmic relationship between the variables. Therefore, a logarithmic analysis

was performed to facilitate ease of interpretation. A later analysis in arithmetic form indicated "degree of fit" was not materially affected by a change in form.

The estimated coefficients of the structural equations are:

$$Q_u^l = 2.85\ P_u^{c\ -.241\ (.092)}\ I_u^{.522\ (.334)}\ Q_u^{s\ .327\ (.160)}$$

and

$$Q_e^l = 34070\ P_e^{c\ -.786\ (.167)}\ I_e^{.144\ (.362)}\ Q_e^{s\ -.003\ (.009)}\ Q_e^{g\ -.238\ (.296)}$$

The coefficient for the price variables are price elasticity coefficients and the income coefficients are income elasticities. Coefficients for the soybean and groundnut variables are not cross-elasticities but reflect relative substitution rates.

The United States demand equation suggests that the demand for lauric oils is highly price inelastic at -0.24. That is, a one percent change in price would result in a 0.24 percent opposite change in the quantity demanded. The income elasticity coefficient of .522 indicates that a one percent income change will result in a one-half percent change in demand. The price and income elasticity coefficients of the United States demand equation are of the expected signs and are significant. There was no "a priori" knowledge upon which to base expectations, regarding the magnitude of the income elasticity. However, an elasticity of .5 does not seem unrealistic.

The theory of two-stage least squares is not fully developed with respect to tests of statistical significance for regression coefficients. A coefficient/standard error (t) ratio of two is usually required to reject the hypothesis of a zero coefficient in ordinary least squares.

However, some authors have suggested that a ratio of one may be sufficient for two-stage least squares estimates.[2]

The magnitude of the price elasticity indicates a more price inelastic demand than might be expected. Apparently, lauric oils are not appreciably substitutable with other oils. This is consistent with statements made by industry personnel as well as with the description of uses stated earlier in this chapter.

Subsequent analyses on a per capita basis and undeflated values resulted in essentially the same price elasticity. Furthermore, analyses using different variable specifications also produced similar price elasticity coefficients. These supplementary analyses add confidence to the reliability of the price elasticity estimates.

Only one previous study of coconut or lauric oils was found which attempted to derive an elasticity coefficient. This analysis, by Kromer,[3] was an arithmetic regression between quantity and price. After regressing price on quantity, he obtained an elasticity coefficient at the mean values using the equation $e = \frac{1}{b} \cdot \frac{\bar{P}}{\bar{Q}}$. The coefficient obtained was -0.9, substantially higher than that obtained in the analysis described earlier. The Kromer analysis does omit the very relevant variable of income, which he acknowledges would be an influencing factor.

2/ L. Langemeier and R. G. Thompson, "Demand, Supply, and Price Relationships for the Beef Sector, Post World War II Period," Journal of Farm Economics, Vol. 49, No. 1, Pt. 1, February 1967, p. 174.

3/ George W. Kromer, "Coconut Oil Imports and Consumption Increasing in the United States," Fats and Oils Situation, United States Department of Agriculture, Economic Research Service, March 1964.

The final variable in the demand equation was quantity of soybean oil utilized. This variable was included as a proxy in an attempt to obtain a measure of substitutability. Therefore, the coefficient would be expected to be negative. However, the coefficient derived was +.327 and was "significant". Consequently, soybean oil might be assumed to be complimentary with lauric oil, although this is doubtful. In later analyses the soybean oil coefficient was found to be non-significant, which is more probable.

The coefficients for the European demand equation are interpreted in similar fashion. The price elasticity of -0.78 indicates that the European demand, relative to the United States demand, is substantially less inelastic. The coefficient was significantly different from zero.

Inasmuch as the primary European use for lauric oils is in edible products a less inelastic coefficient would be anticipated. There have been no previous European demand analyses for lauric oils, thus preventing comparisons.

The estimated income elasticity of 0.14 is not statistically significant. However, the positive sign is assumed to be correct. The non-significance may be attributed to two opposing interactions of income and demand. Margarine may be an inferior good, and hence the coconut oil utilized in margarine may be negatively related to income. Insufficient detail on utilization is available to test such a hypothesis. However, it is not illogical as Europeans are not concerned over cholesterol problems alleged to be associated with butter and animal fats.

The opposing interaction would then come from the alternate uses of lauric oils. Edible confectionery uses and inedible industrial uses

would be expected to be positively associated with income. The relationship of income and lauric use in soap is unclear. If synthetic detergents dominate the cleaning field, the income relationship would be expected to be non-zero and positive.

Quantity utilization of two substitute oils were included in the demand function. One of these, soybean oil, is a major substitute in the margarine-shortening sector. The coefficient obtained was -.008 and is of questionable significance. The negative sign is expected, indicating substitutability but the low magnitude suggests low substitutability. The coefficient indicates a one percent increase in the consumption of soybean oil would cause a reduction in lauric oil consumption of eight-thousandths percent.

The other substitute oil used in the demand function was groundnut oil. The coefficient derived was -.238 and is interpreted in the same manner as the soybean oil coefficient. The negative sign indicates substitutability and the magnitude suggests it is more substitutable with lauric oils than soybean oil. The use of groundnut oil in Europe is primarily in cooking and salad oils with a minor use in margarine.

A subsequent European demand analysis using undeflated prices and incomes, confirms the signs of the elasticity and substitution coefficients. Furthermore, such analysis caused a change in the magnitude of the coefficients, as a result all coefficients became significant.

The theoretical statistical relevance of the standard error of estimate is questionable for simultaneous equation techniques. However, they are presented to provide a guide to the error in the estimate of quantity demanded. For the United States demand equation, the standard

error is about 4.7 percent, for the European demand, about 5.8 percent. Thus if appropriate variables in the European demand equation indicated 1000 metric tons of lauric oil were demanded, an error of ± 58 tons could be expected.

The reader is cautioned that the elasticity coefficients in this and later demand equations are approximations based on a model which aggregates over much of the details of the fats and oils sector of the economy. The approximations are assumed to be reasonably reliable, particularly for the United States demand, as alternate specifications changed the elasticities only slightly. Inasmuch as a number of potential substitute oils have been omitted, the implicit assumption is made that their coefficients are zero. The validity of this assumption is statistically untested, but many oils were omitted after low coefficients were obtained in a correlation matrix.

While convention suggests that deflated prices and constant dollar incomes should be used to derive "true" structural coefficients, actual prices and current incomes may be more relevant for forecasting. Furthermore, elasticity coefficients derived using undeflated data reflect the observed economic reactions to price and income changes. Consequently, the previous functions were re-estimated using undeflated data.

The following coefficients were obtained using the method of two-stage least squares.

$$Q_u^l = 3.35 \; P_u^{c\,(-.238)\,(.088)} \; I_u^{(.596)\,(.303)} \; Q_u^{s\,(.179)\,(.211)}$$

and

$$Q_e^l = 10880 \; P_e^{c\,(-.570)\,(.212)} \; I_e^{(.614)\,(.324)} \; Q_e^{s\,(-.243)\,(.132)} \; Q_e^{g\,(-.529)\,(.438)} \; .$$

Some obvious similarities exist between the new set of equations and the previous set. The United States price and income elasticity coefficients are almost identical to those derived from deflated data. The price elasticity coefficient of -.238 continues to indicate a high degree of inelasticity. The income elasticity of .596, was slightly higher than that obtained using constant dollar income. In this equation the coefficient for the soybean variable was non-significant, but was still a positive value. The standard error of the demand estimate was four percent.

The structural demand equation for Europe exhibited several differences from the previous estimate. The price elasticity became more inelastic with a value of -.57. The income elasticity coefficient became statistically significant with a value of .614. The income elasticity coefficients for European and the United States demand are quite similar. The coefficients for quantity of soybean oil and quantity of groundnut oil consumed were negative and significant.[4] The coefficient for quantity of soybeans consumed was -.243, and -.529 for the quantity of groundnuts consumed. The standard error of the estimate was 8.7 percent.

Per Capita Demand

One of the obvious faults of the previous analyses is the disregard of population. A separate population variable was tested in the analysis, but did not contribute materially to the function. Consequently the

4/ Again a "t" ratio of one is assumed to be significant, for the structural coefficients.

consumption values were put on a per capita basis in an attempt t eliminate part of the specification bias and to obtain more accurate structural coefficients. The specification of the system of equations became more difficult when per capita quantity values were used, particularly in the identity equation. The sub-system of equations used in the analysis consisted of the following equations.

Demand equations:

$$Q_u^1/N = f\,(P_u^c,\ I_u,\ Q_u^s/N)\ ,$$

and

$$Q_e^1/N = f\,(P_e^c,\ I_e,\ Q_e^s/N,\ Q_e^g/N)\ .$$

(The "N" in each equation is the population of the area specified in the subscript of the numerator.)

Identity:

$$Q_x^1 = W_u\,Q_u^1/N + W_e\,Q_e^1/N + W_r\,Q_r^1/N\ .$$

(Where "W" refers to the relative weights or the proportion of the world population relevant to the individual area.)

The demand equations estimated per capita quantity as a function of actual prices and current incomes. It was assumed that this specification would be a superior forecasting system.

The per capita demand equations using undeflated price and income variables are:

$$Q_u^1/N = .218\ P_u^{c\ \underset{(.070)}{-.220}}\ I_u^{\underset{(.186)}{.368}}\ Q_u^s/N^{\underset{(.171)}{.052}}$$

and

$$Q_e^1/N = 8.15\ P_e^{c\ \underset{(.192)}{-.579}}\ I_e^{\underset{(.241)}{.197}}\ Q_e^s/N^{\underset{(.122)}{-.183}}\ Q_e^g/N^{\underset{(.407)}{-.311}}$$

The price coefficients of the equations are similar to the coefficients of the previous demand equations. However, the income coefficients were substantially lower. The standard errors of the estimated United States and European demand are three percent and eight percent, respectively. At current consumption rates the error terms would translate into plus and minus 60 grams and 240 grams for the respective per capita demands.

The price elasticity coefficient for the United States demand equation was 0.22, indicating a one percent change in price would result in an opposite change of .22 percent in quantity consumed. This coefficient is consistent with the previous price elasticities derived and is highly significant.

The U.S. income elasticity coefficient of .37 is probably a more accurate estimate than the previously derived coefficients. This specification separates the effects of income from population which were combined as the income variable in the previous functions. The coefficient indicates that as income increases by one percent, demand will increase by .37 percent.

The U.S. per capita soybean oil consumption coefficient was .052 which was not significantly different from zero. However, the positive sign was still in evidence. As mentioned earlier, the soybean oil consumption variable probably has no effect on lauric oil consumption. Therefore, a non-significant coefficient might be expected.

The price elasticity of European demand was -.58, similar to the estimates previously made. The coefficient, while inelastic, was less inelastic than the U.S. price elasticity. It indicated that a one percent change in price will result in a .58 percent opposite change in the amount consumed. The coefficient was highly significant.

The European income elasticity coefficient continued to exhibit an unstable nature. The income coefficient was .144 when computed using deflated prices and income, but became .614 when actual prices and current income were used. The coefficient was expected to be smaller when demand was computed on a per capita basis. However, the reduction to .197 was rather drastic relative to the expected influence of removing the population effect. Furthermore, the coefficient is not significantly different from zero.

The substitution coefficients for European soybean oil and groundnut oil with lauric oils, bordered on the significant-nonsignificant range at 10 percent level of probability. They were both negative as would be expected. The soybean oil consumption coefficient was -.183 and was assumed to be significant. Whereas the coefficient for the groundnut oil variable was -.311 and appeared to be nonsignificant. The soybean oil coefficient is interpreted as the amount of change in lauric oil consumption that could be expected if soybean oil consumption changed by one percent.

In the past, the expanding demand has been dependent on at least three factors. One is the obvious influence of increasing population. Secondly, is the fact that coconut oil is currently used in minimal proportions in consumer products and cannot be reduced further without adversely affecting quality. Thirdly, is the net increase in uses that has occurred. While coconut oil has been replaced in some minor uses, new uses have developed which prevented a decline in total use.

The factors mentioned above may not prevail in the future, however. Population will, of course, continue to increase. But indications exist

suggesting that not only will the proportion of coconut oil in some uses be reduced, but may be replaced entirely. The current high price of coconut oil relative to other domestically produced vegetable oils provides substantial incentive to replace coconut oil where possible. In 1967 crude coconut oil prices averaged 14.5 cents per pound , 63 percent higher than soybean oil. For the first three months of 1968 crude coconut oil prices have averaged 20.0 cents per pound, 120 percent higher than soybean oil. In the past coconut oil used in margarine has been the only major use that has been replaced, although several minor uses also have been eliminated.

A demand schedule for U.S. lauric oils was computed for the United States data for each year. The computed quantity was on a per capita basis. Therefore, it was multiplied by the midyear population value. The demand schedules, plotted in chart 11, illustrate the annual shift of the demand curve. The curve at the far left represents the U.S. demand for lauric oil in 1953 and each successive curve to its right represents the succeeding years.

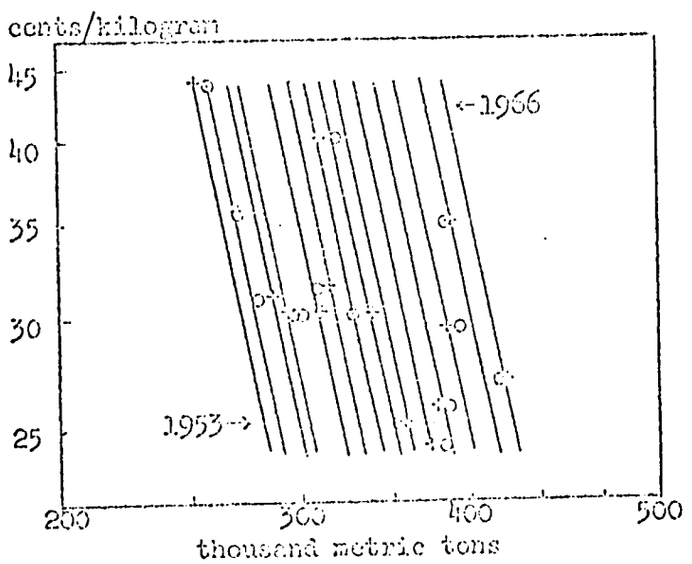

Chart 11: Annual Shift of the United States Lauric Oil Demand Schedule

The actual and computed quantities utilized are indicated in the graph. The computed values are denoted by +'s and the actual values are denoted by circles.

Export Demand for Desiccated Coconut and Copra Meal

There are two other coconut products for which demand should be considered. They are desiccated coconut and copra meal/cake. Most of the desiccated coconut is exported to the United States and most of the copra meal cake is exported to Germany.

Meaningful quantitative demand functions for these two commodities were not obtained. The quantity of desiccated coconut demanded in the United States has remained relatively static in per capita terms during recent years. In 1966 the low price with low imports appears inconsistent. However, labor strikes in the Philippine desiccating plants prohibited an increase in imports. During the past 14 years, annual per capita imports of desiccated coconuts has averaged .62 pounds. The deviation from this average has been slight as indicated by the standard deviation of .04 pounds. A multiple regression analysis was attempted. The price coefficient was highly inelastic, but neither it, nor the income coefficient were significant.

Desiccated coconut products have returned greater value per unit to the Philippines than other coconut products. However, it is doubtful that expansion can occur in this sector except as population increases.

The other product, copra meal cake, is actually a by-product and as such its exports is a function of oil extraction. Germany, the primary importer of Philippine copra cake, is an importer of other oilseed

cakes as well. Therefore, the livestock industry in Germany, and other oilseed cake importing countries, is the factor upon which continued sales hinge.

The demand for cake has been expanding more rapidly than the demand for oil in the importing countries. There are few obstacles to international trade in oilseed cake.

Copra cake has one of the lowest protein contents of any oilseed cake. Consequently its value as a protein supplement feed is rather low. Demand and hence price will depend greatly upon the prices of other oilseed cakes. One could expect a relatively price elastic demand schedule for copra cake. Past experience indicates little difficulty in selling copra cake, although price is somewhat erratic. Prices of oilseed cakes are usually based on the protein content of the cake, with the cost per unit of protein being essentially the same.

Domestic Demand

The domestic demand for coconut products is a small component of the available supply. Domestic consumption assumes three forms: (1) manufactured oil, (2) homemade oil, and (3) foodnuts.

The data are again a limiting factor in performing an analytical demand analysis. Statistics on the production of oil manufactured for domestic use are available. However, oil manufacturers readily admit the statistics fail to reflect actual production. Furthermore, estimates on homemade oil and foodnuts are recognized as quite crude. Inasmuch as homemade oil is a very minor portion of domestic consumption it was neglected in the analysis. Foodnuts were also omitted because of

the erratic data, their relatively minor consumption, and because foodnuts were not considered as part of the available supply of copra. Consequently, only manufactured oil was considered in the domestic demand for coconut products.

Instead of using published data on domestic oil production in attempting to quantify demand, a set of consumption values were generated from alternate data. Export statistics on copra meal and cake is relatively accurate. Furthermore, domestic consumption of copra meal is very small. Consequently, the exports of copra cake reflect the residue of total oil manfacture. The amount of oil extracted is then easily determined and oil exports can be subtracted from this value, leaving the amount of oil available for consumption. Using this data as a reflection of demand, implicitly assumes that the annual available oil is consumed.

A simple regression analysis was attempted, expressing per capita consumption as a function of price and per capita income. Price was assumed to be exogenous as it was determined by the export demand.

The function was estimated in logarithmic form. The equation and computed coefficients were:

$$Y = .1335\, X_1^{\underset{(.140)}{-.093}}\, X_2^{\underset{(.213)}{.583}}$$

$$R^2 = .58 \qquad s_{y.x_1x_2} = 7.8\ \%$$

where Y = per capita copra consumption

X_1 = manila wholesale price of oil, pesos/kilogram

X_2 = per capita income, actual U.S. dollars.

Standard errors of the regression coefficients are in parentheses below the coefficients.

The price coefficient is negative but not significantly different from zero. The process of devaluating the peso affected the price substantially, and the price elasticity coefficient reflects this devaluation effect. In recent years the domestic price has increased substantially but has not appeared to affect consumption. It might be thought that the price elasticity of a food commodity (such as coconut oil) would be relatively elastic in a developing economy. Such may indeed, be true in the Philippines under conditions of decreasing prices.

