An economic analysis of the expansion of United States lemon exports

AN ECONOMIC ANALYSIS OF THE EXPANSION OF UNITED STATES LEMON EXPORTS

by

Gretchen Heimpel

A Thesis Submitted to the Faculty of the

DEPARTMENT OF AGRICULTURAL ECONOMICS

In Partial Fulfillment of the Requirements
For the Degree of

MASTER OF SCIENCE

In the Graduate College

THE UNIVERSITY OF ARIZONA

1 9 7 7

STATEMENT BY AUTHOR

This thesis has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this thesis are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: Gretchen Heimpel

APPROVAL BY THESIS DIRECTOR

This thesis has been approved on the date shown below:

Roger W. Fox
ROGER W. FOX
Professor of Agricultural Economics

April 22, 1977
Date

ACKNOWLEDGMENTS

"Poco a poco se camina lejos." I complete this step of my life owing a special thank-you to my major advisor, Dr. Roger Fox, for his constant, personal assistance throughout my graduate work and before, and to Dr. Donald Wells, who first introduced me to the subject of Economics in such an exciting manner that I remain fascinated by the discipline.

I greatly appreciate the cooperation of Sunkist Growers, Inc., particularly Ms. Darlene Oehmus, Mr. Steve Sparks and Mrs. Elaine Abbott. Thanks are also due to Dr. Jimmye Hillman and Dr. Robert Firch for their willingness to share their knowledge and advise me, and to Mrs. Edith Hallet for all her patient help. I would like to thank La Estrellita Chapter of the American Businesswomens Association whose generous grant made my graduate studies possible.

An especially warm thank-you to all of my family, for the love and understanding they perpetually surround me with make any step less difficult.

TABLE OF CONTENTS

TABLE OF CONTENTS--Continued

LIST OF TABLES

LIST OF TABLES--Continued

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS--Continued

ABSTRACT

The history of the California-Arizona lemon industry was dramatically changed in May 1964 when Japan eased its restrictions on the importation of lemons. The Federal Marketing Order for lemons permits some control of the volume of fresh lemons sold on the domestic market, and with processed lemons bringing low returns, the opportunity to increase exports was actively pursued by the lemon industry. This study utilizes regression analysis and trend analysis to investigate how increased lemon exports have been associated with increased growers' prices, increased returns per acre and with increases in bearing acreage.

The increases in acreage have resulted in current fears of overproduction, and as the quantity of fresh lemons exported begins to level off, the possibility of a decline in the lemon industry becomes more evident.

CHAPTER I

INTRODUCTION

It is widely acknowledged that international trade plays a vital role in the economies of all countries, industrialized or developing, but foreign trade impacts on a single industry are not well understood. This research attempts to trace the effects of exports of a single good on the domestic industry, through the effects on prices, producer returns, bearing acreage and production.

The industry under consideration is the California-Arizona lemon industry; the commodity, fresh lemons. Several characteristics of this industry facilitate the study of export impacts. The industry is concentrated within a relatively small geographic area and wholesale marketing is largely controlled by a grower's cooperative, Sunkist Growers Inc., which accounts for 80-85% of total production (Sunkist Growers Inc. 1950-76 and 1976). Lemons are subject to Federal grade standards (U. S. Department of Agriculture 1964) as well as minimum quality standards imposed by individual states (State of Arizona); most of the lemons produced for fresh use exceed these standards in order to compete with those established by Sunkist (U. S. Department of Agriculture 1975b, pp. 95-98) and other handlers. Furthermore, lemons enter the domestic market under a Federal Marketing Order whose size standards, combined with the state and federal statutes, imply a largely homogenous commodity. More importantly, provisions of the Marketing Order allow weekly regulation of the flow of fresh lemons to domestic markets.

Exporting of fresh lemons has long been a goal of the industry and recent success in the development of foreign markets makes the study impacts more important and interesting. Dr. D. F. McMillen (1976, p. 1) previously a Vice President with Sunkist Growers and now with the Webster International Corporation, recently remarked: "The effect of exports is twofold: (1) it represents an additional outlet for fruit of fresh fruit quality, and (2) in spite of Secretary Butz's efforts to downplay this, it has an effect on increasing our domestic prices. That's what we want exports for and to say anything else is not being candid."

It is one of the objectives of this study to verify empirically Dr. McMillen's statement about price impacts. It is expected that the results of this thesis will not be limited in application to this particular commodity but relevant to other citrus fruits and noncitrus crops.

The study is structured around four specific objectives:

1. description and analysis of the historical trends and changes in U. S. exports of fresh lemons;
2. determination of the relationships between foreign and domestic prices for fresh lemons at various market levels and the identification of the determinants of these prices;
3. examination of the determinants of gross and net revenue per acre to producers, with emphasis on the impact of exports; and
4. examination of the long run effects of exports by estimation of the impact of relative changes in revenue on the expansion

of California-Arizona bearing acreage and production of lemons.

Graphical representation and trend analysis are the basic methods used to attain the first objective. These techniques permit the examination of changes over time in export prices and quantities, and domestic prices. The second objective is approached with the technique of linear regression analysis using historical data to estimate a linear equation which describes the relationship between the dependent and independent variables. The procedures used to achieve the third objective involve first, the computation of gross and net returns per acre, and then the application of trend analysis and linear regression. The attainment of the final objective requires the use of trend analysis on bearing acreage, the computation and comparison of relative returns to other citrus, and linear regression analysis.

The following chapter concerns itself with the theoretical basis for trade and a brief examination of trade policy. This is followed by an historical examination of the U. S. lemon industry's export markets and prices, Objective 1. Chapter Four treats the second objective, the impact of exports on domestic price levels. A grower is more affected by his net returns than by the price of an individual carton of lemons, therefore the impact of exports on net revenue per acre, the third objective, is analyzed in Chapter Five. Changes in revenue affect growers' decisions to expand or contract acreage and hence influence the long run production of the industry. Chapter Six examines the impacts of exports on the industry in the long run.

CHAPTER II

INTERNATIONAL TRADE THEORY AND POLICY

To understand the impact of international trade on a specific industry, one must have some knowledge of the basis for trade, general trade theory and its implications. Such knowledge is useful in formulating the type of models used for empirical analysis in this study.

International trade is theoretically based on the concept of comparative advantage. In strict Ricardian terms, Country A has a comparative advantage in the production of good X relative to Country B if the labor required to produce X relative to that necessary for the production of some other good Y is less in Country A than in Country B (Heller 1973). As we move away from the labor theory of value, a comparison of the costs of production of one product relative to the other can be used to determine in which product a country has the comparative advantage.

The terms of trade depend on the supply and demand for the product in both markets. Assuming both markets are competitive, a two-country, two-commodity world, no barriers to trade and zero transportation costs, the trade price can be determined with the aid of Figure 1. Prior to trade, the price in Country A is that at which the domestic supply (S_A) equals the domestic demand (D_A), price P_A. In Country B, the prevailing price (P_B) also equates its domestic demand (D_B) with the domestic supply (S_B). Under conditions of free trade, the total world

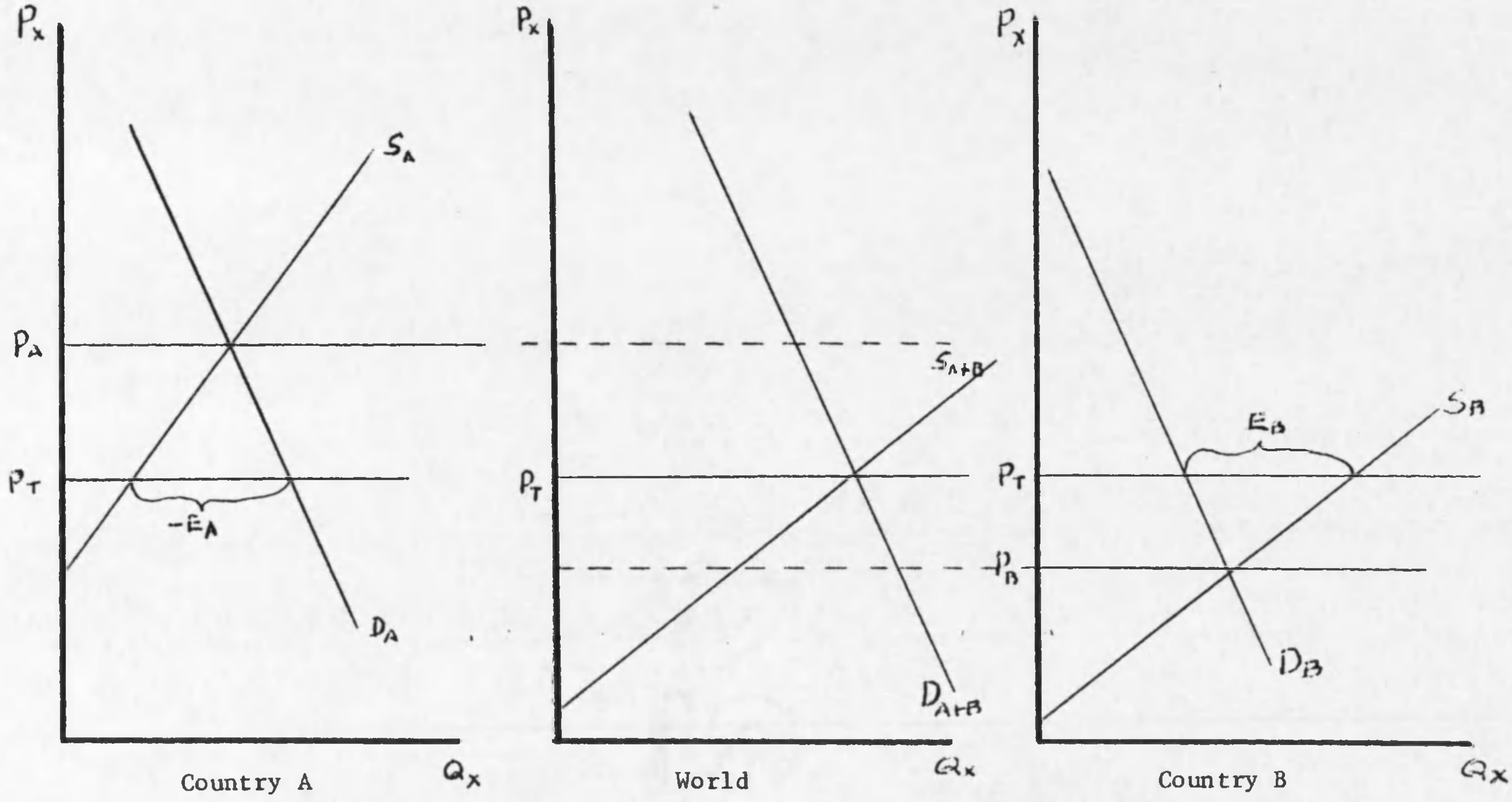


Figure 1. Two-country Model for Free Trade Pricing.

supply ($S_A + S_B$) is available for both countries to satisfy their demands. The world free trade price (P_T) occurs where the aggregate supply curve ($S_A + S_B$) is intersected by the total demand curve ($D_A + D_B$). At this price there is an excess demand for the good in Country A ($-E_A$) that is just equal to the excess supply of the good available in Country B (E_B). Note that the world price falls between the original prices of each country, $P_A > P_T > P_B$.

Given the above conditions, free trade would allow all countries to reach Pareto optimality in both consumption and production, and world Pareto optimality would also exist. (At Pareto optimality no one party can be made better off without decreasing the welfare of another party.) In fact, political, social and economic decisions restrict trade and distort the terms of trade. As is discussed later, international trade in lemons has been influenced by these special considerations.

Exchange Rates

The equilibrium free trade price as determined above is based on a given exchange rate for the currencies of the two trading countries. If the exchange rate is altered, as one country devalues or revalues its currency, the terms of trade are necessarily changed.

If the price axis in Figure 2 is measured in the currency of Country A and Country B devalues its currency relative to that of Country A, it now requires more units of B's currency to be equal to one unit of A's currency. The effect of the increase in relative price for B is similar to a decrease in <u>real</u> income, resulting in a downward shift in the demand curve of Country B, to D'_B. The effect on the supply of the

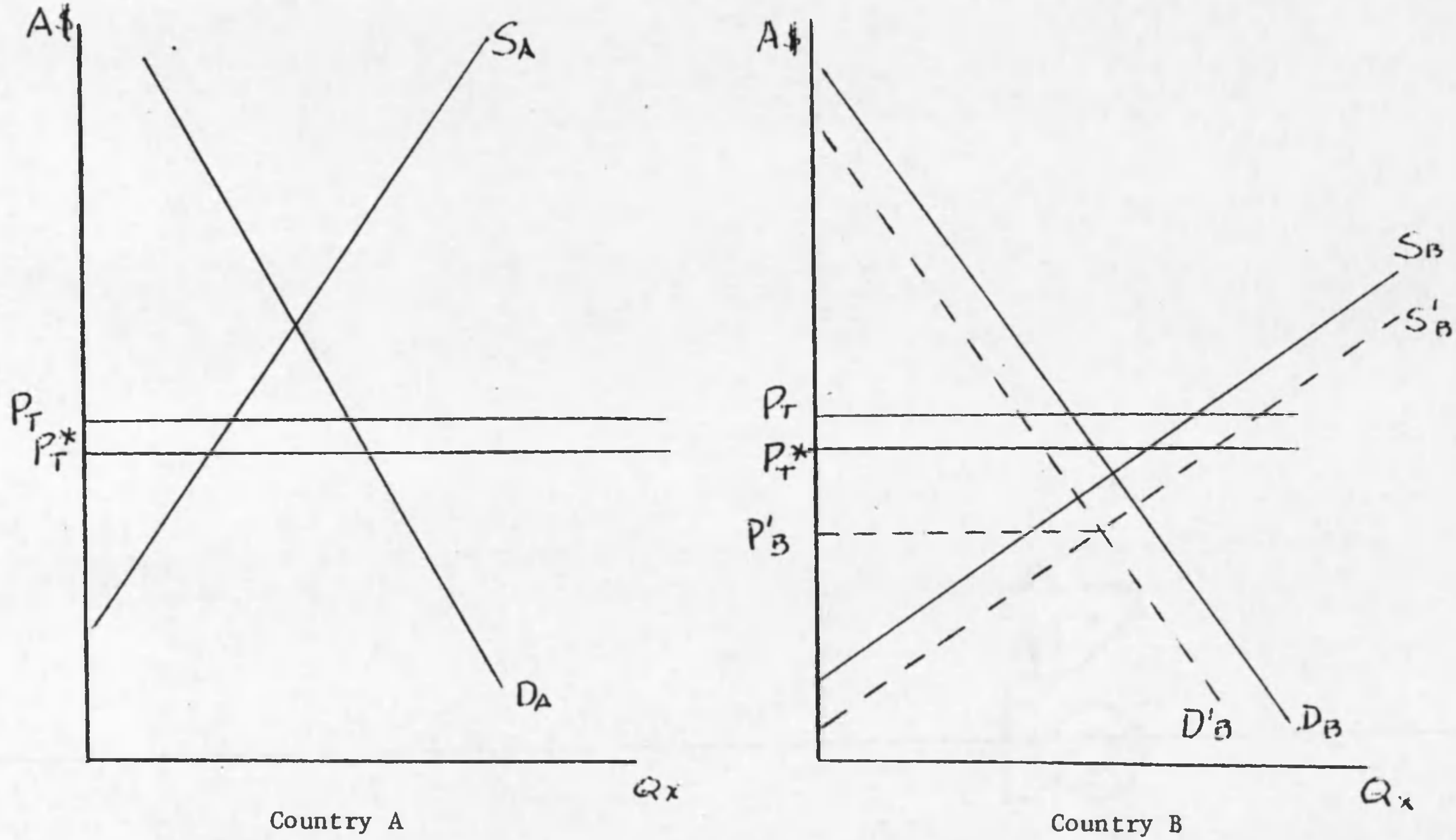


Figure 2. Two-country Model for Exchange Rate Effects.

product in Country B is just the opposite, (S'_B), as the producer is willing to supply more of the good for each unit of A's currency, (which is now worth more in terms of B's currency). The result is a decrease in the terms of trade (P^*_T) in units of A currency. Country A's consumers, the importers, have benefitted by the decrease in the price of their imports, whereas Country B has increased its exports, and the decreased terms of trade reflect its own currency devaluation. The devaluation has also resulted in an increased volume of trade, evident in Figure 2.

In reality the two-country, one-commodity world is expanded to millions of goods, and virtually all countries are both importers and exporters. If a country devalues its currency, imports become more dear and the quantity demanded of imports drops. If a country revalues its currency, increasing the relative value of the money, it raises the price of an export product in terms of foreign currency, acting like an export tax and decreasing foreign demand. Overvaluation of a currency lowers prices in the domestic market (relative to foreign prices) and increases the domestic demand, decreasing the excess supply that is usually available for export (Schuh 1974, pp. 1-13). The domestic monetary policy of a country can thus be manipulated to change its buying power relative to other currencies and hence its advantage in the world market.

Tariffs and Quotas

The most common trade policy tool, and one of the major omissions of the simple free trade model, is the imposition of tariffs and/or quotas by a country on its imports. Figure 3 illustrates the effects of

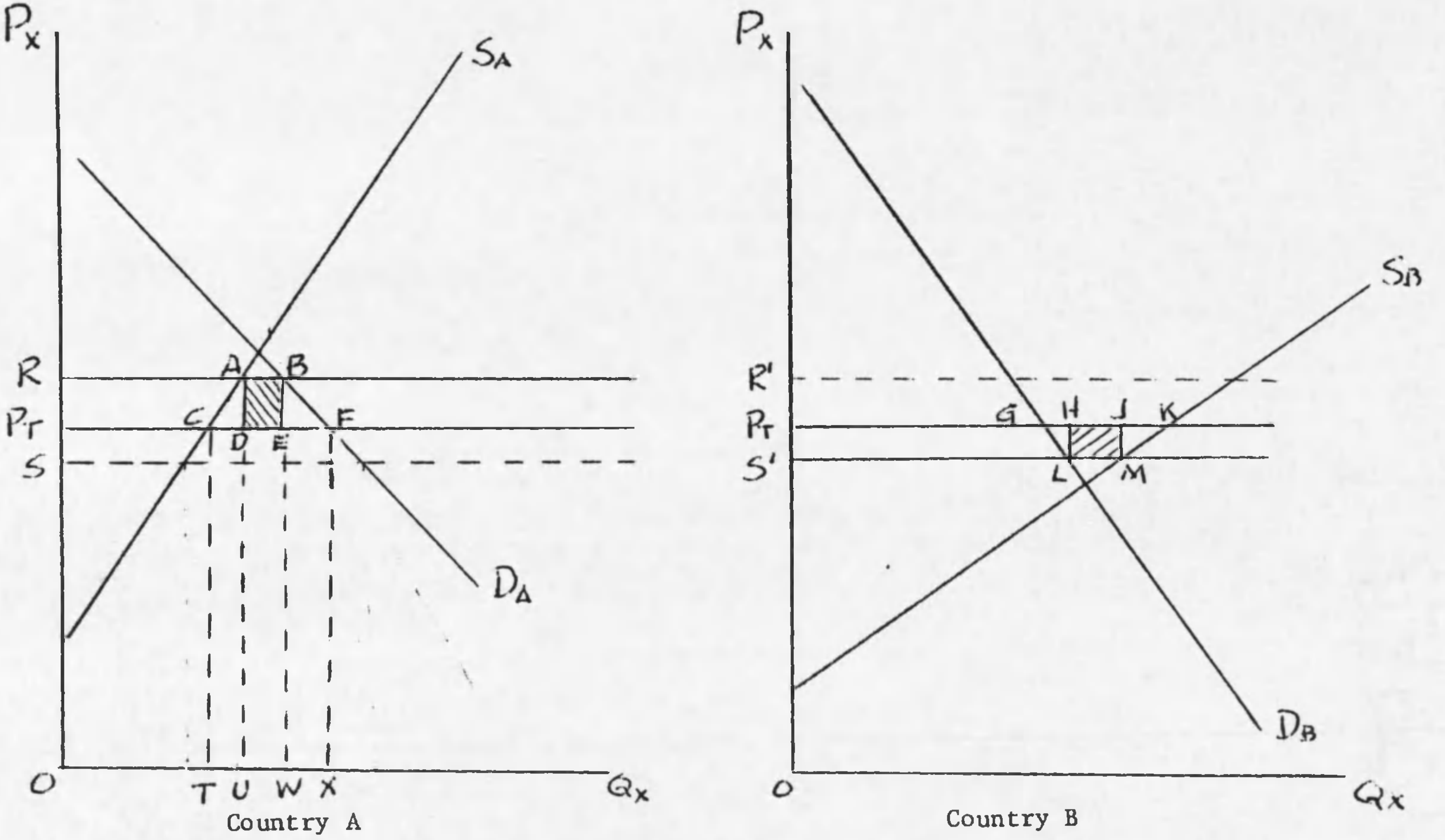


Figure 3. Two-country Model for Import Tariff Imposition.

a tariff on imports imposed by Country A (Heller 1973, pp. 164-167). If the tariff is imposed at a per unit rate RS, consumption in Country A will fall from the free trade level of OX to OW, due to the rise in price that follows directly from the imposition of the tariff. There is also a production effect; with the increased protection afforded the industry of Country A leading to an expansion of output to OU, from the free trade level of OT. There is a revenue effect for the government of Country A; receipts from the tariff equal ABDE plus HJLM, the decreased revenue of Country B. A redistribution effect also occurs as producers receive a price for their commodity that is above the increase in their production costs. This economic rent, $RACP_T$, originally accrued to the consumer but now has been redistributed to the producers.

The tariff has destroyed the free trade equilibrium price (P_T) and in order that imports into Country A equal exports from Country B, the price in the two countries must differ by the amount of the tariff, RS (=R'S'). The price in Country A has increased from OP_T to OR, and the price in Country B has decreased from OP_T to OS' after trade.

The imposition of a quota by the importing country will yield the same price effects. Rather than increasing the price of imports and hence causing a decrease in the quantity demanded, a quota limits the quantity imported (say to UW) and hence causes an increase in price (to OR). What differentiates it from the tariff is the difference in the beneficiaries. It is no longer the government of the importing country that receives the increased revenue, but the importers who have purchased or been granted the right to supply the restricted amount. In the case of State-trading, the importers are a government agency, and there is no difference in the effects of a tariff or an import.

An embargo on imports is when no imports of a specific commodity and/or from a specific country are allowed into the importer's market. Theoretically, it can be viewed as an import quota that restricts the quantity imported to zero, or as a no-trade situation. It provides the greatest protection available to the domestic producers of the importing country, but its imposition is at the greatest risk of retaliation by the exporter.

Trade Policy for Lemons

The obvious barriers to trade posed by quotas, tariffs, levies and exchange controls are greatly supplemented by more subtle barriers in the form of standards, quality regulations, import permits and health standards. Decisions to impose barriers, the extent of the impositions (what products, with respect to which countries, how great the tariffs), and conversely, decisions to negotiate the removal of barriers and to expand trade are all part of a country's trade policy. The extent to which this policy effects trade can be clearly seen in the history of several of the countries under consideration in this study.

The U. S. policy, as regards lemons, has been one of active expansion of exports through multilateral and bilateral trade negotiations. Public Law 480 and the Trade Expansion Act of 1962 have been utilized by the citrus industry as the legal impetus for increased trade. Negotiations to achieve freer markets for U. S. fresh lemons abroad have been conducted at the insistence of citrus producers (California-Arizona

Citrus League 1968), who at the same time are seeking greater protection from the importation of lemon products (California-Arizona Citrus League 1964). The major focus of the negotiations have been bilaterally with Japan, and with the European Economic Community (EEC) through the General Agreement of Tariffs and Trade (GATT) negotiations.

Japan had a long-standing quota on the importation of fresh lemons when it became a member of the Organization for Economic Cooperation and Development (OECD) in 1964. At that time it began to liberalize many of its import restrictions, and, after extensive negotiations with the U. S. Special Trade Representative, the Foreign Agricultural Service and the Department of State, the embargo on fresh lemons and lemon products was lifted in the spring of 1964. In return, concessions were granted on U. S. importations of Japanese mandarin sections. The elimination of the embargo coupled with the Japanese consumer's preference for high quality fruit, rapidly made the Japanese market one of major importance for U. S. lemons. The U. S. now supplies close to 99 percent of the Japanese market. In terms of the quantity of exports, the 252,950 cartons (38 pounds) exported to Japan in 1963 has increased spectacularly to 4,516,750 cartons in 1975 (see Appendix A.5 and A.6).

