AN ABSTRACT OF THE THESIS

THOMAS JAMES CUSACK for the degree of DOCTOR OF PHILOSOPHY

in Agricultural and Resource Economics presented on September 20, 1976

Title: AN ANALYSIS OF DEMAND FOR U.S. WINTER PEARS IN EXPORT MARKETS

Abstract approved: John A. Edwards

The principal objective of this study was to identify and investigate the underlying basis for variations in the volumes of exports of U.S. winter pears during the 1947 to 1974 period. A number of factors thought to be of importance in the determination of the volume of exports of a specific commodity were hypothesized with reference to a two-region partial equilibrium model of trade; these factors were; the price of the exported commodity, the supply of the commodity of interest in importing countries, the prices of substitute commodities, consumer income, population and the general price level in importing countries, transportation costs in international trade, import restrictions against the commodity of interest, and fluctuations in exchange rates between the currency of the exporting country and the currencies of importing countries.

The theoretical model was reformulated in terms of empirical models of demand for U.S. winter pears in specific export markets. The empirical analysis focused upon the effects on season export volumes of changes in prices of U.S. winter pears, changes in consumer income, changes in levels of pear production in consuming areas, and changes in the international trade policies of important importing countries.

The results suggested that changes in the international trade policies of important importing countries and changes in the production levels of pears in consuming regions have been of principal importance in the determination of volumes of export sales of U.S. winter pears. In general, inverse relationships between prices and export volumes of U.S. winter pears were not found. However, an analysis of factors affecting U.S. winter pear prices suggested that fluctuations in demand for exports have significantly influenced season average f.o.b. prices of U.S. winter pears during the 1950 to 1974 period. Important factors influencing domestic demand were found to be the supply of fresh U.S. apples, the supply of fresh Bartlett pears after October 1st, and changes in consumer income.

It was concluded that past unstable and uncertain conditions in export markets will continue into the future because of annual fluctuations in levels of pear production

in foreign countries and because of unpredictable changes in import restrictions against U.S. winter pears in foreign countries.

An Analysis of Demand for U.S. Winter Pears in Export Markets

by

Thomas James Cusack

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Completion September 20, 1976
Commencement June 1977

APPROVED:

Professor of Agricultural and Resource Economics in charge of major

Head of the Department of Agricultural and Resource Economics

Dean of Graduate School

Date thesis is presented September 20, 1976

Typed by Deanna L. Cramer for Thomas James Cusack

ACKNOWLEDGEMENTS

I would particularly like to thank Dr. John A. Edwards, my major professor, for his invaluable and patient assistance during the course of this project. My gratitude is also extended to Drs. R. Johnston, W. Wilkins, S. Miller and R. McMahon for their helpful comments.

I wish to express my appreciation to the graduate students and staff in the Department of Agricultural and Resource Economics, and in other departments, for their rewarding friendships and interesting discussions which I have experienced during my stay at Oregon State University.

TABLE OF CONTENTS

Table of Contents (continued)

LIST OF TABLES

APPENDIX TABLES

LIST OF FIGURES

AN ANALYSIS OF DEMAND FOR U.S. WINTER PEARS IN EXPORT MARKETS

I. INTRODUCTION

The Problem

Within the past decade, there has been a greatly increased concern on the part of the agricultural and food industries, and on the part of policy makers, with the international trading of U.S. agricultural products.[1/] This concern seems to have been precipitated by a number of factors, including: (i) recent unpredicted and often perplexing developments in agricultural trade patterns; (ii) the important role of exports of agricultural products in meeting balance of payments difficulties; and (iii) the increasingly critical role of exports in farm income determination (5, 50). Recent developments in agricultural trade have also been of a wider concern as they are thought to have caused fluctuations in producer and consumer prices, and to have effected changes in the domestic and international trade policies of the U.S. (6, 17, 33, 43).