The relatively high income elasticity was expected. It conforms to the generally accepted notion that the income elasticity for food is high. The implication of these two coefficients is that some variable(s) has been omitted which has a negative cross elasticity. However, as mentioned above, devaluation has tended to cloud the issue of elasticities.

The conclusion from the above suggests that approximately 150,000 metric tons of copra are required to fulfill the domestic demand for coconut oil. This amount can be expected to increase at the rate of population increase plus the effect of income increases.

Summary

The demand for Philippine coconut products is an aggregate of several components, the largest of which is the demand for copra and oil exports. The United States and Europe originate the major share of the external demand for copra. The price elasticities of demand in the United States and Europe were about -.2 and -.6 respectively. Income was the only other factor with a measurable influence on demand

during the period of analysis; the respective elasticities were about +0.4 and +0.2.

The quantity of desiccated coconut demanded in the United States has maintained a relatively static position of .6 pounds per capita and is unlikely to alter. Copra meal demand has primarily come from Germany. The quantity demanded and the price are determined by other oilseed meals, which are more abundant and higher in protein.

Domestic demand is primarily in the form of manufactured oil. The lack of other domestically produced oils creates a rather static internal demand. About three kilograms of oil are consumed per capita, apparently regardless of price. This demand for oil amounts to about 150,000 metric tons of copra.

The composite of the above demands; United States and European demand for copra, United States demand for desiccated coconut, and the domestic demand for coconut oil, constitutes 80 percent of the total demand for Philippine coconut products. The remaining demand is in the form of copra demand, originating in various countries.

CHAPTER VIII

INTERNATIONAL MARKETING

This chapter is limited to a general discussion of the international market structures for coconut products in the Philippines, the United States, and Europe. The discussion will include a simple analysis of marketing margins and derived demand. A limited description of tariff policies will also be included.

Marketing Structures

The comments on market structure pertain only to the copra and coconut oil sector; desiccated coconut is more vertically integrated and oligopolistic than the other products. Alternatively, copra meal falls into a more competitive market.

In Chapter VI, the number of copra and oil exporters were indicated to total 30. However, export concentration is quite high. The International Copra Export Corporation exported more than 25 percent of the Philippine copra exports in 1964-65, and the top four exporting firms exported approximately 70 percent.[1/] Current export concentration is expected to be greater than in 1964-65.

Concentration in coconut oil exporting is similar. The Lu Do and

1/ PHILCOA, Mimeograph of August 11, 1965.

Lu Ym Corporation exports from 35 to 50 percent of the total oil exports and the top two firms normally export about 75 percent of the oil.[2]

For the international market, the exporters comprise the first level in the structure. The international market structure and the commodity flow of copra and coconut oil are illustrated in figure 6.

Historically, copra and oil have passed through dealers before reaching the crushers and the industrial users. However, the number of dealers has decreased and they are now frequently by-passed. In the past, a considerable amount of "paper trading," or speculation, was common among dealers. While a certain amount of speculation still occurs, the trend is for the dealer to act more as a broker or to trade only physical volumes of copra.

In the United States four firms on the West Coast are engaged in copra crushing (oil extraction). Thus, it would appear that both an oligopsony and oligopoly might exist. The 26 potential copra exporters in the Philippines have only four ultimate buyers of their commodity in the United States, although dealers may increase the number of actual buyers. Alternatively the industrial manufacturers using coconut oil would have to purchase the oil from one of the four crushers.

However, the 10 coconut oil exporters in the Philippines must be added to the structure. Their presence prohibits the realization of any real oligopoly power.

Under current freight rates, both ocean conference rates and United States rail rates, an East Coast consumer can acquire coconut oil cheaper

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2/ Ibid.

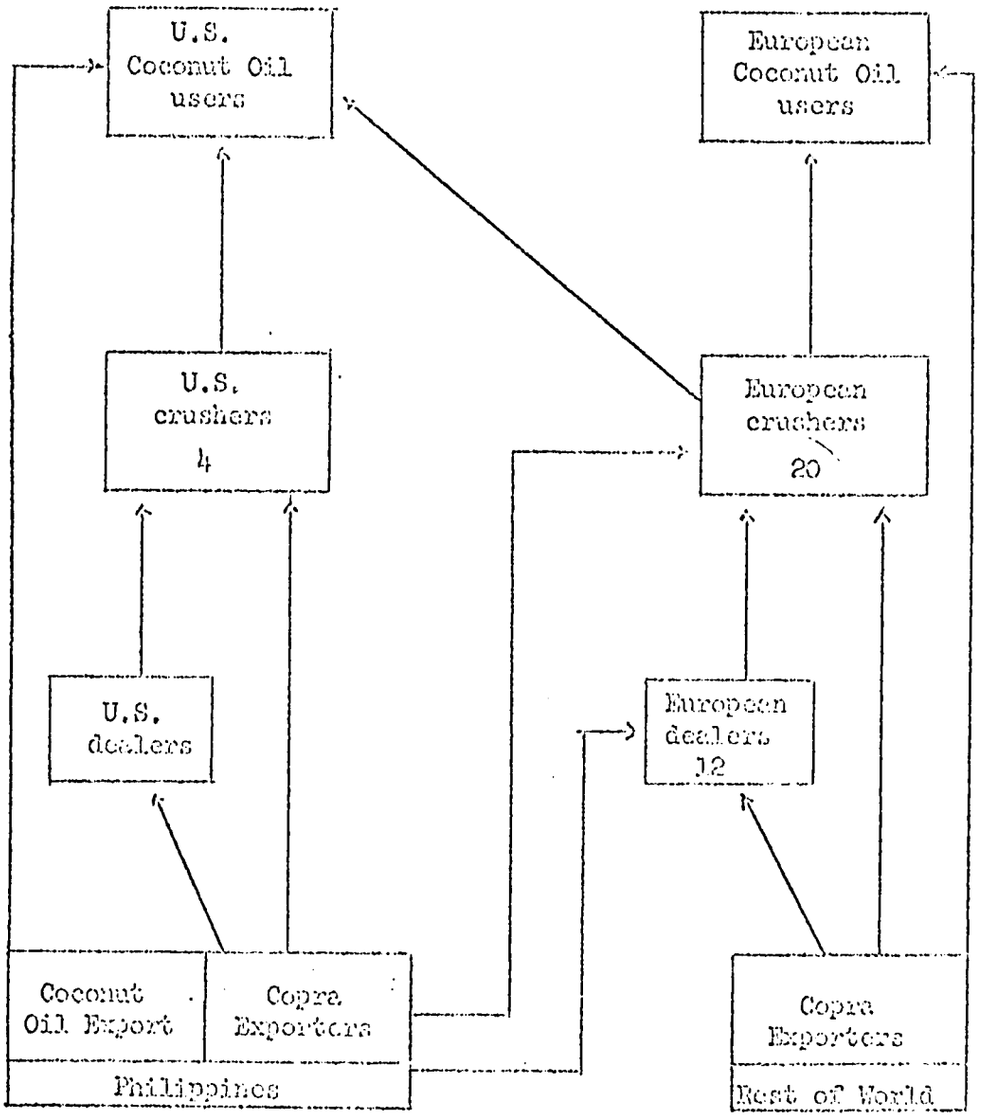

Figure 6: International Market Structure and Market Channels for Copra and Coconut Oil

by buying it directly from the Philippines. Even if the oil import exceeds the quota established under the Revised Philippine Trade Act, paying the one cent per pound tariff is less costly than paying rail freight of 1.45 cents per pound from the West Coast to the East Coast. Consequently, the amount of oligopoly power that the United States crushers can exercise is limited by the fact they can easily be by-passed.

There are several manufacturers who use coconut oil in numerous final products. The largest users are the three large soap manufacturers, but they use only about 20 percent of the United States imports. None of the manufacturers utilize an amount sufficient to exert a controlling influence on the market.

A slightly different situation exists for the European market. Again, the lower level of the structure is the 26 Philippine copra exporters. But exporters in former European colonies and in Commonwealth countries must also be added to the Philippine exporters. The tariff structure in Europe effectively prohibits the importing of Philippine coconut oil but does permit coconut oil entry from former colonies. Essentially no Philippine copra enters the United Kingdom, as their demand is supplied by Commonwealth countries.

There are only 12 dealers handling copra in the European market.[3] These dealers do not handle all of the copra entering Europe as dealers are frequently by-passed.

Copra crushers in Europe number at least 20.[4] Several of the

3/ Obtained in discussions with European importers, dealers and manufacturers.

4/ Ibid.

crushers extract oil for their own use as well as for sale to other industrial manufacturers.

The number of uses of coconut oil is probably less in Europe than in the United States, but the number of users is probably greater. Despite this situation, a high use concentration exists. The dominant firm in Europe is Unilever, which uses about 50 percent of the total European imports of copra. Consequently, the action of Unilever does affect the market within narrow limits.

It is frequently claimed that the London and New York markets determine the world price of coconut oil and that the Philippines exerts no influence. It is indeed true that world price quotations are listed as New York or European Port prices. However, the Philippines, as the predominant supplier of this commodity, exerts a major influence on price.

The argument states that only two or three firms control the major portion of the imports and under such conditions are able to dictate the price of the commodity. However, a simple analysis of available data disspells this myth. If such were the case, very little fluctuation in price would be expected. But, this does not describe the pattern of copra and coconut oil price movements. Fluctuations have been extremely violent with peak prices in 1951, 1953, 1959, and 1969. Furthermore, if the European or American price reached a peak, the wholesale price in the producing country would not follow, if purchase prices were cartel dictated. Again, this has not occurred, price movements between countries are noted for their correlation.

The monthly export price of Philippine copra and the United States monthly import price of copra were plotted to illustrate the parallel movement of the two prices (chart 12). The following section contains a

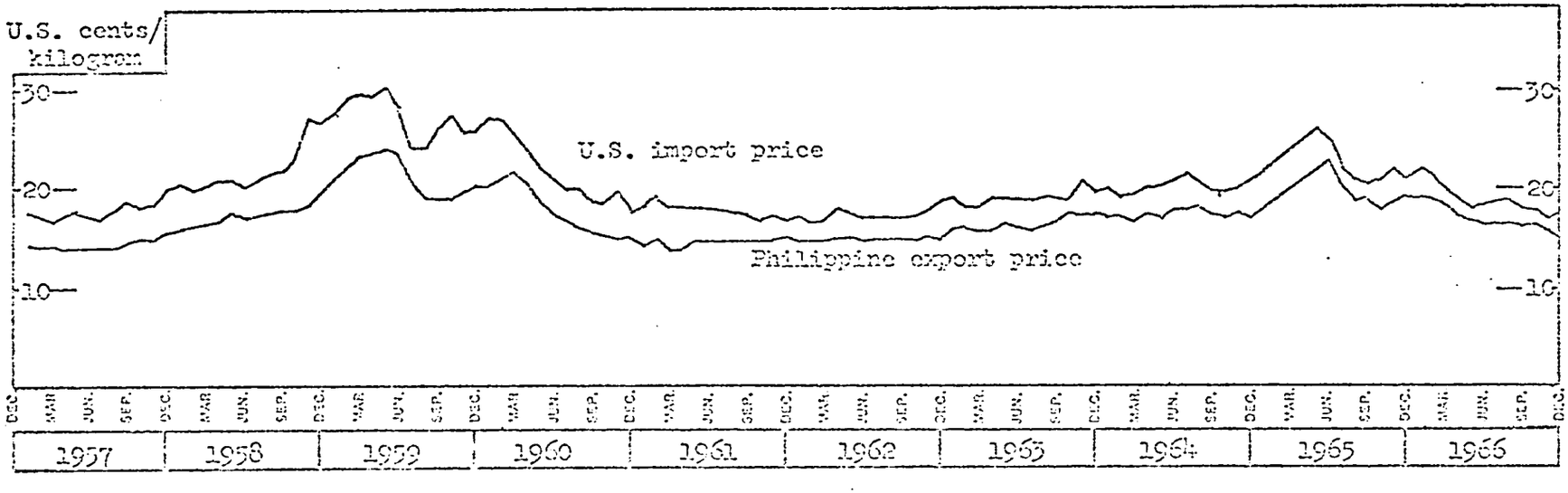

Chart 12: International Price Movements of Copra, Monthly 1957 - 1966

statistical derivation of the price margin. However, the graph indicates the margin is rather narrow. A consistently small margin would not be expected under a monopolistic cartel situation, particularly with the volatile prices.

The Philippine export price is slightly less volatile and does not fully share in the peak prices. Alternatively, price depressions are not fully reflected in the export price. Change in the direction of export prices is lagged one to two months behind the United States import price changes. This is particularly evident in the price fluctuations of 1959, 1960, and 1965. Again, this would not be expected in a monopsonistic-monopolistic cartel dominated structure.

The concentration of Philippine exporters probably permits a greater market influence than do alleged buying cartels, although this influence is rarely exercised. The relatively high price of copra indicates the dependence of manufacturers on the available supply of copra. The inability to substitute other oils for coconut oil without altering the quality of the finished product makes the manufacturers quite dependent upon copra availability.

The foregoing discussion is not intended to condemn or praise concentration within the market structure. The past has been characterized by the presence of many operators, which has tended to prohibit the action of any size of scale economies, particularly at the Philippine export level.

Marketing Margins and Derived Demand

The estimated demand equations were used to derive the demand for exports of Philippine copra. Accurate conversion factors and marketing

margins were applied to the computed demand function, and demand was derived for copra and coconut oil at appropriate levels.

The price margins between transfer points and between coconut oil and copra were analyzed in several ways to determine the form of relationship between the various prices. Data used in these analyses were limited to the nine years 1958-66 to evade the inconsistent price margins due to tariffs in effect prior to 1958.

Margins may be either absolute or percentage. These in turn may be either constant, increasing, or decreasing. A variety of techniques were used to determine the type of margin.[5/] In every instance, a constant percentage margin was found to reflect the actual situation more accurately. This circumstance greatly facilitated the derivation of demand since constant percentage margins do not alter the elasticity at various market levels.

Regressing the upper-level price against the lower-level price in both arithmetic and logarithmic form permitted evaluation of the form of the margin. In the arithmetic regression,

if $\beta = 1$, then a constant absolute margin existed;

if $\beta > 1$, then a decreasing absolute margin existed;

if $0 < \beta < 1$, then an increasing absolute margin existed.

Similarly, in the logarithmic regression,

if $\beta = 1$, then a constant percentage margin existed;

if $\beta > 1$, then a decreasing percentage margin existed;

if $0 < \beta < 1$, then an increasing percentage margin existed.

5/ The various techniques used were graphic analysis, bivariate regression in absolute number and logarithms, and standard deviations of differences and of percentages.

The standard error of the estimate and the coefficient of determination would indicate which form of regression best fitted the data. In regressing each set of data the logarithmic form produced the highest R^2 and lowest standard error of the estimate. Furthermore, in each logarithmic equation the hypothesis that the regression coefficient was one was accepted.

The percentage margins were then derived by dividing the lower level price by the higher level price. These percentages were averaged and standard deviations were determined. In each instance the standard deviation was less than the standard error of the estimate for the same price values. Therefore, the percentage margins were used in deriving demand at the lower levels.

The constant percentage margins are difficult to rationalize or justify. The margin between United States or European imports and Philippine exports is the transportation cost and on occasion some tariff levies. It is reasonable to expect a portion of this margin to be of a constant absolute nature rather than a constant percentage nature.

While justification of constant percentage margins is difficult, there is no doubt regarding their existence. The United States import price of coconut oil was regressed against the Philippine export price of coconut oil, and the European import price of copra was regressed against the Philippine export price of copra. Both regressions were performed in arithmetic and logarithmic form. The following coefficients were obtained:

arithmetic

$$\text{United States} \quad P_u^c = -24.4 + \underset{(.09)}{1.24}\, P_p^c; \quad R^2 = .79$$

$$\text{Europe} \quad P_e^k = 6.09 + \underset{(.158)}{.815}\, P_p^k; \quad R^2 = .79$$

logarithmic

$$\text{United States} \quad P_u^c = -.14734 + \underset{(.034)}{1.036}\, P_p^c; \quad R^2 = .96$$

$$\text{Europe} \quad P_e^k = -.11708 + \underset{(.14)}{1.15}\, P_p^k; \quad R^2 = .95$$

where P_u^c = United States import price of coconut oil

P_p^c = Philippine export price of coconut oil

P_e^k = European import price of copra

P_p^k = Philippine export price of copra

None of the coefficients are precisely one. However, it is apparent that the coefficients in logarithmic function are not significantly different from one. Furthermore, the logarithmic function produces just as good or better "fit" relative to the arithmetic function.

As a starting point for the United States demand for Philippine copra exports, the demand equation for lauric oils on a per capita and current price basis was calculated over the range of actual prices. The other variables were held constant at their means. This demand curve is shown on the accompanying graph as D_1; the elasticity is -.22 (chart 13).

Since 90 percent of the lauric oil used in the U.S. is supplied by Philippine copra or oil, the total quantities demanded were multiplied

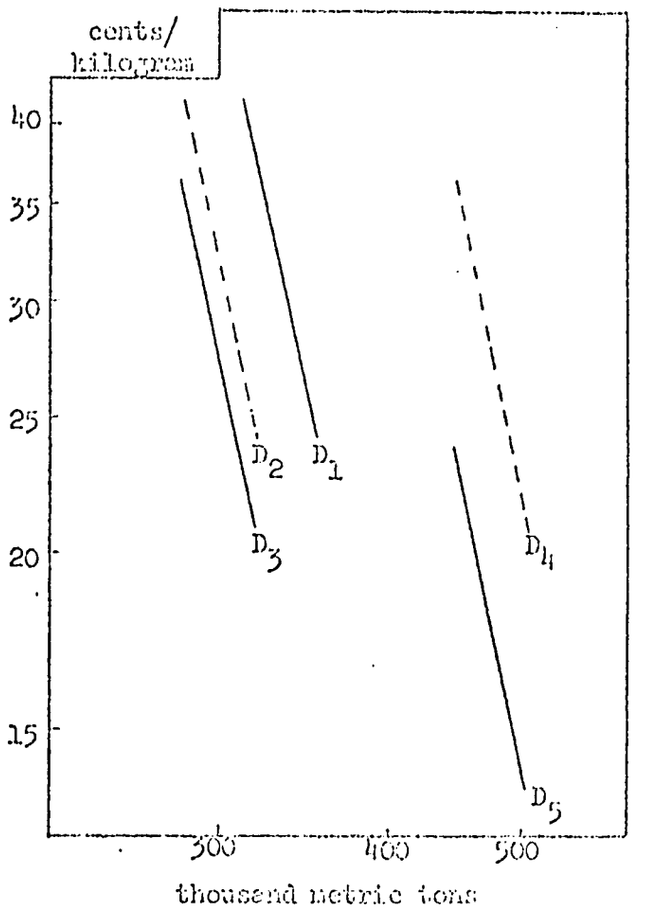

Chart 13: United States Demand for Lauric Oil, Philippine Coconut Oil and Philippine Copra

by .90. This is illustrated by D_2 and is the U.S. demand for Philippine coconut oil. Inasmuch as the United States imports much of its oil in oil form, the U.S. demand for Philippine coconut oil at the export level was derived. This demand is illustrated by D_3, and was derived by multiplying the U.S. import price of coconut oil by .868. The Philippine export price of oil has consistently been 86.8 percent of the U.S. import price.