Export to the Western European markets, particularly those countries which are members of the EEC, is restricted to a considerable degree by the Common Agricultural Policy (CAP). The CAP is structured to protect the agricultural producers of member states, which include some of the major lemon producers in the Mediterranean area. A reference price for lemons (and other citrus) is set based on average producer prices in the member countries, and a compensatory levy is applied to nonmember imports whenever their entry price is below the reference price. (Appendix A.1 shows the changes in the reference price over time.) In addition, citrus production is supported by a system of "buying in" prices and "basic" prices. Member states may fix "buying in" prices at between 40 and 70 percent of the "basic" price, a three-season average. When market prices fall below the set buying in price for three consecutive days, a state of serious crisis is declared and member states must intervene to stabilize the market (Commission of the European Community 1972, p. 23). The surpluses withdrawn from the market may be donated to charity or provided to institutional feeding, or made available to the processing industry at low cost (U. S. Department of Agriculture 1973). Export subsidization is also used to make EEC agricultural products competitive in export markets. Moreover, special preferences and reductions of the Common External Tariff have been granted to Israel and several of the Arabian lemon producing nations, to the probable detriment of U. S. lemon exports (Commission of the European Community 1972).

Trade with the United Socialist Soviet Republic (U. S. S. R.) and Eastern Europe is an example of "state trading." The volume and composition of imports and exports are determined by the central government and normally do not reflect free market demand and supply conditions. In recent years, increased negotiations between the U. S. and U. S. S. R. have achieved an increase in U. S. exports to Soviet markets, including exports of fresh lemons.

Throughout the analysis of export quantities and prices these policy instruments must be kept in mind. Their role in trade determination can be seen most clearly in the Japanese case, but are factors in the international trade of all countries.

CHAPTER III

HISTORICAL TRENDS: THE ROLE OF EXPORTS

The history of citrus production in the Southwest began with its introduction by the Spanish missionaries (U. S. Department of Agriculture 1975b). The fruit did well in the area and as colonization increased, the citrus industry prospered. In 1877 the first shipments of citrus from California to the eastern states began. By 1893 citrus growers had established cooperatives to coordinate their shipping and sales, and although there were years when their continued existence was dubious, they have remained as a major characteristic of the industry today.

Another characteristic of the industry is its operation under a Federal Marketing Order that was established in 1938 to maintain "orderly marketing." Lemon producers and handlers agreed to the imposition of the Marketing Order, and a committee was formed to administer the order. At the beginning of each crop season, the committee establishes a basic marketing policy and sets a tentative schedule for the weekly quantity of lemons to be sold in the domestic market. This volume is adjusted through weekly regulation of domestic shipments of fresh lemons, the "rate of flow" provision of the Order. The other major provision of the Order is a minimum size regulation; few adjustments have been made in this standard over time.

Lemons have three major markets: fresh domestic use, processed products and fresh exports. There is little argument that the domestic market for lemons, with its demand for high quality fruit, expediency of transportation and already established advertising structure, is the most desirable outlet. However, fresh fruit sales in the domestic market have declined in recent years. The returns from processed lemons are extremely low, and the export market, characterized by increased competition, higher costs and greater price elasticity of demand, presents larger risks for the lemon producers. The Marketing Order essentially protects the high returns of the domestic market by its rate of flow provision. This appears to have enhanced domestic prices and reduced risks (U. S. Department of Agriculture 1975a, p. 44) inducing expanded acreage and increased production over time. And as access to the domestic market is limited, export and processed outlets must be used.

Trend Analysis

To examine changes in the allocation of lemons among the three markets over time and to focus particularly on the exports of lemons, trend analysis is used. Extensive use is made of graphical representation of quantities and prices over time; this permits rapid and easy comparison of the various markets. Use of a semi-logarithmic function presents information on relative variations and facilitates mathematical computation of trends (Mills 1955, p. 350). To determine the actual annual percentage change in a variable during a specified time period, the common logarithm of the variable is expressed as a linear function of time (Shao 1976, pp. 582-590):

$$\log_{10} X_i = a + bT \quad \text{or } X_i = 10^a(10^b)^T$$

where: X_i = any variable under consideration

T = time in years

a = constant

$b = \log(1 + r)$

r = rate of increase of a series

Therefore, the actual annual percentage change in X_i, $r \times 100$, can be computed as:

$$r \times 100 = (10^b - 1)\ 100.$$

The primary limitation of trend analysis is that it is merely descriptive and does not offer any explanation of the changes over time.

Data Set

Various sources of data exist for prices of lemon and quantity allocations, but are rarely comparable and often inconveniently aggregated. The data on annual export prices and quantities were computed by the U. S. Department of Commerce (1949-75), which gives monthly quantities and total values (Free Alongside Ship, FAS) of exports to all major purchasers. For this study, all Western European importing countries were aggregated, as were the Eastern European importers. The monthly data were added to give seasonal information. The quantity data, reported in pounds, was first converted to standard 38-pound cartons, and dividing the given total value by the number of cartons exported, an export price per carton was derived for all major importers (Appendix Tables A.2 and A.3). Because of the Marketing Order, Canada is considered a part of the domestic market by the lemon industry and those agencies reporting on it. Exports to Canada have been treated individually in this Chapter's analysis of quantities and values, but are included in most available data on domestic prices and quantities. The retail prices of fresh lemons (U. S. Department of Agriculture 1976) are for U. S. cities only; the Free On Board (FOB) packed prices and on-tree fresh prices (U. S. Department of Agriculture 1950-75b) are for all fresh uses of lemons, and therefore include all exports. Although the FOB and FAS prices are not strictly comparable, in view of the available data, these were chosen as the most appropriate indicators of trends in values.

Values recorded for exports (FAS) are not the actual prices received for the shipments. In Western Europe, lemons are frequently sold at auction and the actual prices received may differ considerably from the shipment value as originally declared on the manifest. The distortion is minimal in the Japanese and Eastern European trade as shipments are based on prearranged quantities and prices. Lack of long term price data for importing countries forced the use of FAS figures as representative of export values.

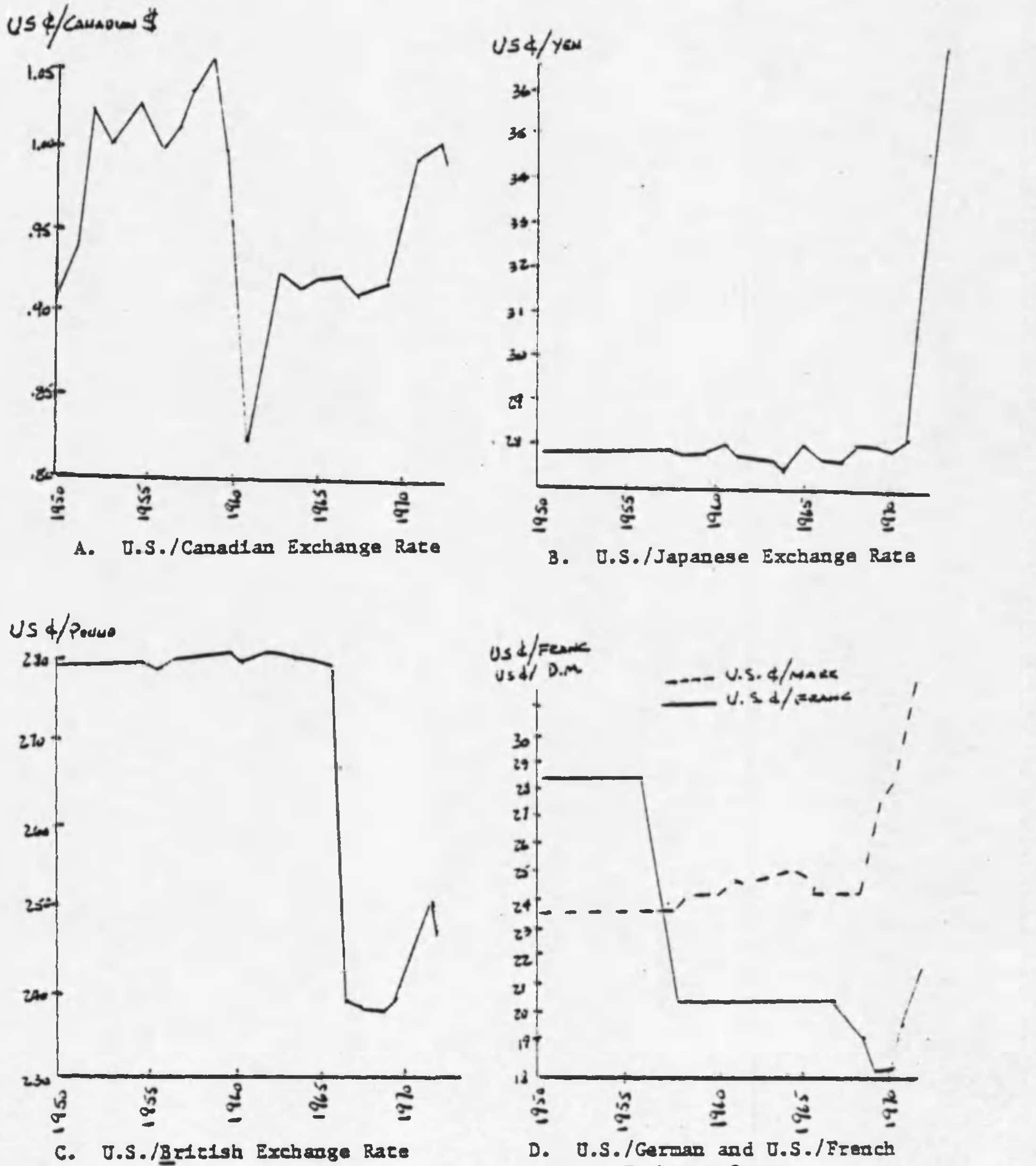
The lemon industry recognizes two distinct seasons and crops, simply referred to as summer lemons and winter lemons. Summer lemons are defined as those marketed between May and October; winter lemons are sold between November and April. The demand for lemons has been shown to be positively related to temperature (Hoos and Seltzer 1952); as the heat increases, so does the demand for lemons and lemonade. This effect on fresh lemons has apparently diminished since the 1951 introduction of frozen lemonade concentrate (Hoos and Seltzer 1952), but is nonetheless still evident. Different growing areas in California and Arizona dominate in the production of lemons during the two seasons. Marketing conditions also differ, so the two seasons will be treated separately in the analysis of historic trends. The trend analysis is concerned with the 1950 to 1975 time period, although data for some of the earlier years were unavailable. Use is also made of five-year moving averages (centered on the third year) in the study of total production, exports and processed sales.

A further difficulty with time series data is that the available data may be inconsistent. For example, the U. S. Department of Commerce (1949-75) has periodically changed the format for its trade statistics, at times excluding shipments of less than $500 from the accounts and at other times including estimates of their values. Until January of 1965, exports of fresh lemons and limes were aggregated, but the insignificant volume of U. S. fresh lime exports minimizes distortion when comparing pre- and post-1965 exports. The agencies collecting and reporting data on the lemon industry have also made changes in their estimates of carton weights, from 39-1/2 pounds to a carton to the current 38-pound carton, and from 930 cartons in a carload to 1,000. Adjustments of the data used in this study were necessary to assure comparison of standard units over time.

Another major difficulty in using time series data is that unmeasured changes in many other factors affect the measured changes in the variables under consideration. A change in the relative buying power of a country's currency, the exchange rate, (see Chapter II) is just such a factor.

The U. S.-Canadian exchange rate has fluctuated within a 25-cent range from 1950 to 1973 (Figure 4A), yet fresh lemon exports to Canada have remained remarkably stable over the long time period. Both the number of U. S. cents to the yen (Figure 4B) and the volume of exports to Japan have shown spectacular rises, but the beginnings of the increases do not coincide. Exports to Japan began their dramatic increase in 1964 with the liberalization of trade; yet, it was not until 1971 that the value of the yen rose dramatically relative to the dollar, and these two events cannot be shown to be directly related. Attempts to establish or dispute any relationship between export quantities and exchange rates is also very difficult in the case of Western Europe as each country has its own currency. Examining the German Deutsche-mark, the French new franc, and the British pound, (Figure 4.C and 4.D) one notes that they were all relatively stable until 1966/67 when both the pound and franc took a plunge, and that the values of all three currencies increased significantly after 1970. Relating this to the wildly fluctuating volume of exports to Western Europe over time is difficult although summer exports did drop off in 1966/67 and both winter and summer export quantities began climbing after 1971. This is the relationship one would expect to find if the effects of the many other factors could be removed: as the value of the importer's currency increases relative to that of the exporter, his volume of imports would also increase.

The difficulty in observing this hypothesized relationship can be partially explained by the insignificance of lemon purchases as part of a consumer's total expenditures. Although lemons are somewhat of a luxury item and may be expected to have an elastic demand (quantity



A. U.S./Canadian Exchange Rate

B. U.S./Japanese Exchange Rate

C. U.S./British Exchange Rate

D. U.S./German and U.S./French Exchange Rates

Figure 4. Exchange Rates: U. S./Canadian, U. S./Japanese, U. S./British, U. S./French and U. S./German, 1950-73.

Source: United Nations (1973).

demanded sensitive to small changes in price and income) they are at the same time a small item in the total income of a consumer and therefore will be bought even as their real price varies within a certain range.

Export Quantities

With the quantity sold fresh to the domestic market effectively limited, the excess crop can be diverted into processed goods or exports, or, at a cost, stored. As Figures 5 and 6 illustrate, the percentage of total production exported has shown a tendency to rise over time, approximately three-fourths of one percent each year (Tables 1 and 2). Total production and exports are generally higher in the summer months (Figures 7 and 8), and a larger percentage of the summer crop is exported. Conversely, the percentage of the total crop processed is less in the summer than winter season, as evident in a comparison of Figures 5 and 6.

The correlation, based on 26 years of data, between the quantity processed and the quantity exported is positive and statistically different from zero for both seasons, but is much greater in the winter months (.8138) than in the summer (.3517). Several relationships between the quantities exported, processed and sold fresh in the domestic market can be hypothesized. The identity which seems to best describe the basic allocation of supplies is:

$$TP - DS = EXP + PROC \quad .$$

where: TP = total quantity produced (carloads),

DS = domestic sales (carloads),

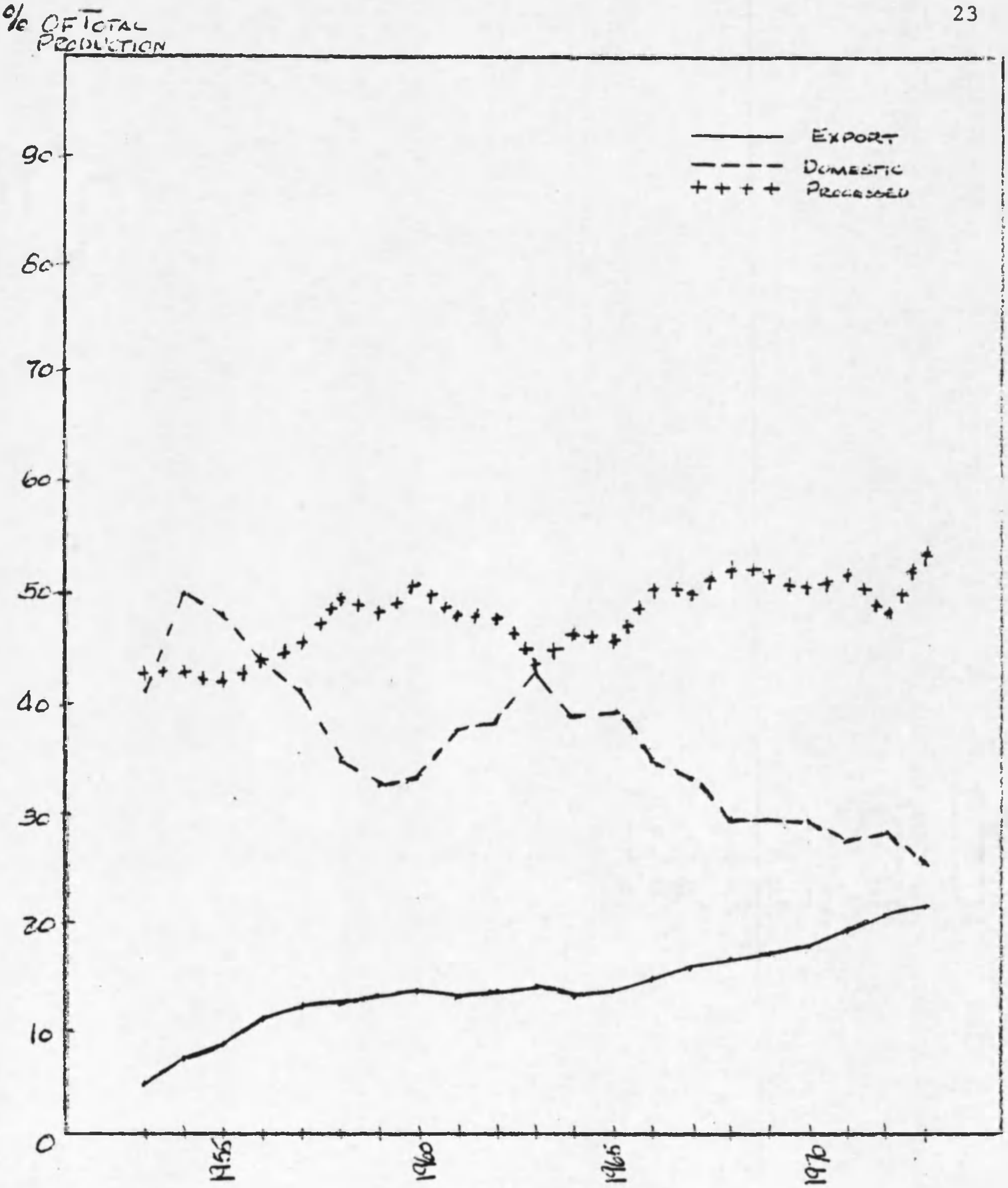


Figure 5. Five-year Moving Averages of Percentage Allocation of California-Arizona Winter Lemons, 1953-73.

Source: Appendix Table A-1.

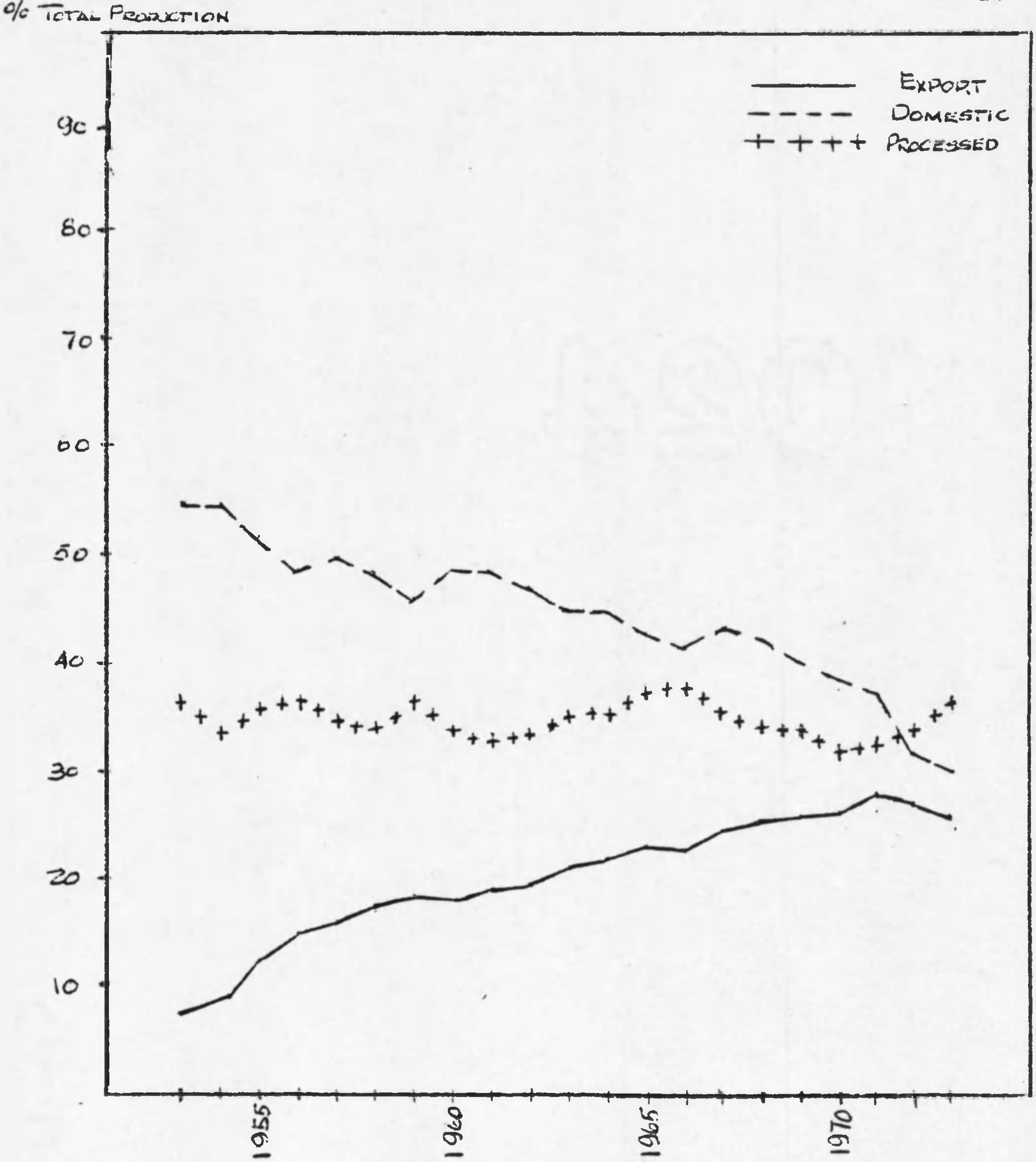


Figure 6. Five-year Moving Averages of Percentage Allocation of California-Arizona Summer Lemons, 1953-73.

Source: Appendix Table A-2.

Table 1. Trend Analysis of Total Production, Exports and Processed Quantities of Winter Lemons.

Item	Annual Percent Change		
	1950-63	1964-75	1950-75
Total Production	2.80[a]	5.24[b]	2.99[b]
Export Quantity	19.92[b]	11.97[b]	11.28[b]
Processed Quantity	2.97[c]	6.51[a]	8.84[b]
Percent Exported	1.02[b]	.93[b]	.67[b]
Percent Processed	.37[c]	.45[c]	.42[b]
Export to Japan	33.88[b]	23.48[b]	30.17[b]
Export to Europe	63.61[b]	3.80[c]	18.90[b]

a. Low consistency of trend, variable coefficient not significantly different from zero at probability levels $\geq .05$ and $< .20$.

b. High consistency of trend, variable coefficient not significantly different from zero at probability levels $< .05$.

c. No trend or no consistency of trend-variable coefficient not significantly different from zero only at probability levels $> .20$.

Table 2. Trend Analysis of Total Production, Exports and Processed Quantities of Summer Lemons.

Item	Annual Percent Change		
	1950-63	1964-75	1950-75
Total Production	-.09[c]	1.48[c]	.53[a]
Export Quantity	16.33[b]	3.56[b]	8.27[b]
Processed Quantity	-.90[c]	1.48[c]	.72[c]
Percent Exported	1.30[b]	.39[a]	.81[b]
Percent Processed	-.21[c]	0	.05[c]
Exports to Japan	24.82[b]	16.33[b]	29.30[b]
Exports to Europe	27.94[b]	-1.95[c]	7.78[b]

a. Low consistency of trend, variable coefficient not significantly different from zero at probability levels $\geq .05$ and $< .20$.

b. High consistency of trend, variable coefficient not significantly different from zero at probability levels $< .05$.

c. No trend or no consistency of trend-variable coefficient not significantly different from zero only at probability levels $> .20$.