It is not surprising therefore, that the recent research literature is full of exhortations on the part of

---

[1/] For example, see a group of papers on the subject of foreign market prospects and potential in the Journal of Farm Economics (54) and a group of papers concerned with U.S. policies for food, agriculture and trade in the American Journal of Agricultural Economics (13).

policy makers and economists to conduct research into the many current and long-standing problems in international trade in agricultural products. There seems to be a particular concern regarding the need to estimate the export demand for specific U.S. farm products; for example:

> Even with the short-term influences of weather and the political and institutional uncertainties that surround foreign trade, there is an obvious need to develop long-term price-quantity commodity export demand schedules for individual countries, based on informed and meticulously researched supply and demand developments in each of the major exporting countries. The degree of success in such an endevour could mean the difference between economic health and economic chaos for production agriculture (43, page 402).

and

> Lack of economic research on the response of exports to price and the widespread practice of assuming a zero price elasticity of export demand for farm products is indefensible (55, page 366).

A limited amount of analysis has been done in the area of export demand. Studies have been oriented towards estimating export and import demand equations for commodity aggregates; the major objective of this work has been to obtain price elasticities for internationally-traded aggregates in order to assist in the analysis of policy questions such as the choice between alternative exchange rate systems (1, 22). Kreinin was led to comment in 1967 that

elasticity estimates for individual commodities are rare (28, page 510).

More recently, attention has centered upon describing the international flows of individual agricultural commodities. The small number of completed studies have concentrated upon those commodities which have comprised a large proportion of total agricultural exports: for example, see (21) and (79) for soybeans and (49) for wheat. In fact, a wide range of less voluminous U.S. agricultural commodities have important export outlets. Many of the lower-volume commodity exports are of important regional significance and are facing uncertain export markets (12). However, detailed analyses of these export markets have been almost non-existant. This study is concerned with the analysis of the export markets for one such commodity, winter pears.

Winter pears are chosen for investigation in this study because they are an important agricultural product in Oregon and Washington (27, page 12), and the U.S. winter pear industry appears to be confronted with a high degree of uncertainty with regard to its future export markets. Additionally, some recent trends within the domestic market for winter pears have caused widespread concern (4). This study attempts to integrate domestic and export considerations in order to analyze past performance and to consider future demand prospects.

It is intended that the results of the analyses will be directly useful in aiding the decisions of public policy makers and winter pear producers and shippers, as well as serving as a useful basis for the investigation of several other U.S. agricultural commodities which enter international trade.

The U.S. Winter Pear Industry

Pears produced in the United States may be broadly classified into two categories, according to variety: (i) summer and fall varieties (almost all are Bartletts); and (ii) winter varieties. Bartlett pears are used for canning and for fresh sales, whereas winter varieties of pears are marketed almost exclusively as the fresh product.[2/] Bartletts are sold on the fresh market from the end of June until December, and have a relatively limited storage life. Winter varieties have a relatively long storage life so the marketing season for winter pears extends into the spring and early summer of the year following harvest. Winter pears are generally harvested from August until October, but large quantities are not moved through domestic retail outlets until the end of November, when stocks of Bartletts have reached low levels.

[2/] Small quantities of winter pears, mainly cullage from packing houses, are processed into such products as pear juice and vodka.

Production of winter varieties of pears in the U.S. is concentrated almost exclusively in Oregon, Washington and California. Approximately 90% of U.S. winter pear production is located in Oregon and Washington. Within the Pacific Coast states, there are six principal producing districts: the Medford and Mid-Columbia districts of Oregon, the Wenatchee and Yakima districts of Washington, and the Santa Clara and Placeville areas of California.

After being harvested, winter pears are delivered to the packing house where they are graded, sized and placed into "packed" boxes ready for shipping. Some packers store the pears in bulk bins until they are packed to order, while others pack early in the season and store their pears as "packed boxes."

Four varieties of winter pears (Beurre D'Anjou, Beurre Bosc, Doyenne Du Comice and Winter Nelis) make up approximately 95% of all winter pears packed. Beurre D'Anjou is the prominent variety and is shipped throughout the season as it has superior storage qualities. The Bosc and Comice varieties are usually marketed only during the earlier part of the marketing season. A comparison of production levels of U.S. winter pears, by variety and district, is made in Table 1. It can be seen from Table 1 that (i) most of the production consists of the Anjou variety, (ii) most of the Bosc production is in Oregon, and particularly in the

Table 1. Packout of U.S. winter pears, by variety and district, average of the 1970-74 period in thousand boxes.[1/]

District	Total Packout of Four Varieties	Packout of				% of Total	
		Anjou	Bosc	Comice	W. Nelis	Anjou	Bosc
Mid-Columbia	1,909	1,774	124	11	-	93	6
Medford	1,227	635	529	59	4	52	43
Yakima	612	576	36	-	-	94	6
Wenatchee	1,474	1,471	3	-	-	100	*
Placeville	74	11	41	1	21	15	55
Santa Clara	144	37	10	33	64	26	7
Total	5,440	4,504	743	104	89	83	14

Source: (80)

*Less than 1%.