To obtain the U.S. demand for Philippine coconut oil and copra, at the export level, two additional steps are required. The intermediate step is the determination of the U.S. demand for Philippine coconut oil in copra equivalent, export level. This is obtained by dividing the coconut oil quantities by .63, the oil extraction rate. This is shown in the graph as D_4. The Philippine copra export demand, D_5, is obtained by taking 65.3 percent of the coconut oil price. The Philippine export price of copra has been 65.3 percent of the export price of coconut oil.

The European demand for Philippine copra was derived in a similar fashion. The computed equation for lauric oil demand, with current prices and a per capita base, was used. The demand was computed over the range of prices incurred and at the mean value of the other factors. The European demand for lauric oils is indicated by the D_1 curve in chart 14. The price elasticity is -.58.

In deriving the European demand for Philippine copra exports, several steps were required. Inasmuch as the Philippines has supplied 40 percent of the lauric oil equivalent, in the European market, the quantity values had to be reduced to 40 percent of the total quantity demanded. This is shown as D_2, and is the European demand for Philippine coconut oil. However, Europe imports very little oil, but imports oil in the form of copra. The European demand for Philippine coconut oil in copra equivalent was computed by dividing the coconut oil values by the oil extraction rate of 63 percent. This is represented by D_3.

The next step was to obtain the price in terms of copra. In the European market the price of copra has consistently been 65 percent of the oil price. Thus, the oil prices were multiplied by .65 to obtain

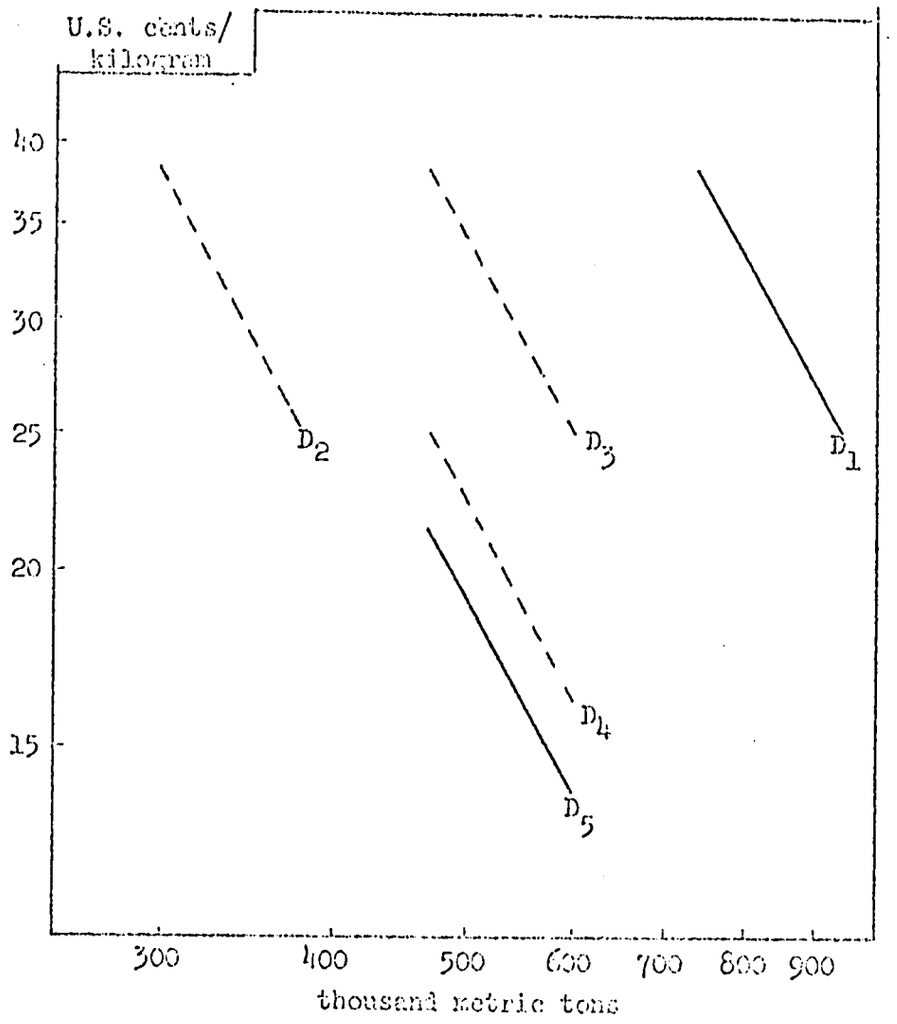

Chart 14: European Demand for Lauric Oil and Philippine Copra

the equivalent copra price. This is shown as D_4 and is the European demand for Philippine copra.

The European demand for Philippine copra at export was then derived by multiplying the European import price by 86 percent. Philippine copra export prices have typically been 86 percent of the European import price. This is the demand function represented by D_5.

The derived demand curves permit the derivation of the quantity of Philippine copra demanded by the United States and Europe under

various price conditions. For example if the price of oil was $0.30 per kilogram, approximately 850,000 metric tons of lauric oil would be demanded in Europe. However, under normal conditions, the Philippines would export only 540,000 metric tons of copra to Europe at an export price of about 16.7 cents per kilogram. At the same price the United States would require about 340,000 metric tons of lauric oil. The Philippines would provide about 480,000 metric tons of copra equivalent, again at about 16.7 cents per kilogram.

These demand schedules have assumed the "ceterus paribus" condition for all factors. The demand schedules are subject to shifts, the most notable of which is income. For the United States, a one percent increase in income would cause a .36 percent increase in demand. For Europe a .20 percent increase would be expected.

Tariffs

Tariff structures and preferential tariffs would be expected to affect the pattern of international trade. Tariffs would also be expected to affect the form of export if they are applicable only to the manufactured product.

Inasmuch as the United States is the major buyer of Philippine coconut products, the United States tariff structure is reviewed. Tariffs of other countries are viewed in limited form.

Tariffs have been applicable to coconut products entering the United States, since World War I. Copra meal and desiccated coconut are subject to tariffs of 0.3 cents and 3.5 cents (1.75 cents for "most favored nations") per pound, if of non-Philippine origin. If of

Philippine origin, they are subject to a proportion of the tariff. As provided by the Revised United States-Philippine Trade Act, this proportion is increasing with the passage of time. The proportion of duty applied is indicated in table 33. The effect of the tariff has been to prohibit non-Philippine desiccated coconut from the United States market. There has been no real effect on copra meal as the United States is a surplus producer of oilseed meals and does not import copra meal.

Table 33: Proportion of Duty Applicable to Imports of Philippine Desiccated Coconut and Copra Meal

Years	Percent of duty
1956 - 58	5
1957 - 61	10
1962 - 64	20
1965 - 67	40
1968 - 70	60
1971 - 73	80
After 1973	100

Source: Revised United States-Philippine Trade Act

Most of the Philippine copra meal is exported to Europe, which does not impose tariffs on oilseed meals, regardless of the origin.

Copra is subject to tariffs in only two countries studied, the United States and the United Kingdom. However, both countries have exceptions. The United Kingdom permits free entry of copra originating in Commonwealth countries, otherwise a 10 percent duty is imposed.[6/]

6/ Commonwealth Secretariat, Vegetable Oils and Oilseeds 1967, London.

The United States has always permitted free entry of Philippine copra. However, the 1934 U.S. Internal Revenue Act levied a processing tax of 1.87 cents per pound plus an "additional" tax of 1.25 cents per pound on non-Philippine copra. Various Congressional Acts (U.S. P.L. 77-711, U.S. P. L. 78-390, and Presidential Proclamation 2693 of 27 June 1946) suspended the "additional" tax from September 17, 1942 until August 27, 1949. The tax was then reimposed by Presidential Proclamation No. 2847 of 27 July 1949.

The processing tax was suspended on October 1, 1957 by U.S. P.L. 85-235. Two additional acts (U.S. P.L. 86-432 and U.S. P.L. 87-859) continued the suspension until April 15, 1966 when U.S. P.L. 89-388 eliminated the processing tax.

Coconut oil is subject to tariffs in all of the major importing countries. Currently, the tariffs which most affect the Philippines are those in the United Kingdom, the European Economic Community and the United States.

The tariff regulations of the United Kingdom levy a 15 percent duty on coconut oil of non-Commonwealth origin. Consequently, only oil of Commonwealth origin enters the United Kingdom. The European Economic Community countries levy a split duty on imported coconut oil; 10 percent on crude coconut oil and 15 percent on refined oil. As a result, essentially all imports are in the form of copra.

The history of United States tariffs on coconut oil commenced with the Emergency Act of 1921 which levied a duty of 2.67 cents on each pound of coconut oil imported. The U.S. Tariff Act of 1922 reduced the duty to two cents per pound. The effect of the duty was to provide the

Philippines with a market, free of competition as oil produced from Philippine copra was exempt from duty.

The U.S. Internal Revenue Act of 1934 provided an oil quota for the Philippines of 200,000 long tons. Imports in excess of this amount were subject to the normal tariff of two cents per pound. This provision had no real effect as imports never surpassed 200,000 long tons during the effective period.

The same act provided for the collection of a three cents per pound processing tax on all imported oil made from coconut, palm and palm kernals. This was imposed on Philippine oil as well as non-Philippine oil. However, the taxes collected on Philippine oil was returned to the Philippines.

Section 2470 (a)(2) of the 1939 Internal Revenue code levied an additional tariff on imported coconut oil if of non-Philippine origin. This additional tariff had little effect as it was suspended September 17, 1942 by U.S. P.L. 77-711 and remained suspended by a number of congressional acts until it was finally reinstated August 27, 1949 by Presidential proclamation. Its suspension was based on inadequate coconut oil supplies.

In 1946, with the advent of Philippine independence, the three cents per pound processing tax was no longer returned to the Philippines. The previous tax refund was to prepare the Philippines for the economic adjustment of independence. The United States-Philippine trade agreement of 1946 provided for the continuation of the duty free quota of 200,000 long tons, but reduced the duty to one cent per pound for imports over the quota.

The GATT Agreement of 1948 reduced the two cents per pound duty to one cent per pound on oil imported from GATT member countries.

The Revised United States-Philippine Trade Act of 1955 provided for a declining tariff-free quota until all coconut oil imported would eventually be subject to tariff. The duty free schedule is indicated in table 34. Imports in excess of the quota were subject to the one cent per pound duty. The Act had no real effect until 1963, as prior to that year the quota had not been filled.

Table 34: Philippine Oil Tariff-Free Quota

Years	Quota
	(1000 long tons)
1946 - 54	200
1955 - 58	190
1959 - 61	180
1962 - 64	160
1965 - 67	120
1968 - 70	80
1971 - 73	40
1974	0

Source: Revised United States-Philippine Trade Act

The three cents per pound processing tax continued to be levied until it was suspended on October 1, 1957 by U.S. P.L. 85-235. The processing tax continued to be suspended by U.S. P.L. 86-432 and U.S. P.L. 87-859 until it was abolished by U.S. P.L. 89-388 on April 13, 1966.

The termination of the Revised United States-Philippine Trade Agreement on July 3, 1974 will cause coconut oil from the Philippines to be

subjected to the regular one cent per pound tariff and the two cents per pount additional tax.

Europe n tariffs have generally either prevented or retarded the importation of Philippine coconut oil. Continental Europe has structured tariffs to encourage copra imports. Thus, permitting the extraction to be performed domestically.

United States tariffs have been discriminatory to the point of virtually eliminating coconut products of non-Philippine origin. The tariff structure also discriminates against coconut oil after a certain amount is imported. However, the tariff was irrelevant until 1963 as the tariff-free quota was not filled until that year.

Institutional barriers other than tariffs has retarded the United States importation of Philippine coconut oil. These barriers have been Philippine foreign exchange control and discriminatory oceanic freight rates.

CHAPTER IX

THE COCONUT INDUSTRY AND THE PHILIPPINE ECONOMY

Contribution to the Economy

The coconut industry has contributed substantially to the Philippine farm sector. The farm value of coconut production has been approximately 20 percent of the value of all farm crops. Palay is the only commodity which contributes more to the total value of farm crops. Inasmuch as coconuts are predominantly a cash crop, their contribution to cash farm income is undoubtedly greater than 20 percent.

The work by Hicks suggests that most of the value added in the coconut industry accrues to the farm sector.[1/] The distribution of value added is: farm sector, 70 percent; marketing sector, 20 percent; and manufacturing sector, 10 percent. Thus, it appears that the coconut industry has contributed only minimally to the manufacturing sector. Furthermore, it appears that the potential contribution is small. The value added by separating oil and copra meal from copra is only six to seven percent. The value added by desiccating the coconuts amounts to about 33 percent. However, all desiccated coconut is currently manufactured domestically, with little prospect for additional demand.

1/ Hicks, op cit, p. 189. Total value of output is the sum of the value of exports and the wholesale value of domestically consumed coconut oil.

Furthermore, if the entire copra exports of 1969 had been in the form of coconut oil and copra meal, the value added by this manufacturing process would have been only $11,000,000 or four percent greater than actual value of exports.

The distribution of value added by the market sector was previously reported to be about 20 percent.[2/] However, a comparison of implicit copra prices at the farm level and export levels indicates that the marketing sector contributes approximately 28 percent of the value for each ton of copra exported.

The coconut industry has also contributed materially to the Philippine National Treasury in the form of franchises, tariffs, assessments and taxes. Intentionally or unintentionally the government has managed to drain off or squeeze out "surpluses" that have existed in the industry. A considerable portion of the revenue extracted from the coconut industry was not used for developmental purposes. However, the amount provided by the industry is creditable.

The initial contribution was in 1780 when the Spanish Government initiated "Toddy Franchises". The franchises permitted a legal monopoly for tuba sales within specific geographic areas. Most of Central Luzon was covered by franchises which initially sold for $45,200.[3/] By 1809, government net proceeds were $221,426 from franchise sales.

Coconuts and coconut products have not been directly taxed by the Philippine Government. However, a processing tax was levied in the

2/ Hicks, op cit

3/ Thomas de Comyn, State of the Philippine Island, 1820.

United States which was returned to the Philippines. Section 602 1/2 of the 1934 U.S. Internal Revenue Act, imposed upon the first domestic processing of coconut oil, a tax of three cents per pound, payable by the processor. Taxes paid on the processing of copra originating from the Philippines were placed in a special account for the Philippines. Interest was paid on the balance of the account at the rate of two percent per annum. Section 6 of the 1939 Internal Revenue Act provided for the continued collection but reduced the interest rate to one percent.

The Philippine Government could withdraw from the account on 90 day written notice. Withdrawals are indicated in table 35.

Table 35: Philippine Withdrawals from the Processing Tax Account

Year	Amount
1939	$ 32,000,000.00
1940	10,000,000.00
1941	20,000,000.00
1942	14,000,000.00
1943	--
1944	1,247,329.41
1945	20,206,676.90
1946	35,000,000.00
Balance	2,459,208.82
Total Available	$134,913,215.13

Source: Annual Report of the Secretary of the Treasury on the State of the Finances, for the fiscal year, June 30, 1946

Therefore, the coconut industry indirectly contributed approximately $135 million to the Philippine Government. The proceeds from the processing tax were prohibited from use in the coconut industry. Section 602 1/2 of the 1934 Revenue Act stated "...all taxes collected ... with respect to coconut oil wholly of Philippine production...shall be paid into the Treasury of the Philippine Islands, but if at any time the Philippine Government provides by any law for any subsidy to be paid to the producers of copra, coconut oil, or allied products, no further payment to the Philippine Treasury shall be made...".

The Philippine Trade Act (U.S. P.L. 79-371) eliminated the refunding of the processing tax, but it continued to be imposed.

Section 13 of Republic Act 1145, provided for the funding of the Philippine Coconut Administration. It levied a fee of ten centavos for every 100 kilograms of desiccated coconut, coconut oil, and copra produced and/or exported. The fees were to be paid by the desiccating factory, the oil mill, or copra exporter as applicable. The proceeds of this levy was to accrue to a "Coconut Development Fund".

With the enactment of the Moisture Meter Act (R.A. 1410) an additional fee of five centavos per 100 kilograms of copra was levied on the first domestic purchase of copra. This fee was to be paid by the purchaser and was to be used for supervising moisture testing.

PHILCOA collections of export fees and moisture meter fees have been substantial, as is indicated in table 36. Over the 12 years which PHILCOA has existed, approximately 22 million pesos have been collected.

In addition to the previously mentioned schemes of revenue derivation, the industry has contributed substantial tax revenue. Precise

Table 35: PHILCOA Income by Source

Year	Export fees	Moisture meter fees	Other	Total
		(pesos)		
1954/55	761,973	- - -	12,172	774,145
1955/56	1,351,241	- - -	41,847	1,393,088
1956/57	1,383,727	253,240	64,775	1,701,742
1957/58	1,251,441	548,551	13,483	1,813,475
1958/59	1,013,073	447,978	12,525	1,473,576
1959/60	1,141,407	538,086	12,003	1,691,496
1960/61	1,104,295	520,534	23,606	1,636,432
1961/62	- - -	- - -	- -	1,706,693
1962/63	1,722,035	463,311	59,155	2,244,501
1963/64	1,546,138	780,166	15,486	2,341,790
1964/65	1,462,861	746,397	14,110	2,223,368
1965/66	1,760,635	1,042,758	14,501	2,817,894
Grand Total				21,828,200

Source: PHILCOA Annual Reports, 1957/58 - 1965/66

measures of taxes are unavailable and relative measures are unavailable for post-war years.