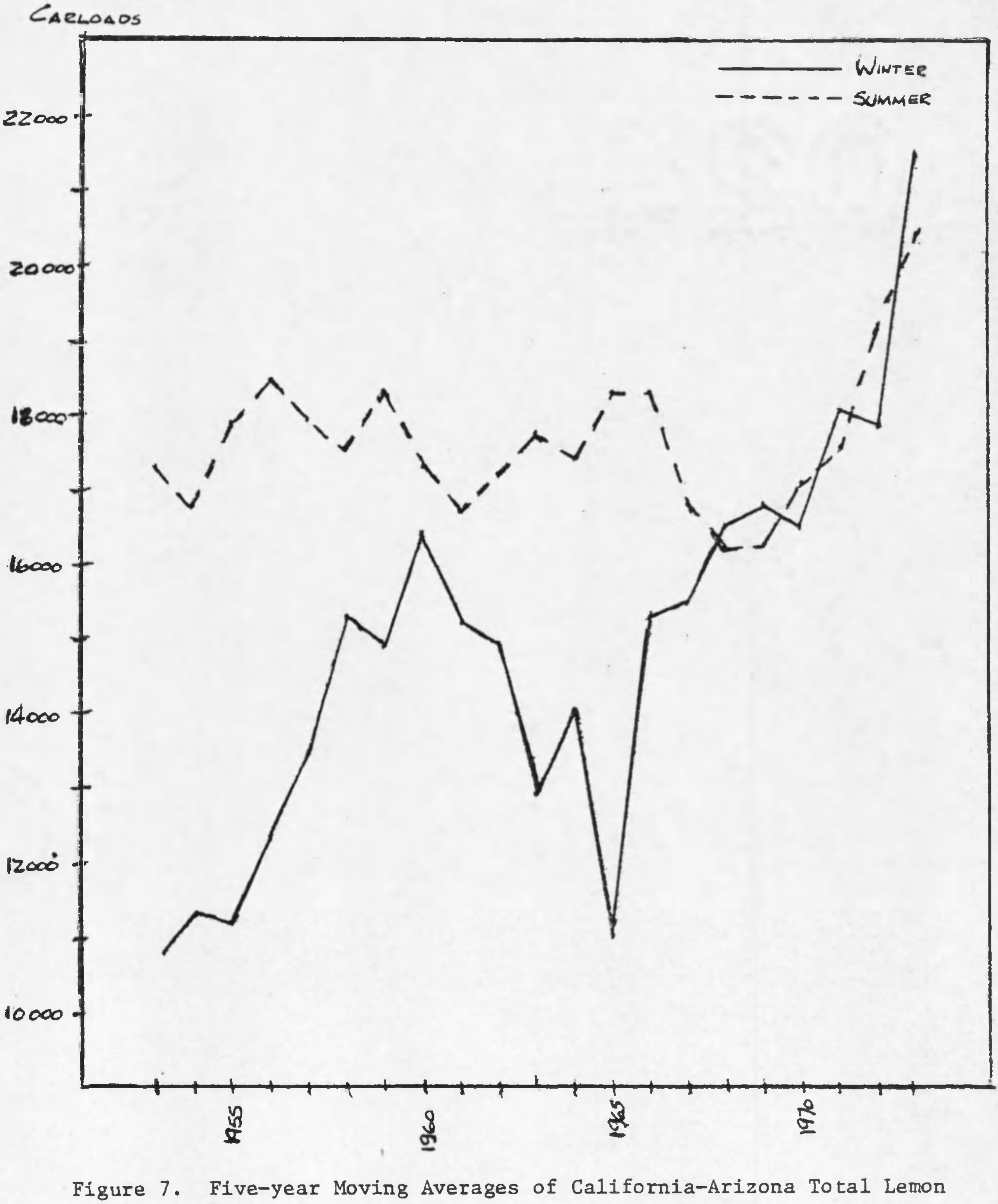


Figure 7. Five-year Moving Averages of California-Arizona Total Lemon Production, 1953-73.

Source: Appendix Tables A-3 and A-4.

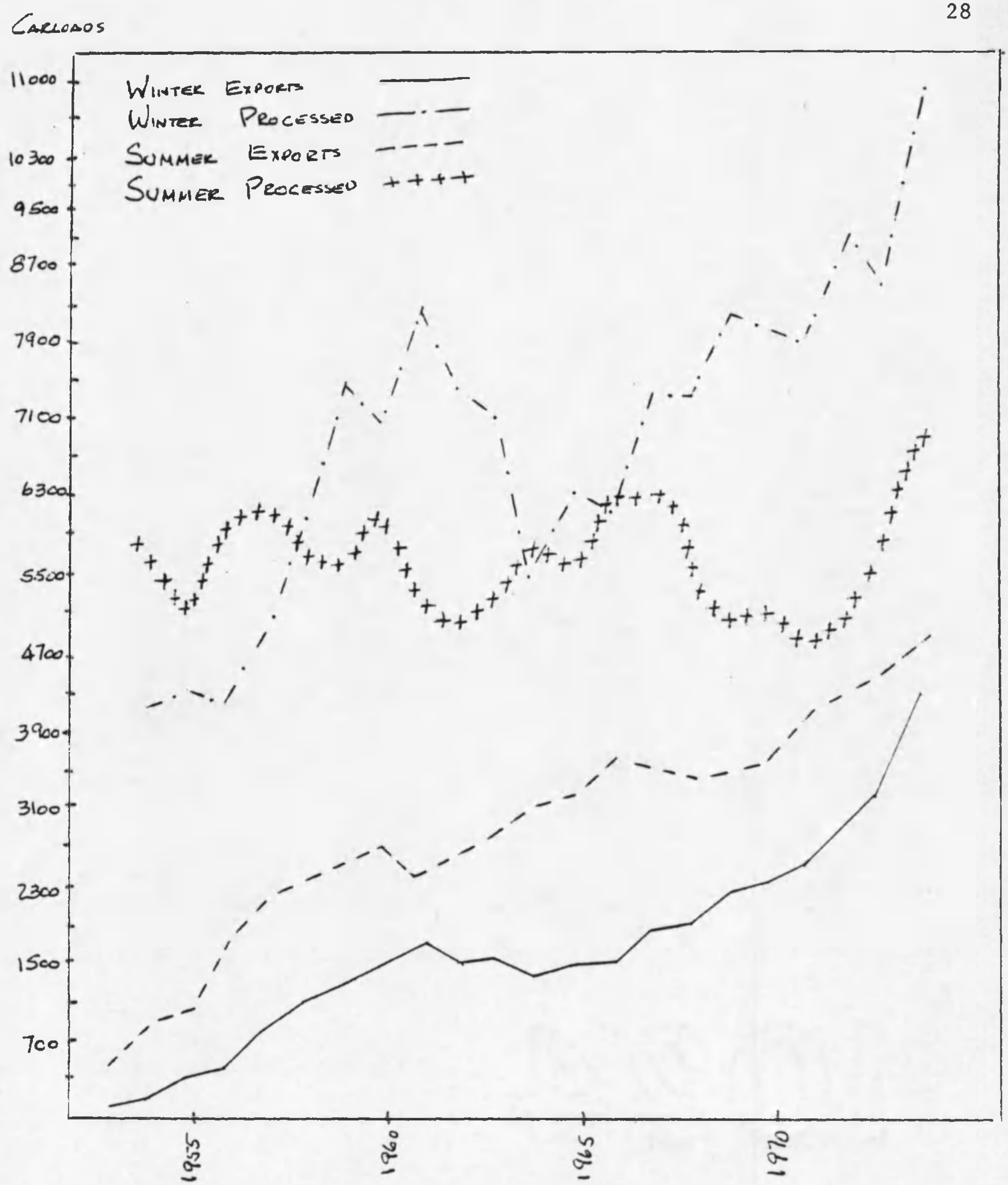


Figure 8. Five-year Moving Averages of California-Arizona Fresh Lemon Exports and Processed Lemons, 1953-73.

Source: Appendix Tables A-3 and A-4.

EXP = quantity exported (carloads),

PROC = quantity processed (carloads).

If both total production and domestic sales remain relatively constant, then a negative correlation between exports and products is necessary, with one exhibiting an increase in quantity only if the other decreases. If instead total production increases over time, yet domestic sales remain relatively stable, then export quantities and/or processed quantities will rise, and the correlation between exports and products may be either positive or negative. Figure 8 illustrates five-year moving averages of the quantities processed and exported. A decrease in the actual quantity of summer lemons processed occurred from 1951 to 1964, yet summer exports were rising throughout this time. This would suggest a negative correlation for this particular time period, followed by a period of positive correlation (both exports and processed quantities increasing), which helps explain the low overall correlation coefficient. One may speculate that the decrease in the quantity of summer lemons processed was related to the relatively stable production and rising summer exports during this time. Overall, the annual percentage increase in exports (11.28 percent in winter and 8.27 percent in summer) has been significantly greater than that of total production (2.99 percent for winter and .53 percent for summer), further demonstrating that exports have become increasingly more important (Tables 1 and 2).

The foreign markets for California-Arizona fresh lemons have also changed over time, although exports of fresh lemons to Canada have remained at a nearly constant level, close to 400,000 cartons each season, for the 26-year period under consideration.

The increase in exports to Japan is the most spectacular, rising from virtually nothing prior to 1964 to 3,200,000 cartons in the summer of 1974. This great change was precipitated by the 1964 removal of a long-standing import quota. Japan rapidly became the largest importer of U. S. fresh lemons; recently it has imported even larger quantities than the combined Western European countries. Japanese imports have exhibited greater than twenty-nine percent annual increase over the entire time period, for both seasons (Tables 1 and 2). The rate of change was greater during the first 14 years (33.88 percent in winter and 24.82 percent for summer), but the base was much smaller.

The Japanese market has not been without its difficulties. The Ministry of Health has prohibited the importation of fruit treated with the common fungistats Thiabendazole (TBZ) or Orthophenylphenol (OPP), and certain waxes and inks used on the fruit in preparation for its marketing. When the fungistats were found on a shipment of Florida grapefruit in 1975, the Japanese reacted by subjecting lemon imports to a rigorous testing procedure, and, in the process, a large quantity of fruit spoiled, was rejected and wasted. Fear of other losses lead to a cutback in subsequent shipments (Figure 9), and exports to Japan exhibited a significant decrease in the summer of 1975 (Figure 10).

Western Europe has historically been the major U. S. export market for fresh lemons, even though it is highly unstable. Use of the semi-logarithmic trend analysis shows that the 18.9 percent annual increase in the quantity of winter exports (7.78 percent for summer exports)

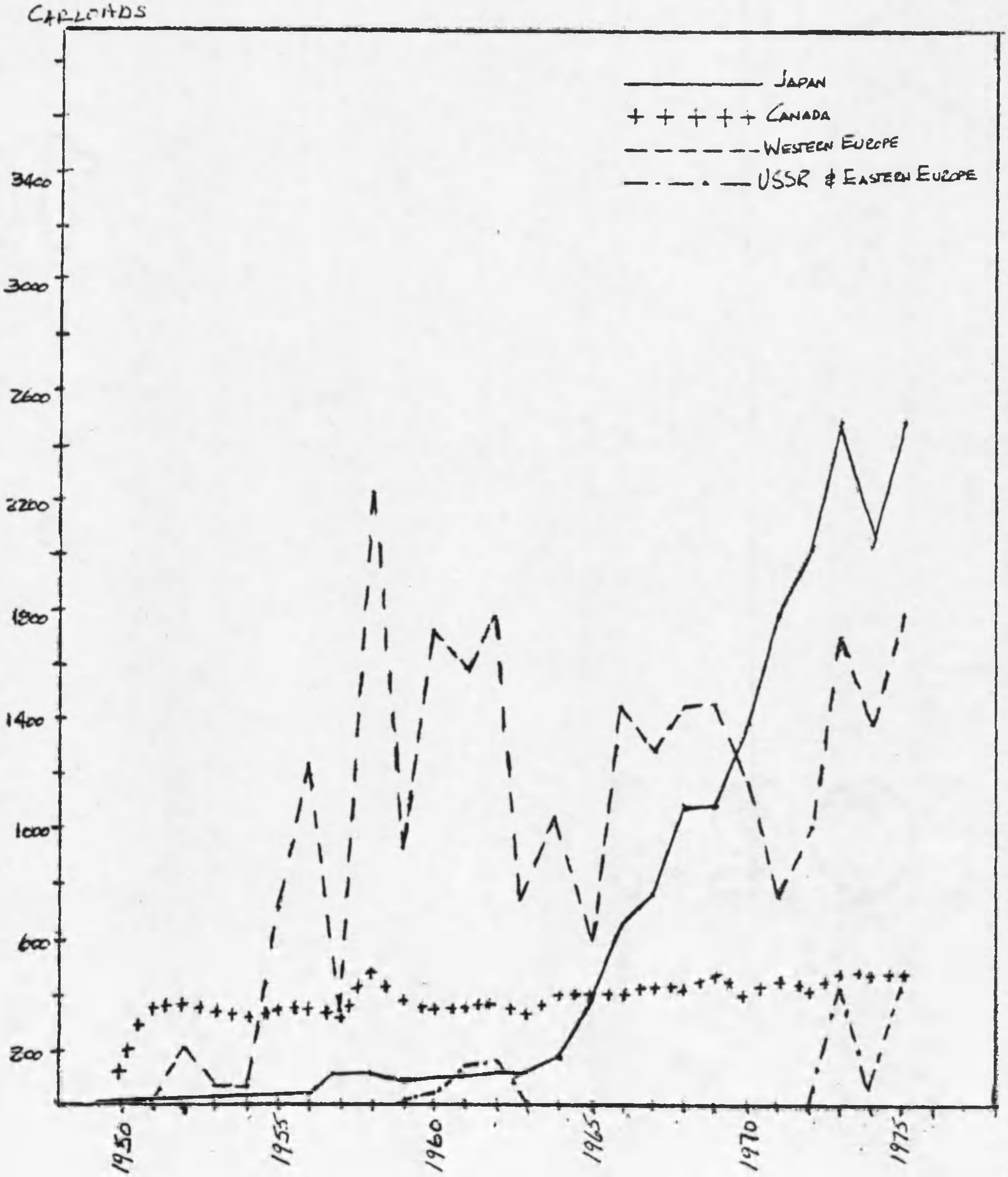


Figure 9. California-Arizona Winter Exports of Fresh Lemons to Japan, Canada, and Western Europe, 1950-75.

Source: Appendix Table A-5.

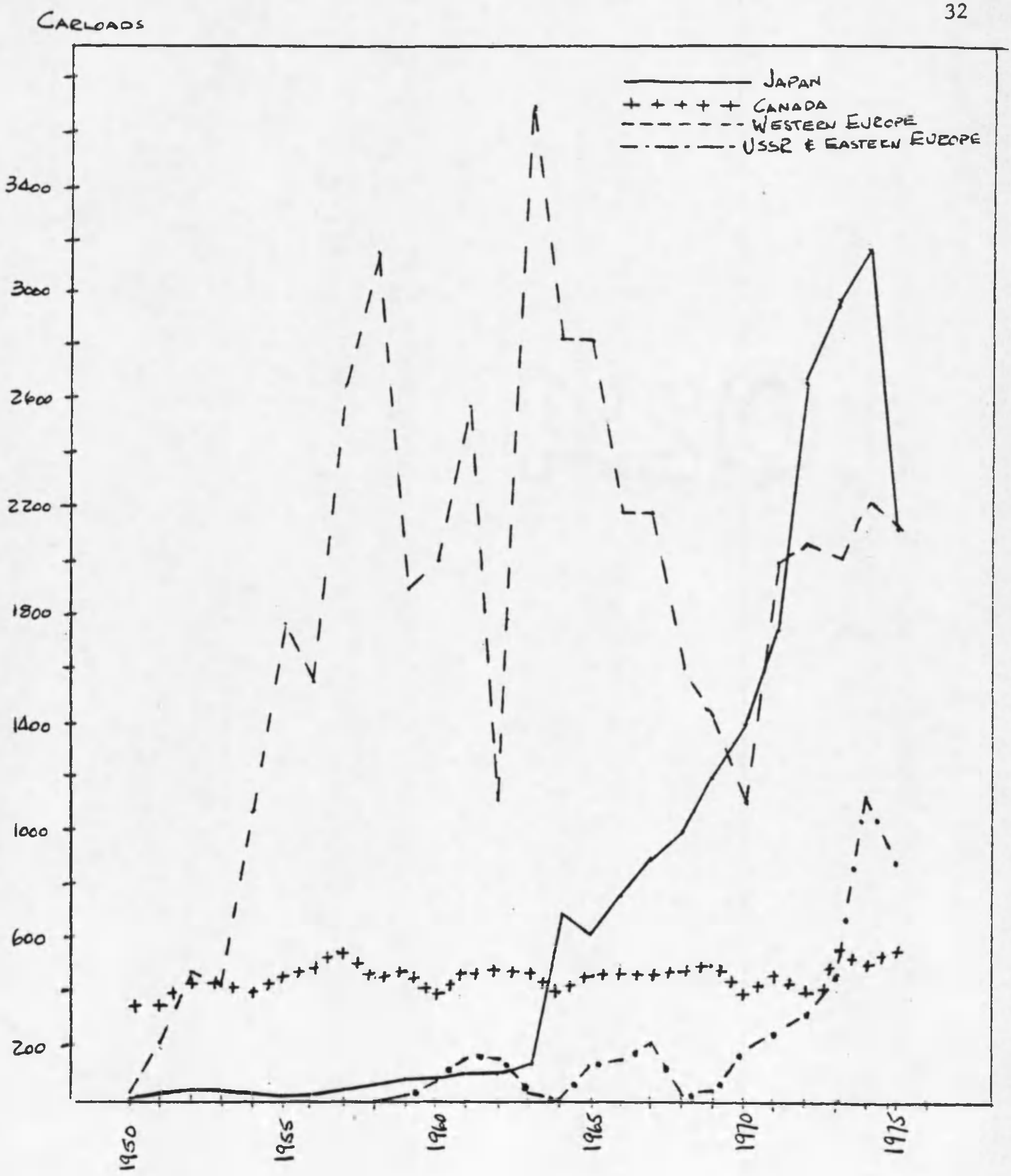


Figure 10. California-Arizona Summer Exports of Fresh Lemons to Japan, Canada, and Western Europe, 1950-75.

Source: Appendix Table A-6.

to Europe is due to extremely large annual increases in the earlier years, 1950 to 1963 (Tables 1 and 2). The year-to-year fluctuations in U. S. sales to Europe may be due to several factors, including the large number of competitors in the European market for fresh lemons. Because the market demand is for a lower quality fruit than in the Japanese case, many countries of the world export to Europe. Since the formation of the EEC in 1958, special trade advantages are given to member countries such as Italy, a major lemon producer. Other competitors in the Western European market include Spain, Turkey, Greece, Israel and Lebanon. Variations in the total U. S. supply of fresh lemons, given a relatively constant domestic market, may also have a greater impact on exports to Europe than on those to Japan, because Japan purchases a higher quality, higher priced lemon and exporters would prefer to make any necessary export supply cutbacks in the lower priced market. This source of instability would be more evident in European exports only after the 1964 Japanese market expansion. The large decline in summer exports to Western Europe in the latter half of the 1960's (Figure 10) seems to coincide with the increased access to the Japanese market, a preferred, substitute outlet for lemon exports.

The Eastern European market is largely determined by government decisions and historically has been virtually nonexistent. Recent years have seen increased exports to the U.S.S.R. and to a growing number of other Eastern European countries, especially in the summer months.

Export Values

Data on the quantity of exports give some indication of historical trends but are incomplete without observation of the values of exports over time. Prices of exports to various markets were determined from the total value and quantity data reported by the U. S. Department of Commerce (1949-75). To simplify comparison, all data on export values have been converted to U. S. dollars per 38-pound carton. No price deflator was used because this portion of the study was not concerned with the actual purchasing power of the earnings, but primarily with comparisons of various markets during the same time periods. The implicit assumption is that the rate of inflation was the same for all prices.

Export prices vary considerably from year to year for all major export markets, but a general increasing trend is evident for both Canada and Japan (Figures 11 and 12). Prices of exports to Japan have generally been the highest of the three major markets, due largely to the high quality of the fruit demanded and the relative lack of competitors in the Japenese market. Prices of exports to Japan increased remarkably in 1973/74 and 1974/75, reflecting in part the shortage of lemons that resulted from the crackdown on shipments containing OPP or TBZ in the summer of 1975. Although the annual percentage change over the entire time period (1950-75) is only 1.20 percent for winter exports to Japan and 2.24 percent for summer exports, the last eleven years show a 2.40 percent and 5.49 percent annual change for each season, respectively, (Table 3 and Table 4).

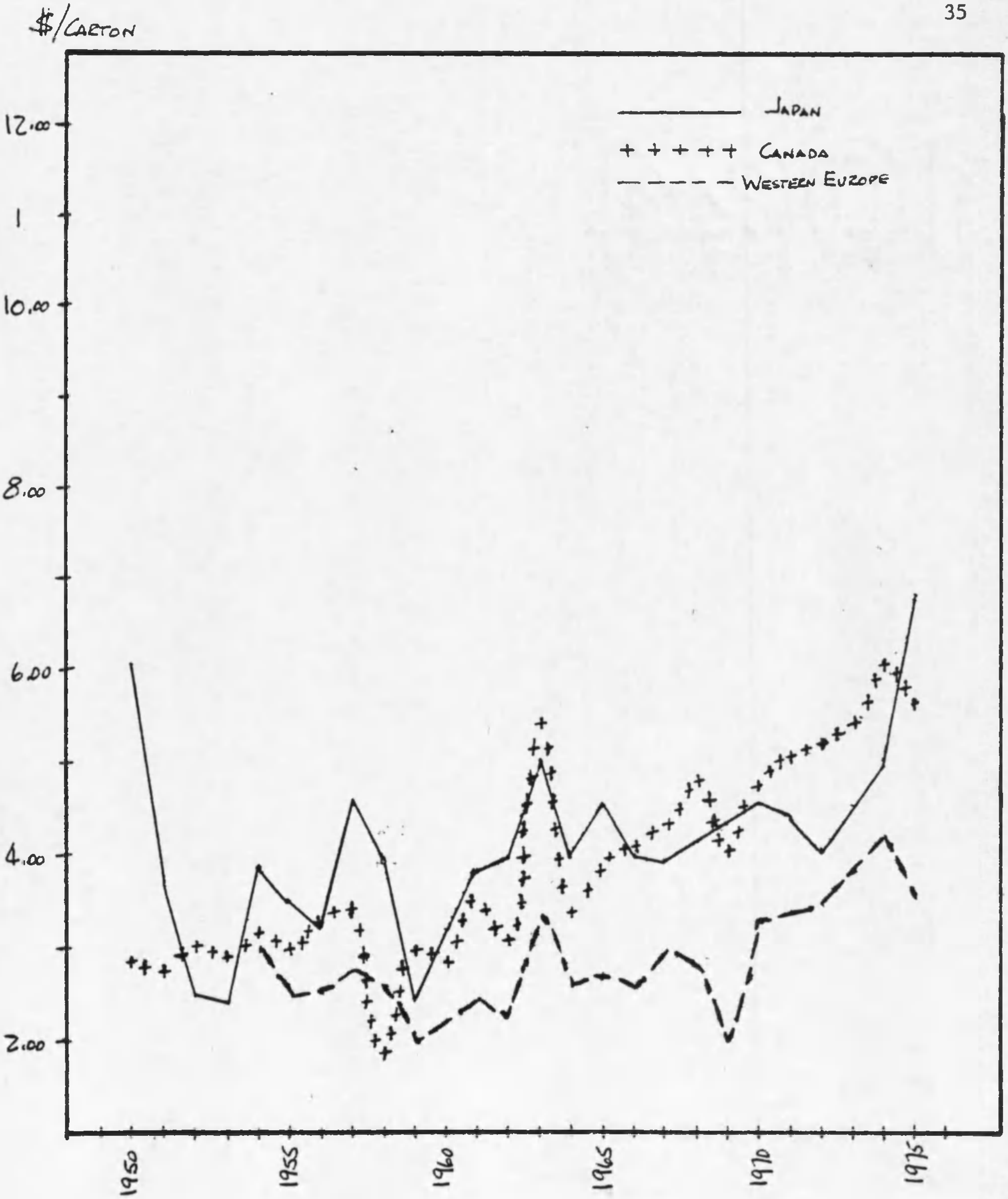


Figure 11. Prices of Winter Exports of Fresh Lemons to Japan, Canada, and Western Europe, 1950-75.

Source: Appendix Table A-7.

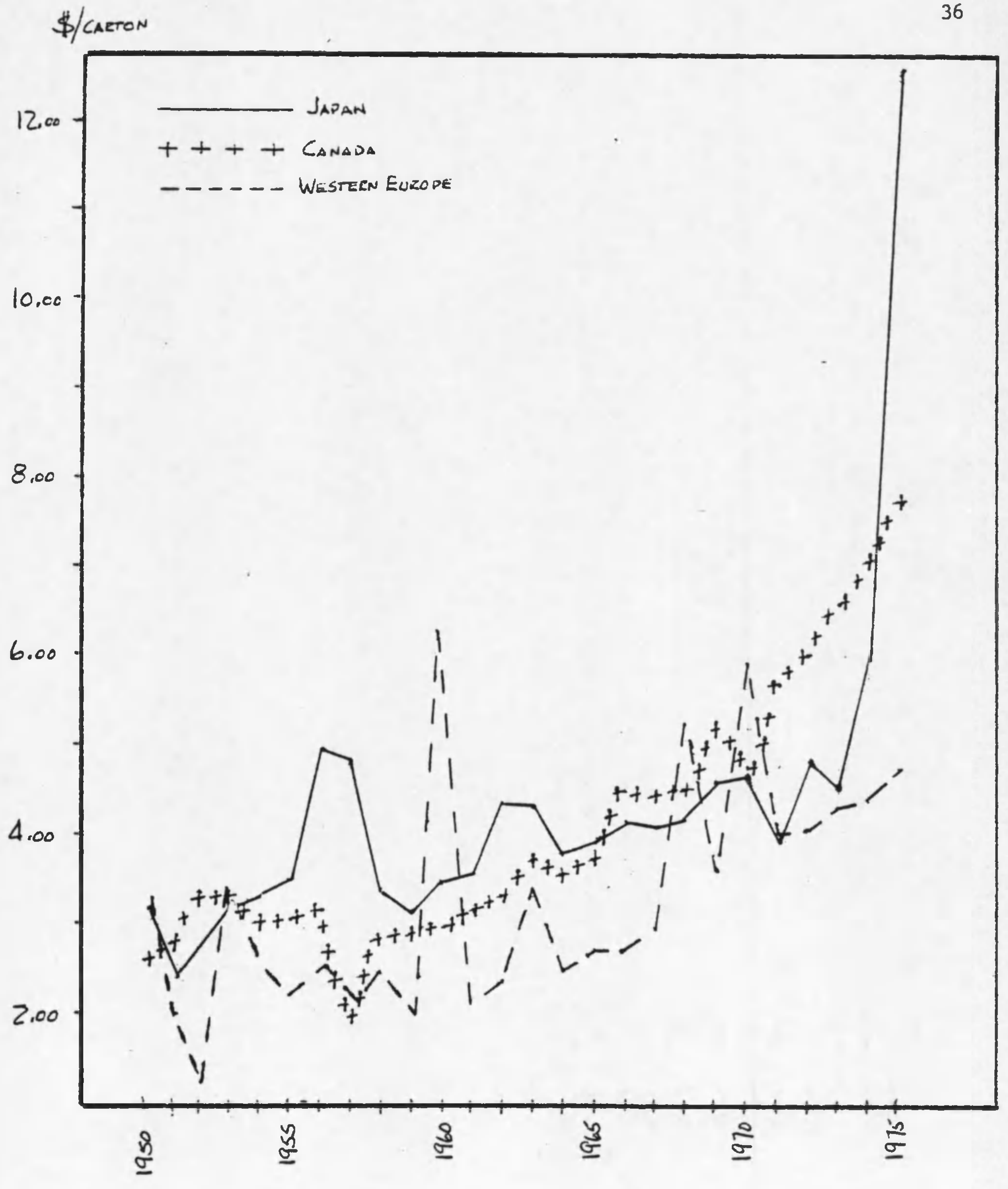


Figure 12. Prices of Summer Exports of Fresh Lemons to Japan, Canada, and Western Europe, 1950-75.