[1/] Quantities of winter pears are reported by the Winter Pear Control Committee (80) in "boxes"; this refers to the Standard Western pear box which ranges from about 44 to 48 pounds, depending on the year and district. Pears packed in other containers have been converted to the equivalent of a Standard Western pear box and are included in the box totals.

Medford district, and (iii) the California districts are relatively unimportant in terms of total production.

Almost all winter pears are marketed through "shippers." Shippers normally provide services such as the grading, storing, packing, and shipping of the fruit. Most shippers are also growers. There are also a small number of grower co-operatives which undertake shipping functions. In terms of volume of output, there are a few large shippers and numerous low-volume shippers.

There are a number of umbrella organizations and agreements which are designed to look after the interests of growers and shippers of winter pears: (i) the Oregon-Washington-California Pear Bureau was organized in 1931 and is devoted primarily to the advertising and promotion of winter pears. Membership is voluntary and operating funds are derived from an assessment on the volume handled by its members. Approximately 90% of the tonnage is encompassed by this organization; (ii) there are a number of district-based organizations which are financed by a per box assessment on growers and handlers, and function as central sources of marketing and price information throughout the season; (iii) since 1939, the Pacific Coast winter pear industry has been covered by a Federal Marketing Order[3/]; under the auspices

---

[3/] Order #927, covering: Beurre D'Anjou, Beurre Bosc, Winter Nelis, Doyenne Du Comice, Beurre Easter, Beurre Clairgeau varieties of pears grown in Oregon, Washington, and California.

of the order, industry statistics are developed and attempts are made to regulate marketings by controlling grades and sizes.

A wide range of problems appear[5] to be confronting the markets for winter pears at the present time; for example, see a recent American Farm Bureau Federation report (4, pages 45-46). It is considered that important problems in the winter pear industry include: (i) the loss of export markets due to increased foreign competition; (ii) unpredictable changes in export demand; (iii) increasing competition from imported pears during the latter part of the winter pear season; and (iv) a continuing encroachment of fresh Bartlett sales into the early part of the winter pear season. These problems are compounded by the fact that there have been large annual fluctuations in the total production and packout of U.S. winter pears. Table 2 shows that fluctuations have been particularly severe in recent years. Production levels from season to season are primarily determined by weather conditions during a six-week period of flowering and bud development in the spring (3).

The export market has generally been a significant factor in total sales of U.S. winter pears (Table 3). However, it is apparent from Table 3 that export volume has fluctuated greatly from year to year and that the importance of the export market in total sales has possibly declined since the mid-1960's.

Table 2. Total packout of U.S. winter pears, 1950/51-1974/75 seasons.

Season Beginning	Total Packout (1,000 boxes)	% Change from Previous Season
1950	4,727	11
1951	3,995	15
1952	4,038	1
1953	4,733	17
1954	4,199	11
1955	4,544	8
1956	5,263	16
1957	5,384	2
1958	4,423	18
1959	4,565	3
1960	4,080	11
1961	4,124	1
1962	4,835	17
1963	3,622	25
1964	3,987	10
1965	4,889	23
1966	5,227	7
1967	4,539	13
1968	3,864	15
1969	5,736	48
1970	3,800	34
1971	5,793	52
1972	4,546	22
1973	6,161	36
1974	6,845	11

Source: (80)

Table 3. Export sales of U.S. winter pears, 1950/51-1974/75 seasons.