For 1936, Houston reports that over 75 percent of the taxes in Quezon Province came from assessments on coconut lands.[4/] Furthermore, between 50 and 75 percent of the total tax revenue in the provinces of Laguna, Marinduque, Masbate, Misamis Oriental, Romblon, and Zamboanga came from assessments on coconut land. Coconut land assessment in ten

4/ Charles O. Houston, Jr., "The Philippine Coconut Industry - 1934-1950," Journal of East Asiatic Studies, University of Manila, Vol. III, No. 2, January 1954.

other coconut producing provinces contributed from 15 to 50 percent of the total tax revenue.

No doubt the ratio of taxes derived from the coconut industry has declined since 1936. However, the above data indicate the magnitude of the contribution of coconuts to various levels of the economy.

The coconut industry has also subsidized Philippine import industries. Prior to devaluation, the controlled exchange rate of the peso was considerably above the equilibrium price. The validity of this is evidenced by the flourishing "black market" for dollars prior to devaluation. The difference between the equilibrium and controlled exchange was passed on to importers who purchased the foreign exchange at a rate much lower than its equilibrium price.

The amount of subsidy per dollar is indicated in table 37. The equilibrium price is assumed to be reflected in the price of pesos on the Hong Kong market. The difference between the controlled selling rate and the Hong Kong rate reflects the size of the subsidy. This difference multiplied by the amount of foreign exchange earned by coconut product exports reflects the magnitude of the subsidy paid by the coconut industry. Since 1950 this subsidy has amounted to approximately ₱ 1,294,000.[5/]

In addition to the subsidy, the difference between the buying and selling price of foreign exchange represents an export tax.[6/] The

5/ Free market exchange rates were not available for 1950 and 1951. Therefore the free market rate was assumed to be the same as the selling rate for dollars.

6/ Inasmuch as the buying rate reflects the export rate of exchange and the selling price represents the rate of exchange for imports.

Table 37: Exchange Rates, Philippine Pesos per Dollar

Year	Free[1/] market rate	Official[2/] selling rate	Official[3/] buying rate	Subsidy column (3) - (2)	Tax column (4) - (3)
(1)	(2)	(3)	(4)	(5)	(6)
1950	N.A.	2.02	2.01	.00	.01
1951	N.A.	2.36	2.01	.00	.35
1952	2.81	2.36	2.01	.45	.35
1953	2.85	2.36	2.01	.49	.35
1954	2.97	2.36	2.01	.61	.35
1955	2.99	2.36	2.01	.63	.35
1956	3.24	2.02	2.01	1.22	.01
1957	3.44	2.02	2.01	1.42	.01
1958	3.38	2.02	2.01	1.36	.01
1959	3.52	2.52	2.01	1.00	.52
1960	3.60	3.60	2.50	.00	1.10
1961	3.84	3.45	2.75	.39	.70
1962	3.92	3.92	3.51	.00	.41
1963	3.93	3.91	3.51	.02	.40
1964	3.91	3.91	3.51	.00	.40
1965	4.00	3.92	3.88	.08	.04
1966	3.91	3.91	3.89	.00	.02

Sources: 1/ Pick, Frank, Pick's Currency Yearbook, Pick Publishing Corp., 1961 and 1967.
2/ United Nations, Monthly Bulletin of Statistics.
3/ International Monetary Fund, International Monetary Statistics.

disparity between the buying and selling price has been somewhat less than that between the official selling rate and the free market rate. From 1950 through 1966 an implicit export tax of approximately ₱ 942,000 was collected on coconut products.

The coconut industry has also made major contributions to foreign exchange earnings during this century. Prior to World War II, approximately 25 percent of the Philippines' foreign exchange was contributed by coconut product exports. The proportion increased to about 38 percent for the post-war period. The annual official post-war contribution to foreign exchange earnings has ranged from 70 percent in 1947 to 25 percent in 1961. However, it was mentioned earlier that smuggling was particularly bad in 1961 and 1962, consequently the actual dollar earnings were greater than the recorded statistics indicate.

Since 1900 the Philippines has earned $13.6 billion in foreign exchange. Coconut products have contributed $4.6 billion or about one-third of the total.

Just as the acquisition of foreign exchange is a process of development, so is the extraction of capital from the agricultural sector. The method of extraction, whether by direct taxation, export taxes, franchises, or assessments, is not particularly important. The coconut industry has contributed more to this capital formation process than any other agricultural commodity. If capital extraction is to continue, efforts must be made toward alleviating some of the industry's problems.

Policy Implications

The problems and their solutions, as seen by the Philippine government, are reflected in public policy pertaining to the industry. The following paragraphs mention some of the goals of past policy. Policies related to the development of the coconut industry are also discussed.

Some attempts have been made to improve the quality of copra. The Moisture Meter Law was partially designed for this end. There is no

doubt that some of the larger plantations produce copra of superior quality to that produced by many of the small holders. But, there is an economic incentive for the large plantation operator to produce a quality product. Part of this incentive is provided by a size economy. The small producers, who do not have a continuous flow of coconuts for copra manufacture, may not be able to afford adequate drying and storage facilities as they would frequently lie idle. The large producers, having a continuous flow of coconuts, would make continuous use of the copra producing facilities.

Furthermore the market structure at the lower levels prevent any real price differential on a quality basis. A plantation owner can deliver a sizeable quantity, five or ten tons, of copra to the exporter's warehouse. The exporter can determine the quality from a small sample and a quality price differential can be allocated. However, at the lower levels, inadequate storage space prevents the separation of the various copra qualities. Consequently when a barrio or town buyer sells his copra he will be paid a single price applicable to the entire lot. Inasmuch as the barrio buyer will be paid on this basis, he will also buy on this basis. The barrio buyer purchases copra in quantities of 500 kilograms or less and quality differentiation is impractical. Consequently, it is impractical for the smallholder to produce high quality copra.

This phenomenon raises the question of why more private individuals have not operated copra manufacturing stations. The situation of small farmers selling nuts to a "central" where copra can be manufactured on an economic scale and with a certain amount of expertise is common in

Ceylon. This situation also exists in the Philippines but its practice is quite limited. The addition and effective utilization of such an institution could eliminate the barrio buyer from the market structure.

The intent of Commonwealth Act 518 was copra quality improvement and increased market efficiency, similar to that mentioned above. Its implementation was not effective; however, its purpose was admirable.

The past official policy relating to marketing appears to have been based on an "exploitative middleman" philosophy. One would be naive indeed to assume economic exploitation does not occur. However, as mentioned in Chapter VI, much of the marketing margin can be attributed to the transportation cost.

One of the activities, which could contribute greatly to development in general and at the same time assist the coconut industry, is the development of transportation networks. The effects of an improved transportation network are many. It would lower the marketing margin by lowering transportation costs. It may also increase the competition for farm copra further lowering the margin and hence increase the farm price. This may encourage the expansion of plantings and could conceivably increase productivity.

Considerable attention and legislation has been directed toward by-product development and industrialization. The coconut does have a multitude of uses. However, the primary "waste" is the fibrous husk. Considerable attention and money has been devoted to the development of coir fiber products. The potential for success in such a venture is rather limited. Competing on the fiber market with other natural and artificial fibers, usually superior to coir, is a courageous but

unprofitable undertaking, as measured by failures in coir manufacturing attempts. It would appear more logical to fully develop the potential of the primary products before devoting resources to by-product development.

A small amount of resources have been devoted toward determining the cause of the "cadang-cadang" disease. This has been a worthwhile effort. However, it would appear logical to devote similar resources toward containing the disease. The incidence of unaffected coconuts surrounded by cadang-cadang infestations suggests that it can be contained. Prevention would be preferable to curing.

A small amount of resources have also been directed toward improving the technology of coconut oil extraction. The design of this research has been to devise a method of extracting oil from fresh coconut meat. Its success would permit the elimination of the time consuming process of copra manufacture. Inasmuch as the copra manufacturing process is the point the quality factor is introduced, if it was by-passed, quality would be assured. Lastly, the introduction of an economical extraction process such as this would provide the Philippines with an advantage in oil extraction, facilitating the exportation of oil instead of copra. While no significant results have yet developed, this research is probably the most progressive that has recently been undertaken.

There has been no concentrated effort toward increasing productivity. The activities of the Ceylon Coconut Research Institute (CRI) are worth reviewing in this regard. The CRI is devoted to improving productivity, genetically and agronomically. They have a continuing program on fertilization, plant spacing, planting design, other manage-

ment practices, and experiments in increasing income from the land. Additional work on micro-nutrient requirements and plant breeding has been in progress. The breeding work has been concerned with greater productivity, shorter trees, resistance to nut drop as well as other genetic characteristics. Recent success has been shown in a coconut cross which produces 150 nuts per tree, or about 6000 nuts per acre (equivalent to 15,000 nuts per hectare).

Work devoted toward genetic improvement requires a lengthy time period before results are apparent. Even agronomic research may require two or more years work before significant results are obtained. Consequently, success is difficult to measure and initially, expenditures on such research are difficult to justify. However, for a long term perspective this type of research is necessary if the coconut industry is to remain viable.

The need for such research is not immediately apparent as the average yield in the Philippines has increased without the benefits of such research. However, a number of the early writers on the subject of coconut production indicated that maximum productivity ranged from 200 to 300 nuts per tree. (Indeed, photoplates of coconut trees exist, on which 200 plus nuts can be counted.) Currently, maximum productivity is assumed to be about 125 nuts per tree. Thus, the need for breeding research becomes more apparent.

The Philippines has frequently lamented the technological innovation that has permitted petroleum derivatives and other synthetics to replace coconut oil. However, the replacement is a combination of technological stagnation in the coconut industry and dynamic technology in the chemical

industry. A cost reduction technology is necessary for the coconut industry, and the most effective form would probably be yield expansion.

The Philippines has made previous attempts to reduce tariffs in the importing countries. These attempts have not met with great success except for obtaining tariff-free quotas in the United States market. Persuading the United States to eliminate the import duty on coconut oil may be possible, if convinced that coconut oil doesn't compete with domestically produced oils. However, elimination of the duty could not be expected unilaterally, as reciprocal action would be expected.

Eliminating tariffs on imports of coconut oil into Europe would be a more difficult task, even though coconut oil may not compete directly with domestically produced oils. Europe is a deficit area of oilseed meal-protein concentrates for livestock feed. Inasmuch as the area needs both the oil and oilseed meal, it is to their advantage to import the oilseeds and extract the oil locally.

It may be useful to review actively pursued policies of other coconut producing countries. These policies are not recommendations for the Philippines, but are merely solutions to problems as viewed by the respective governments.

Malaysia has a Coconut Rehabilitation Scheme which subsidizes rehabilitation. Its purpose is production expansion through increased productivity not area expansion. The subsidation is considered only in areas where the probability of successful rehabilitation is good, such as only on drained land. The subsidy is in materials such as fertilizer and planting materials, not cash. A certain amount of direction is implemented and intercropping is required. Eventually, marketing

facilities will be added to the activities of the Scheme. The Scheme was initiated in 1963, consequently its effectiveness cannot yet be evaluated.

In addition to activities of the Coconut Research Institute, Ceylon has implemented other policies directed toward domestic industry problems. Fertilizer for coconuts is subsidized 50 percent for small holders (20 acres or less) and 33 percent for largeholders.

Marketing efficiency, per se, has not been of concern in Ceylon. Instead policy has been directed toward the insuring of maximum competition, and assuming competition will narrow the marketing margin and offer the farmer the highest price.

Competition is forced at the top level by requiring all copra, that is exported, to be purchased through the Ceylon Coconut Board Auction. All coconut oil exported must have been extracted from copra, purchased through the Auction. Anyone, farmer or dealer, having copra for sale may register with the Auction Board and sell the copra through its facility. Daily auctions are conducted, attended by copra and coconut oil exporters.

Summary

Philippine policy should be directed toward the central problem of the coconut industry. The main problem is not one of low prices and exploitation but is a problem of inefficiency and high cost. The potential for cost reduction appears to rest in three or four areas.

Policies aimed at higher productivity, not the symptoms of low productivity, should be encouraged. To accomplish and sustain greater .

productivity, long term as well as short term research is required. Varietal improvement work and farm management research appears to be necessary.

Improving the quality of copra appears to be a price increasing factor rather than a cost decreasing factor at the farm level. However, the quantity and quality of the oil in the copra is the pricing factor. Improving the quality may raise the copra price but it acts by lowering the cost of obtaining a given quantity of quality oil. Improving quality cannot be accomplished by legislative decree, but an economic incentive must be established to make quality improvement both possible and profitable. Specific recommendations for this objective are difficult to construct. But, for a predominantly smallholder sector an addition or replacement of an institution in the market structure should be considered.

The marketing and transportation system is where improvement would produce more immediate results. Inadequate transportation networks limit the physical accessability to some areas. If this barrier was alleviated, the results could be both cost reducing and quality improvement. Aside from the obvious reduction in transportation cost, competition may increase. Furthermore, if copra could be transported immediately, the quality would not deterioriate in local storage.

The final area of cost reduction appears to be in oil extraction. Limited resources have been used to develop a process of extracting coconut oil directly from the fresh coconut meat. This technique has not yet proven to be commercially feasible. However, research for a more efficient process should certainly continue.

CHAPTER X

SUMMARY, PROJECTIONS, AND CONCLUSIONS

Summary

Coconuts have long been an important crop in the underdeveloped tropics. The multiple uses of the coconut have made it an ideal subsistence crop. Coconuts have gradually evolved into a commercial crop for food, drink, fiber, and finally oil.

The Philippine coconut industry does not fit either of the stereotypes of agriculture in developing economies. It is not a "subsistence" or "traditional" agriculture, neither is it an "estate" or "enclave" agriculture. Instead it bridges the two types by being a small holder, commercial agriculture.

Commercial importance of coconuts in the Philippine economy is limited to the twentieth century. Production has expanded at a relatively constant rate of five percent per year since 1910, and value of production has increased by 10 percent annually.

The growth in exports has also averaged above five percent annually. However, the growth rate has declined in recent years to 3.7 percent. Export value has increased at the rate of 4.5 percent since 1950. The contribution to the export value by the four coconut products for 1966 was: copra, 60 percent; coconut oil, 25 percent; desiccated coconut, 10 percent; and copra meal, five percent. In the last five years

coconut oil exports have increased at the expense of copra exports.

The increase in coconut production and exports is somewhat surprising, considering the adverse price changes copra has experienced relative to other domestically produced crops. From 1912-14 to 1966, the price of copra tripled while the price of corn and palay increased six-fold. The domestic sugar price increased about five-fold over the same time period.

Most of the recent expansion in coconut production has occurred in the frontier areas, primarily Mindanao. Most of this expansion is occurring on plantations of 50 or more hectares. Inasmuch as productivity is higher in Mindanao and also higher on the larger plantations, one effect of the new plantings is an increase in average productivity.

A farm survey disclosed that very few cash inputs were used in coconut production, aside from labor. Intercropping was widely practiced throughout the coconut area. Cover cropping and grazing livestock on the plantation was common on the larger holdings.

A budgeting analysis indicated that coconuts were profitable at average production levels. Well-managed plantations may make a net profit of over ₱1,000 per hectare under price conditions prevailing in 1965.

A statistical supply analysis was performed on the response of tree plantings to price changes, since 1953. The analysis covered the six census regions which are major coconut producing areas. Price elasticity coefficients were estimated by a distributed lag function. The elasticities ranged from .15 in the two oldest production areas to .62 in the two newest and most rapidly expanding areas. The elasticity estimate for the entire country was .30.

Yield functions were also estimated in which yield was expressed as a function of typhoons and rainfall during the dry season. Generally, the rainfall coefficients were not significantly different from zero. However, a destructive typhoon was estimated to cause a yield reduction of about 18 percent.

The market structure within the coconut industry displays an oligopsony framework at the last domestic buyer level. The oligopsony is not by firm but by product use. Price leadership is practiced by coconut desiccators and oil extractors. However, within the copra marketing structure, competitive forces prevail. Vertical integration in the form of physical ownership of market facilities at various levels does not exist. However, several marketing firms extend credit, tied to the delivery of copra, thus having the same effect as a vertically integrated structure.

Prices at the various marketing levels are highly correlated and a price change at the export level is quickly reflected in the farm price. The marketing margin between the farm and export levels is about 27 percent of the export price.

The post-war demand for lauric oils was derived for the United States and European markets. Coconut oil is the major component of the lauric oil group. Thus, coconut oil price was used in the analysis. Lauric oil demand was found to be quite price inelastic in both markets. Price elasticities of -.22 and -.53 were obtained for the United States and Europe, respectively. These coefficients were obtained using actual price data and a per capita demand basis. The respective income elasticities were 0.37 and 0.20. A matrix of correlation

coefficients for soybean, groundnut, and coconut oil prices suggests that coconut oil does not substitute for the other oils at the prices prevailing in 1953-1966.

Using the above coefficients to project demand and assuming "ceterus paribus" conditions may be misleading as some uses of coconut oil are being replaced by other oils.

The domestic demand for coconut oil was also estimated. The price elasticity of -.09 was even more inelastic than the elasticty coefficients of the United States and Europe. The coefficient was influenced by currency devaluation over the last six years, which influenced domestic price but did not affect the international price. The income elasticity was also estimated and found to be .58.

In the international market structure, the number of importers, exporters, and users of coconut oil is small. However, competition appears to prevail. The world price of copra has fluctuated substantially, primarily in response to its availability. The Philippine export price has traditionally been about 86 percent of the import prices of coconut oil and copra into the United States and Europe. This proportion has existed during periods of both high and low prices.

A number of policies have been directed specifically toward coconut products and several other policies have affected coconuts. These policies are both domestic and "other government".

Internationally, tariff policies have had the greatest effect on the export of coconut products. Tariffs discriminate against coconut oil, making copra the economic choice for importation. The tariff-free quota established under the United States-Philippine Trade Act provides an exception to oil tariffs.

Ocean freight rates, until recently, also discriminated against coconut oil shipments. The cost of oil freight was twice the cost of an equivalent amount of copra.