Source: Appendix Table A-8.

Table 3. Trend Analysis of Winter Lemon Export Prices.

Item	Annual Percent Change		
	1950-63	1964-75	1950-75
Average Export Price	-.32[c]	2.47[b]	1.46[b]
Japanese Price	.37[c]	2.40[b]	1.20[b]
European Price	10.28[b]	3.54[b]	4.64[b]
Canadian Price	1.72[a]	3.78[b]	2.57[b]
Russian Price	5.00[a]	15.96[b]	4.14[b]
Export/F.O.B. Price Ratio	-.90[a]	-1.22[b]	-.48[b]

a. Low consistency of trend, variable coefficient not significantly different from zero at probability levels ≥ .05 and < .20.

b. High consistency of trend, variable coefficient not significantly different from zero at probability levels < .05.

c. No trend or no consistency of trend-variable coefficient not significantly different from zero only at probability levels > .20.

Table 4. Trend Analysis of Summer Lemon Export Prices.

Item	Annual Percent Change		
	1950-63	1964-75	1950-75
Average Export Price	0	4.57[b]	2.92[b]
Japanese Price	2.07[b]	5.49[b]	2.24[b]
European Price	1.65[c]	4.35[b]	2.42[b]
Canadian Price	.74[c]	5.95[b]	3.20[b]
Ru-sian Price	14.55[b]	9.27[b]	8.14[b]
Export/F.O.B. Price Ratio	.72[c]	-1.62[c]	.30[c]

See Table 3 for footnotes.

The prices of exports to Canada have generally remained above the average export price for all markets, and have increased rapidly in 1973/74 and 1974/75. Of the four export markets under consideration, the Canadian one seems to be the most closely tied to domestic market conditions, not surprising considering its proximity and regulation under the domestic Marketing Order.

The fluctuations of export prices to Western Europe are as bold as the changes in the quantities sold. In general, the prices have been below the average export price, and often the lowest of the three regular export markets under consideration. This is most likely due to the lower quality of fruit demanded by the European consumer and the vigorous competition in that market.

The Eastern European and Russian market is too new to note any trends in export prices.

Export Values Relative to Domestic Prices

Figures 13 and 14 show the average export price as it compares with domestic prices at the retail, F.O.B. and fresh on-tree levels. The reported F.O.B. and on-tree prices are for all fresh lemons and include exports. Both F.O.B. and on-tree prices have increased over time. A sharply increasing retail price, associated with an ever-increasing margin between F.O.B. and retail prices, has accompanied the increasing on-tree and F.O.B. prices. The very direct relationship between the on-tree and F.O.B. price, with its slightly increasing difference, is expected as on-tree price equivalents are computed simply by subtracting picking, packing and hauling costs from the F.O.B. values. The average

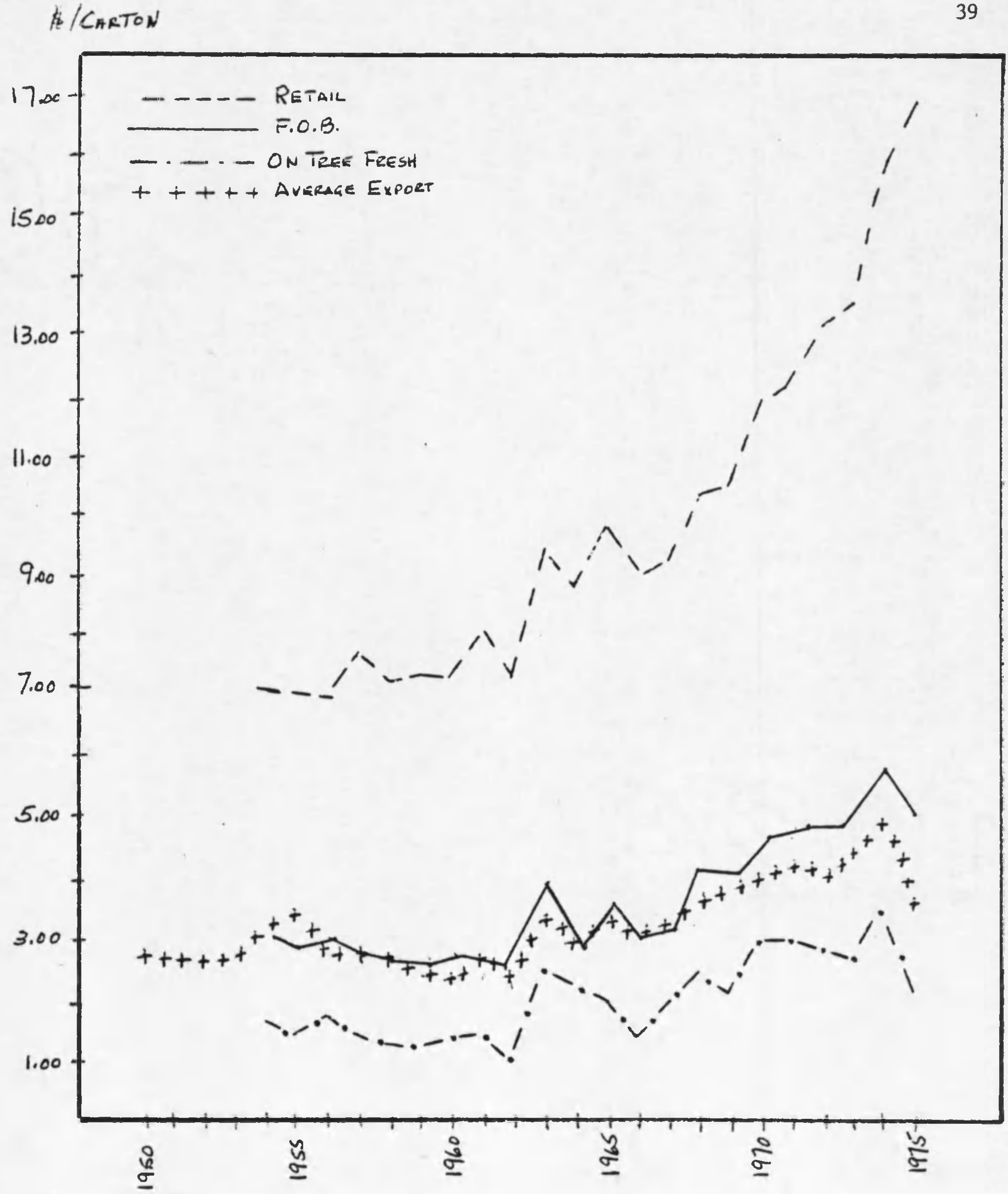


Figure 13. Prices of Winter Fresh Lemons at the Retail, F.O.B., and On-tree Levels, and Average Export Prices, 1950-75.

Sources: Appendix A-7 and A-9.

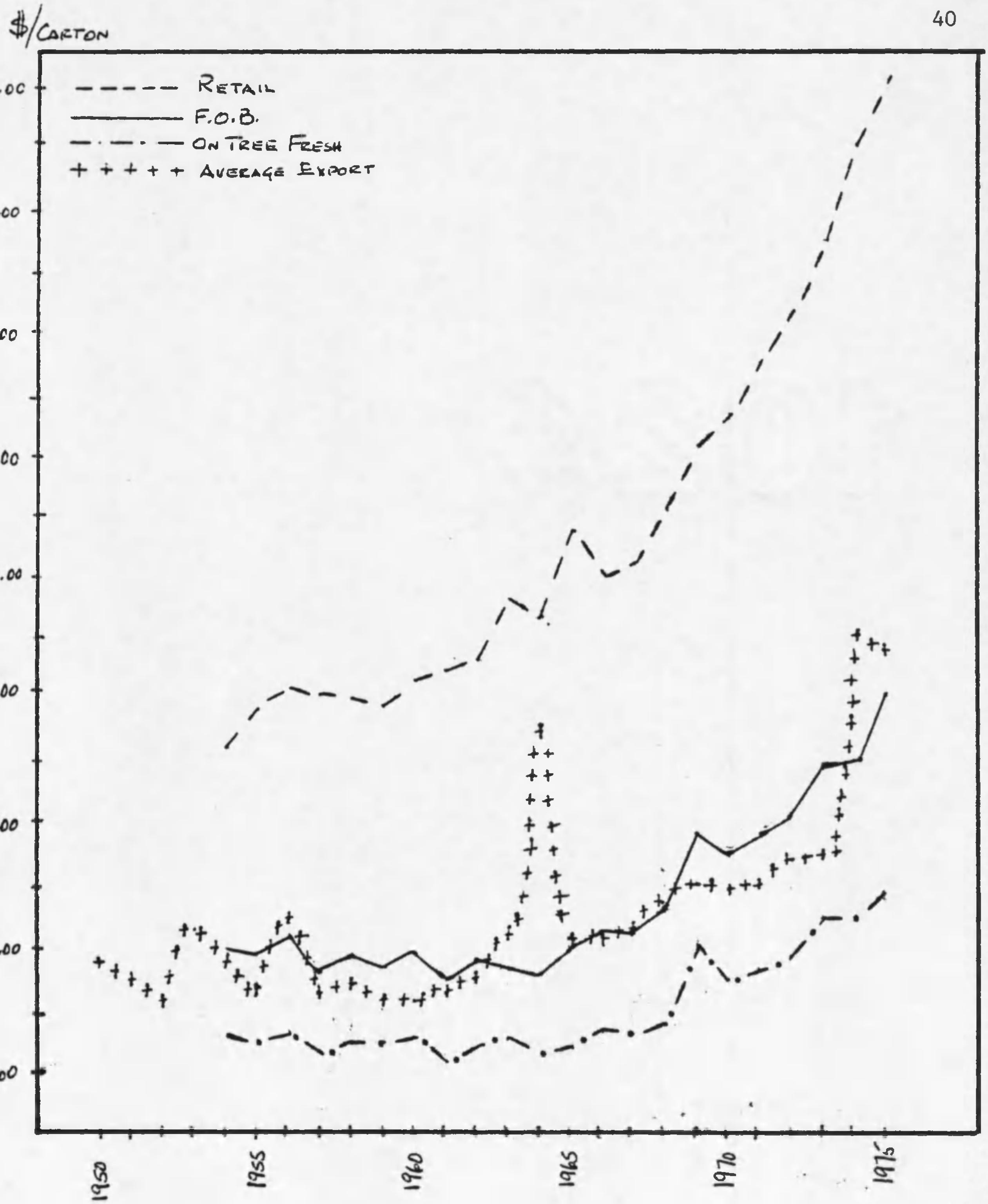


Figure 14. Prices of Summer Fresh Lemons at the Retail, F.O.B., and On-tree Levels, and Average Export Prices, 1950-75.

Sources: Appendix Tables A-8 and A-10.

export price has usually fallen below the F.O.B. price, with some notable exceptions. For example, the high level of the average export price in the summer of 1964 coincides with the commencement of Japanese trade; its peak in the summer of 1975 is probably also attributable to the Japanese market, where the sudden turning away of TBZ- and OPP-treated imports skyrocketed prices.

Export prices to Japan, Canada and Western Europe, as a proportion of the U. S. F.O.B. price, are graphed in Figures 15 and 16. The fluctuations are considerable and more noticeable in the summer season. In general, Japanese and Canadian prices have been greater than the domestic F.O.B. price. The large fluctuations in the price of exports to Europe are again evident.

Although average export prices are often below the F.O.B. price, one cannot be surprised that exports are at the relatively high levels they reach. The grower has several alternative uses for fruit not sold fresh domestically -- storage, processing and export. Storage can be used only for short periods, is costly, and interferes with future orderly marketing. Returns from processing are usually abysmally low, often not covering the costs of growing. Consequently, when the domestic market is saturated as determined by the Marketing Order Committee, exporting the fruit presents the next more desirable alternative.

The export and domestic markets are essentially separate markets with different demand elasticities. It has been shown that the elasticity of demand (its sensitivity to price changes) is higher in the markets characterized by more competition and more substitutes, in this case, the world market. If the lemon industry could discriminate

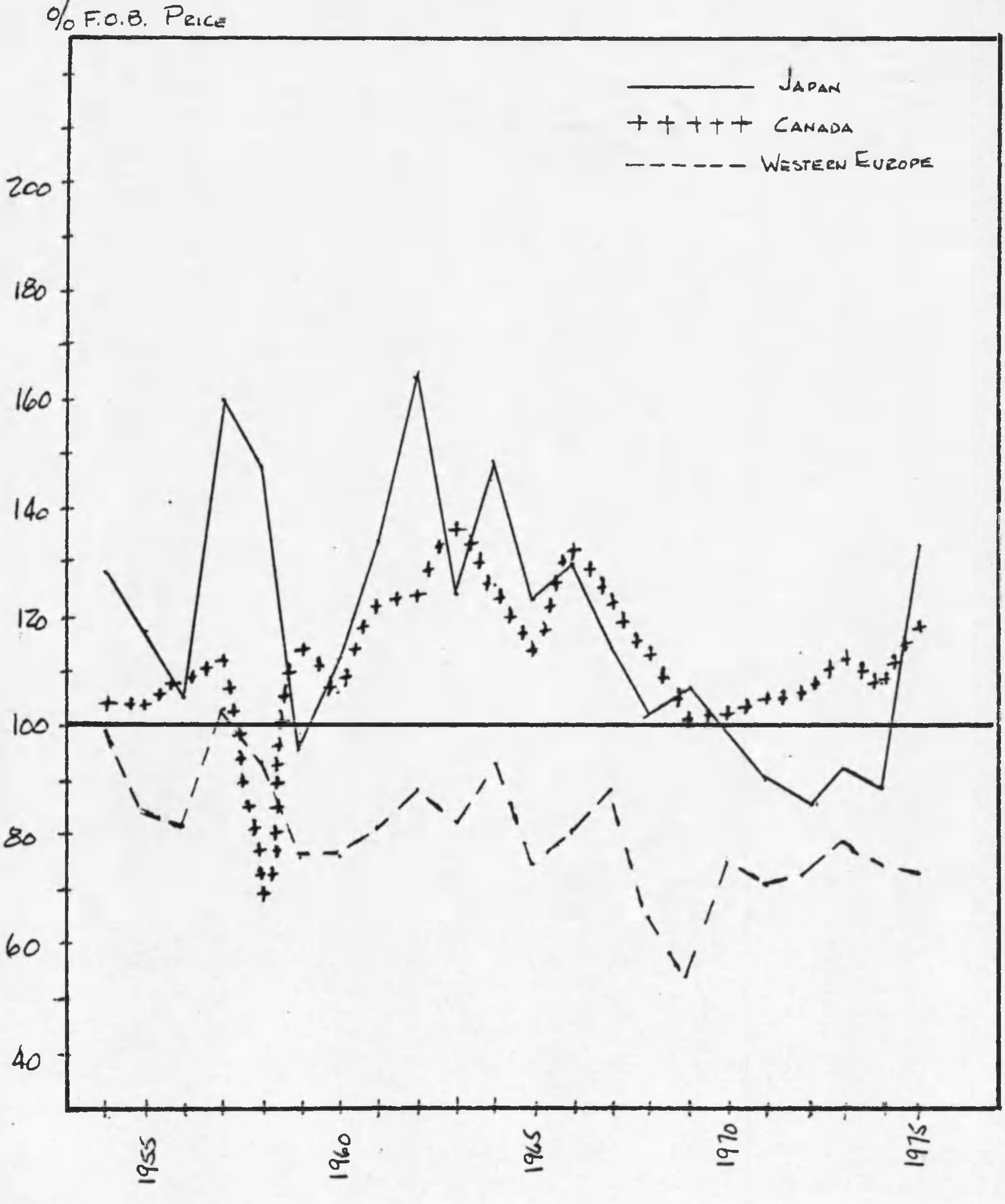


Figure 15. Prices of Winter Exports to Selected Markets as a Percentage of F.O.B. Prices, 1954-75.

Source: Appendix Table A-11.

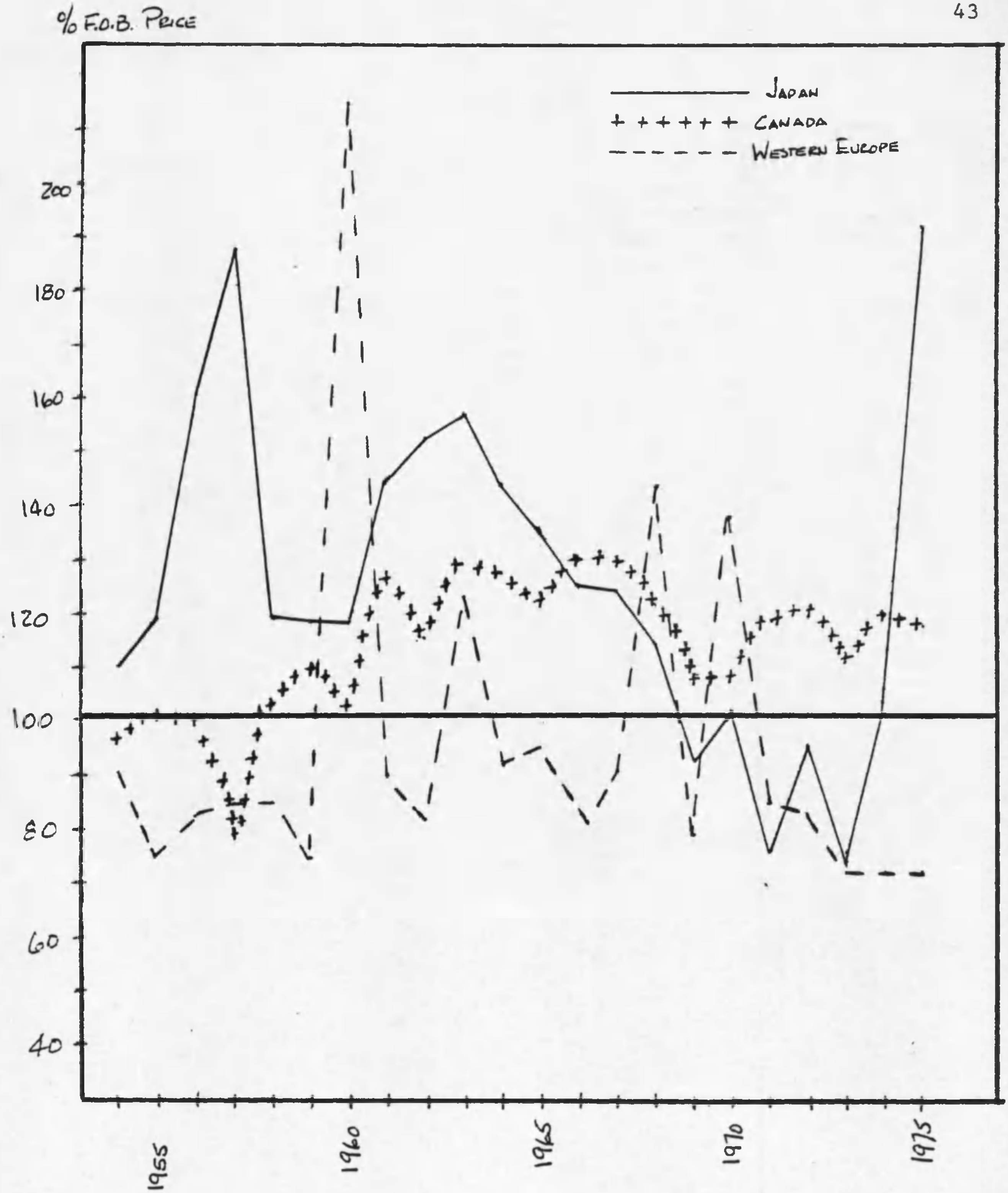


Figure 16. Prices of Summer Exports to Selected Markets as a Percentage of F.O.B. Prices, 1954-75.

Source: Appendix Table A-12.

between markets with perfect knowledge, the total quantity produced would be allocated so as to equalize the marginal revenues received from each market (Leftwich 1970). Because the Lemon Administrative Committee cannot control total supply, it cannot act as a discriminating monopolist, but rather adopts a total revenue maximization attitude in the domestic market (Jamison 1971, p. 296). This requires that the supply to the domestic market be established as that quantity which intersects the demand curve at its point of unitary elasticity. The remainder is distributed between export and processed markets. The greater elasticity of demand in the export market implies that the average export price will be lower than the domestic price. As long as export prices cover variable costs and production remains higher than allowed domestic sales, exports of fresh lemons should be expected to continue.

Price Variations

A more accurate measure of the variation of prices over a long period of time can be attained by the examination of variances and coefficients of variation of the basic price series. Table 5 gives the means, variances and coefficients of variations for the various winter export and domestic prices; Table 6 has the same information on summer lemon prices. The variance shows the deviations of prices around the mean; because the differences in the means of the various prices are significant, the coefficient of variation better serves the purpose of comparing the variances of the prices. The coefficient of variation shows relative variation, that is, the variation in a price (measured by the standard deviation) as a percentage of its mean ($\sigma/\overline{X} \times 100$).

Table 5. Winter Lemon Prices: Means, Variances and Coefficients of Variation.

Item	Variance ($\sigma 2$)	Mean ($\overline{X}$)	Coefficient of Variation ($\sigma/\overline{X}$ x 100)
Average Export Price	.435	3.235	20.39
Canadian Price	1.242	3.835	29.59
Japanese Price	.936	4.057	23.85
West European Price	.809	2.612	34.43
U.S.S.R. Price	.545	3.140	23.50
F.O.B. Price	.826	3.636	24.99
On-tree All Price	.900	3.587	26.45
Retail Price	8.619	9.846	29.82

Table 6. Summer Lemon Prices: Means, Variances and Coefficients of Variation.

Item	Variance ($\sigma 2$)	Mean ($\overline{X}$)	Coefficient of Variation ($\sigma/\overline{X}$ x 100)
Average Export Price	2.592	3.578	44.99
Canadian Price	2.178	4.011	36.79
Japanese Price	3.468	4.239	43.93
West European Price	1.600	3.255	38.86
U.S.S.R. Price	1.331	2.730	.42
F.O.B. Price	1.760	3.846	34.49
On-tree All Price	1.570	3.635	34.00
Retail Price	10.386	9.689	33.26

In general, the variation is larger in the summer than winter season, particularly the average export price and the price of exports to Japan.

One would expect the average export price and the domestic F.O.B. price to vary similarly as a reflection of the total quantity produced and available for fresh distribution. If their variances are significantly different, one must conclude that the variations in the prices do not reflect the play of the same combination of forces. The forces that determine supply and demand, and therefore prices, include such factors as weather, yield, bearing acreage, the decisions of the Administrative Committee on domestic shipments, seasonality of demand, consumer's income, promotion and advertisement, and the quality of the fruit available. Many of these factors, especially on the supply side, should have similar effects on export and domestic prices. To test the hypothesis that the variances of the two prices are equal, the Snedecor F-test ($F = S_1^2 / s_2^2$) was used (Shao 1976, pp. 452-457). If the ratio falls within the bounds determined to be significant at a specific level (say the .025 percent level), with the appropriate degrees of freedom, there is no rejection of the hypothesis. Both of the computed F-values fall within this range; implying no significant difference in the variation of the average export price and the F.O.B. price. There is no cause for rejecting the hypothesis that both are samples of the same population, the price of fresh lemons.