Season Beginning	Total Export Volume (1,000 boxes)	Export Sales as a % of Total Sales
1950	471	10
1951	527	13
1952	346	9
1953	534	11
1954	301	7
1955	452	10
1956	690	13
1957	1,115	23
1958	581	15
1959	1,049	24
1960	627	16
1961	907	26
1962	1,002	21
1963	592	17
1964	779	20
1965	1,213	25
1966	829	17
1967	820	18
1968	417	11
1969	714	13
1970	495	13
1971	708	12
1972	619	14
1973	1,027	16
1974	963	14

Source: (80)

Due to these problems, there is great uncertainty regarding future prospects in winter pear markets; moreover, growers need to make long term decisions regarding plantings. This study attempts to analyze the problems outlined above. Particularly, attention is focused upon historical events in export markets. The results of the analysis of factors affecting winter pear markets in the past are used as aids in the prediction of future market conditions.

Overview

The main objective of this study is to identify and describe the influence of the principal factors affecting the volumes of U.S. winter pears which enter international trade. The principal factors affecting changes in the U.S. demand for winter pears and affecting changes in winter pear prices are also considered and possible future trends in the export markets for U.S. winter pears are assessed. The methodology used is least squares regression analysis. Essentially, models of demand for U.S. winter pears are developed and solved, using economic logic and statistical techniques.

Chapter II establishes the theoretical framework which is used as a basis for the analysis of exports of U.S. winter pears. Chapter III discusses some further theoretical problems, the methodology, and the available data; and a general model of the export markets for U.S. winter pears

is presented. Chapter IV identifies and estimates empirical models of demand for U.S. winter pears in specific export markets. Chapter V is concerned with the analysis of all of the principal hypothesized demand and supply factors affecting U.S. winter pear markets. Finally, Chapter VI focuses upon the principal conclusions of the empirical analyses, and the implications of the analyses for: (i) past market performance, (ii) future market propsects, and (iii) further research.

II. THE THEORETICAL FRAMEWORK

The principal thrust of this study is to analyze those factors which have caused fluctuations in the volume of exports of U.S. winter pears. There are a number of points of departure for such an investigation, but there are two main possibilities. The most fundamental is the group of hypotheses suggested by the classical and neo-classical theories of trade. The second is a two-region partial equilibrium model of commodity trade around which much of the empirical work in international and regional commodity trade has been centered.

Theories of Trade

Theories of international trade have focused upon the questions: what goods are traded, what quantity of goods are traded, and at what prices? Modern concern with international trade probably began with the mercantalists. Mercantalist theory was concerned with promoting national unity and the strength of the state. Wealth in the form of gold and silver was thought to be a necessary condition of national power; therefore, for countries without gold and silver mines and not willing to rely solely upon warfare or piracy, their means of gaining such wealth was an export balance of trade. In 1664 Thomas Mun wrote

> The ordinary means therefore to increase our wealth and treasure is by forraign trade wherein wee must ever observe this rule; to sell more to strangers yearly than we consume of theirs in value (2, page 6).

John Stuart Mill describes merchantalist behavior as

> ...money being the only wealth, selling, or in other words, exchanging goods for money, was (to countries without mines of their own) the only way of growing rich - and importation of goods, that is to say, parting with money, was so much subtracted from the benefit (35, page 350).

Mercantalist preoccupation with the monetary aspects of foreign commerce and protectionism was effectively cleared away by David Hume, Adam Smith and the French Physiocrats.[4/] David Hume concluded, in a 1752 essay, that welfare among nations would be enhanced by that "free communication and exchange which the author of the world has intended, by giving them soils, climates and geniuses, so different from each other" (2, page 40). Adam Smith also rejected the mercantalist theory by suggesting that instead of using foreign trade to augment a nation's gold supply, it should be used (1) to exchange surpluses and (2) to effect a greater territorial division of labor, so that the size of the market is expanded and specialization is increased (52).

[4/] The Physiocrats, who were followers of Quesnay in 18th century France, emphasized the powers of nature as the source of public wealth and national prosperity.

Smith goes on to imply the following concept of absolute advantage; in a two-commodity, two-country model, if each country can produce one good cheaper than it can be produced in the other, then each will have an advantage in the production of one commodity and a disadvantage in the production of the other. Each country will then be anxious to export the commodity in which it has an advantage and import the commodity in which it has a disadvantage.