The domestic policy which has had the greatest impact on the industry was devaluation which occurred in five steps over a six-year period commencing in 1960. The effect of devaluation was to essentially double the peso price of export products.

Considerable domestic legislation has been enacted, directed toward the coconut industry. Most of this legislation has had little direct effect on the industry except to extract taxes and assessments.

The coconut industry has contributed a great deal to the Philippine economy in terms of employment, income and foreign exchange earnings. In addition, the industry has provided substantial sums to the capital formation process in the form of the taxes and assessments mentioned above. Since 1954, the industry has contributed approximately 1500 million to the government, in addition to regular land and income tax.

The industry has expanded ten-fold in terms of hectarage, production, and exports since 1910. Value of production and exports expanded twenty-fold over the same time span. Despite this expansion the industry has not developed in terms of efficiency. To continue to be an influential force in the fats and oils sector, the industry must become more efficient. The price of coconut oil is quite high, relative to other oils and considerable incentive exists to replace it with synthetics. Therefore, policy directed toward cost reduction appears imperative.

Projections

No attempt was made to analyze the world's supply of lauric oil or coconut oil. The magnitude of such a study was beyond the scope of this thesis. However, to evaluate the relative position of the Philippines in the lauric oil industry, a comparison of growth rates was undertaken. Growth rates were estimated from 1952 to 1966. (Data used in the computation of these growth rates are found in the appendix.)

The annual growth in world exports of lauric oil has averaged 0.9 percent since 1952. The positive growth rate is attributable wholly to coconut oil exports which increased at the rate of 1.2 percent annually. The other major component of lauric oils, palm kernel oil, declined at the rate of 0.44 percent. A growth rate for babassu oil, the minor lauric, was not estimated as frequently there are no recorded exports.

Of the major coconut product exporting countries, the Philippines is the only country which has contributed to the increasing exports. Computed on an oil equivalent basis, the Philippines' exports have increased at the annual rate of 3.7 percent since 1952. Exports of Ceylon, Malaysia, and Indonesia have been declining at the annual rate of -0.22 percent, -5.3 percent, and -7.7 percent respectively.

The South Sea Islands of Oceania, while individually of minor importance, are collectively of major importance.[1/] Exports from Oceania have increased at the annual rate of 0.20 percent.

1/ Oceania is composed of the following island groups: Solomons, Cooks, Fiji, French Polynesia, Gilberts, Ellice, Samoa, New Caledonia, New Guinea, New Hebrides, Papua, and Tonga.

From the growth rates it appears that the Philippines is contributing essentially all of the growth in world exports of coconut products. If present trends continue, the Philippines will supply an even greater share of the world's indigenous exports. It becomes quite important to determine if the trends are likely to continue or reverse. A limited amount of knowledge is available for making projections, but it appears the trends will continue for the foreseeable future.

Making assumptions about future exports from Ceylon is the most difficult, as any increase will have to come from increased productivity. In turn, improved productivity depends almost exclusively on the success of the CRI in breeding new varieties and disseminating them. There are two time consuming problems. First is the successful breeding of a high yielding palm. Second is the multiplication of seedlings. A high yielding variety has been developed, but it will be several years before it is commercially bearing.

For the immediate future, Ceylonese exports could be expected to decline at about the same rate as in the past. Population increase will continue to create a greater domestic demand, and climatic and topographic conditions prohibit much expansion in area planted.

Malaysian exports of the coconut products will probably continue to decline as they have in the past. However, Malaysian exports of lauric oils will be buffered by increasing exports of palm kernals.

There has been and probably will continue to be a shift in production away from coconut palm to oil palm and rubber, both of which are reputed to be more profitable than coconut with present yield levels. There is substantial economy of size associated with oil palm production

and oil processing. However, much of the coconut land is in large estates which do not encounter the size problem. In addition the Federal Land Development Authority has emphasized rubber and oil palm on the smallholder development projects. These schemes are developed on contiguous land areas permitting operation and scheduling much like an estate operation.

If palm oil were added to the oil exports statistics, an increasing trend would be indicated. But, since palm oil is not a lauric oil it was excluded from the analysis.

The data which indicated Indonesian exports were declining at the annual rate of 7.7 percent were official data. It was impossible to obtain an estimate of unrecorded exports since copra that is smuggled out, is also smuggled into the recipient country. The actual exports have probably not declined at the rate estimated because of the smuggling factor.

Nonetheless, there is no evidence that a reversal in the trend will occur. Increased population pressure will increase domestic demand and the multiple foreign exchange rate policy will make it more profitable to sell on the domestic market. The rather chaotic politico-economic situation also retards or removes the initiative to increase export production as there is no assurance it will be exported.

No first-hand knowledge is available on which to base a judgment on copra exports from Oceania.

The foregoing are merely projections based on the past 15 years. If prices change drastically from previous levels it would be expected to influence exports and could accelerate or reverse the trends.

Based on the assumptions of static conditions, the outlook for the Philippines is bright. The Philippines is the only major coconut producer which is increasing exports. This fact coupled with the assumption of an increasing demand creates speculation as to whether the Philippines can meet the challenge.

Conclusions

The conclusions which follow are based on the research contained in this thesis and to some extent on the judgment of the author. Certain recommendations for public investment in the coconut industry are implicit in the conclusions. However, it should be clearly understood that there is a larger, unanswered question with respect to the allocation of limited public resources to many competing uses. No judgment is made in these conclusions as to whether the returns from a given investment in the coconut industry would be larger or smaller than from the same investment in another sector of the Philippine economy. Rather, if investment is to be made in the coconut industry, then the following conclusions should be considered.

The study led to three major conclusions related to the general components of marketing, supply, and demand.

Certain internal inefficiencies exist in the domestic market structure. The copra price margin between the average farm and average port is twice as great as the margin between Philippine ports and United States or European ports. The high cost of transportation coupled with what is probably an excessive number of marketing firms contributes materially to the large margin.

The establishment of efficient transportation networks would be a considerable asset to copra marketing. Water transportation in the Islands is relatively inexpensive and efficient. However, interior waterways to not abound and all-weather, hard-surface roadways are badly needed.

The marketing system has also failed to provide incentives for the manufacture of superior quality copra. The magnitude of production by individual small holders is inadequate to economically maintain high quality standards. Therefore, provision should be made to physically permit the economical manufacture of superior quality copra. Consideration should be given to the establishment of copra manufacturing stations where quality control could be exercised and size economy might exist.

The influence of increased copra supply is an important question for the Philippines. The shift in new plantings and production to more productive regions of Mindanao, and to large, well-managed plantations, suggests that supply can and will be increased substantially in the near future. New plantings, stimulated by devaluation, will soon add to available supply. However, the amount of additional land that can be brought under coconut cultivation is limited.

Notwithstanding the shift to larger plantations, for the immediate future, small holders will supply the bulk of the copra. Furthermore, the older coconut production areas will remain . as no suitable alternatives exist. Therefore, increased productivity is necessary to increase the income of individual coconut producers. The use of adapted intercrops may supplement income by utilizing land more efficiently.

The public sector would have to assume the responsibility for increasing productivity. An extension function designed to disseminate existing knowledge and to assist its implementation needs to be adopted. For a long-term perspective, research is required to increase the coconut's genetic production capacity.

Under the assumption that individual coconut producers face a perfectly elastic demand for their copra a productivity increase would result in increased income. But assuming the industry demand is inelastic, a supply increase would depress prices and lower total revenue would result. Consequently, the shape of the demand function, demand shifts and potential shifts require consideration.

A past preoccupation with price per se has led to disregard of the economic factors influencing price. To successfully direct and develop an industry, the uses and demand of the commodity require evaluation. Neither the short-run nor long-run implications of the shape of and shift in the demand function have been considered.

Market demand has been increasing annually and the quantity supplied has gradually increased. But, the increase has primarily resulted from a movement along the supply function rather than a shift of the supply curve. The effect has been to increase price in the short-run, but the probable long-run effect of higher prices could be the curtailment of demand expansion and possibly a reduction in demand.

Industrial chemical research, currently underway, will probably prevent demand from expanding as rapidly in the future as it has in the immediate past. Coconut oil as an industrial oil may well be replaced by alternatives because of its relatively high price. Unless the price

of coconut oil becomes more competitive with other oils, its replacement in some uses is likely. Future uses of coconut oil will probably be in the edible field, except for toilet soap. Currently, the expanding uses are in speciality foods such as confections and filled milk.

When the demand curve is inelastic and demand is expanding it appears economically irrational to consciously shift the supply function at a more rapid rate than the shift of the demand function. Under such conditions, not only would price decline but total revenue would also be reduced. However, as mentioned above, the high price of coconut oil probably affects demand adversely by stimulating the development of substitutes. Thus, a hypothesis is that two different demand elasticities exist, relatively price inelastic in the short run but probably more elastic in the long run. Given a price inelastic short-run demand, a positive shift of the supply curve initially results in lower prices, larger quantities, and less revenue. But the hypothesized elastic long-run demand may later result in an increase in prices and revenue. Alternatively, a static supply curve with implied high prices may stimulate substitution and the long-run effect may be lower prices and less revenue.

For long-term survival, a reduction in price appears necessary to prevent the elimination of some uses of coconut oil and the consequent decline in demand. Thus, greater productivity is imperative for adequate farm incomes and sustained production. The alternative may be the elimination of the industry.

APPENDIX A

Statistical Techniques, Custom Ports and Census Regions

The Addition Theorem for Analysis of Variance

The addition theorem for analysis of variance states that if the variance (mean square) of all the sources of variation is multiplied by its respective degrees of freedom and the resulting products (sums of squares) are summed, the value obtained will equal the variance (mean square) of the entire sample or population, multiplied by its degrees of freedom. (Computationally the mean square is obtained by dividing the sum of squares by the degrees of freedom.) Thus the sum of the component sums of squares will equal the total sum of squares. This characteristic normally permits the sum of squares for "interaction" or "error" sources to be computed indirectly by subtraction rather than by direct computation.

However, this theorem does not hold in analyses of variance which have disproportionate subclass numbers. Under such conditions the sum of the sums of squares of the various components, will be greater than the sum of squares for the entire sample. Thus the sum of squares must be computed for each individual component or source of variation.

The Scheffé Test Statistic

The test statistic adopted to determine significant differences between means was developed by Scheffé, and is known as the Scheffé procedure or S-method of testing multiple differences. The S-method as a means for testing multiple comparisons is the least precise of the multiple comparison test procedures. However, it is a valid estimator under conditions or non-orthogonality, heteroscedasticity, non-normality, and unequal sample sizes. The following is an adaptation of the method as described by Scheffé[1] and Guenther.[2]

The statistics required to derive the test statistic are a multiplier obtained from the "F" table and the standard error of the difference between means. The product of the square roots of these statistics is the test statistic, "S". The statistics are defined as:

$$\Lambda^2 = (r - 1)\, F_{1-\alpha;\ (r-1,\ N-r)},$$

$$\sigma_d^2 = MS_e \sum \frac{(c_j)^2}{n_j},$$

and

$$S = \Lambda \times \sigma_d .$$

Where,

r = the number of means which are to be compared,

$(N - r)$ = the degrees of freedom of the error term from the analysis of variance,

α = the probability of a Type I error.

1/ Scheffé, Henry, The Analysis of Variance, New York, Wiley and Sons, Inc., 1959.

2/ Grenther, William C., Analysis of Variance, Englewood Cliffs, N.J., Prentice Hall, Inc., 1964.

The value, $F_{1-\alpha;\ (r-1,\ N-r)}$, is the tabular "F" value for the desired α, with $r - 1$ and $N - r$ degrees of freedom. When multiplied by $r - 1$, A^2 is obtained.

MS_e = the mean square of the error term from the analysis of variance,

c_j = a set of constants, selected in such a manner that $\Sigma c_j = 0$; in this analysis all combinations of two means were compared, and the constants consisted of sets of 1, -1, and 0's.

n_j = the number of observations in the factors "j", whose means are being compared.

The actual differences of the sample means are compared with the "S" statistic. If the difference is greater than "S", the means are assumed to be significantly different. The computed test statistics are in parentheses beneath the mean differences to which they apply in text tables 19 and 20.

The following example, compares the mean plantings of Davao (province 11) and Zamboanga (province 9) plantations.

Since 11 provinces were tested for comparisons, $r = 11$,

$(N - r) = 11640$ (infinity was used in the "F" table)

let $\alpha = .05$

then $F_{1-\alpha;\ (r-1,\ N-r)} = 1.83$

and $A^2 = (10)(1.83) = 18.3$

$\therefore\ A = 4.28$

$MS_e = 489,776$

let $c_9 = 1$ and $c_{11} = -1$, $n_9 = 330$ and $n_{11} = 400$

then $\sum \frac{(1)^2}{330} + \frac{(-1)^2}{400} = 730/132{,}000$

and $\sigma_d^2 = (489{,}776)(730/132{,}000) = 2{,}703$

$\therefore \quad \sigma_d = 52.04$

Consequently, $S = 4.28 \times 52.04 = 222.$

Nerlove's Distributed Lag Model

The distributed lag model used in the supply function is essentially the same as that used by Nerlove.[1/] The only difference in the model used here is in the specification of the price variable. Nerlove derived a long-run supply function from a static expectation model with production plans based on the price of only the immediately preceeding year. The model used here assumes the average price of the two previous years is the relevant base for production plans. Thus, an expected price P_t^* is the relevant price variable and is specified as

$$P_t^* = \frac{P_{t-1} + P_{t-2}}{2} .$$

Inasmuch as this analysis is concerned with a "permanent" crop, logically, consideration would be given to prices of more than just one previous year. Indeed, it could be argued that prices over a three or five year period should be considered. Nerlove states, "There are many forms we might give to a weighting system" and the one which he specifies, "is by no means the only possibility".[2/]

The long-run static expection supply function is $\bar{q}_y = \beta_o + \beta_1 P_t^* + v$, where $P_t^* = \frac{P_{t-1} + P_{t-2}}{2}$. The long run adjustment coefficient is identical to that described by Nerlove, $\gamma = \frac{q_t - q_{t-1}}{\bar{q}_t - q_{t-1}}$ and $\gamma \bar{q} - \gamma q_{t-1} = q_t - q_{t-1}$.

1/ Nerlove, Marc, "Distributed Lags and Estimation of Long-Run Supply and Demand Elasticities: Theoretical Considerations," Journal of Farm Economics, Vol. XL, No. 2, May 1958.

2/ Nerlove, Marc, "Estimates of the Elasticities of Supply of Selected Agricultural Commodities," Journal of Farm Economics, Vol. XXXVIII, No. 2, May 1956.

A supply function, in which all variables are observable, is obtained by substituting the equilibrium function into the adjustment function.

$$\gamma\,(\beta_o + \beta_1 P_1^* + v) - \gamma\, q_{t-1} = q_t - q_{t-1}\,.$$

$$\gamma\,\beta_o + \gamma\,\beta_1 P_1^* + (1 - \gamma)\, q_{t-1} + \gamma\, v = q_t\,.$$

The function which is estimated is

$$q_t = \pi_o + \pi_1 P_t^* + \pi_2\, q_{t-1} + u\,.$$

The specification of the price variable permits the price coefficient to be applicable to both P_{t-1} and P_{t-2}, i.e.

$$q_t = \pi_o + 1/2\, \pi_1 P_{t-1} + 1/2\, \pi_1 P_{t-2} + \pi_2\, q_{t-1} + u.$$

The coefficient for the lagged dependent variable, is defined as $\pi_2 = 1 - \gamma$. Therefore, the adjustment coefficient is $\gamma = 1 - \pi_2$, and the long-run price coefficient is π_1 / γ.

If a relevant variable is omitted from the distributed lag model, then the estimated coefficients may be biased. Consequently, the exclusion of other variables needs to be justified. The supply, which is estimated by the above function, is tree numbers. Technology has not been a relevant factor for plantings. It is unlikely weather has affected plantings, except for the possibility of larger plantings being made following typhoons. In practice, this appears to have not happened. Another potentially relevant variable would be the price of substitute commodities. Corn is a potential substitute crop; however, when a corn price variable was added to the analysis it was not statistically significant. Furthermore, the coefficients of the other variables were not affected by the inclusion of the corn variable.