District Comparisons

The proportion of total production that is exported varies considerably among the different districts (Figure 17). Because some of

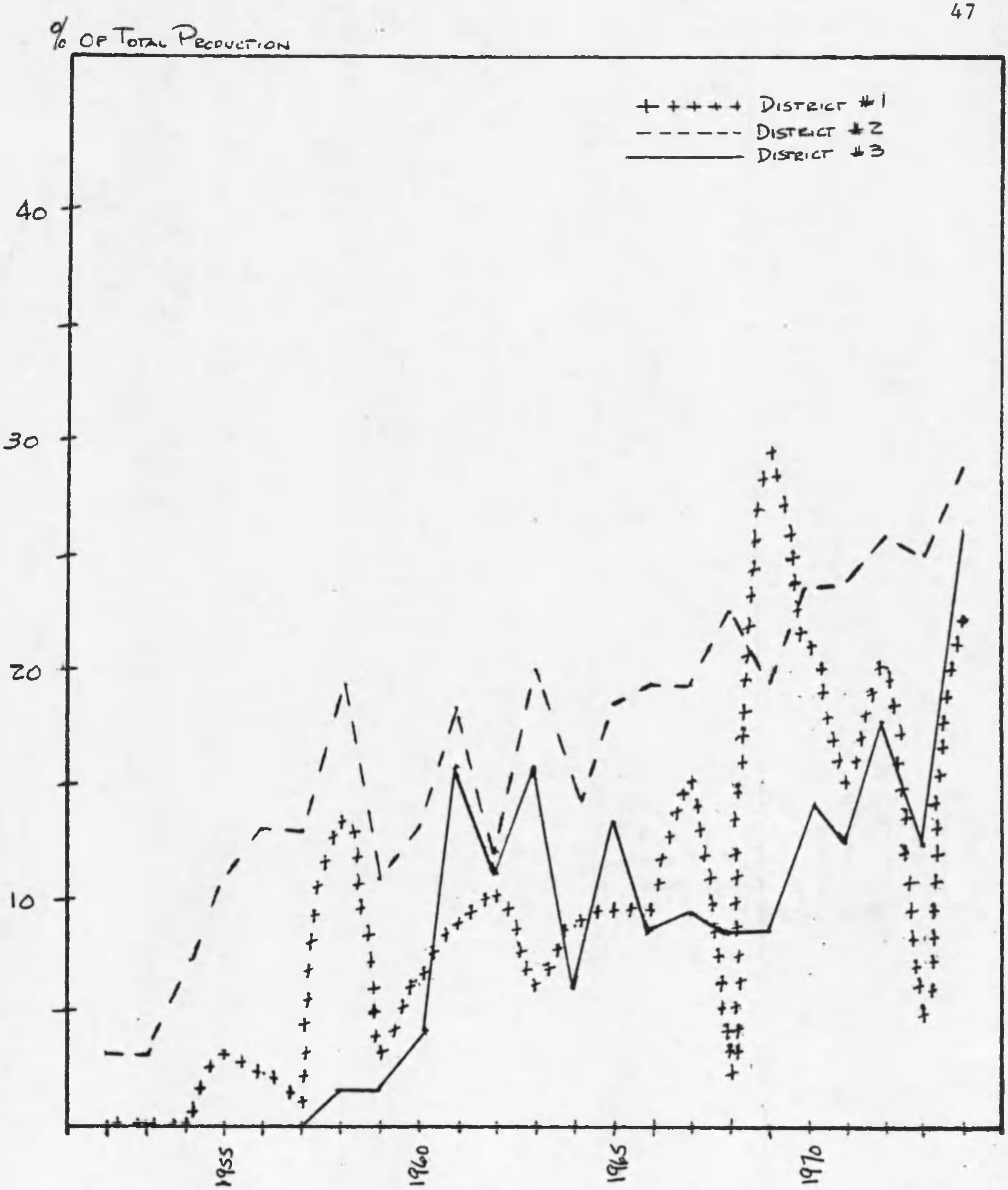


Figure 17. Export Proportion of the Annual Total Production of Each Producing District, 1952-75.

Source: Appendix Table A-13.

the districts produce primarily during the season of high export demand and others during the slack export season, the export proportion of their seasonal production would be affected. To partially bypass this influence, total annual exports are examined. District 2, Southern California, consistently exports the largest proportion of its production, somewhat greater than 20 percent in recent years. This district is also the largest producer, followed by District 3 (Arizona and the California Desert Region). District 3 total production has increased over time as has the percentage of production that it exports. District 1, Central California, has diminished in size, producing less and with a shorter marketing season than the other two regions. Its export percentage has shown the greatest fluctuation, particularly since 1964. Trend analysis indicates a significant increase in the percentage of total production exported from Districts 2 and 3 (Table 7). The rate of growth of exports has slowed for the three regions, but the actual quantity has continued to increase. The importance of exports for each individual producing district varies because of its seasonality of production and marketing, but for all districts foreign markets have increased in importance over the 1950 to 1975 time period,

Trend Comparisons

A comparison of annual percentage changes in the many variables under consideration serves to summarize the historical trends of the lemon industry's international trade (Tables 1 and 2). Expressing the natural log of the dependent variable as a function of time, the coefficient of the independent time variable, the slope can be manipulated

Table 7. Trend Analysis of Lemon Exports by Producing District.

District	Annual Percent Change in Export Proportion of Total District Production		
	1950-63	1964-75	1950-75
District 1	32.83[a]	6.51[b]	14.95[a]
District 2	13.37[a]	5.68[a]	6.68[a]
District 3	30.77[a]	9.62[a]	13.95[a]

a. High consistency of trend, variable coefficient not significantly different from zero at probability levels < .05.

b. No trend or no consistency of trend, variable coefficient not significantly different from zero only at probability levels > .20.

to determine the annual percentage change in the variable. While total winter production increased only 2.99 percent annually (.53 percent for summer), exports were growing at 11.28 percent (8.27 percent summer) annually. The most rapid period of growth for exports was the earlier 14 years, 1950-63, when the export base quantity was very low. Exports to both Japan and Western Europe exhibit strong increasing trends over time, as high as 30.17 percent annual increase to the Japanese market and 18.90 percent to Europe. From 1950 to 1963 exports to Europe increased very rapidly (63.61 percent), yet after that time period there is no consistency in the trend or no significant trend. Although the rate of growth of exports to Japan also decreased after the first 14 years, the rate of change remained consistently high even as the base quantities expanded remarkably.

Export prices also exhibit consistent trends over time (Tables 3 and 4). The average export price showed no trend during the 1950-63 time period, but has increased more than 2.0 percent annually since 1964. All of the export prices to the individual countries have increased significantly over time in current dollars; the changes in constant dollars, given the rate of inflation, are probably not significant.

In conclusion, it is evident that exports have become an increasingly more important part of the fresh lemon market, growing in absolute values as well as percentage of total production. The need for export markets, as well as the benefits derived from them, appear to have been accentuated by the Marketing Order Committee's regulation of the fresh domestic market and its inability to control total production. The Japanese market has become the major export outlet for California-Arizona fresh lemons, surpassing even the combined Western European countries. Export prices to Japan have generally been among the highest of export prices and have contributed to an overall average export price that approximates the F.O.B. price. The rate of growth of fresh lemon exports has been greater than that of total production, and although the importance of various foreign markets and the rates of growth have changed over time, the increasing overall impact of the export markets cannot be denied.

CHAPTER IV

THE RELATIONSHIP BETWEEN FOREIGN AND DOMESTIC LEMON PRICES

Historical trends show the increasing importance of foreign trade in lemons, but most U. S. consumers and producers are more interested in the impact of exports on prices. Conflicts arise as the price changes desired by the consumer, decreased prices, are contrary to the increasing prices the grower hopes to receive. This study focuses primarily on the benefits from trade to the lemon industry and consequently does not treat welfare gains and losses by consumers.

Theory, Models and Data

Standard price theory expresses the relationship between the quantity demanded and the quantity supplied, and hence the price of a commodity, as one that is simultaneously determined by market conditions. But from an agricultural producer's point of view, the supply of a crop in the short run is often a given quantity, whatever has been harvested or is ready to be harvested. When the quantity supplied is given, price is influenced, ceteris paribus, by the allocation of this quantity among various markets. This is the situation in the lemon industry when viewed each crop season (Chapter III).

Prices may be affected by marketing decisions concerning the allocation of the crop between domestic, export and processed markets.

Within this decision, further influences on price may arise from choices of the specific markets in which the exports are sold.

The theory suggests particular models for the lemon industry that describe price as a function of the allocation of total supply among various markets. Five single equation models were used to represent this behavior:

$$PO = f(QDOM, QEXP, QPROC) \quad (1)$$

$$PO = f(QCAN, QJAP, QEUR, QUSSR, QPROC, QDOM) \quad (2)$$

$$Pexp = f(QEUR, QJAP, QCAN, QUSSR) \quad (3)$$

Where: PO = on-tree price for fresh lemons

Pexp = average price of exports to all markets

QDOM = quantity sold domestically, including Canada

QPROC = quantity diverted to processing

QEXP = total exports, excluding Canada

QJAP = exports to Japan

QCAN = exports to Canada

QEUR = exports to Western Europe

QUSSR = exports to Russia and Eastern Europe

Model 1 specifies the relationship between the on-tree price per carload of fresh lemons, and the allocation of the total production of lemons among domestic, export and processed markets -- the three major outlets. To further explore the impact of exports on on-tree prices, Model 2 disaggregates total exports and examines exports to four major purchasing regions (Western Europe, Canada, Japan and the Communist Countries). Allocation to the other market outlets, processed and fresh domestic sales, are also considered. The third model investigates the impact of each of the four major export markets on the average export price, giving indication of the relative importance of the markets and their individual impact on the export price.

The expected relationships between the on-tree price of fresh lemons and the allocation of total production among various market outlets is easy to hypothesize for each crop season, but much more difficult to determine when time series data are used. For a given crop, it is expected that the quantity allocated to the domestic market is negatively related to the on-tree price; that is, as the quantity sold domestically increases, the price decreases, the usual price-quantity relationship. When the quantity of lemons diverted to processing outlets is increased, given the total supply, the quantity available for fresh use is reduced, and an increase in the on-tree price of fresh lemons is expected. The expansion of total exports is hypothesized to have a positive effect on the on-tree price.

The difficulty encountered when time series data are used is that total production has been changing over time and an increase in allocation to one outlet may not necessarily require a decrease to another outlet. As was explained in Chapter III, an increase in total production may permit an increase in processed lemons and an increase in fresh lemon use (both domestic and export). This effect makes it impossible to hypothesize the sign of the quantity processed variable over the long time period under consideration.

To circumvent the difficulty caused by changes in total production and to better determine the impact of processed quantities, another set of single equation models was defined:

$$P = f\left(\frac{QDOM}{TP}, \frac{QEXP}{TP}, \frac{QPROC}{TP}\right) \quad (4)$$

$$P = f\left(\frac{QEXP}{QDOM}, \frac{QPROC}{QDOM}\right) \quad (5)$$

where: P = on-tree price for all lemons

TP = total quantity produced

and all other quantity variables are as previously defined (page 53).

The use of the on-tree all price, as opposed to the on-tree fresh price, allows a more direct accounting of the impact of processed quantities. If total production were constant, one would hypothesize a negative relationship between the quantity sold domestically and the on-tree all price, and a positive relationship between the price and the quantities diverted to export and processed outlets.

To normalize the quantity variables, their ratios to total production are used as the independent variables in Model 4. It is hypothesized that as the ratio of processed quantity to total production increases, the on-tree price for all lemons would decrease. A positive relationship between the price and the ratio of exports and domestic sales to total production is expected.

Model 5 utilizes the ratio of export and processed quantities to domestic sales. One would probably expect a decrease in the on-tree price as the ratio of export to domestic sales increased. The same relationship, albeit stronger, would be expected between the price and the ratio of processed to domestic sales.

To determine the appropriate functional relationships between the dependent variables and each of the independent variables, the observed price and quantity values for the 26-year period under consideration were plotted and quadratic as well as linear functions were suggested. The Ordinary Least Squares method was used to compute the equations that minimize the sum of squares of the differences between the observed values and the estimated ones. The preferred equation, the one of "best fit," was chosen as that one which had the highest coefficient of determination (R^2) and significant variables with economically rational coefficients. The sign of the coefficients of the variables in the estimated equations show the direction of change of each independent variable in relationship to the dependent variable; the coefficient of determination (R^2) shows how much of the variation in the dependent variable is associated with variation in the independent variables. The significance of a particular variable in the equation can be determined by examining the probability level at which the coefficient is not significantly different from a hypothesized value such as zero. For example, if the coefficient of a particular variable is not significantly different from zero with a .05 probability, it is more closely associated with variation in the dependent variable than another independent variable with a .15 probability level of significance. The models used in this chapter do not attempt to be complete; other variables may be necessary to explain price; the objective of this analysis is to isolate the effects of exports on price.

The data set used to estimate the model equations is defined as follows:

On-tree Fresh Price (PO) is the price per carload received by growers for fresh lemons at the on-tree level. This is the F.O.B. price minus picking, packing, hauling and selling charges (U. S. Department of Agriculture 1950-75b).

The On-tree All Price (P) is the price per carload received by growers for all uses of lemons, at the on-tree level (U. S. Department of Agriculture 1950-75b).

The total production in carloads (TP) and the quantities of this supply diverted into the domestic market (QDOM) and into processed use (QPROC) are reported by the Lemon Administrative Committee (1950-76).

The Average Export Price (Pexp) and carload quantities of exports to various markets (QJAP, QCAN, QEUR, QUSSR, QEXP) are those that were derived in the previous chapter from the U. S. Department of Commerce (1949-75), with exports to Canada excluded from the total export quantity.

Total Quantity

Table 8 lists the equations that were fitted to express fresh on-tree prices as a function of the total quantity exported (excluding Canada), domestic sales (including Canada) and the quantity processed (Model 1). The best fit for summer lemons was obtained from a quadratic equation, Number 4. This equation not only yielded higher correlation coefficients than the linear equation, but also had statistically significant and economically rational coefficients for many of the variables. Significance levels and other statistical properties of the equation are presented in Table 8.

Table 8. Regression Equations of On-tree Fresh Prices with the Quantities of Lemons Exported, Processed and Sold Domestically.[a]

Equation Number	Dependent Variable	Constant	Independent Variables (and Levels of Significance)	R^2
1	PO_w	8194.3762	−1.147332 QDOM + .34681149 QEXP − .10002888 QPROC (.111) (.007) (.017)	.52755
2	PO_w	144345.6	−50.726244 QDOM − .01600683 $QPROC^2$ − .14702311 QEXP (.226) (.046) (b) +.16223507 QPROC + .12760004 $QEXP^2$ + 4.4947742 $QDOM^2$ (.216) (.088) (.238)	.67407
3	PO_s	6965.0881	−.66462408 QDOM + .088099875 QPROC − .062465377 QEXP (.007) (.293) (b)	.63612
4	PO_s	30799.997	−6.2397452 QDOM − .60086918 QPROC + .078393871 $QEXP^2$ (.000) (.040) (.100) −34273790 QEXP + .040533028 $QPROC^2$ − .35826368 $QDOM^2$ (.349) (.052) (.000)	.93562

a. PO_w = On-tree fresh price, winter lemons (November-April), dollars per carload.

PO_s = On-tree fresh price, summer lemons (May-October), dollars per carload.

QDOM = Quantity sold domestically, carloads.

QEXP = Total quantity exported, carloads.

QPROC = Quantity diverted into processing, carloads.

Table 8. (continued)

Numbers in parentheses indicate the level of probability at which the coefficient is not significantly different from zero.

b. Probability level > .50.

The quadratic equation for winter on-tree prices (Equation 2) yields a higher coefficient of determination than the linear model for that season (Equation 1), but has several variables that are significant only at low probability levels. The overall effect of increased domestic sales, all other variables held constant at their mean levels, appears to be negative. The quadratic form of the fitted equation implies a minimum point after which the curve will be positively sloped, but this point is beyond the relevant range of the data.

The effect of increased exports is positively related with the winter on-tree price throughout the 1950-75 period considered (Equation 2). The processed quantity appears to have a slightly negative relationship with the on-tree price, yet its low simple correlation with fresh prices prohibits its consideration as a major explanatory variable.

The linear equation for winter lemons (Equation 1) has a lower correlation coefficient than the quadratic form (Equation 2), but shows the expected inverse relationship between domestic sales and the on-tree price, and the positive relationship between the price and export sales. The importance of the processed quantity variable is questionable because of its low simple correlation, although its coefficient is very significant.

Equation 4 for summer lemons yielded a high coefficient of determination and several very significant coefficients. The negative relationship between the on-tree price and the quantity sold domestically changes to a positive one as domestic sales exceed approximately 8,500 carloads. Summer domestic sales in excess of 8,500 carloads were observed prior to 1962, and may suggest a structural change in the industry around that time.

Export quantity shows a strong positive relationship with the summer on-tree price throughout the range of the data, as was hypothesized (Equation 4). The processed quantity exhibits a negative relationship, but its relevance must be greatly discounted because of its low simple correlation with the price for fresh lemons.

On the basis of the scatter diagrams, there appears to be considerable difference in the level of the fresh on-tree prices associated with the processed quantities after 1968. This was a further motivation to develop the price equation models on the basis of two different time periods, 1950 through 1963, and 1964 through 1975, the post-trade expansion period. These equations for both winter and summer on-tree prices for fresh lemons are presented in Table 9.

For the winter season, division of the 25-year period into two time periods allows for the estimation of an equation with a higher coefficient of determination for the latter time period (Equation 6), but the fit is poor for the 1951-63 time period and the signs of the coefficients are not as hypothesized. It is difficult to know whether to attribute the unexpected signs to improper form of the equation, or to the effects of changes in total production. From 1964 to 1975, an increase in the on-tree price of fresh winter lemons was associated with an increase in exports and a decrease in domestic sales.

For the summer on-tree price for fresh lemons, the equation for the earlier time period (1951-63), Equation 7, yielded a very low coefficient of determination and coefficient signs contrary to those

Table 9. Regression Equations of On-tree Fresh Price for Time Periods 1951-63 and 1964-74.[a]

Equation Number	Dependent Variable	Constant	Independent Variable (and Levels of Significance)	R^2
5	PO_w 1951-63	2388.88355	-.05605 QDOM - .10800 QEXP - .06054 QPROC	.263
			(.13)	
6	PO_w 1964-75	11834.8935	-1.75349 QDOM + .63671 QEXP - .20098 QPROC	.690
			(.13) (.0001) (.006)	
7	PO_s 1951-63	702.26514	+.13999 QDOM - .05114 QEXP - .05900 QPROC	.398
			(.425) (.20)	
8	PO_s 1964-75	10746.5126	-1.30689 QDOM + .18146 QEXP + .04225 QPROC	.759
			(.0025) (.475) b	

a. PO_w = On-tree fresh price, winter lemons (November-April), dollars per carload.

PO_s = On-tree fresh price, summer lemons (May-October), dollars per carload.

QDOM = Quantity sold domestically, carloads.

QEXP = Total quantity exported, carloads.

QPROC = Quantity diverted into processing, carloads.

Numbers in parentheses indicate the level of probability at which the coefficient is not significantly different from zero.

b. Probability level > .50.

hypothesized and none of coefficients were significant. Equation 8 for the latter time period (1964-75) exhibits all the expected signs for the coefficients, and a relatively high coefficient of determination. This equation expresses a significant negative relationship between the on-tree price and the quantity sold domestically, while the quantities allocated to both exports (not significant) and the processed markets (significant) are positively related to the price for fresh lemons.

Model 4 was also run as a linear regression equation and the results are presented in Table 10. Equations 9 through 11 are concerned with the winter season, Equations 12 through 14 with summer lemons. Equation 9 exhibits the expected positive signs for the export and domestic variables, and an insignificant coefficient for the processed ratio variable. The coefficient of determination is extremely low in this equation.

Equations 10 and 11 represent Model 4 for each of the time periods, 1951 through 1963 and 1964 through 1974. Equation 10 also exhibits the expected positive relationships of on-tree all price with the ratio of domestic and export sales to total production, but the significant positive coefficient on the processed ratio is inconsistent. The coefficient of determination (R^2 = .62) is acceptable but not particularly high. Equation 11 for the latter time period also has a reasonably high coefficient of determination, but none of the variables have significant coefficients.

For summer lemons, the results are extremely poor for Model 4. All of the indpendent variables in Equations 12 and 13 lack significance. For the latter time period (Equation 14) the coefficient of the ratio of

Table 10. Regression Equations of On-tree All Price of Lemons and the Ratio of Domestic, Export and Processed Quantities to Total Production.[a]

Equation Number	Dependent Variable	Constant	Independent Variable (and Level of Significance)	R^2
9	P_w 1951-74	-10.7	$+ 14.2 \left(\frac{QEXP}{TP}\right) + 11.9 \left(\frac{QDOM}{TP}\right) + 10.6 \left(\frac{QPROC}{TP}\right)$ (.035) (.075) (.125)	.32
10	P_w 1951-63	17.3	$+ 16.9 \left(\frac{QEXP}{TP}\right) + 19.1 \left(\frac{QDOM}{TP}\right) + 17.1 \left(\frac{QPROC}{TP}\right)$ (.04) (.025) (.05)	.62
11	P_w 1964-75	5.8	$+ 2.2 \left(\frac{QEXP}{TP}\right) - 4.4 \left(\frac{QDOM}{TP}\right) - 6.7 \left(\frac{QPROC}{TP}\right)$ (b) (b) (.30)	.64
12	P_s 1951-74	4.5	$+ .85 \left(\frac{QEXP}{TP}\right) - 3.8 \left(\frac{QDOM}{TP}\right) - 4.5 \left(\frac{QPROC}{TP}\right)$ (b) (.14) (.15)	.31
13	P_s 1951-63	-22.5	$+ 20.9 \left(\frac{QEXP}{TP}\right) + 23.5 \left(\frac{QDOM}{TP}\right) + 23.4 \left(\frac{QPROC}{TP}\right)$ (.41) (.35) (.39)	-.013
14	P_s 1964-74	2.3	$+ 11.2 \left(\frac{QEXP}{TP}\right) - 4.5 \left(\frac{QDOM}{TP}\right) - 4.2 \left(\frac{QPROC}{TP}\right)$ (.052) (.10) (.25)	.44

a. P_w = On-tree price all winter lemons (November-April), dollars per carload.
P_s = On-tree price all summer lemons (May-October), dollars per carload.

Table 10. (continued)

TP = Total quantity of lemons produced, carloads.

QDOM = Quantity sold domestically, carloads.

QEXP = Total quantity exported, carloads.

QPROC = Quantity processed, carloads.

Numbers in parentheses indicate the level of probability at which the coefficient is not significantly different from zero.

b. Probability level is > .50.

exports is positive as expected, but that for the ratio of domestic sales to total production is negative. In all cases the coefficient of determination was quite low.

Table 11 displays the regression equations based on Model 5. These express the on-tree all price per carton as a linear function of the ratio of export quantity to domestic sales, and of processed to domestic sales. Equation 15 for winter lemon prices from 1951 through 1974 has significant coefficients for both variables, but the sign of the export ratio variable is not negative, as hypothesized. In Equation 16, for the early time period, the coefficient for the processed quantity remains significant and negative, as expected. Both equations have very low coefficients of determination. Although the coefficient of determination is acceptably high for Equation 17 and both variables are significant, the positive coefficient for the export ratio suggests the possibility that the hypothesis is wrong. This could be due to a shift to the right in the export demand function rather than a movement along the curve. Such a shift clearly occurred in the case of Japan after the liberalization of trade in 1963.

For summer lemons, only Equation 18, covering the entire time period, has a significant variable, the ratio of export quantities to domestic sales. Again, the variable has a positive coefficient, rather than the hypothesized negative sign. All of the equations concerning summer lemon prices have low coefficients of determination.

The evidence is not conclusive of the existence of a structural change on the fresh lemon industry in the mid-1960's, but it does raise

Table 11. Regression Equations of On-tree All Price of Lemons with the Ratio of Export Quantities and Processed Quantities to Domestic Sales.[a]

Equation Number	Dependent Variable	Constant	Independent Variables (and Level of Significance)		R^2
15	P_w 1951-74	1.2	$+ 1.4 \left(\frac{QEXP}{QDOM}\right)$ (.006)	$- .5 \left(\frac{QPROC}{QDOM}\right)$ (.008)	.31
16	P_w 1951-63	1.5	$- .4 \left(\frac{QEXP}{QDOM}\right)$ (b)	$- .4 \left(\frac{QPROC}{QDOM}\right)$ (.06)	.33
17	P_w 1964-74	1.3	$+ 2.0 \left(\frac{QEXP}{QDOM}\right)$ (.004)	$- .7 \left(\frac{QPROC}{QDOM}\right)$ (.01)	.64
18	P_s 1951-74	.73	$+ 22 \left(\frac{QEXP}{QDOM}\right)$ (.002)	$- .42 \left(\frac{QPROC}{QDOM}\right)$ (.50)	.43
19	P_s 1951-63	1.3	$- .37 \left(\frac{QEXP}{QDOM}\right)$ (.50)	$- .37 \left(\frac{QPROC}{QDOM}\right)$ (.46)	-.02
20	P_s 1964-74	.20	$- .02 \left(\frac{QEXP}{QDOM}\right)$ (b)	$+ .2 \left(\frac{QPROC}{QDOM}\right)$ (b)	-.22

a. P_w = On-tree price all winter lemons (November-April), dollars per carload.
P_s = On-tree price all summer lemons (May-October), dollars per carload.

Table 11. (continued)

QDOM = Quantity sold domestically, carloads.

QEXP = Total quantity exported, carloads.

QPROC = Quantity processed, carloads.

Numbers in parentheses indicate the level of probability at which the coefficient is not significantly different from zero.

b. Probability level > .50.

that possibility for further detailed examination. This would coincide with the period of rapid expansion of exports of U. S. lemons to Japan.

There are several possible reasons for the poor fits in many of the equations: the cause may be an error in specification, i.e., the use of the wrong functional form; there could be errors in the measurements of the variables, although it is unlikely that serious errors would exist in one season and not the other; major variables may have been omitted, implying a structural difference between the seasons; statistical problems could arise because of the limited degrees of freedom.

The poor fit of the equations makes it difficult to draw a strong conclusion as to the effect allocation of the total crop among the three outlets has on the on-tree price. Nonetheless, the regression equations of Model 1, in both their linear and quadratic forms and for both the individual and total time periods, consistently yielded a positive relationship between the on-tree fresh price and the quantity of fresh lemons exported, whenever this variable had a significant coefficient. A positive relationship between the ratio of exports to total production and the on-tree all price was exhibited in the equations of Model 4, whenever the export ratio variable was considered significant. It, therefore, seems correct to conclude that an increase in the quantity of fresh lemons exported, in total or as a ratio of total production, is usually associated with an increase in the on-tree level price of lemons.

Individual Export Markets

Breakdown of the total quantity exported into the various foreign markets, as described in Model 2, also yields some interesting results (Table 12). In these equations, the quantity of exports to Japan is the single most important variable in the explanation of fresh on-tree prices, not only because of its high level of significance in both seasons, but also because of its relatively large coefficients, indicating that a one unit increase in exports to Japan is associated with a .9 (winter) and a .6 (summer) unit increase in the on-tree price for fresh lemons. In the winter, the quantity processed and exports to Canada both are associated with negative impacts on the price (Equation 21); in summer, the Canadian impact is positive but that of exports to Europe is negative (Equation 22). The change in the sign of the Canadian variable is not particularly disturbing since the coefficient of that variable for winter lemons is significant only at relatively low probability levels. Regardless of the season, an increase in the quantity of exports to Japan is directly associated with an increase in the on-tree price of fresh lemons.

Average Export Price

To isolate the importance of the Japanese market on the average export price, an equation (Model 3) was constructed to express the average export price as a function of the quantity of exports to each of the various markets under consideration, and to the domestic and processed markets. Table 13 gives the estimated regression equations for each season.

Table 12. Regression Equations of On-tree Fresh Price with the Quantity of Fresh Lemon Exports to Various Markets and Domestic and Processed Sales, 1951-75.[a]

Equation Number	Dependent Variable	Constant	Independent Variables (and Level of Significance)	R^2
21[b]	PO_w	2593.913	+ .89279868 QJAP − .060599328 QPROC − 1.8738146 QCAN	.86047
			(.000) (.005) (1.40)	
			− .62983949 QEUR	
			(.334)	
22	PO_s	1666.023	+ .4802923 OJAP − .26019993 QUER + 3.1540289 QCAN	.89545
			(.021) (.046) (.071)	
			+ .50791123 QUSSR − .11375898 QDOM − .015679653 QPROC	
			(.264) (.426) (c)	

a. PO_w = On-tree price, fresh winter lemons (November-April), dollars per carload.
PO_s = On-tree price, fresh summer lemons (May-October), dollars per carload.
QDOM = Quantity sold domestically (excluding Canada) carloads.
QPROC = Quantity processed, carloads.
QJAP = Quantity exported to Japan, carloads.
QCAN = Quantity exported to Canada, carloads.
QEUR = Quantity exported to Western Europe, carloads.
QUSSR = Quantity exported to Russia and Eastern Europe, carloads.
Number in parentheses indicates level of probability at which the coefficient is not significantly different from zero.

b. Based on criteria of the stepwise regression routine, variables not in equation (QDOM and QUSSR) did not have high enough level of F-significance to be entered.

c. Probability level > .50.

Table 13. Regression Equations of Average Export Price with the Quantity of Fresh Lemon Exports to Various Markets, 1951-75.[a]

Equation Number	Dependent Variable	Constant	Independent Variables (and Level of Significance)	R^2
23[b]	$Pexp_w$	2949.49	+ .82833579 QJAP − 1.39903 QUSSR − .18189614 QEUR (.000) (.049) (.136)	.77210
24	$Pexp_s$	4084.492	+ 3.253438 QUSSR + .53377672 QJAP − 3.9440256 QCAN (.015) (.142) (.398) + .174133719 QEUR (.458)	.70002

a. $Pexp_w$ = Average export price per carload of fresh winter lemons, (November-April).

$Pexp_s$ = Average export price per carload of fresh summer lemons, (May-October).

QJAP = Quantity exported to Japan, carloads.

QCAN = Quantity exported to Canada, carloads.

QEUR = Quantity exported to Western Europe, carloads.

QUSSR = Quantity exported to Russia and Eastern Europe, carloads.

Numbers in parentheses indicates the level of probability at which the coefficient is not significantly different from zero.

b. Based on criteria of the stepwise regression routine, variables not in equation (QCAN) did not have high enough level of F-significance to be entered.

The results clearly show the positive effects of the quantity of exports to Japan on the average export price. The effects of the other markets vary with the seasons, as shown by the changes in the signs and levels of significance of their coefficients. Perhaps the most unpredictable variable is that of exports to the extremely sporadic Eastern European market. This market has a highly significant association with price changes, but the impact of expanded exports to U.S.S.R. and Eastern Europe is negative for winter lemon prices (Equation 23) and positive for summer lemon prices (Equation 24). This is most likely explained by the fact that winter exports continue to be scarce and volatile, while the summer market for U. S. lemons in the Eastern European countries has become relatively stable.

The importance of the expansion of the Japanese market can thus be traced through its effects on the average export price to its impact on the on-tree price for fresh lemons. This on-tree price is the one the grower actually receives, after the costs of marketing and transportation have been subtracted from the retail price, and the picking, packing and hauling costs subtracted from the resulting F.O.B. price for fresh lemons. The prices at the different levels (retail, F.O.B., and on-tree) are directly related to one another; although this particular study focuses only on the on-tree price, the effects on the "consumer's price," the retail price, are analogous. This does not imply that the impacts will be identical since retail prices are not perfectly correlated with F.O.B. and on-tree prices because of changes in the wholesale and retail margins.

CHAPTER V

NET RETURNS TO GROWERS AND THE EXPORT MARKET

The effect of exports on prices has been demonstrated in the previous chapter, but the grower is not as concerned with the price he receives for each box of lemons as he is with his net returns and revenue per acre. It is on the basis of these net revenue figures and the returns from other crops that decisions to expand acreage, or change to another crop, are made. This chapter examines the effect of the export market on the returns to the grower: the total on-tree and per acre revenues.

A grower cannot long remain in business unless his revenue covers his costs of production. But covering costs is a minimum requirement; economic theory assumes that a rational goal of a firm is profit maximization, and empirical observation supports this as a common goal of producers. Profit maximization occurs at the level of production where the difference between the total value of the output and the total cost of producing that output is greatest.

The difference between total revenue and total cost is the net return to the growers, and can be more easily calculated by using price levels which already take some of these costs into account. For the lemon industry, gross on-tree returns were calculated from the on-tree price per carton for all uses and the total number of cartons produced annually by the industry. Dividing this figure by the bearing acreage gives a per acre return. The net on-tree returns began with the same price and production base, but the cultural cost per carton (the costs of growing lemons) was subtracted from the on-tree price. The values calculated for gross and net on-tree returns are presented in Table 14 in constant (devalued) dollars.

The analytical techniques used in this chapter are those of trend analysis and linear regression, as already detailed in earlier chapters.

Net On-tree Returns

The on-tree returns (net and per acre) have varied considerably over the 26-year period under consideration. The fluctuations in year-to-year returns are quite large, brought about by fluctuations not only in price but also in the quantity produced. This is perhaps most clearly seen in the changes in revenue per acre, where downward changes occur frequently and the extent of the change ranges from $3.70 (1966-67) to a change of $585.80 in 1962-63.

Expressing the common log of net and gross revenues per acre as a function of time, one can derive a trend coefficient (Chapter III), measuring the annual percentage change in revenue. Net revenue per acre (in real dollars) shows a significant trend of a 6.7 percent annual decrease from 1950 to 1963, then changes direction and increases 7.8 percent annually from 1964 to 1975 (Table 15). The reversal of the decline of net revenue per acre is significant and coincides very closely with the expansion of the Japanese market in 1964. The gross revenue per acre does not exhibit such strong trends, but declines at 2.3 percent

Table 14. Gross and Net On-tree Returns to California-Arizona Lemons.[a]

Year	Gross On-tree Returns (Constant $)			Net On-tree Returns (Constant $)		
	Total ($1000)	Per Acre	Δ in Per Acre	Total ($1000)	Per Acre	Δ in Per Acre
1949-50	63907.06	$1129.10	$-201.30	34412.80	$608.00	$-197.60
1950-51	49282.90	927.80	194.70	21798.20	410.40	217.90
1951-52	60935.40	1122.50	150.01	34105.70	628.20	48.80
1952-53	67755.50	1272.60	-234.40	36049.40	677.10	-178.80
1953-54	56234.20	1038.20	-166.50	26992.40	498.30	-219.40
1954-55	46627.00	871.70	232.00	14920.70	278.90	85.80
1955-56	50615.20	1103.70	-333.20	16728.80	364.80	-304.00
1956-57	37122.50	770.50	- 18.60	2930.70	60.80	12.30
1957-58	37233.40	751.80	- 64.20	3619.90	73.10	- 61.20
1958-59	31257.30	687.60	-107.20	538.90	11.90	- 40.90
1959-60	31346.80	580.40	80.80	-1567.30	-29.00	13.30
1960-61	34698.80	661.20	- 50.90	826.20	-15.70	- 54.00
1961-62	32369.10	610.30	585.80	-3699.30	-69.80	478.60
1962-63	59159.70	1196.10	377.40	20219.20	408.80	-362.30
1963-64	45192.80	818.70	23.80	2567.20	46.50	- 38.60
1964-65	38641.80	794.90	155.20	386.40	7.90	124.00
1965-66	45823.00	950.10	3.70	6364.30	132.00	- 5.10
1966-67	44478.20	946.40	247.60	5961.00	126.80	282.80

Table 14. (continued)

Year	Gross On-tree Returns (Constant $)			Net On-tree Returns (Constant $)		
	Total	Per Acre	Δ in Per Acre	Total	Per Acre	Δ in Per Acre
	($1000)			($1000)		
1967–68	56565.00	$1194.00	$– 62.60	19405.50	$409.60	$–113.10
1968–69	51858.50	1131.40	125.20	13590.50	296.50	177.40
1969–70	60332.70	1256.60	240.60	22754.10	473.90	271.00
1970–71	68370.90	1497.30	–333.30	34015.40	744.90	–317.20
1971–72	67532.20	1164.00	– 88.20	24816.00	427.70	– 90.60
1972–73	63314.10	1075.90	152.70	19838.40	337.10	
1973–74	79556.00	1228.50	–439.60	n.a.	n.a.	
1974–75	50257.70	788.90		n.a.	n.a.	

a. The GNP implicit price deflator was used.

Sources: Sunkist Growers, Inc. (1950–76); U. S. Department of Agriculture (1950–75b); Lemon Administrative Committee (1950–76).

Table 15. Trend Analysis of On-tree Revenue for Lemons.

Item	Annual Percentage Change		
	1950-75	1950-63	1964-75
Net Revenue per Acre	-.43[a]	-6.71[b]	7.78[b]
Gross Revenue Gross Acre	.44[a]	-2.34[b]	1.48[a]
Domestic Percent of Total Revenue	.24[b]	.60[a]	-.42[a]
Export Percent of Total Revenue	.31[b]	.25[b]	.56[b]
Processed Percent of Total Revenue	.0002[a]	.16[a]	.31[b]

a. No trend or no consistency (significance $\leq$ .20).

b. High consistency of trend (significance $\leq$ .04999).

annually until 1963, then shows a 1.5 percent annual increase for the second time period, although that coefficient is not statistically significant, indicating that there is no consistency of trend.

Regression equations were fitted to the change in net revenue and gross revenue per acre expressing each of these variables as a function of changes in the quantity sold domestically, the quantity processed and the quantity exported:

$$\Delta NRA = f(\Delta QDOM, \Delta QEXP, \Delta QPROC) \tag{6}$$

$$\Delta GRA = f(\Delta QDOM, \Delta QEXP, \Delta QPROC) \tag{7}$$

where: ΔNRA = annual change in net on-tree revenue per acre for lemons,

ΔGRA = annual change in gross on-tree revenue per acre for lemons,

$\Delta QDOM$ = annual change in the quantity of fresh lemons sold domestically,

$\Delta QEXP$ = annual change in the quantity of fresh lemons exported,

$\Delta QPROC$ = annual change in the quantity of lemons processed.

It was hypothesized that the variation in the distribution of total production among these three markets would be related to variations in the change in net revenue per acre. A positive change in the quantity sold on the relatively inelastic domestic market would be expected to have a negative effect on the on-tree price of the industry. The same negative relationship would be expected if there was a positive change in the quantity of lemons directed to the low-paying processed outlets. A positive change in exports could be associated with a positive change in the on-tree net returns not only because of its conceptually greater price elasticity of demand, but also because of the apparent shifts to the right of export demand during the time period under consideration.

The computed regression equations were surprisingly poor, showing substantial lack of fit and (except for the change in the quantity processed) insignificant coefficients. The equations are presented in Table 16, Numbers 25 and 28. Breakdown of the equation into two distinct time periods (1950-63 and 1964-75) does little, if anything, to improve the fit, (Table 16, Equations 26, 27, 29, and 30). Even the signs of the coefficients are not as hypothesized in all cases.

There are many possible reasons for poor fit and lack of significant variables in a regression equation. As was stated earlier, the most common causes are: (1) improper specification -- the use of the wrong functional form, (2) incomplete or improper specification of the independent variables, and (3) data errors.

Time series data on prices and quantities actually reflect equilibrium points over time, and accurate estimation of either the supply curve (or the demand curve) can be achieved only if the demand function (or the supply curve) has remained relatively constant. For the time period under consideration, both the supply of lemons and the demand for the fruit have changed frequently. Because the focus of the model was on the impact of the quantities of lemons allocated to the various markets, many variables were omitted which may have more completely explained changes in net returns. Primary among these, in an analysis of changes in net revenue per acre, would be cost variables that have also changed considerably over time.

Table 16. Regression Equations on Net and Gross On-tree Revenue per Acre of Lemons.

Equation Number	Dependent Variable	Constant	Independent Variables (and Significance Levels)[b]	R^2
25	ΔNRA 1950-75	53.13549	+.36112775ΔQDOM + .18109709ΔQEXP - .20918869ΔQPROC (.797) (.647) (.065)	.22515
26	ΔNRA 1950-63	-169.82628	-1.2503984ΔQDOM - .1968814ΔQPROC - .31242931ΔQEXP (.591) (.219) (.682)	.26222
27	ΔNRA 1964-75	880.18065	+2.3980695ΔQDOM - .16893486ΔQPROC - .18652992ΔQEXP (.497) (.519) (.852)	.12963
28	ΔGRA 1950-75	157.01276	+.054715317ΔQDOM + .083505436ΔQEXP - .25307824ΔQPROC (.968) (.782) (.007)	.40223
29	ΔGRA 1950-63	-10.602164	-2.1383653ΔQDOM - .28953805ΔQPROC - .64771327ΔQEXP (.403) (.108) (.441)	.39378
30	ΔGRA 1964-75	845.6909	2.407361ΔQDOM - .15932326ΔQPROC - .34359814ΔQEXP (.279) (.323) (.562)	.50943

a. ΔNRA = annual change in net on-tree returns per acre, all uses, constant $1,000.
ΔGRA = annual change in total on-tree returns per acre, all uses, constant $1,000.
ΔQDOM = annual change in the quantity of fresh lemons sold domestically (including Canada), carloads.
ΔQEXP = annual change in the quantity of fresh lemons exported (excluding Canada), carloads.
ΔQPROC = annual change in the quantity of lemons processed, carloads.

b. The numbers in parentheses state the level of probability at which the coefficient is not significantly different from zero.

Export, Domestic and Processed Returns

To isolate the impact of the export market, it was necessary to identify total on-tree returns from this individual market, as well as from the domestic and products markets. On-tree prices for processed lemons were available, but government and industry sources do not give a breakdown for the domestic and export markets, rather both are aggregated into an on-tree "fresh" price. It was necessary to use Sunkist data that separate the fresh market values into domestic (including Canada) and export. As Sunkist handles the largest proportion of total industry production and is the major exporter of fresh lemons, it was assumed that their disaggregation of the on-tree price into its export and domestic components is also representative of the industry (Sunkist Growers, Inc. 1976).

The on-tree prices were multiplied by the quantity allocated for each use to determine gross on-tree revenue from the domestic market, the products market and the export market. These values were then divided by the total gross revenue to find the proportional contribution of each market, as given in Table 17.

There is no doubt that revenue from the domestic market is the greatest component of total on-tree returns, but the actual contribution from this market appears to be decreasing slowly; after 12 years of averaging 87.3 percent, it has been greater than 90 percent only once since 1962 (in 1964) and averaged 75.4 percent the last 11 years. Trend analysis shows a significant 0.24 percent annual decrease over the entire time period, due largely to the 0.42 percent decrease since 1964 (Table 15).

Table 17. The Proportion of On-tree Revenues from Domestic, Export and Processed Markets.[a]

Year	Domestic Percent On-tree Returns	Export Percent On-tree Returns	Processed Percent On-tree Returns
1950	101.1	.9	4.4
1951	94.3	1.8	10.3
1952	77.9	2.1	22.2
1953	87.9	5.0	11.0
1954	95.5	8.0	2.4
1955	92.8	9.6	5.1
1956	97.4	11.0	3.2
1957	89.4	16.3	5.6
1958	118.8	9.4	-15.4
1959	111.8	12.9	- 9.7
1960	96.2	13.0	2.8
1961	103.8	10.4	11.7
1962	73.0	18.9	14.9
1963	71.0	14.9	26.8
1964	95.6	17.6	9.0
1965	82.9	18.9	11.3
1966	84.9	22.3	14.4
1967	75.4	25.7	11.3
1968	87.7	27.3	6.9
1969	67.0	28.8	7.5
1970	61.3	29.3	7.8
1971	59.8	36.5	11.0
1972	71.3	46.1	11.9

a. Totals often greater than 100 percent due to lack of exact comparability of data from various sources.

Sources: U. S. Department of Commerce (1949-75); U. S. Department of Agriculture (1950-75b); Lemon Administrative Committee (1950-76).

The export market has shown a trend of increasing its contribution to total revenue, increasing from less than one percent to greater than 45 percent. The increase has been consistent since 1963, increasing most rapidly in 1971 and 1972. The annual percent increase in the role of the export market was 0.25 percent from 1950-63, then 0.56 percent thereafter (Table 15).

The fluctuating contributions of the processed outlet have remained rather low, averaging only 8.1 percent, and at times being negative. This occurred in the years when revenue from this market was negative for the growers (it did not cover costs) and so decreased the total returns. There is no apparent trend for the overall time period, nor during 1950-63, but the 1964-75 time period exhibits a highly consistent trend, with an annual decrease of 0.31 percent (Table 15).

The impact and importance of exports of fresh lemons on the returns to growers is most clearly shown in the trend analysis of revenue per acre, which decreased sharply until the sudden expansion of the Japanese market in 1963-64. It is also evident that revenue from exported fruit has become an increasingly larger proportion of the total revenue accruing to growers. How these changes have affected growers' decisions and hence the long-run outlook for the industry are the subject of the next chapter.

CHAPTER VI

CHANGES IN BEARING ACREAGE

Growers' responses to on-tree returns and changes in per acre revenue are translated into the long run changes of the industry as decisions to expand or contract acreage or substitute other crops. A recognition time lag is involved before the grower takes note of the changes in revenue, another before the grower accepts these returns as indicative of a lasting trend and they affect his planting and removal decisons, and yet another technical lag exists before the newly planted trees reach bearing age. Conceivably five to ten years could lapse between the time a grower first experiences increased returns and the time his bearing acreage shows an increase. Time lags in the case of acreage contraction could be much shorter as the removal of trees does not involve a technical lag.

Historical Trends in Bearing and Nonbearing Acreage

French and Bressler (1962) first developed the model of lagged supply response in the lemon industry with two equations, one to explain the acreage of trees planted each year and the other explaining tree removal. The proportion of new plantings was given by the equation:

$$N_t/B_{t-1} = b_0 + b_1\pi_{*t-1} + b_2{*}A_{t-1}/B_{t-1}) + v_{t-1}$$

where: N = acres planted

B = bearing acres

π^* = long run profit expectations

A = acres of crop over a certain age, say 25 years old (A_{t-1}/B_{t-1} accounts for the effect on new plantings of anticipated removals of old trees)

t = particular crop year

v = disturbance term

The proportion of bearing trees removed at the end of a season was expressed as:

$$R_t/B_t = a_0 + a_1\pi^1 + a_2(A_t/B_t) + K_t/B_t + u_t$$

where: R_t = acres of trees removed

B_t = bearing acreages

a_0 = average proportion of trees removed because of disease

π^1 = expected short run profitability

A_t/B_t = proportion of trees over 25 years of age in time t

K_t/B_t = proportion of trees removed for urban expansion

u_t = random term for year-to-year variability

The model was further expanded by French and Matthews (1971) to include equations that explain the quantity of bearing acreage and production desired by growers and variations in average yields.

Of particular interest for this study are the importance of the actual net returns and the expected profit variables in the equations which determine net changes in the bearing acreage, and the role of returns from exports as a component of net revenue. This chapter examines the changes in bearing acreage in terms of some of the factors which affect the crucial planting-removal decision: returns from the alternative market outlets (domestic, export and processed) and per acre returns from alternative crops that compete with lemons.

The two models presented are:

$$\Delta AC_t = f(DOM_{t-i}, PROC_{t-i}, EXP_{t-i}) \quad (8)$$

$$\Delta AC_t = f[(RA_n/GRA)_{t-i}] \quad (9)$$

where: ΔAC_t = change in bearing acreage as of January 1 of year t

DOM_{t-i} = domestic revenue proportion of total returns lagged i years

$PROC_{t-i}$ = processed revenue proportion of total returns lagged i years

EXP_{t-i} = export revenue proportion of total returns lagged i years

$(RA_n/GRA)_{t-i}$ = on-tree returns per acre to any substitute crop relative to per acre gross on-tree returns to lemons, lagged i years.

These models were selected to identify the relationship between returns from various lemon markets and relative returns to other crops, and changes in lemon bearing acreage over time. It is hypothesized that an increase in the revenue from any lemon market will be associated with an increase in bearing acreage after some time lag. An increase in the returns to a close substitute crop (relative to returns to lemons) would most likely be associated with a decrease in lemon bearing acreage over time as acres are converted to the substitute crop.

Length of Lag

The impacts of changes in domestic revenue, export revenue and processed revenue may conceptually be characterized by differing lengths of lags. To empirically identify which length of lag for each independent variable has the greatest impact on the dependent variable, a Pearson correlation matrix was constructed. This gives the correlation coefficient of the changes in bearing acreage with various lags of each independent variable: the greater the coefficient, the more explanatory that particular lag. It is interesting to note that export revenue is the variable that is most highly correlated with changes in bearing acreage for all lags (Table 18).

Domestic, Export and Processed Returns

The change in bearing acreage was described as a function of the proportion of total returns originating in each of the export, domestic and processed markets, with an appropriate time lag (Model 8). Based on the Pearson correlation matrix, a seven-year lag was chosen as the most significant for domestic and processed revenues, and a five-year lag for export revenue. The goal of the model was not complete explanation of the changes in acreage, but rather isolation of the role of exports. Table 19 gives the estimated regression equation. All signs are positive, as hypothesized. The domestic variable is not significant, but the change in acreage is associated with the revenues from both processed and export sales. The export sales make their major impact on acreage after only a five-year time period -- as opposed to the seven years required by revenue from products. This impact is rapid, considering the recognition, decision and mechanical lags involved, and is quite large relative to the coefficients of the other variables.

It is interesting to note that the long-run forecasts of French and Bressler (1962) are almost opposite of what has actually occurred

Table 18. Correlation Coefficients of the Change in Bearing Acreage of Lemons with Market Revenues Lagged Zero to Eight Years.