Customs Ports From Which Copra is Exported

Region I

Manila
Pangi, Marinduque
Boac, Marinduque
Quinabigan, Mindoro Oriental
Romblon, Romblon

Region II

Siain, Quezon
Mauban, Quezon
Castanas, Quezon
Guisguis, Quezon
Hondagua, Quezon
Catanauan, Quezon

Region III

Legaspi, Albay
Bulan, Sorsogon
Tabaco, Albay
Jose Panganiban,
Camarines Norte
Masbate, Masbate

Region IV

Tacloban, Leyte
Borongan, Samar
Calbayog, Samar

Region V

Cebu, Cebu
Jagna, Bohol
Tagbilaran, Bohol
Dumaguete, Negros Oriental
Iloilo, Iloilo

Region VI

Cagayan de Oro, Misamis Oriental
Ozamis City, Misamis Occidental
Plaridel, Misamis Occidental
Medina, Misamis Occidental
Jimenez, Misamis Occidental
Nasipit, Agusan
Surigao, Surigao del Norte

Region VII

Dipolog, Zamboanga del Norte
Zamboanga, Zamboanga del Sur
Basilan, Zamboanga del Sur
Davao, Davao
Mati, Davao
Parang, Cotabato
Jolo, Sulu

Source: Standards Department, PHILCOA

Provinces by Census Region

Ilocos

- Abra
- Batanes
- Ilocos Norte
- Ilocos Sur
- La Union

Cagayan Valley

- Cagayan
- Isabela
- Mountain Province
- Nueva Vizcaya

Central Luzon

- Bataan
- Bulacan
- Nueva Ecija
- Pampanga
- Pangasinan
- Tarlac
- Zambales

Southern Tagalog

- Batangas
- Cavite
- Laguna
- Marinduque
- Mindoro Occidental
- Mindoro Oriental
- Palawan
- Quezon
- Rizal

Bicol

- Albay
- Camarines Norte
- Camarines Sur
- Catanduanes
- Masbate
- Sorsogon

Eastern Visayas

- Bohol
- Cebu
- Leyte
- S. Leyte
- Samar

Western Visayas

- Aklan
- Antique
- Capiz
- Iloilo
- Negros Occidental
- Negros Oriental
- Romblon

N. and E. Mindanao

- Agusan
- Bukidnon
- Lanao del Norte
- Lanao del Sur
- Misamis Occidental
- Misamis Oriental
- Surigao del Norte
- Surigao del Sur

S. and W. Mindanao

- Cotabato
- Davao
- Sulu
- Zamboanga del Norte
- Zamboanga del Sur

APPENDIX B

Statistics on Philippine Coconut Area, Production, and Yield

Table B1: Philippine Coconut Production

Crop Yr. Jul. 1 - Jun. 30	Hectares	Trees		Production		Value of* Production
		Total	Bearing	Nuts	Copra	
		(thousand)		(million)	(MT)	(1000 ₱)
1909-10	164,193	32,839	22,000	937.9	118,141	26,162
1910-11	208,476	41,695	24,129	965.1	118,323	26,261
1911-12	230,682	46,136	28,922	1041.2	174,036	35,926
1912-13	223,212	44,642	24,425	781.6	116,700	30,535
1913-14	245,952	49,190	23,651	591.2	107,383	25,652
1914-15	264,148	52,795	28,861	865.8	171,574	24,462
1915-16	270,769	54,154	29,721	735.2	141,764	24,431
1916-17	301,220	60,244	30,965	880.6	186,511	31,975
1917-18	335,602	67,120	37,173	1398.0	346,657	56,534
1918-19	373,251	73,720	41,197	1450.0	349,384	75,438
1919-20	397,030	79,406	43,585	1509.5	361,605	128,196
1920-21	417,959	83,592	46,459	1547.6	374,622	76,192
1921-22	444,570	84,536	49,379	1467.7	366,809	55,267
1922-23	456,440	86,707	49,809	1515.2	368,130	64,366
1923-24	460,440	87,460	51,154	1576.6	387,036	68,134
1924-25	472,050	89,637	53,166	1584.5	362,220	71,848
1925-26	485,030	91,909	54,650	1627.4	365,629	81,369
1926-27	500,010	94,877	58,414	1800.0	410,160	81,986
1927-28	515,510	98,056	61,068	1906.8	432,663	85,408
1928-29	531,040	101,527	65,083	2155.5	480,191	89,093
1929-30	550,840	105,269	68,734	2056.7	460,130	76,263
1930-31	561,450	107,089	69,634	1869.0	419,636	45,636
1931-32	566,100	107,926	71,542	1943.8	406,188	33,485
1932-33	600,700	114,054	73,375	2142.4	472,537	29,040
1933-34	608,200	115,339	74,372	2114.4	475,239	27,146
1934-35	617,890	116,986	85,785	2874.0	539,696	45,485
1935-36	631,980	119,555	88,356	3146.9	650,894	61,975
1936-37	637,950	120,695	90,360	2982.8	521,885	83,326
1937-38	634,110	121,685	91,179	3450.1	697,776	92,126
1938-39	1,051,214	139,209	84,064	2303.1	504,392	28,013

Table B1: Philippine Coconut Production (cont'd)

Crop Yr. Jul. 1 - Jun. 30	Hectares	Trees Total	Trees Bearing	Production Nuts	Production Copra	Value of* Production
		(thousand)		(million)	(MT)	(1000 ₱)
1945-46	960,000	128,093	98,836	917.0		22,744
1946-47	960,000	142,405	109,880	4565.0		233,872
1947-48	960,000	137,133	105,812	4138.3	882,780	282,592
1948-49	965,500	137,454	106,060	3590.9	698,120	262,967
1949-50	985,000	138,122	106,575	3997.5	780,111	260,757
1950-51	987,000	180,211	139,051	5279.6	1,071,882	307,535
1951-52	987,800	150,689	116,271	3406.2	748,540	184,223
1952-53	989,970	149,296	115,197	4182.0	856,400	246,922
1953-54	990,000	164,300	126,774	4602.9	942,000	211,161
1954-55	990,000	164,350	126,813	5321.4	1,102,900	241,355
1955-56	992,000	164,400	126,851	5504.0	1,140,000	255,494
1956-57	992,000	164,400	126,851	5951.0	1,319,200	299,934
1957-58	995,610	165,000	127,380	5973.6	1,293,400	345,819
1958-59	1,006,100	166,580	128,600	6041.3	1,071,600	276,903
1959-60	1,059,440	167,109	133,759	6015.9	1,075,349	426,933
1960-61	1,199,880	185,032	149,031	6189.7	1,071,000	360,037
1961-62	1,283,740	197,634	167,138	7395.5	1,356,100	486,376
1962-63	1,392,310	211,667	183,356	7704.4	1,488,700	631,580
1963-64	1,482,890	232,135	191,392	7222.1	1,487,200	661,454
1964-65	1,604,740	240,864	185,300	7052.0	1,470,900	685,212
1965-66	1,610,920	244,784	185,174	7089.8	1,484,706	778,014

* farm value of all coconut products

Sources: 1909-10 to 1920-21 Philippine Agricultural Review, Vol. IV, No. 1, 1911; Vol. XIII, No. 1, 1920; Vol. XI, No. 2, 1918; Vol. XIV, No. 2, 1921; Vol. XV, No. 1, 1922.

1921-22 to 1927-28 Philippine Islands, Bureau of Commerce and Industry, Statistical Bulletin of the Philippine Islands, No. 11, 1928.

1928-29 to 1938-39 Philippines (Republic), DANR, BAE, Philippine Agricultural Statistics, Vol. 1, 1954.

1945-46 to 1953-54 _____, NEC, Raw Material Resources, Survey Bulletin, 1957.

1954-55 to 1965-66 _____, DANR, BAE, Crop and Livestock Survey, 1955 - 1966.

Table B2: Coconut Area by Census Region, 1954 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao
			(million hectares)			
1954	256,000	185,000	199,340	97,310	114,970	117,330
1955	256,000	185,000	199,340	97,310	114,970	117,330
1956	256,530	185,370	199,740	97,510	115,200	117,570
1957	256,530	185,370	199,740	97,510	115,200	117,570
1958	257,460	186,050	200,460	97,870	115,620	118,000
1959	250,880	192,940	188,420	95,190	124,620	127,330
1960	262,310	179,130	177,510	105,940	176,370	138,790
1961	285,090	155,590	215,840	119,390	225,670	173,290
1962	282,320	172,160	252,500	123,220	238,390	189,790
1963	277,260	181,080	264,670	125,950	266,180	251,820
1964	277,790	218,280	306,350	124,230	274,590	257,480
1965	273,170	232,190	389,810	127,420	272,300	291,500
1966	274,750	238,500	383,270	125,020	272,170	298,390

Source: Philippines (Republic), DANR, BAE, Crop and Livestock Survey, 1954 - 1966

Table B3: Copra per Bearing Hectare by Region, 1960 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao	Phil.
				(kilograms)			
1960	1887	1221	953	821	1124	1017	1268
1961	1217	1359	761	786	1283	1025	1107
1962	1399	1147	980	1523	1204	1217	1250
1963	1486	1289	795	1824	1135	1199	1234
1964	1549	1593	798	1891	985	1001	1217
1965	1067	1439	1095	1377	850	1623	1192
1966	864	1439	1184	1361	1079	1720	1219

Source: Philippines (Republic), DANR, BAE, Crop and Livestock Survey, 1960 - 1966

Table B4: Coconut Trees by Census Region, 1953 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao
			(thousand trees)			
1953	42,175	27,544	29,053	14,376	16,527	16,479
1954	46,413	30,312	31,973	15,821	18,188	18,136
1955	46,424	30,321	31,982	15,827	18,194	18,142
1956	46,438	30,330	31,992	15,832	18,199	18,148
1957	46,438	30,330	31,992	15,832	18,199	18,148
1958	46,607	30,441	32,109	15,890	18,265	18,214
1959	44,715	32,338	30,257	15,750	19,752	19,872
1960	49,540	31,815	25,338	16,188	25,911	17,910
1961	53,065	27,557	35,252	15,920	29,344	20,214
19622	47,580	24,981	47,993	20,031	30,141	23,137
1963	52,136	25,965	44,207	21,022	33,498	30,778
1964	52,110	38,746	51,196	20,637	33,389	31,929
1965	48,607	39,353	56,684	21,464	32,572	39,296
1966	52,741	40,306	55,801	20,703	38,554	39,685

Source: Philippines (Republic), DANR, BAE, Crop and Livestock Survey, 1954 - 1966

Table B5: Bearing Coconut Trees by Census Region, 1953 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao
			(thousand trees)			
1953	32,542	21,253	22,417	11,093	12,752	12,715
1954	35,813	23,389	24,670	12,208	14,034	13,993
1955	35,821	23,396	24,678	12,212	14,038	13,999
1956	35,831	23,403	24,685	12,216	14,042	14,003
1957	35,832	23,403	24,685	12,216	14,042	14,003
1958	35,962	23,488	24,775	12,260	14,094	14,054
1959	34,502	24,952	23,424	12,153	15,240	15,333
1960	43,494	22,815	18,229	12,693	20,662	14,019
1961	47,489	18,960	24,472	12,801	25,110	17,295
1962	47,553	18,198	35,391	16,555	26,895	19,681
1963	49,426	20,117	35,744	17,848	29,844	26,963
1964	48,475	22,126	41,212	17,561	29,998	28,655
1965	44,618	22,007	42,241	16,712	27,099	30,458
1966	42,469	22,586	41,251	16,684	28,468	31,495

Source: Philippines (Republic), DANR, BAE, Crop and Livestock Survey, 1954 - 1966

Table B6: Coconut Production by Census Region, 1953 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao
			(million nuts)			
1953	1419.1	676.3	672.2	320.5	583.1	449.7
1954	1538.9	756.0	751.4	353.2	633.7	499.3
1955	1779.1	874.1	868.7	414.1	732.6	577.3
1956	1841.4	903.5	898.0	428.0	758.3	596.9
1957	1988.6	978.3	972.4	463.4	819.0	645.8
1958	2002.8	978.4	972.1	463.9	824.7	647.5
1959	2041.5	983.4	972.6	451.0	849.3	640.6
1960	2407.2	860.9	671.4	423.6	965.9	600.6
1961	1822.2	731.5	748.5	422.2	1418.5	866.0
1962	2061.8	728.8	1191.3	821.5	1418.3	1023.6
1963	2011.6	757.8	1037.7	893.7	1311.7	1468.9
1964	1804.5	913.3	937.5	899.1	1157.2	1364.0
1965	1386.3	924.1	1395.1	617.4	945.5	1738.6
1966	1000.1	936.9	1509.8	620.6	1053.7	1891.6

Source: Philippines (Republic), DANR, BAE, Crop and Livestock Survey, 1954 - 1966

Table B7: Value of Coconut Production by Census Region, 1953 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao
			(thousand pesos)			
1953	80,889	41,657	39,277	19,813	33,102	28,286
1954	69,963	35,223	33,238	16,750	23,588	24,022
1955	79,048	40,696	38,307	19,385	32,361	27,594
1956	90,656	37,228	42,163	17,582	33,193	29,491
1957	106,731	43,246	48,628	19,797	40,305	36,370
1958	113,655	59,262	60,309	25,703	44,348	35,955
1959	92,715	41,358	42,005	19,055	46,321	29,918
1960	169,549	63,636	60,212	27,030	74,071	42,116
1961	109,022	45,683	39,139	26,222	79,584	51,429
1962	156,935	43,819	77,924	52,101	79,430	66,905
1963	181,492	71,820	77,553	73,200	99,104	117,616
1964	185,861	92,989	73,949	71,732	95,007	127,482
1965	137,366	93,278	133,308	67,118	86,056	165,240
1966						

Source: Philippines (Republic), DANR, BAE, Crop and Livestock Survey, 1954 - 1966

Table B8: Copra Production by Census Region, 1953 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao
			(metric tons)			
1953	271,628	148,446	147,546	70,224	112,993	95,847
1954	298,778	163,283	162,294	77,243	124,287	105,426
1955	353,713	189,471	188,587	89,441	146,859	122,473
1956	365,611	195,844	194,930	92,449	151,799	126,593
1957	423,080	226,650	225,526	106,970	175,660	146,480
1958	413,273	222,872	221,726	105,278	171,697	144,002
1959	347,511	191,118	182,160	79,668	144,863	113,760
1960	434,215	156,878	121,644	68,194	171,282	110,616
1961	310,691	145,483	114,078	75,480	247,682	151,985
1962	394,718	143,803	182,345	159,532	256,173	196,332
1963	390,602	180,661	170,107	195,034	269,359	264,453
1964	400,221	198,649	196,584	199,673	242,913	231,397
1965	267,682	191,827	318,015	136,570	192,729	371,465
1966	191,299	192,248	335,509	136,989	216,737	406,889

Source: Philippines (Republic), DANR, BAE, Crop and Livestock Survey, 1954 - 1966

Table B9: Value of Copra Production by Census Region, 1953 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao
			(thousand pesos)			
1953	62,527	40,365	37,588	19,139	26,481	26,390
1954	54,193	34,002	31,809	16,191	21,783	22,148
1955	61,698	39,450	36,966	18,749	25,817	25,725
1956	72,771	35,985	40,977	16,876	27,324	27,501
1957	84,209	41,933	47,422	19,055	31,619	34,022
1958	130,238	57,845	58,896	25,030	35,692	33,547
1959	68,659	39,691	38,217	16,226	36,393	25,504
1960	146,073	56,030	41,463	19,635	61,939	38,243
1961	83,836	43,645	31,941	22,644	64,397	41,036
1962	130,257	43,141	58,353	47,859	66,605	62,826
1963	156,240	70,458	61,238	72,162	88,888	95,239
1964	160,334	91,378	70,770	71,882	87,448	104,128
1965	112,426	88,241	133,306	66,919	77,092	159,730
1966	82,258	101,891	187,885	53,426	99,699	203,444

Source: Philippines (Republic), DANR, BAE, Crop and Livestock Survey, 1954 - 1966

APPENDIX C

Statistics on Coconut Product Prices

Table C1: Implicit Export Price of Philippine Copra by Month, 1957 - 1966

Year	Month												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
	(U.S. cents/kilogram)												
1957	13.9	13.7	13.7	13.5	13.5	13.6	13.5	13.9	14.4	14.7	14.5	15.3	14.0
1958	15.8	15.9	16.1	16.5	17.2	16.6	16.8	17.9	17.5	17.5	17.9	19.3	17.1
1959	20.3	21.3	22.5	22.9	23.7	23.1	20.8	18.5	18.6	18.7	19.1	19.8	20.3
1960	19.9	20.7	21.3	20.3	18.3	17.1	16.2	15.8	15.1	14.7	14.4	14.4	17.2
1961	13.7	14.5	13.5	13.5	13.8	13.8	14.1	14.4	14.2	14.3	14.1	14.0	14.1
1962	14.1	14.4	14.3	14.7	14.6	14.3	14.4	14.4	14.3	14.4	14.7	14.5	14.5
1963	15.9	16.0	15.6	15.6	16.0	15.9	15.7	16.0	16.2	17.2	17.0	17.2	16.3
1964	16.7	16.8	16.4	17.0	16.9	17.5	17.8	17.9	17.3	16.9	17.2	16.9	17.2
1965	17.8	18.7	19.7	20.4	21.8	22.9	20.6	18.8	18.8	17.9	18.2	18.6	19.2
1966	18.9	18.8	18.1	17.0	16.5	16.2	16.3	16.3	16.1	16.2	15.3	14.8	16.6

Table C2: United States Import Price of Copra by Month, 1957 - 1966

Year	Month												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
	(U.S. cents/kilogram)												
1957	17.2	16.7	16.5	17.0	17.3	16.6	16.7	17.8	18.2	17.9	18.1	19.6	17.5
1958	20.0	19.8	20.1	20.5	20.5	19.9	20.4	21.1	21.7	22.8	26.7	26.1	21.6
1959	27.1	28.6	28.9	28.9	29.5	27.4	23.7	23.1	25.6	27.2	25.0	25.7	26.7
1960	26.9	26.4	24.9	22.9	21.5	20.2	19.6	19.5	18.1	18.1	19.1	17.4	21.2
1961	17.9	18.5	17.4	17.6	17.6	16.8	17.2	17.3	17.0	16.6	16.8	16.4	17.3
1962	16.5	16.1	16.3	17.2	16.9	16.1	16.6	16.5	16.4	16.9	17.1	18.2	16.7
1963	18.5	17.8	17.8	18.6	18.6	18.2	18.3	18.7	18.7	18.7	20.2	19.9	18.8
1964	19.5	18.7	19.2	19.8	19.9	20.3	20.8	20.0	19.2	19.5	19.9	20.5	19.8
1965	21.3	22.6	23.6	24.9	25.5	24.9	21.9	20.7	20.0	20.9	21.4	20.9	22.4
1966	21.5	20.9	19.2	18.8	17.8	18.1	18.5	18.6	17.8	17.6	17.0	17.5	18.6

Table C3: Copra Prices Received by Farmers, Resecada Basis, 1957 - 1965

Year	Month												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
	(pesos/100 kilograms)												
1957	20.00	20.00	20.00	21.00	21.00	20.00	21.00	22.00	23.00	22.00	23.00	24.00	21.00
1958	24.00	26.00	26.00	26.00	26.00	26.00	25.00	27.00	29.00	30.00	35.00	37.00	28.00
1959	39.31	40.12	41.13	41.95	39.72	35.61	29.61	34.37	34.84	36.44	35.25	35.88	37.02
1960	37.71	36.98	32.81	31.55	31.22	29.87	31.08	30.40	29.15	29.73	30.39	29.48	31.70
1961	30.26	30.69	30.65	30.16	30.36	29.45	29.49	30.15	30.23	29.93	31.08	29.51	30.16
1962	30.49	35.52	36.17	37.40	36.90	37.36	37.43	36.69	36.79	37.01	39.08	39.80	36.72
1963	42.38	42.15	41.39	43.12	42.88	42.78	41.99	43.79	43.63	44.56	44.08	45.02	43.18
1964	44.85	44.01	43.84	44.67	43.58	46.35	44.02	40.40	41.16	41.12	42.04	--	43.28
1965	--	--	--	--	54.56	54.11	49.96	50.50	49.92	52.29	53.36	49.94	51.85
1966													

Source: Philippines (Republic), DANR, BAE, Prices Received and Prices Paid by Farmers, 1957 - 1965

Table C4: Manila Wholesale Price of Copra by Month, 1919 - 1966

Year	Month												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
	(Buen Corriente - pesos/picul)												
1919	14.88	13.06	12.44	13.19	15.09	18.76	23.13	21.88	21.13	21.63	23.93	24.50	18.64
1920	27.48	26.45	24.85	25.05	23.65	18.65	15.98	16.60	17.25	16.58	14.10	12.15	19.90
1921	10.90	9.20	9.50	8.79	9.90	9.39	9.65	9.78	9.79	9.77	9.30	9.85	9.68
1922	9.56	9.18	9.93	9.93	9.96	9.28	9.48	9.58	9.06	9.26	10.17	10.58	9.66
1923	11.14	11.07	11.74	12.44	11.10	10.54	10.19	9.90	10.56	10.75	10.99	11.28	10.98
1924	11.67	11.39	11.35	11.07	10.75	10.49	11.22	11.90	11.65	12.44	12.85	13.22	11.67
1925	13.57	12.29	13.05	12.10	12.20	12.95	13.28	13.07	13.33	13.90	14.27	14.46	13.20
1926	14.39	13.41	14.14	13.38	12.62	13.14	12.42	11.66	11.59	10.82	10.77	10.27	12.39
1927	10.88	11.15	10.97	11.12	11.38	11.65	11.75	11.69	11.62	11.21	11.47	11.60	11.37
1928	11.90	11.95	11.93	11.74	11.87	11.60	10.85	10.74	10.19	10.23	10.59	11.12	11.23
1929	10.85	10.52	10.05	10.10	9.10	8.13	8.76	9.03	8.83	9.19	9.19	9.29	9.45
	(Resecada - pesos/100 kilograms)												
1929	19.12	18.56	17.85	18.00	16.30	14.91	15.45	15.81	15.46	16.10	16.10	16.29	16.66
1930	16.36	15.93	14.92	14.97	15.03	13.97	13.73	13.27	11.96	10.90	11.22	11.13	13.62
1931	9.49	8.51	8.82	9.65	5.45	7.64	7.73	7.25	5.65	5.82	6.87	7.21	7.76
1932	6.87	7.12	7.63	6.98	5.71	5.77	6.14	6.64	6.49	6.24	5.83	5.88	6.44
1933	5.70	5.42	4.88	4.80	5.20	5.45	5.33	5.28	4.81	4.65	4.52	4.27	5.02
1934	4.00	3.92	3.60	3.62	3.45	3.43	3.38	3.97	4.81	5.50	5.17	6.55	4.28
1935	8.60	11.22	11.49	10.87	10.30	8.37	6.61	6.32	7.33	8.66	8.27	8.50	8.80
1936	9.48	8.87	8.75	8.64	7.24	8.82	9.04	10.21	12.70	14.18	14.48	18.72	10.84
1937	21.27	19.17	19.79	17.26	13.83	12.27	10.76	9.42	8.28	8.94	7.91	7.43	13.03
1938	7.90	7.02	6.81	5.51	5.77	5.35	6.09	5.72	5.75	5.52	5.31	5.31	6.01
1939	5.33	5.32	5.69	5.86	6.13	5.93	5.54	5.01	6.72	6.86	6.07	5.87	5.86
1940	5.67	5.30	4.98	4.71	3.78	3.38	3.51	2.84	2.85	3.02	3.17	3.25	2.87
1941	4.23	4.07	5.01	6.36	9.37	7.70	8.78	8.78	8.42	9.90	10.54	10.35	9.80

Table C4: Manila Wholesale Price of Copra by Month, 1919 - 1966 (con't)

Year	Month												Ave.
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
	(Resecada - pesos/100 kilograms)												
1949	36.20	32.80	35.40	32.30	31.90	25.90	26.40	29.60	27.40	29.10	32.90	32.80	31.15
1950	35.25	35.00	36.00	39.00	34.75	30.38	34.00	36.10	40.12	35.38	38.71	37.07	35.98
1951	43.27	49.97	50.63	43.66	37.13	29.79	27.98	29.90	30.73	33.11	29.46	28.32	36.16
1952	27.06	23.73	19.85	18.49	19.58	23.44	20.80	20.90	23.24	28.99	34.99	34.50	24.63
1953	39.40	39.85	44.91	40.53	34.31	30.77	31.76	31.16	33.16	35.93	38.74	38.99	36.62
1954	39.55	36.87	31.92	29.59	29.60	29.17	28.78	28.36	26.76	29.10	29.70	29.75	30.76
1955	31.18	30.69	28.12	27.68	25.80	26.75	29.16	24.50	24.85	26.16	25.44	25.10	27.12
1956	24.94	25.62	26.45	27.50	28.80	26.00	24.81	25.00	25.52	25.28	25.80	26.50	26.02
1957	26.20	26.31	26.03	26.31	27.25	26.56	26.80	29.10	31.60	30.58	31.87	32.56	28.43
1958	33.55	35.87	35.47	35.95	34.94	34.19	34.50	36.18	36.81	38.85	46.66	49.25	37.79
1959	51.06	51.62	53.00	53.25	51.75	46.06	37.62	37.84	42.15	47.19	43.31	45.10	46.66
1960	43.88	47.31	43.90	37.62	38.50	41.56	39.50	37.50	33.38	36.88	37.81	36.25	39.92
1961	37.38	38.88	38.70	38.00	38.12	36.12	37.25	38.10	38.19	38.44	39.20	39.25	38.14
1962	40.60	42.12	45.00	49.62	48.30	46.12	48.75	47.90	47.00	48.60	50.50	53.25	47.31
1963	53.30	52.50	54.38	54.88	52.20	51.38	53.10	54.56	54.88	55.20	56.12	56.62	54.09
1964	56.50	53.25	55.00	56.80	58.00	59.75	61.30	49.00	51.70	52.50	57.00	61.20	56.00
1965	63.62	67.75	69.70	74.00	73.25	69.80	58.75	56.75	53.80	58.00	62.60	62.00	64.25
1966	66.00	61.62	58.40	56.80	48.80	54.60	53.62	55.70	50.00	54.00	51.20	56.25	55.57

Sources: 1919-29 - Statistical Bulletin of the Philippine Islands, 1922 - 1929
1929-41 - Philippine Agricultural Statistics, Vol. 1, 1954
1949-66 - Central Bank of the Philippines, Statistical Bulletin, 1949 - 1966

Table C5: Philippine Copra Prices, Implicit and Quoted, 1950 - 1966

Crop year	Farm price (implicit)	Farm price (resecada)	Manila Wholesale (resecada)	Export price (implicit)
	(pesos/100 kilograms)			
1950	27.00			
1951	39.15		39.82	43.13
1952	19.53		25.97	29.56
1953	25.00		32.77	33.00
1954	19.15		33.87	37.29
1955	19.14		28.55	31.13
1956	19.67		26.21	28.14
1957	19.83	20.33	25.96	27.47
1958	23.67	24.08	32.70	30.41
1959	21.24	35.07	46.60	38.33
1960	34.08	33.04	42.58	39.65
1961	27.43	30.15	37.37	36.01
1962	30.60	32.85	41.85	43.12
1963	36.93	40.12	51.22	52.04
1964	40.00	44.20	55.81	57.10
1965	43.37	48.04	62.56	63.13
1966	50.55	50.99	58.26	68.01

Sources: Philippines (Republic), DANR, BAR, Prices Received by Farmers, 1957 - 1965
Central Bank of the Philippines, Statistical Bulletin, 1949 - 1966

Table C6: Implicit Farm Price of Copra by Census Region, 1953 - 1966

Crop year	Southern Tagalog	Bicol	Eastern Visayas	Western Visayas	N and E Mindanao	S and W Mindanao
	(pesos/100 kilograms)					
1953	23.01	27.19	25.47	27.25	23.43	27.53
1954	18.13	20.82	19.59	20.96	17.53	21.00
1955	17.44	20.82	19.60	20.97	17.57	21.00
1956	19.90	18.37	21.02	18.25	18.00	21.72
1957	19.90	18.50	21.02	17.81	18.00	23.22
1958	31.52	25.95	26.56	23.77	20.78	23.29
1959	19.75	20.76	20.97	20.36	25.12	22.41
1960	33.64	35.71	34.08	28.79	51.07	34.57
1961	27.00	29.65	28.00	30.00	26.00	27.00
1962	33.00	30.00	32.00	30.00	26.00	32.00
1963	40.00	39.00	36.00	37.00	32.00	36.00
1964	40.05	46.00	36.00	36.00	36.00	45.00
1965	42.00	46.00	42.00	47.52	40.00	43.00
1966	43.00	53.00	56.00	39.00	46.00	50.00

Table C7: Prices of Philippine Coconut Products, 1906 - 1966

Year	Wholesale prices			Implicit copra prices	
	Coconut oil	Desiccated Coconut	Copra meal	Farm*	Export
	(pesos/kilogram)			(pesos/100 kilograms)	
1906	.20				14.43
1907	.25				16.32
1908	.24				12.42
1909					14.07
1910				10.35	17.66
1911				15.00	18.31
1912				17.00	19.86
1913	.49		.08	18.00	23.21
1914	.44		.06	16.17	18.27
1915	.42			10.70	15.97
1916	.48		.03	13.40	19.70
1917	.50		.04	14.23	18.07
1918	.48		.03	13.34	18.84
1919	.57		.06	17.23	35.22
1920	.58		.06	29.69	28.81
1921	.31		.03	15.87	17.39
1922	.28	.44	.04	12.01	16.30
1923	.33	.42	.035	14.11	18.58
1924	.35	.39	.052	14.84	19.58
1925	.41	.42	.061	16.55	21.63
1926	.40	.39	.049	17.83	21.36
1927	.35	.37	.055	15.73	19.22
1928	.34	.36	.071	15.81	19.23
1929	.32	.31	.067	14.06	17.93
1930	.26	.30	.04	12.50	15.42
1931	.18	.22	.03	8.01	10.50
1932	.13	.20	.03	6.41	7.48
1933	.11	.19	.02	4.89	5.80
1934	.10	.19	.02	4.10	5.02
1935	.18	.23	.03	7.02	8.69
1936	.20	.26	.03	7.87	10.30
1937	.25	.31	.05	11.96	13.51
1938	.13	.22	.04	10.94	7.16
1939	.12	.21	.04	3.89	6.69
1940	.09	.18	.03		5.46
1941	.14	.21	.02		6.11

(con't)

Table C7: Prices of Philippine Coconut Products, 1906 - 1966

Year	Wholesale prices			Implicit copra prices	
	Coconut oil	Desiccated coconut	Copra meal	Farm *	Export
	(pesos/kilogram)			(pesos/100 kilograms)	
1946	.57	.88	.11		20.00
1947	.80	.90	.16		35.16
1948	.98	.94	.14	36.96	52.74
1949	.62	.68	.09	31.35	33.90
1950	.68	.66	.11	27.06	39.01
1951	.70	.67	.12	39.15	39.51
1952	.46	.53	.15	19.53	27.03
1953	.69	.67	.12	25.00	38.33
1954	.57	.61	.10	19.15	34.08
1955	.48	.56	.11	19.14	29.49
1956	.45	.54	.12	19.67	27.75
1957	.47	.54	.11	19.83	27.98
1958	.65	.63	.11	23.67	34.26
1959	.80	.73	.15	21.24	40.54
1960	.70	.61	.15	34.08	40.03
1961	.66	.49	.14	27.43	38.36
1962	.79	.72	.22	30.60	49.56
1963	.88	.90	.26	36.93	57.19
1964	.96	.98	.23	40.00	60.20
1965	1.12	1.05	.27	43.37	67.90
1966	.98	1.03	.32	49.20	66.06

* crop year

Sources:

Wholesale prices

1906-29 - Philippine Islands, Bureau of Commerce and Industry, Statistical Bulletin of the Philippines, 1922 - 1929.

1930-40 - Philippines (Republic), Bureau of Commerce, unpublished data.

1941-48 - _____, DANR, BAE, Philippine Agricultural Statistics, Vol. 1, 1954.

1949-66 - Central Bank of the Philippines, Statistical Bulletin, 1949 - 1966.

Farm prices

1910-28 - Philippine Islands, Department of Agriculture, Annual Report, 1923 - 1928.

1929-53 - Philippine (Republic), DANR, BAE, Philippine Agricultural Statistics, Vol. 1, 1954.

1954-66 - _____, _____, _____, Crop and Livestock Survey, 1954 - 1966.

Export prices derived from table D1.

APPENDIX D

Statistics on Coconut Product Exports

Table D1: Philippine Coconut Product Exports, 1873 - 1966

Year	Copra	Coconut oil	Desiccated coconut	Copra meal
		(metric tons)		
1873	379[a]	7		
1874	1,056[a]	2		
1875	--	-		
1876	--	-		
1877	82[a]	23		
1878	488[a]	372		
1879	1,304[a]	1,274		
1880	1,363[a]	343		
1881	1,560[a]	65		
1882	763[a]	1		
1883	1,315[a]	-		
1884	--	33		
1885	--	144		
1886	585[a]	267		
1887	2,367[a]	341		
1888	6,560[a]	573		
1889	8,378[a]	1,528		
1890	--	145		
1891	8,128[a]	-		
1892	17,242[b]	853		
1893	11,894[b]	147		
1894	34,810[b]	457		
1895	37,829	-		
1896	38,661	-		
1897	51,445			
1898[c]	2,494	51		
1899	15,353	59		
1900	64,891	-		
1901	32,517	-		
1903	82,154	1		
1904	38,572	-		
1905	55,748	10		
1906	60,586	653		
1907	58,622	819		
1908	97,495	2,852		
1909	109,033	--		
1910	120,485	--		
1911	142,147	--		
1912	142,793	--		

Table D1: Philippine Coconut Product Exports, 1873 - 1966 (con't)

Year	Copra	Coconut oil	Desiccated coconut	Copra meal
		(metric tons)		
1913	82,219	5,010		2,658
1914	87,344	11,943		3,967
1915	139,093	13,464		--
1916	72,277	16,091		1,566
1917	92,180	45,198		1,067
1918	55,061	115,280		237
1919	25,094	139,942		37,597
1920	25,803	77,571		36,982
1921	150,335	90,292		44,419
1922	173,054	107,208	960	67,146
1923	207,131	89,183	4,349	50,819
1924	156,761	111,629	8,134	65,781
1925	146,708	104,127	12,523	55,787
1926	174,021	117,291	14,328	71,265
1927	199,319	144,803	15,183	90,762
1928	234,417	142,243	20,364	81,652
1929	173,572	190,519	22,285	113,792
1930	174,300	147,364	19,933	89,903
1931	174,239	164,970	16,821	98,625
1932	137,240	114,672	16,072	75,847
1933	308,753	159,620	17,927	99,916
1934	342,706	144,835	23,536	99,652
1935	252,899	165,194	33,968	101,864
1936	291,087	159,623	33,712	108,267
1937	236,543	163,297	40,744	110,529
1938	331,005	164,018	34,277	129,341
1939 d/	400,667	167,688	16,989	114,399
1940	341,930	185,902	41,541	105,028
1941	265,149	192,007		55,396
1946	389,985	2,537	6,297	5,858
1947	1,008,402	30,242	28,623	27,088
1948	586,633	78,798	83,018	53,670
1949	528,747	61,304	57,637	65,275
1950	707,186	69,806	73,050	62,999
1951	775,026	77,854	47,452	65,897
1952	670,843	80,548	39,081	78,779
1953	606,964	59,473	49,496	63,884
1954	763,230	65,208	45,659	75,361
1955	804,838	74,177	48,529	81,394

Table D1: Philippine Coconut Product Exports, 1873 - 1966

Year	Copra	Coconut oil	Desiccated coconut	Copra meal
		(metric tons)		
1956	966,303	108,929	48,691	99,710
1957	943,011	97,646	54,935	99,239
1958	811,878	86,956	51,631	94,292
1959	681,107	64,629	49,499	80,780
1960	804,371	59,695	58,775	81,162
1961	627,532	74,378	59,150	88,646
1962	779,441	147,603	62,584	144,058
1963	1,032,660	195,321	70,297	168,114
1964	910,019	229,447	69,491	192,530
1965	883,495	235,759	67,730	181,575
1966	1,014,680	313,804	67,161	239,093

a/ thousand nuts
b/ thousand kilograms of nuts
c/ August - December
d/ January - June

Sources: 1873-1900 Philippine Islands, Bureau of Census, Census of the Philippine Islands, Vol. IV, 1903.
1901-1940 _____, Bureau of Customs, Annual Report, 1910-1940.
1946-1948 Philippines (Republic), DAFR, BAE, Philippine Agricultural Statistics, Vol. I, 1954.
1949-1966 Central Bank of the Philippines, Statistical Bulletin, Vol. XVIII, No. 4, 1966.