Years Lagged	Change in Bearing Acreage with Ratio of[a] Domestic Total Revenue	Export Total Revenue	Processed Total Revenue
0	.1853 (.409)	.5300 (.011)	.0381 (.860)
1	.2376 (.300)	.4923 (.023)	.0683 (.757)
2	.2270 (.350)	.5023 (.028)	-.0045 (.985)
3	-.0249 (.924)	.6979 (.002)	.0669 (.785)
4	.0983 (.727)	.6400 (.010)	.0391 (.882)
5	.0282 (.927)	.7031[b] (.007)	.0629 (.824)
6	-.3306 (.321)	.5539 (.077)	.1428 (.642)
7	-.4046[b] (.280)	.5465 (.128)	.3543[b] (.285)
8	-.4113 (.359)	.4993 (.254)	-.1924 (.620)

a. Numbers in parentheses are levels of significance of correlation.

b. Chosen for regression equation because of highest absolute value of correlation coefficient.

Table 19. Regression Equations of Annual Changes in Lemon Bearing Acreage, 1950-75.

Equation Number	Dependent Variable[a]	Constant	Independent Variables (and Significant Levels)[b]	R^2
31	Δ Ac	-5587.2257	$+ 3.6558686\ DOM_8$ (.493) $+ .22928269\ PROC_7$ (.009) $+ 52.256432\ EXP_5$ (.001)	.84385
32	Δ Ac	5297.7716	$+ 793.85758\ DES\ GRAP_7$ (.518) $- 8555.9487\ NAVEL_5$ (.004)	.83455
			$+ 674.03325\ SUM\ GRAP_i$ (.484) $+ 3207.1422\ VAL_5$ (.227)	

a. Δ Ac = Change in bearing acreage.

b. DOM_8 = Domestic revenue proportion of total returns lagged eight years.
$PROC_7$ = Processed revenue proportion of total returns lagged eight years.
EXP_5 = Export revenue proportion of total returns, lagged five years.
$DES\ GRAP_7$ = Relative returns per acre to desert grapefruit, lagged seven years.
$NAVEL_5$ = Relative returns per acre to Navel oranges, lagged five years.
$SUM\ GRAP_8$ = Relative returns per acre to summer grapefruit, lagged eight years.
VAL_5 = Relative returns per acre to Valencia oranges, lagged five years.
The numbers in parentheses state the level of probability at which the coefficient is not significantly different from zero.

in the lemon cycle. The forecast period of decreasing production and acreage, bottoming out around 1975-77, has instead been marked by increases in both production and bearing acreage, and appears to have reached a peak in 1975-76. The French and Bressler model was based on their observations of the lemon cycle prior to 1962, and forecasts were made on the assumptions of no major structural changes in the near future. It was only two years later that the abrupt expansion of exports began, with the lifting of the Japanese quota. This change appears to have become the catalyst which led to a reversal of the long run trends forecast by French and Bressler (1962).

Relative Returns from Other Citrus

One factor affecting a lemon grower's decision to expand or contract his acreage is the revenue he could conceivably receive by switching to the production of another crop. Taking account of all possible substitute crops is an impossible task, as climate, soil conditions, markets and the ability of the farmer (management) all play a role in determining the feasibility of each substitute. Because the desirable growing environment and cultivation skills demanded by the various types of citrus fruits do not vary greatly, only other citrus will be examined as possible substitute crops for the lemon grower.

Gross on-tree per acre returns were calculated for Valencia oranges, Navel oranges, desert grapefruit and summer grapefruit from price and production data (Appendix Table A-14). Figure 18 presents the total revenue information from these California-Arizona citrus in terms of five-year moving averages. These per acre revenue values were

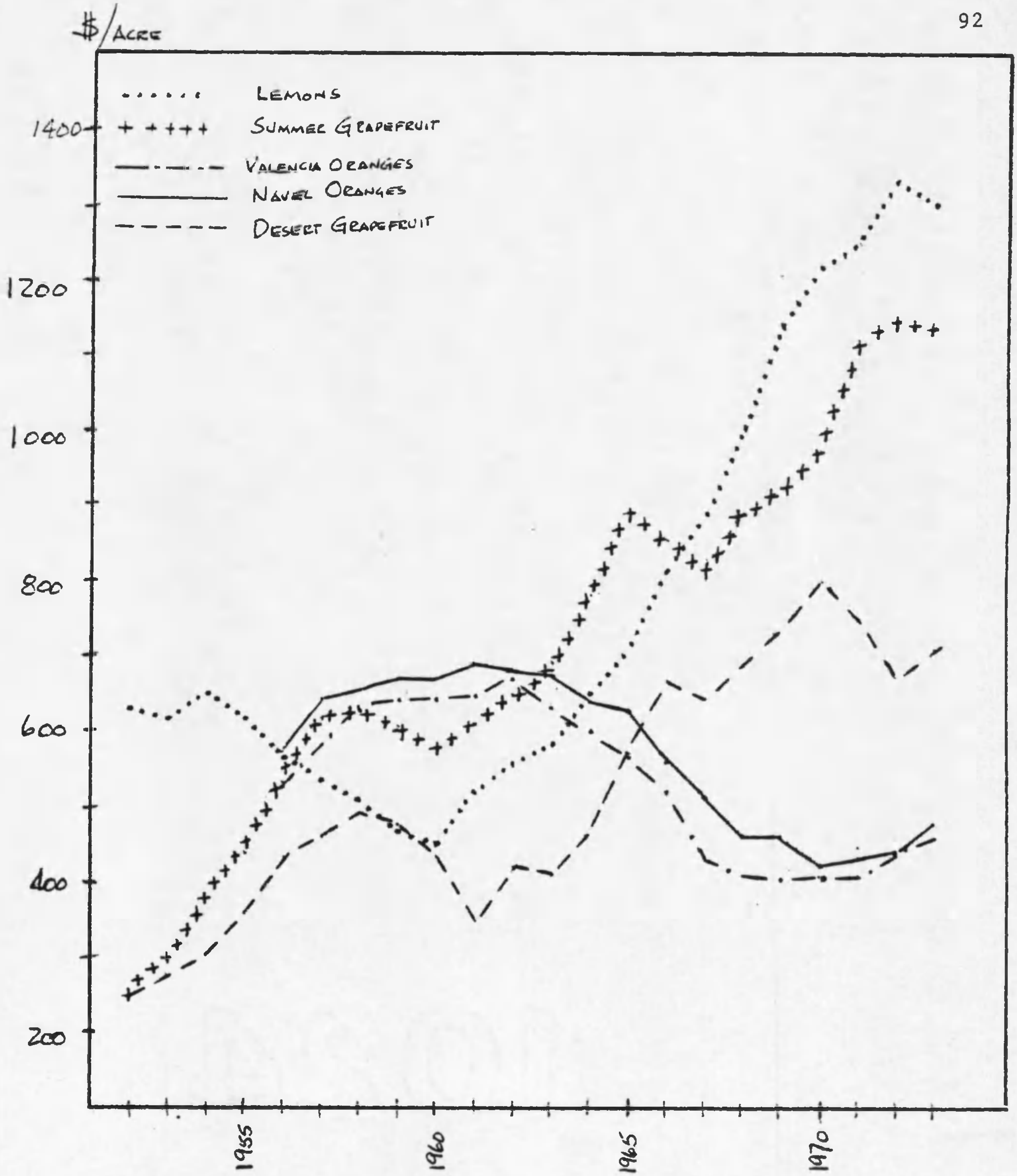


Figure 18. Five-year Moving Averages of Gross Returns per Acre for Lemons and Other California-Arizona Citrus.

Source: Appendix Table A-14.

then divided by the gross on-tree returns per acre for lemons to determine the relative returns to other citrus.

Per acre revenue to oranges, both Navel and Valencia, appears to have maintained a rather constant level from 1952 through 1962, then began a long decline until the early 1970's.

Both summer and desert grapefruit received the lowest per acre returns in the early 1950's, but began increasing rapidly following that, with small declines in the five-year averages occurring in 1960, 1966 and 1972.

Lemon revenue per acre declined from 1950 to approximately 1960, and has risen since that time. Returns to lemons surpassed those to oranges and desert grapefruit around 1964, and became larger than summer grapefruit revenue in 1968.

There appears to have been a decade, 1957-67, when most other citrus crops experienced higher returns per acre than lemons. Part way through this period the bearing acreage of lemons began to decrease to a post-World War II low in 1969, then rapidly increased again to a high level in 1975. Throughout most of the 26-year period under consideration, gross returns to lemon growers have been higher than those accruing from other citrus types.

Using the trend analysis method of expressing the log of the dependent variable as a function of time one finds that all four of the other citrus types showed trends of increased returns per acre (relative to lemons) from 1950 to 1963. The annual percent changes are given in Table 20; relative returns to both Navel oranges and grapefruit increased more than one percent per year, with desert grapefruit exhibiting the

Table 20. Trend Analysis of Lemon Returns Relative to Oranges and Grapefruit.

Item	Annual Percentage Change		
	1950-63	1964-75	1950-75
Bearing Acreage	-.15[a]	.36[b]	1.93[b]
Relative Returns to Navel Oranges	-.51[b]	1.14[b]	-1.12[b]
Relative Returns to Valencia Oranges	-.55[b]	.81[b]	-1.01[b]
Relative Returns to Desert Grapefruit	3.50[b]	3.55[c]	-2.20[a]
Relative Returns to Summer Grapefruit	.32[c]	1.37[b]	- .72[c]

a. No trend or no consistency (significance $\geq$ .20)

b. High consistency of trend (significance $\leq$ .049999)

c. Low consistency of trend (significance .05 - .19999) greatest annual percentage change. For the 1964-75 period, all showed significant declining trends, with the exception of desert grapefruit, whose negative coefficient was not significant.

A Pearson correlation matrix was also used on the relative revenues (Appendix Table A-14) to determine the most significant lag period (Table 21), then these relative returns were used as variables in a regression equation on the change in bearing acreage, Equation 31 (Table 19). The fitted equation presents some interesting information. The greatest impact of relative returns from grapefruit is not felt on the lemon bearing acreage until seven or eight years later; the relationships are not negative as hypothesized but the coefficients are insignificant. The relative returns to Valencia oranges also has a positive but insignificant coefficient when a comparatively short five-year lag is used. The variable that is truly significant is that of relative returns to Navel oranges. Causation cannot be shown by regression methods, but five years after the returns per acre for Navels have increased relative to those for lemons, a decrease in the lemon bearing acreage is evident.

Changes in Bearing Acreage by District

A comparison of the changes in bearing acreages of lemons, Navel and Valencia oranges for each district exhibits differing trends for each region (Table A-15).

In District 1, Central California, lemon bearing acreage increased steadily through the 1950's, leveling off at approximately 18,000 acres throughout the 1960's, and has increased rapidly since

Table 21. Correlation Coefficients of the Change in the Bearing Acreage of Lemons with Relative Returns to Oranges and Grapefruit.

Years Lagged	Change in Bearing Acreage with Relative Returns to:[a] Navel Oranges	Valencia Oranges	Desert Grapefruit	Summer Grapefruit
0	-.3248 (.140)	-.2922 (.176)	-.1344 (.531)	-.0311 (.885)
1	-.4190 (.059)	-.3987 (.006)	-.2891 (.171)	-.0787 (.715)
2	-.6292 (.005)	-.5940 (.006)	-.3055 (.167)	-.1524 (.498)
3	-.7000 (.003)	-.6868 (.001)	-.2998 (.199)	-.2398 (.308)
4	-.7296 (.003)	-.7964 (.000)	-.2595 (.298)	-.0999 (.693)
5	-.8457[b] (.001)	-.7993[b] (.000)	-.0368 (.892)	.0285 (.917)
6	-.4035 (.248)	-.7725 (.000)	.0978 (.739)	.3019 (.294)
7	-.3522 (.392)	-.5813 (.023)	.4184[b] (.176)	.4451 (.147)
8	-.3248 (.140)	-.4063 (.149)	.1629 (.653)	.5620[b] (.091)

a. Numbers in parentheses arelevels of significance of correlation.

b. Chosen for regression equation because of highest absolute correlation coefficient.

1970. Valencia orange harvested acreage showed an almost opposite trend, decreasing until 1960 then increasing during the next decade and finally leveling off around 32,000 acres since 1970. Navel orange acreage increased throughout most of the time period under consideration, reaching a peak of 94,321 acres harvested in 1974.

District 2, Southern California, producing acreage of all three citrus fruits (lemons, Valencia and Navel oranges) has decreased substantially from 1950 to 1975. Lemon bearing acreage has dropped almost 20,000 acres (35 percent), Valencia oranges declined almost 64 percent (80,000 acres) and Navel orange bearing acreage decreased 30,000 acres (63 percent). These decreases are largely a result of the rapid urbanization of Southern California, a factor not included in the models explaining changes in lemon acreage.

The California-Arizona desert region, District 3, has shown a strong increase in lemon bearing acreage since 1953 (574 acres) to 1975 (22,361 acres). Valencia orange acreage also increased to a peak in 1970 (21,613 acres) and has declined slightly since then (1975 -- 17,310 acres). The harvested acreage of Navel oranges has been increasing since 1958 but at a relatively slow rate.

Conclusion

As one reviews the relationship between other citrus revenues and those to lemon growers, and especially as one notes the increase in returns per acre to lemons relative to other citrus types, it seems much more than coincidental that it is lemons that have been so successful in expanding their export market. For some time now the orange industry has been involved in negotiations with the goal of having the Japanese import quota on oranges removed. The Japanese have resisted such a move, alleging competition with their mandarin orange industry. But the lemon quota was removed in 1964, and the resultant benefits to the U. S. industry have been traced, albeit imperfectly, through prices, returns per acre and expansion of bearing acreage.

CHAPTER VII

CONCLUSION

This study has traced the impact of exports, and the expansion of exports to a particular market, on the fresh lemon industry of the United States. The impact is initially reflected in the prices received by the grower, which show an increase as the favorable export market is exploited. The higher prices and new outlet contribute to increased revenues for the grower, in total and on a per acre basis. These revenue changes, in absolute and relative to substitute crops, influence producers' decisions to expand or contract bearing acreage. This can change the quantity available for sale in following periods, and again decisions must be made as to how this new quantity will be distributed among domestic, export and processed markets. In all these stages, the vital role of lemon exports is clear, and the increased benefits to the grower from increased exports, so clearly illustrated with the Japanese case, are evident.

The lemon industry is unique in some ways, with its Market Order regulation of domestic sales and large percentage of growers belonging to one cooperative, yet there is no reason to believe that these characteristics would bias the impact of exports. Our country is characterized by a low population growth rate, particularly when compared with that of the world as a whole, and U. S. demand for agricultural products has shown only relatively small increases over time. At the same time, we are characterized by a propensity for innovation, often augmenting our already considerable efficiency in the production of food and other goods. The grower must continually seek new markets for his output, either through enhanced domestic demand, new or increased products, or in foreign markets. At a time when the once forgotten specter of a world food crisis again is feared, this latter alternative can be very promising for the American grower even though it may bring only short run benefits. Trade may be expanded as current importers increase their demands, but as McMillen (1976, p. 3) clearly stated, " . . . there's a significant difference between exporting when the demand is such that the buyers seek you out and going out to build an export market. What I am talking about is the need to go out and build an export market."

It was through deliberate market building (in Japan) that the lemon industry was able to so radically expand their exports and experience all the subsequent benefits illustrated in this study. There are, of course, many difficulties in market development, not the least of which are tariffs, quotas and other barriers to trade imposed by the potential importer, but with proper negotiation and perseverance many of these barriers can be overcome, in much the same way as the California-Arizona lemon industry managed to overcome even the strict Japanese import quota.

The benefits derived from this export expansion seem to have reached their peak in 1974. Currently the industry is experiencing a period of decreasing prices and increasing bearing and nonbearing acreage. Exports to Japan appear to have leveled off and overproduction has become a major concern for the U. S. lemon industry. Perhaps the future will be characterized by the decline forecast by French and Bressler, but delayed a decade by the sudden expansion of exports in 1964, and exaggerated by the increased acreage in production. It is conceivable that in ten years or less a thesis will be written explaining how the export market led to chaos in the California-Arizona lemon industry!

APPENDIX A

MISCELLANEOUS DATA

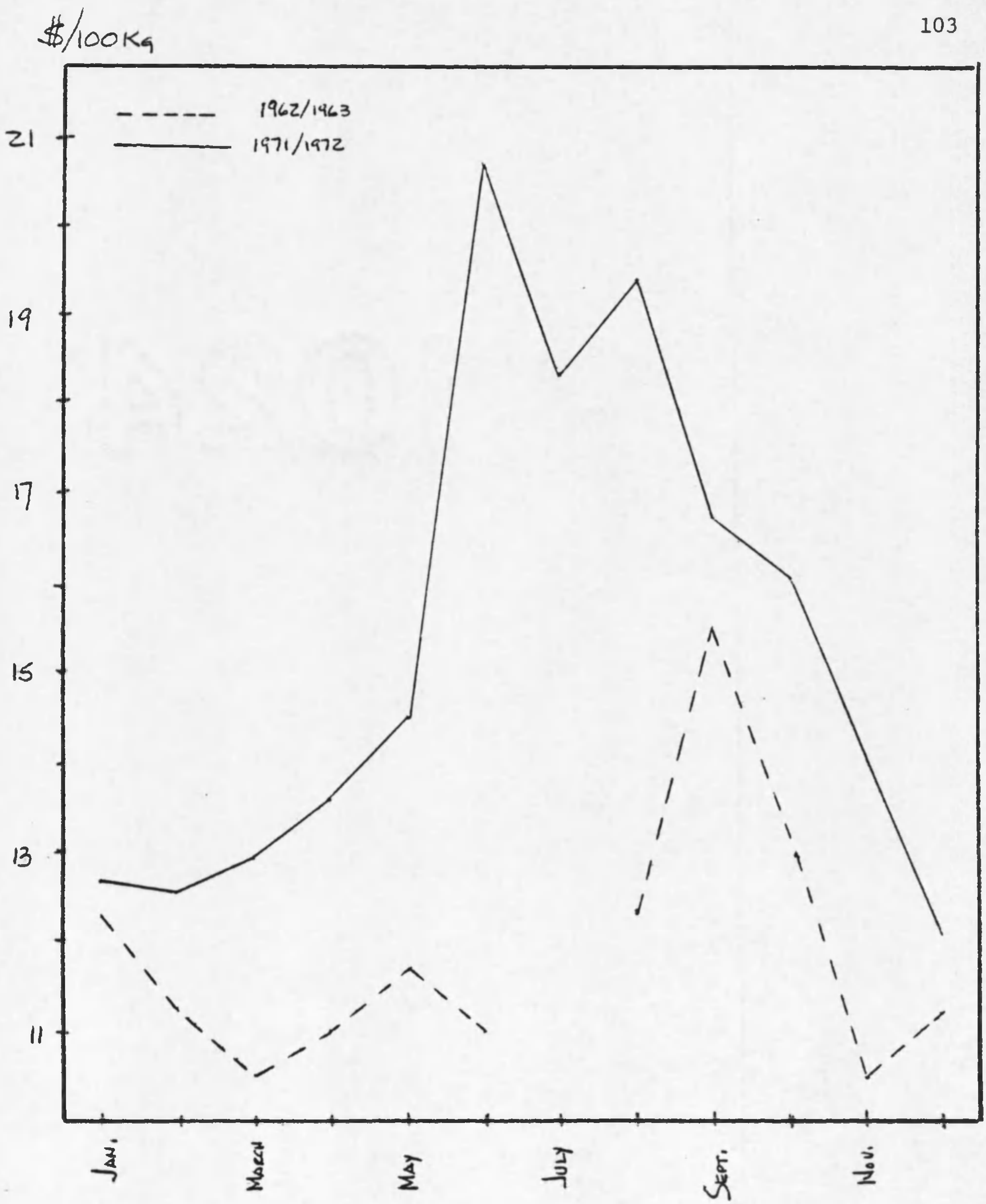


Figure A-1. Monthly E.E.C. Reference Price for Fresh Lemons, 1962-63 and 1971-72.

Source: United Nations (1973).

Table A-1. Winter Lemon Distribution Among Domestic Export and Processed Outlets.[a]

Year	Domestic Sales[b] Percentage of Total Production		Export Percentage of Total Production		Processed Percentage of Total Production	
	Annual	5-year Moving Average	Annual	5-year Moving Average	Annual	5-year Moving Average
1950-51	55		4		40	
1951-52	51		5		43	
1952-53	57	41	4	5	37	42
1953-54	43	50	4	7	51	42
1954-55	48	48	8	8	40	42
1955-56	44	43	14	11	40	43
1956-57	49	41	9	12	40	45
1957-58	33	36	19	12	45	50
1958-59	29	33	8	14	62	48
1959-60	26	33	11	14	62	51
1960-61	48	38	21	14	30	48
1961-62	29	38	13	14	57	47
1962-63	57	42	15	15	29	43
1963-64	31	39	10	14	58	47
1964-65	47	39	14	14	39	46
1965-66	32	34	17	15	51	51
1966-67	28	33	15	16	55	51
1967-68	31	30	19	17	52	53
1968-69	27	30	13	17	56	52
1969-70	31	30	19	18	49	51
1970-71	31	28	20	19	49	52
1971-72	28	28	20	21	50	50
1972-73	21	25	22	22	58	54
1973-74	30		25		43	
1974-75	14		23		70	

a. May not total 100 percent because of rounding error.

b. Does not include Canada.

Source: Lemon Administrative Committee (1950-76).

Table A-2. Summer Lemon Distribution Among Domestic, Export and Processed Outlets.[a]

Year	Domestic Sales[b] Percentage of Total Production		Export Percentage of Total Production		Processed Percentage of Total Production	
	Annual	5-year Moving Average	Annual	5-year Moving Average	Annual	5-year Moving Average
1950-51	58		4		37	
1951-52	64		5		30	
1952-53	59	56	5	7	34	36
1953-54	46	56	7	9	46	33
1954-55	54	52	14	11	32	36
1955-56	59	49	15	14	25	36
1956-57	42	49	16	16	41	34
1957-58	44	49	20	17	36	34
1958-59	48	46	14	17	38	36
1959-60	52	49	18	17	30	34
1960-61	45	49	19	18	35	33
1961-62	56	47	14	19	30	34
1962-63	43	46	26	20	31	35
1963-64	38	46	20	21	42	35
1964-65	48	42	23	23	37	37
1965-66	44	41	23	22	34	38
1966-67	36	43	21	23	42	35
1967-68	38	42	24	24	37	34
1968-69	49	41	25	25	27	34
1969-70	42	39	29	26	30	31
1970-71	38	37	27	27	34	32
1971-72	27	32	24	27	28	34
1972-73	31	30	31	26	39	37
1973-74	29		22		37	
1974-75	27		26		46	

a. May not total 100 percent because of rounding error.

b. Does not include Canada.

Source: Lemon Administrative Committee (1950-76).

Table A-3. Five-year Moving Averages of Winter Lemons; Total Production, Exports and Processed Quantitites.

Middle Year	Total Production	Exports	Processed Quantity
	- - - - - - - - - thousands of cartons - - - - - - - -		
1952		381	
1953	10,800	528	4,599
1954	11,268	783	4,782
1955	11,221	879	4,691
1956	12,345	1,361	5,365
1957	13,444	1,552	6,305
1958	15,305	1,823	7,973
1959	14,930	1,924	7,612
1960	16,414	2,212	8,849
1961	15,215	1,913	8,008
1962	14,948	1,965	7,707
1963	12,941	1,821	5,962
1964	14,033	1,924	6,952
1965	11,008	1,978	6,768
1966	15,269	2,310	7,924
1967	15,452	2,443	7,970
1968	16,539	2,751	8,724
1969	16,792	2,833	8,648
1970	16,499	3,000	8,411
1971	18,069	3,439	9,615
1972	17,848	3,791	9,079
1973	21,448	4,764	12,291

Source: Lemon Administrative Committee (1950-76).

Table A-4. Five-year Moving Averages of Summer Lemons: Total Production, Exports and Processed Quantities.

Middle Year	Total Production	Exports	Processed Quantity
	- - - - - - - - thousands	of cartons	- - - - - - - - - -
1952		845	
1953	17,264	1,225	6,925
1954	16,778	1,530	5,747
1955	17,881	2,044	6,530
1956	18,450	2,614	6,795
1957	17,904	2,822	6,241
1958	17,545	2,892	6,071
1959	18,283	3,142	6,642
1960	17,343	2,859	5,800
1961	16,715	3,020	5,542
1962	17,186	3,327	5,899
1963	17,751	3,624	6,320
1964	17,402	3,702	6,137
1965	18,267	4,104	6,843
1966	18,261	4,051	6,961
1967	16,760	3,896	5,982
1968	16,187	3,943	5,571
1969	16,249	4,099	5,605
1970	17,092	4,412	5,307
1971	17,566	4,795	5,592
1972	19,072	5,023	6,427
1973	20,410	5,301	7,513

Source: Lemon Administrative Committee (1950-76).

Table A-5. Winter Lemon Export Quantity.

Year	Total Exports	Japan	U.S.S.R.	Canada	Western Europe
	------------- 1,000 cartons -------------				
1949-50	143.83	.46	0	132.51	0
1950-51	385.16	1.14	0	360.26	0
1951-52	493.48	14.60	0	380.20	203.26
1952-53	413.71	32.43	0	357.23	59.70
1953-54	470.49	25.71	0	336.55	71.70
1954-55	876.62	26.24	0	364.64	705.62
1955-56	1661.88	26.35	0	372.89	3220.62
1956-57	963.96	113.44	0	347.00	350.91
1957-58	2831.12	138.29	0	563.07	2268.00
1958-59	1425.26	69.60	0	399.23	904.46
1959-60	2232.52	88.52	17.00	371.86	1690.01
1960-61	2164.43	88.19	108.00	382.29	1588.40
1961-62	2407.26	112.76	161.58	389.53	1769.03
1962-63	1335.58	107.83	0	316.43	705.23
1963-64	1686.89	157.89	0	412.10	1002.23
1964-65	1511.41	387.13	0	398.99	602.03
1965-66	2679.47	656.06	0	391.96	1481.30
1966-67	2674.41	781.98	0	413.88	1298.49
1967-68	2999.76	1077.80	0	408.94	1520.63
1968-69	2352.01	1072.56	0	478.99	1531.20
1969-70	3047.75	1396.92	1.65	397.41	1142.44
1970-71	3091.43	1786.49	0	435.53	731.75
1971-72	3509.89	2053.56	0	416.54	921.27
1972-73	5193.83	2335.52	451.58	535.06	1734.12
1973-74	4113.33	2054.56	86.03	486.43	1866.46
1974-75	7909.95	2377.64	468.72	513.53	1793.49

Source: U. S. Department of Commerce (1949-75).

Table A-6. Summer Lemon Export Quantity.

Year	Total Exports	Japan	U.S.S.R.	Canada	Western Europe
	- - - - - - - - - - - - - - -	1,000 cartons	- - - - - - - - - -		
1949-50	424.18	2.00	0	376.28	30.72
1950-51	617.25	13.45	0	373.30	205.17
1951-52	795.07	34.63	0	425.46	482.75
1952-53	852.32	31.25	0	419.18	398.78
1953-54	1535.95	13.38	0	394.67	1088.42
1954-55	2322.97	19.94	0	407.34	1774.16
1955-56	2144.82	18.00	0	484.80	1562.49
1956-57	3354.03	47.67	0	545.52	2676.29
1957-58	3699.80	61.45	0	432.08	3123.16
1958-59	2575.86	80.07	17.05	475.09	1913.97
1959-60	2675.66	84.29	93.00	399.67	2000.80
1960-61	3392.75	99.72	136.15	445.62	2578.99
1961-62	1950.35	99.62	130.12	442.83	1141.94
1962-63	4506.41	145.12	28.03	454.62	3702.79
1963-64	4109.04	702.75	0	391.08	2850.22
1964-65	4159.02	622.02	115.08	453.89	2804.06
1965-66	3783.56	747.89	179.42	453.79	2148.89
1966-67	3959.77	887.80	247.46	459.13	2182.39
1967-68	4245.16	1072.74	12.28	464.12	1661.62
1968-69	3334.16	1197.88	33.45	508.96	1464.53
1969-70	4393.36	1396.92	160.10	397.41	1142.44
1970-71	4560.52	1709.38	277.97	460.25	1992.09
1971-72	5528.94	2633.06	345.45	405.94	2055.98
1972-73	6158.05	2962.08	517.53	561.48	2023.95
1973-74	4472.43	3086.78	1145.21	491.02	2228.20
1974-75	5783.10	2139.11	863.60	528.14	2156.65

Source: U. S. Department of Commerce (1949-75).

Table A-7. Winter Lemon Export Prices.

Year	Average	Canada	Japan	Western Europe	U.S.S.R. & Eastern Europe
	dollars per carton[a]				
1949-50	2.91	2.87	6.02	0	0
1950-51	2.75	2.72	3.64	0	0
1951-52	2.63	2.94	2.56	.58	0
1952-53	2.79	2.85	2.48	.68	0
1953-54	3.11	3.12	3.82	2.96	0
1954-55	3.42	2.98	3.41	2.41	0
1955-56	2.68	3.15	3.13	2.43	0
1956-57	2.87	3.17	4.54	2.88	0
1957-58	2.61	1.83	3.92	2.50	0
1958-59	2.44	2.98	2.52	1.98	1.99
1959-60	2.29	5.88	3.07	2.11	2.28
1960-61	2.65	3.51	3.84	2.35	2.98
1961-62	2.36	3.06	3.99	2.14	3.03
1962-63	3.65	5.41	4.99	3.30	3.90
1963-64	2.84	3.41	3.94	2.49	0
1964-65	3.47	4.03	4.41	2.63	2.05
1965-66	3.07	4.05	3.94	2.47	1.80
1966-67	3.40	4.22	3.89	2.92	2.99
1967-68	3.61	4.68	4.14	2.64	3.55
1968-69	3.80	3.98	4.26	2.08	3.85
1969-70	3.99	4.57	4.47	3.35	3.32
1970-71	4.06	5.01	4.28	3.37	3.91
1971-72	3.99	5.07	4.05	3.45	3.09
1972-73	4.36	5.39	4.41	3.88	4.22
1973-74	4.80	6.07	4.96	4.20	3.48
1974-75	3.51	5.83	6.78	3.52	3.81

a. Prices per carton were derived from the total quantity of exports to each market and the total value of these exports, as reported by the U. S. Department of Commerce (1949-75).

Table A-8. Summer Lemon Export Prices.

Year	Average	Canada	Japan	Western Europe	U.S.S.R. & Eastern Europe
	------------ dollars per carton[a] ----------				
1949-50	2.70	2.65	3.16	3.23	0
1950-51	2.49	2.79	2.43	1.99	0
1951-52	2.11	3.24	2.85	1.14	0
1952-53	3.35	3.25	3.19	3.37	0
1953-54	2.75	2.89	3.28	2.68	0
1954-55	2.37	2.91	3.46	2.22	0
1955-56	3.24	3.03	4.89	2.53	0
1956-57	2.32	2.05	4.77	2.20	0
1957-58	2.47	2.89	3.33	2.40	0
1958-59	2.22	2.96	3.19	2.03	0
1959-60	2.22	2.99	3.39	6.23	2.00
1960-61	2.34	3.10	3.56	2.16	2.36
1961-62	2.63	3.25	4.25	2.31	.39
1962-63	3.31	3.61	4.24	3.28	0
1963-64	6.37	3.46	3.80	2.41	0
1964-65	3.00	3.60	3.92	2.75	0
1965-66	3.12	4.39	4.11	2.72	0
1966-67	3.31	4.36	4.06	2.89	0
1967-68	3.66	4.38	4.13	5.15	0
1968-69	4.76	5.06	4.40	3.72	0
1969-70	4.00	4.57	4.47	5.93	3.66
1970-71	4.05	5.71	3.70	4.01	0
1971-72	4.43	6.00	4.65	4.07	0
1972-73	4.48	6.39	4.36	4.22	3.91
1973-74	8.13	7.05	6.03	4.26	3.35
1974-75	7.82	7.71	12.59	4.72	3.46

a. Prices per carton were derived from the total quantity of exports to each market and the total value of these exports, as reported by the U. S. Department of Commerce (1949-75).

Table A-9. Winter Lemon Domestic Prices at Retail, F.O.B. and On-tree Levels.

Year	Retail	F.O.B.	On-tree Fresh
	- - - - - - - - - -	dollars per carton	- - - - - - -
1949-50	0	0	0
1950-51	0	0	0
1951-52	0	0	0
1952-53	0	0	0
1953-54	7.10	3.00	1.64
1954-55	7.01	2.88	1.51
1955-56	6.98	2.98	1.74
1956-57	7.66	2.83	1.49
1957-58	7.25	2.67	1.26
1958-59	7.26	2.59	1.26
1959-60	7.27	2.75	1.40
1960-61	8.01	2.86	1.47
1961-62	7.29	2.42	1.04
1962-63	9.64	3.95	2.56
1963-64	8.70	2.69	1.33
1964-65	9.84	3.57	2.06
1965-66	8.91	3.03	1.50
1966-67	9.36	3.35	1.84
1967-68	10.39	4.07	2.44
1968-69	10.45	3.94	2.22
1969-70	11.92	4.46	2.80
1970-71	12.29	4.75	2.82
1971-72	12.99	4.78	2.74
1972-73	13.55	4.78	2.58
1973-74	15.82	5.69	3.29
1974-75	16.91	4.87	2.09

Sources: U. S. Department of Agriculture (1950-75b and 1976).

Table A-10. Summer Lemon Domestic Prices at Retail, F.O.B. and On-tree Levels.

Year	Retail	F.O.B.	On-tree Fresh
	- - - - - - - dollars per carton	- - - - - - -	
1949-50	0	0	0
1950-51	0	0	0
1951-52	0	0	0
1952-53	0	0	0
1953-54	6.07	2.97	1.65
1954-55	6.69	2.91	1.53
1955-56	7.01	3.06	1.77
1956-57	6.98	2.58	1.26
1957-58	6.94	2.80	1.38
1958-59	6.88	2.72	1.38
1959-60	7.03	2.91	1.54
1960-61	7.28	2.45	1.05
1961-62	7.37	2.81	1.42
1962-63	8.61	2.72	1.59
1963-64	8.34	2.65	1.30
1964-65	9.81	2.94	1.41
1965-66	9.04	3.32	1.80
1966-67	9.07	3.30	1.76
1967-68	10.02	3.63	1.98
1968-69	11.02	4.80	3.02
1969-70	11.67	4.33	2.64
1970-71	12.63	4.78	2.75
1971-72	13.14	5.02	2.88
1972-73	14.49	5.88	3.55
1973-74	15.89	5.91	3.56
1974-75	17.19	6.57	3.83

Sources: U. S. Department of Agriculture (1950-75b and 1976).

Table A-11. Winter Lemon Export Prices as a Percent of F.O.B. Price.

Year	Average	Japan	Canada	Europe
1949-50	0	0	0	0
1950-51	0	0	0	0
1951-52	0	0	0	0
1952-53	0	0	0	0
1953-54	1.04	1.27	1.04	.99
1954-55	1.19	1.18	1.04	.84
1955-56	.90	1.05	1.06	.82
1956-57	1.01	1.60	1.12	1.02
1957-58	.98	1.47	.69	.94
1958-59	.94	.97	1.15	.76
1959-60	.83	1.12	1.05	.77
1960-61	.92	1.34	1.23	.82
1961-62	.98	1.65	1.26	.88
1962-63	.93	1.26	1.37	.83
1963-64	1.06	1.47	1.27	.93
1964-65	.97	1.24	1.18	.74
1965-66	1.01	1.30	1.33	.81
1966-67	1.01	1.16	1.26	.87
1967-68	.89	1.02	1.15	.65
1968-69	.96	1.08	1.01	.53
1969-70	.89	1.00	1.02	.75
1970-71	.85	.90	1.05	.71
1971-72	.84	.85	1.06	.72
1972-73	.81	.92	1.13	.80
1973-74	.84	.87	1.07	.74
1974-75	.72	1.39	1.20	.72

Table A-12. Summer Lemon Export Prices as a Percent of F.O.B. Price.

Year	Average	Japan	Canada	Europe
1949-50	0	0	0	0
1950-51	0	0	0	0
1951-52	0	0	0	0
1952-53	0	0	0	0
1953-54	.93	1.10	.97	.90
1954-55	.81	1.19	1.00	.76
1955-56	1.00	1.60	.99	.83
1956-57	.90	1.85	.80	.85
1957-58	.88	1.19	1.03	.86
1958-59	.82	1.17	1.09	.74
1959-60	.76	1.17	1.03	2.14
1960-61	.95	1.45	1.26	.88
1961-62	.94	1.51	1.16	.82
1962-63	1.21	1.56	1.32	1.20
1963-64	2.40	1.43	1.30	.91
1964-65	1.02	1.34	1.23	.94
1965-66	.94	1.24	1.32	.82
1966-67	1.00	1.23	1.32	.88
1967-68	1.01	1.14	1.21	1.42
1968-69	.87	.92	1.06	.78
1969-70	.92	1.03	1.06	1.37
1970-71	.85	.77	1.19	.84
1971-72	.88	.93	1.20	.81
1972-73	.76	.74	1.09	.72
1973-74	1.38	1.02	1.19	.72
1974-75	1.19	1.92	1.17	.72

Table A-13. Exports as a Percentage of Total District Production.

Year	District 1	District 2	District 3
1951-52	-	3	-
1952-53	-	3	-
1953-54	-	7	-
1954-55	3	11	-
1955-56	2	13	-
1956-57	1	13	-
1957-58	13	19	2
1958-59	3	11	2
1959-60	6	13	4
1960-61	8	18	16
1961-62	10	12	11
1962-63	6	20	16
1963-64	8	14	6
1964-65	9	18	13
1965-66	9	19	8
1966-67	15	19	9
1967-68	2	22	8
1968-69	29	19	8
1969-70	21	23	14
1970-71	15	24	12
1971-72	20	26	17
1972-73	5	25	14
1973-74	22	28	26

Source: Lemon Administrative Committee (1950-76).

Table A-14. On-tree Returns per Acre to Lemons and Other California-Arizona Citrus.

Year	Lemons			Valencia Oranges		
	Bearing Acreage	Per Acre Returns (Current $)	5-year Moving Average Returns per Acre ($)	Per Acre Returns (Current $)	5-year Moving Average Returns per Acre ($)	Per Acre Returns Relative to Lemons[a]
1949-50	56,600	597.74		406.54		68.0
1950-51	55,400	525.20		479.08		91.2
1951-52	54,800	648.56		n.a.		n.a.
1952-53	58,138	748.80	613.51	n.a.		n.a.
1953-54	58,453	617.00	646.06	408.03		66.1
1954-55	57,160	528.00	615.91	442.95		83.9
1955-56	56,575	687.94	565.08	556.16	523.81	80.8
1956-57	56,460	497.80	534.01	532.20	578.15	106.9
1957-58	57,358	494.64	507.85	679.70	627.50	137.4
1958-59	58,086	461.68	461.66	679.73	643.62	147.2
1959-60	59,983	397.20	447.78	689.69	641.55	173.6
1960-61	60,073	456.96	519.49	636.77	646.79	139.3
1961-62	57,431	428.40	545.78	521.88	669.32	121.8
1962-63	57,592	853.20	583.74	705.88	627.99	82.7
1963-64	54,872	593.12	648.80	792.40	602.99	133.6
1964-65	53,225	587.00	705.82	483.01	565.08	82.3
1965-66	50,538	722.52	814.95	511.80	577.84	70.8
1966-67	48,484	742.05	890.05	332.30	430.82	44.8
1967-68	48,535	974.07	999.45	469.71	411.17	48.2
1968-69	47,902	968.60	1139.16	357.29	404.15	36.9
1969-70	49,067	1134.00	1221.16	384.75	407.19	33.9
1970-71	51,893	1421.07	1250.14	476.72	410.30	33.5
1971-72	53,119	1152.04	1334.41	347.50	441.41	30.2
1972-73	59,509	1119.00	1303.84	485.22	461.44	43.4
1973-74	62,322	1389.96		512.87		36.9
1974-75	67,117	981.12		484.90		49.4

Table A-14. -- On-tree Returns (continued).

Year	Navel Oranges: Per Acre Returns (Current $)	Navel Oranges: 5-year Moving Average Returns per Acre ($)	Navel Oranges: Per Acre Returns Relative to Lemons[a]	Desert Grapefruit: Per Acre Returns (Current $)	Desert Grapefruit: 5-year Moving Average Returns per Acre ($)	Desert Grapefruit: Per Acre Returns Relative to Lemons[a]
1949-50	357.94		59.9	212.38		35.5
1950-51	418.82		79.7	218.55		41.6
1951-52	n.a.		n.a.	191.86	251.22	29.6
1952-53	n.a.		n.a.	300.88	274.10	40.2
1953-54	435.25		70.5	332.43	306.16	53.9
1954-55	487.00		92.2	326.79	358.43	61.9
1955-56	634.75	575.08	92.3	378.82	438.20	55.1
1956-57	646.43	642.00	129.9	453.23	457.22	91.0
1957-58	671.97	655.61	135.9	699.73	491.09	141.5
1958-59	769.84	669.44	166.7	427.53	476.97	92.6
1959-60	702.82	670.80	176.9	496.14	434.84	124.9
1960-61	716.13	691.16	156.7	308.24	350.51	67.5
1961-62	652.69	682.25	152.4	242.57	422.38	56.6
1962-63	773.73	676.59	90.7	278.08	413.05	32.6
1963-64	725.31	640.04	122.3	786.88	470.20	132.7
1964-65	674.54	630.73	114.9	449.49	571.45	76.6
1965-66	533.37	562.20	73.8	593.98	665.60	82.2
1966-67	606.12	515.31	81.7	348.74	645.33	47.0
1967-68	431.09	464.68	44.3	748.83	688.24	76.9
1968-69	490.86	459.83	50.7	685.50	734.40	70.8
1969-70	421.40	424.62	37.2	664.08	803.04	58.6
1970-71	509.12	432.44	35.8	825.20	749.49	58.1
1971-72	430.06	443.23	37.3	691.50	675.96	60.0
1972-73	470.20	480.31	42.0	481.07	711.65	43.0
1973-74	544.78		39.2	317.85		22.9
1974-75	606.84		61.9	842.54		49.2

Table A-14.-- On-tree Returns (continued).

Year	Summer Grapefruit		
	Per Acre Returns (Current $)	5-year Moving Average Returns per Acre ($)	Per Acre Returns Relative to Lemons[a]
1949-50	204.32		34.2
1950-51	202.82		38.6
1951-52	251.47	249.17	38.8
1952-53	272.50	300.53	36.4
1953-54	314.75	377.20	51.0
1954-55	461.11	439.38	87.3
1955-56	586.67	531.81	85.3
1956-57	561.86	615.86	112.9
1957-58	734.65	623.09	148.5
1958-59	735.00	603.05	159.2
1959-60	497.25	580.28	125.2
1960-61	486.50	607.55	106.5
1961-62	448.00	648.32	104.6
1962-63	871.00	670.79	102.1
1963-64	938.86	785.23	158.3
1964-65	709.57	891.63	120.9
1965-66	958.70	864.76	132.7
1966-67	980.00	815.11	132.1
1967-68	736.68	887.24	75.6
1968-69	690.61	925.18	71.3
1969-70	1070.20	975.92	94.4
1970-71	1148.40	1115.72	80.8
1971-72	1233.73	1153.17	107.1
1972-73	1435.64	1138.76	128.3
1973-74	877.87		63.2
1974-75	988.18		101.7

Table A-14. -- On-tree Returns (continued).

a. Relative returns derived by dividing on-tree returns per acre for particular citrus by on-tree returns per acre to lemons.

Sources: Lemon Administrative Committee (1950-76)
U. S. Department of Agriculture (1950-75a and 1950-75b)

Table A-15. Orange and Lemon Bearing Acreage for Each District.

Year	District #1 (Central Calif)			District #2 (Southern Calif)			District #3 (Calif-AZ Desert)		
	Lemons	Valencia Oranges	Navel Oranges	Lemons	Valencia Oranges	Navel Oranges	Lemons	Valencia Oranges	Navel Oranges
1949-50	n.a.	10,518	29,865	n.a.	126,373	51,263	n.a.	2,829	3,408
1950-51	n.a.	11,945	29,881	n.a.	124,177	50,279	n.a.	3,808	3,808
1951-52	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1952-53	1,241	n.a.	n.a.	56,323	n.a.	n.a.	574	n.a.	n.a.
1953-54	1,287	11,470	28,633	56,465	102,349	41,708	701	3,378	2,183
1954-55	1,246	11,428	28,816	55,055	92,495	38,543	859	3,502	2,141
1955-56	1,322	11,409	28,829	54,421	84-128	34,781	832	3,572	2,076
1956-57	1,457	11,456	29,440	53,438	79,080	32,904	1,565	3,518	2,172
1957-58	1,457	11,543	29,611	54,113	75,123	30,266	1,788	3,644	2,215
1958-59	1,523	11,920	31,034	53,362	73,202	30,351	3,201	3,622	2,200
1959-60	1,657	12,150	32,748	54,314	70,316	29,797	4,012	4,781	2,807
1960-61	1,781	12,556	33,742	53,396	65,239	28,464	4,896	5,721	2,895
1961-62	1,713	13,734	36,034	50,148	61,807	27,664	5,570	6,633	3,119
1962-63	1,983	14,713	38,150	48,614	58,051	26,610	6,995	7,368	3,271
1963-64	1,883	18,547	40,730	46,123	56,357	26,136	6,866	10,195	3,609
1964-65	1,702	21,692	46,102	43,934	55,200	25,309	7,589	12,450	3,908
1965-66	1,764	25,204	51,934	41,242	54,369	24,519	7,532	13,300	3,874
1966-67	1,754	27,420	56,704	39,126	56,423	25,159	7,604	17,266	3,870
1967-68	2,014	22,394	59,309	38,770	54,098	24,721	7,751	18,638	4,027
1968-69	1,989	31,457	71,062	37,840	52,996	21,547	8,073	20,816	4,142
1969-70	2,517	32.145	80,167	36,105	54,017	23,933	10,445	21,613	4,340
1970-71	3,211	31,850	82,863	37,176	50,623	23,148	11,506	18,883	4,143
1971-72	3,617	32,667	88,535	37,339	50,514	22,660	12,163	20,075	4,076
1972-73	4,971	30,630	85,842	38,002	48,318	22,084	16,536	19,571	4,724
1973-74	5,127	33,215	94,321	39,165	45,433	19,133	18,030	18,583	4,118
1974-75	5,830	32,430	87,887	38,926	44,528	20,221	22,361	17,130	4,591

Sources: Lemon Administrative Committee (1950-76); Navel Orange Administrative Committee (1976); Valencia Orange Administrative Committee (1976).

LIST OF REFERENCES

California-Arizona Citrus League, Statement of Position on GATT Negotiations, Sunkist Growers, Inc., P. O. Box 7888, Van Nuys, Calif. 91409, September 1964.

California-Arizona Citrus League, Statement Concerning Foreign Tariff and Nontariff Barriers and U. S. Trade Practices, Special Report of the Trade Information Committee of the Office of the Special Representative for Trade Negotiations, Sunkist Growers, Inc., P. O. Box 7888, Van Nuys, Calif. 91409, March 1968.

Commission of the European Community, The Common Agricultural Policy, Belgium, August 1972.

French, Ben C. and Raymond G. Bressler, "The Lemon Cycle," Journal of Farm Economics, November 1962, pp. 1021-1036.

French, Ben C. and Jim L. Matthews, "A Supply Response Model for Perennial Crops," American Journal of Agricultural Economics, August 1971, pp. 478-490.

Heller, H. Robert, International Trade, Prentice-Hall, New Jersey, 1973.

Hoos, Sidney S. and R. E. Seltzer, "Lemons and Lemon Products: Changing Economic Relationships 1951-1952," California Agricultural Experiment Station Bulletin, No. 729, University of California, Berkeley, 1952.

Jamison, John A., "Marketing Orders and Public Policy for Fruit and Vegetable Industries, Food Research Institute Studies, Vol. 10, No. 3, 1971, pp. 223-392.

Leftwich, Richard H., The Price System and Resource Allocation, Dryden Press, Illinois, 1970.

Lemon Administrative Committee, Annual Report, 117 W. 9th Street, Los Angeles, Calif. 90015, 1950-1976.

McMillen, P. F., "Citrus Export Marketing Situation," Unpublished talk given at the Citrus Institute Day, San Bernadino, California, March 18, 1976.

Mills, Frederick C., Statistical Methods, Henry Holt and Co., New York, 3rd Ed., 1955.

Navel Orange Administrative Committee, Annual Report, 117 W. 9th Street, Los Angeles, Calif. 90015, 1976.

Schuh, G. Edward, "The Exchange Rate and U. S. Agriculture," American Journal of Agricultural Economics, Vol. 56, No. 1, February 1974.

Shao, Stephen P., Statistics for Business and Economics, Merrill Publishing Co., Columbus, Ohio, 1976.

Sunkist Growers, Inc., Citrus Fruit Industry Statistical Bulletin, P. O. Box 7888, Van Nuys, Calif. 91409, 1950-1976.

Sunkist Growers, Inc., P. O. Box 7888, Van Nuys, Calif. 91409, unpublished data, 1976.

United Nations, F. A. O., Committee on Comodity Problems, CCP:CI/CONS 74/3, New York, New York, December 1973.

U. S. Department of Agriculture, Standards for Grades of Lemons, September 1, 1964.

U. S. Department of Agriculture, The Common Agricultural Policy, Foreign Agricultural Service, FAS M-255, November 1973.

U. S. Department of Agriculture, Price Impacts of Federal Market Order Programs, Farmer Cooperative Service- Special Report 12, January 7, 1975a.

U. S. Department of Agriculture, The Sunkist Adventure, Farmer Cooperative Service Information 94, May 1975b.

U. S. Department of Agriculture, Citrus Fruits by States, 1950-75a.

U. S. Department of Agriculture, Prices Received by Farmers, 1950-75b.

U. S. Department of Agriculture, Economic Research Service, unpublished data, 1976.

U. S. Department of Commerce, Trade Statistics, Commodity by Country of Destination, 1949-1975.

Valencia Orange Administrative Committee, Annual Report, P. O. Box 7888, Van Nuys, California 91409, 1976.