Table D2: Value of Philippine Exports, 1873 - 1966

Year	Copra	Coconut oil	Desiccated coconut	Copra meal	Total coconut products	Total exports
			(thousand pesos)			
1873	4	-			4	16,753
1874	13	1			14	17,309
1875	3	-			3	18,256
1876	3	-			3	15,912
1877	1	2			3	16,062
1878	8	40			48	17,470
1879	15	186			201	18,813
1880	15	41			55	23,450
1881	14	6			20	24,579
1882	9	-			9	20,673
1883	16	-			16	26,381
1884	--	3			3	22,673
1885	--	13			13	24,553
1886	7	19			26	25,731
1887	47	27			74	25,257
1888	178	29			207	26,295
1889	285	100			385	34,927
1890	104	33			137	26,213
1891	640	--			640	26,905
1892	1,086	74			1,160	27,976
1893	676	17			693	36,188
1894	2,349	60			2,410	33,150
1895	3,279	--			3,278	36,655
1896	4,965	--			4,965	33,210
1897	5,659	--			5,659	44,166
1898[a]	253	11			264	10,330
1899	1,453	10			1,463	29,693
1900	6,365	--			6,365	45,980
1901	3,223	--			3,223	49,006
1902	5,403	1			5,403	57,344
1903	7,639	--			7,639	64,793
1904	3,962	--			3,962	58,299
1905	6,489	2			6,489	66,909
1906	8,747	132			8,879	65,285
1907	9,568	203			9,771	66,195
1908	12,117	684			12,801	65,202
1909	15,345	--			15,245	69,848
1910	21,278	--			21,278	81,257
1911	26,039	--			26,039	89,674
1912	28,367	--			28,367	109,846

Table D2: Value of Philippine Exports, 1873 - 1966 (con't)

Year	Copra	Coconut oil	Desiccated coconut	Copra meal	Total coconut products	Total exports
			(thousand pesos)			
1913	19,091	2,292		219	21,602	95,546
1914	15,960	5,238		233	21,431	97,379
1915	22,223	5,641		--	27,864	107,626
1916	14,232	7,851		46	22,129	139,874
1917	16,654	22,818		37	39,509	191,203
1918	10,377	63,328		7	73,712	270,389
1919	8,839	73,719		2,173	84,731	226,255
1920	7,434	46,537		2,393	56,364	302,248
1921	26,147	32,103		1,209	59,459	176,230
1922	28,206	31,468	419	2,435	62,528	191,166
1923	38,494	28,133	1,806	1,798	70,231	241,506
1924	30,703	37,622	3,197	3,427	74,949	270,689
1925	31,737	39,640	5,217	3,397	79,991	297,754
1926	37,173	44,690	5,515	3,472	90,850	273,768
1927	38,311	49,681	5,700	4,969	98,661	311,148
1928	45,084	46,978	7,447	5,772	105,280	310,109
1929	31,131	58,370	7,080	7,585	104,166	328,893
1930	26,867	38,310	5,929	5,486	79,592	273,803
1931	18,301	30,070	3,644	3,681	55,696	215,478
1932	10,266	15,302	3,233	2,107	30,908	200,748
1933	17,912	18,339	3,365	2,115	41,731	221,243
1934	17,210	13,589	4,509	2,102	37,410	252,476
1935	21,974	24,509	7,924	3,279	57,686	203,852
1936	29,999	27,743	8,794	3,659	70,195	295,354
1937	31,969	41,051	12,693	5,800	91,513	333,921
1938	23,701	21,383	7,632	5,495	58,211	294,001
1939 b/	26,802	18,339	3,444	4,250	52,835	315,784
1940	18,802	19,723	8,732	2,741	49,998	311,849
1941	22,305	28,921		1,264	52,490	322,270
1946	78,021	630		657	79,308	128,375
1947	354,415	13,940		4,263	372,618	531,097
1948	309,400	40,738		7,425	357,562	638,410
1949	179,286	35,019	38,733	7,858	260,886	511,701
1950	275,906	42,964	48,314	7,588	358,262	665,405
1951	306,262	48,993	29,804	6,914	391,973	831,484
1952	181,341	30,842	19,480	11,314	242,977	704,812
1953	232,647	34,287	31,497	7,924	306,355	801,229
1954	260,230	33,136	27,047	7,620	327,954	824,181
1955	237,361	33,069	25,620	8,816	304,866	838,512

Table D2: Value of Philippine Exports, 1873 - 1966 (con't)

Year	Copra	Coconut oil	Desiccated coconut	Copra meal	Total coconut products	Total exports
			(thousand pesos)			
1956	268,201	47,952	25,716	9,952	351,821	945,352
1957	263,917	42,711	30,307	8,362	345,297	861,329
1958	278,158	48,183	32,819	8,780	367,940	919,612
1959	276,146	44,968	36,332	10,826	368,272	1,011,075
1960 c/	138,643	15,669	18,837	4,861	178,010	560,389
1961 c/	88,196	15,939	14,529	4,210	122,874	499,512
1962 c/	112,955	31,570	15,070	9,098	168,693	556,021
1963 c/	168,259	46,714	18,405	11,754	245,132	727,106
1964 c/	156,091	59,936	19,524	10,828	246,439	742,036
1965 c/	170,004	68,095	20,477	11,803	270,379	768,448
1966 c/	169,626	75,468	17,713	17,231	280,038	838,007

a/ August - December only
b/ January - June only
c/ reported in thousand U.S. dollars

Sources: See table D1.

Table D3: Ceylon Coconut Product Exports, 1878 - 1966

Year	Coconut oil	Copra	Desiccated coconut
		(metric tons)	
1878*	5,742		
1879*	10,873		
1880*	16,110		
1881*	12,578	2,205	
1882*	9,353	2,749	
1883*	15,590	6,251	
1884*	21,573	9,026	
1885*	13,997	9,078	
1886*	11,926	6,510	
1887*	15,498	5,498	
1888*	19,635	8,845	
1889*	16,666	7,109	
1890	18,460	6,591	
1891	20,844	2,324	643
1892	28,044	6,850	1,749
1893	19,836	2,286	2,915
1894	24,817	1,559	2,600
1895	19,552	1,566	3,886
1896	17,499	2,547	4,819
1897	20,848	5,426	5,476
1898	22,141	25,755	5,908
1899	20,411	16,542	6,135
1900	22,599	18,426	6,181
1901	23,057	22,345	6,363
1902	26,060	19,037	7,363
1903	35,019	37,259	8,347
1904	26,010	36,800	8,602
1905	29,878	19,902	9,365
1906	27,435	22,854	9,264
1907	24,381	19,545	10,434
1908	32,779	38,124	12,521
1909	30,540	39,956	11,758
1910	31,609	36,342	10,282
1911	25,705	41,830	14,872
1912	20,450	31,256	14,191

Table D3: Ceylon Coconut Product Exports, 1878 - 1966 (con't)

Year	Coconut oil	Copra	Desiccated coconut
		(metric tons)	
1913	27,841	56,870	15,463
1914	24,751	71,867	15,873
1915	25,526	61,513	17,764
1916	16,441	66,675	15,582
1917	22,126	54,906	13,848
1918	26,848	64,761	10,351
1919	34,408	89,559	34,360
1920	25,832	69,115	26,403
1921	24,672	69,602	44,309
1922	28,230	85,847	39,102
1923	24,459	51,687	41,676
1924	28,128	90,051	44,351
1925	31,446	115,732	40,422
1926	29,036	123,147	38,397
1927	34,263	100,891	44,426
1928	39,656	100,612	40,043
1929	44,716	103,962	35,144
1930	38,876	92,261	35,868
1931	49,004	95,555	34,038
1932	52,174	46,522	30,502
1933	54,025	65,498	40,203
1934	71,100	107,367	32,918
1935	56,466	49,638	33,815
1936	35,081	52,706	30,629
1937	68,059	72,124	29,967
1938	75,735	76,537	30,226
1939	64,032	54,005	34,255
1940	30,387	79,709	14,506
1941	28,656	108,824	5,395
1942	25,297	116,917	5,700
1943	48,915	150,307	3,359
1944	42,094	102,818	2,952
1945	39,396	115,746	5,446
1946	43,825	39,498	9,874
1947	43,061	30,285	11,758

Table D3: Ceylon Coconut Product Exports, 1878 - 1966 (con't)

Year	Coconut oil	Copra	Desiccated coconut
		(metric tons)	
1948	77,113	55,430	12,012
1949	90,805	21,937	15,880
1950	77,062	21,480	45,703
1951	111,725	19,698	40,465
1952	108,620	41,483	56,600
1953	95,234	21,785	58,331
1954	70,140	46,828	56,193
1955	99,000	69,580	58,891
1956	86,428	58,789	64,897
1957	55,023	35,375	49,780
1958	45,148	28,198	57,771
1959	70,700	43,366	53,445
1960	56,499	29,674	55,939
1961	93,503	55,990	49,220
1962	103,836	73,703	49,933
1963	82,509	43,875	49,220
1964*	119,666	59,145	54,972
1965	88,464	41,687	54,987
1966	74,161	21,174	47,337

* fiscal year Oct. 1 - Sept. 30.

Sources:

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1939 - 1966	Ceylon, Bureau of Customs, Annual Report, 1940 - 1966.

Table D4: Malaysian* Lauric Product Exports, 1904 - 1966

Year	Copra	Coconut oil	Palm kernals
		(long tons)	
1904	976		
1905	1,796		
1906	2,307		
1907	2,936		
1908	4,284		
1909	6,337		
1910	7,486		
1911	8,040		
1912	7,710		
1913	9,287		
1914	14,509		
1915	13,937		
1916	14,823		
1917	21,054		
1918	25,489		
1919	26,650		
1920	24,999		
1921	36,210		
1922	54,977		
1923	90,570	6,026	
1924	91,734	6,084	
1925	86,421	7,673	
1926	104,394	8,504	
1927	86,504	10,275	
1928	95,628	9,884	
1929	112,429	8,725	
1930	102,014	9,473	
1931	100,568	9,928	
1932	97,277	11,949	
1933	110,298	17,582	
1934	95,599	25,484	
1935	111,753	35,910	
1936	76,680	46,504	
1937	75,592	39,760	
1938	68,754	49,140	
1939	34,420	61,360	
1940	- 9,904	69,446	
1941	-32,682	64,945	

Table D4: Malaysian* Lauric Product Exports, 1904 - 1966

Year	Copra	Coconut oil	Palm kernals
		(long tons)	
1948	-28,624		
1949	-24,424	60,504	
1950	10,878	56,045	
1951	15,750	68,139	
1952	22,952	54,111	
1953	20,120	58,083	
1954	12,240	60,720	
1955	9,984	70,013	
1956	10,859	80,637	14,185
1957	35,177	64,858	16,206
1958	37,867	48,671	20,931
1959	61,468	27,164	19,733
1960	114,832	26,664	25,213
1961	23,472	40,629	21,098
1962	11,247	31,856	20,284
1963	21,832	27,840	19,474
1964	38,123	12,951	18,042
1965	29,586	16,694	18,710
1966	37,014	23,806	22,545

* Western Malaya only prior to 1951.

Sources:

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1950 - 1951	_____, _____, Malayan Agricultural Journal, Vol. XXXV, No. 4, 1952, p. 237.
1952 - 1956	_____, Department of Statistics, Monthly Statistical Bulletin, June 1958 - September 1967

Table D5: Indonesian Coconut Product Exports, 1891 - 1965

Year	Copra	Coconut oil	Copra meal
		(metric tons)	
1891	69,076		
1892	22,590		
1893	21,981		
1894	58,897		
1895	42,722		
1896	52,832		
1897	23,715		
1898	33,754		
1899	97,626		
1900	93,733		
1901	67,723		
1902	124,637		
1903	74,008		
1904	86,954		
1905	202,726		
1906	120,080		
1907	167,546		
1908	229,491		
1909	183,801		
1910	248,147		
1911	266,578		
1912	247,454		
1913	229,339		
1914	243,724	2,610	
1915	174,842	7,498	
1916	152,229	12,143	
1917	116,771	28,393	
1918	68,578	26,414	
1919	330,382	76,618	
1920	182,053	80,200	
1921	311,570	38,410	
1922	339,463	2,822	
1923	320,361	1,354	
1924	343,685	7,324	
1925	351,010	9,568	32,045
1926	376,900	13,990	37,942
1927	311,100	8,129	46,081
1928	448,600	30,754	63,191
1929	464,600	29,133	66,045
1930	382,300	13,555	53,053

Table D5: Indonesian Coconut Product Exports, 1891- 1965 (con't)

Year	Copra	Coconut oil	Copra meal
		(metric tons)	
1931	366,500	3,738	48,192
1932	487,500	2,408	52,965
1933	495,800	8,302	58,736
1934	423,900	2,533	63,890
1935	493,008	8,150	55,459
1936	516,853	594	57,328
1937	506,072	28,181	80,867
1938	565,483	20,018	92,156
1939	537,024	9,453	92,038
1940	258,103	14,509	47,236
1950	292,414		56,022
1951	543,924		68,370
1952	347,478		87,296
1953	311,029		114,379
1954	300,321		141,555
1955	237,763		159,319
1956	266,255		139,574
1957	312,544		128,240
1958	127,879		117,850
1959	133,305		119,842
1960	170,403		109,430
1961	251,182		159,589
1962	109,848		75,966
1963	108,500		92,662
1964	175,468		157,803
1965	123,450		125,274

Sources:

1891 - 1924	Statistiek van den Handel, de Scheepvaart en de In-Ex Vitvoerrechten in Nederlandsch-Indie, 1891 - 1925.
1925 - 1940	Nederlandsch-Indie, Centraal Kantoor Voor de Statistiek, Departement van Economische Zaken, Jaaroverzicht In- en Uitvoer van der Nederlandsch-Indie, 1939 - 1940.
1950 -1965	Indonesia, Biro Pusat Statistik, Personal correspondence.

Table D6: World Exports of Lauric Oils and Oilseeds in Oil Equivalent (1952 - 1966)

Year	Coconut						Palm kernal
	Philippines	Ceylon	Indonesia	Malaya	Oceania	World	World
	(thousand metric tons)						
1952	532	179	239	69		1138	354
1953	478	152	222	72	150 ave.	1017	376
1954	580	141	222	69		1120	399
1955	617	186	187	77		1179	385
1956	754	171	200	89	171	1389	418
1957	732	114	227	88	175	1419	390
1958	637	106	108	74	168	1132	429
1959	530	137	112	67	172	1014	420
1960	610	117	133	100	167	1186	402
1961	513	165	195	56	185	1317	390
1962	685	187	87	39	173	1249	359
1963	898	146	90	42	171	1337	361
1964	854	197	147	37	190	1333	365
1965	842	155	79	36	174	1255	360
1966	1003	122		48	169	1383	376

Sources:
- Philippines - Central Bank of the Philippines
- Ceylon - Bureau of Customs
- Indonesia - Biro Pusat Statistik
- Malaya - Department of Agriculture
- Oceania - United Nations, FAO
- World - U.S. Department of Agriculture, FAS.

APPENDIX E

Data Used in Estimating Yield and Demand Functions

Table E1: Data Used in Estimating Demand Functions

	Europe							
	Per Capita National Income		Quantities Supplied					
Year	current dollars	constant dollars	lauric oil	soybean oil	groundnut oil	WPI	Coconut oil price	Population
			(thousand metric tons)				(US cents/ kilogram)	(million)
1953	567	655	814	132	476	94	32.7	244.8
1954	602	684	876	112	524	96	30.2	246.5
1955	618	725	885	150	539	97	25.4	248.3
1956	705	760	1014	185	601	99	26.5	250.5
1957	774	813	1051	234	570	100	27.4	252.5
1958	803	803	852	210	612	100	31.6	254.6
1959	840	825	710	331	623	97	38.3	256.7
1960	924	892	855	449	555	100	31.2	258.9
1961	1003	942	910	357	623	102	25.4	261.4
1962	1074	969	775	428	654	103	24.9	264.4
1963	1152	1058	827	440	721	105	28.4	267.2
1964	1249	1087	872	542	648	106	29.6	269.9
1965	1330	1113	840	444	728	107	34.6	272.6
1966	1404	1135	892	475	675	109	31.2	275.0

Table E1: Data Used in Estimating Demand Functions (con't)

	United States							
Year	Per Capita disposable income, current dollars	CCPI	Quantities Consumed: Lauric oil	Quantities Consumed: Soybean oil	WPI	Coconut oil price	Population	World lauric oil exports
			(thousand metric tons)			(U.S. cents/ kilogram)	(millions)	(thousand metric tons)
1953	1589	93.2	259	1057	92.7	41.9	158.9	1397
1954	1589	93.6	273	1186	92.9	35.8	161.9	1522
1955	1668	93.3	277	1154	93.2	32.0	165.0	1568
1956	1744	94.7	298	1166	96.2	31.3	168.1	1811
1957	1802	98.0	302	1386	99.0	31.3	171.2	1813
1958	1831	100.7	308	1501	100.4	32.2	174.1	1564
1959	1904	101.5	320	1534	100.6	40.3	177.1	1437
1960	1944	103.1	322	1513	100.7	31.3	180.0	1591
1961	1991	104.2	352	1609	100.3	25.4	183.0	1711
1962	2072	105.4	388	1647	100.6	23.8	185.9	1611
1963	2145	106.7	388	1844	100.3	26.0	188.6	1701
1964	2239	101.1	396	1850	100.5	29.5	191.4	1701
1965	2436	109.9	381	2129	102.5	35.1	193.8	1618
1966	2593	113.1	417	2120	105.9	26.9	195.8	1763

Table E2: Data Used in Estimating Yield Functions

Year	Philippines			Southern Tagalog			Bicol		
	Yield/ tree	Typhoons	Rain-fall	Yield/ tree	Typhoons	Rain-fall	Yield/ tree	Typhoons	Rain-fall
	(nuts)		(inches)	(nuts)		(inches)	(nuts)		(inches)
1958	47	0	29.1	55	0	16.7	41	0	46.4
1959	47	0	25.0	59	0	20.0	39	0	51.5
1960	45	1	29.4	55	0	14.0	38	1	56.7
1961	41	0	31.5	38	1	42.2	38	1	33.8
1962	44	0	27.7	43	0	17.2	40	0	60.2
1963	42	0	28.4	40	0	18.2	37	0	49.7
1964	37	1	21.2	37	0	9.6	41	0	33.6
1965	38	1	33.9	31	0	33.1	42	0	55.3
1966	38	1	37.8	23	1	13.5	41	0	54.1

Table E2: Data Used in Estimating Yield Functions (con't)

Year	Eastern Visayas			Western Visayas			N. and E. Mindanao			S. and W. Mindanao		
	Yield/ tree	Ty-phoons	Rain-fall	Yield/ tree	Ty-phoons	Rain-fall	Yield/ tree	Ty-phoons	Rain-fall	Yield/ tree	Ty-phoons	Rain-fall
	(nuts)		(inches)	(nuts)		(inches)	(nuts)		(inches)	(nuts)		(inches)
1958	39	0	40.2	37	0	14.2	58	0	18.1	46	0	39.1
1959	41	0	41.0	37	0	10.7	55	0	16.0	41	0	18.4
1960	37	0	41.4	33	1	16.7	47	0	15.9	43	0	32.7
1961	31	1	33.4	33	1	14.2	56	0	21.7	41	0	35.3
1962	34	1	32.8	49	0	20.2	52	1	39.9	52	0	27.3
1963	29	1	38.8	50	0	15.1	44	0	13.7	54	0	36.5
1964	23	1	31.0	51	0	12.4	38	0	26.3	47	0	18.9
1965	33	1	40.1	37	1	26.2	35	1	25.4	57	0	27.3
1966	36	0	47.5	37	1	30.1	36	1	43.8	60	0	52.5

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