In 1817, David Ricardo extended the analysis to encompass the more general case of comparative advantage (45). In a simple two-commodity, two-country model, Ricardo observed that although one country may have an absolute advantage in both goods, provided that the degree of superiority is not uniform, the country would export the product in which it had the greatest advantage, or a comparative advantage, and import the commodity in which its advantage was less, or in which it had a comparative disadvantage.

Ricardo concluded that there would be mutual gains in trade (i) if each country exports the commodity in which it has a comparative advantage, regardless of whether it has an absolute advantage, and (ii) assuming that the terms of trade are one to one -- if it can produce a unit of the exported commodity more cheaply than it can produce a unit of the imported commodity.

In 1848, Mill, in restating and further developing Ricardo's theory in a more general way, permitted condition (ii) to be dropped. Mill demonstrated that "it is not a difference in the absolute cost of production which determines the interchange, but a difference in the comparative cost" (35, page 348). A nation was thought to gain if the amount of labor embodied in the entire volume of its exports is less than the total labor which would be required to replace all of its input by domestic production. Mill then went on to postulate what would determine the terms of trade. He suggested that the price at which foreign trade would take place is determined by the "law of reciprocal demand"; i.e., the strength of one country's demand for products as compared to the reciprocal strength of the other country's demand for the same products.

Mill's concept was reformulated in terms of offer curves by Marshall (32) and Meade (34) showed how the offer curve could be constructed from the production possibilities curve and the consumption indifference map.

The orientation of the classical analysis was largely towards the gains from trade. Heckscher and Ohlin, early in the twentieth century, developed an approach which was primarily oriented towards the bases for trade. Heckscher considered his theory to be basically an inquiry into the reasons for differences in Ricardo's comparative costs among countries. On the other hand, Ohlin stated that his

theory couldn't be fitted into the classical labor cost theory at all (39, page 34).

The Heckscher-Ohlin approach to the conditions permitting trade can be characterized briefly. Each country tends to produce and export those goods which require for their production relatively large amounts of those factors which are relatively cheap. Heckscher and Ohlin account for the differences in relative factor prices primarily by differences in relative factor supplies.

A number of recent theories of trade have been based upon a relaxation of one or more of the assumptions of pure trade theory. One approach is briefly considered here as it may be useful in assessing the bases of trade in U.S. winter pears. Staffan Linder built a theory of trade in manufactures on the basis of similar tastes, linked to not widely dissimilar incomes (31). He suggests that countries at roughly the same level of income will trade with each other, exchanging one differentiated product for another. Linder's theory starts from the proposition that manufacturers produce first for the domestic market and then spill over into foreign markets. New products are sold first to those countries with roughly the same level of income that are in a position to develop a taste for the new goods.

The Heckscher-Ohlin and Linder theories are useful, in a general sense, for analyzing trading patterns.

Heckscher-Ohlin's theory, based upon factor endowments between countries, would seem to suggest a possible basis for international trade in U.S. winter pears. Countries which import large quantities of U.S. winter pears include the Scandinavian countries and Canada which have too northerly a latitude for optimal pear production. Other important importers of U.S. winter pears, such as Brazil and Venezuela, are situated close to the equator and therefore tend to have relatively unsuitable climates for pear production. Also, the U.S. has relatively abundant land resources compared to some European countries and Japan; for example, the United Kingdom, West Germany and the Netherlands have been important importers of winter pears.

Staffan Linder's theory of trade, although based upon international trade in manufactures, may offer some insights into trade in U.S. winter pears. Most production of U.S. winter pears goes onto the domestic market. Also, the two principal export outlets have been Canada and some European countries; these are countries with similar income levels to the U.S. and are able to develop the taste for, and to afford, fresh pears out-of-season. Some of the more prosperous Latin American countries such as Brazil and Venezuela are also important importers of U.S. winter pears.

Although international trade theory may provide a valuable framework for investigating past trends and

possible future trends in trade, the theory is much too general for use as a guide to an empirical analysis which is primarily concerned with annual fluctuations in export volume. Nevertheless, the conclusions of the international trade theories discussed here do have implications for the levels of demand for and supply of fresh pears in the various export markets for U.S. winter pears.

A Partial Equilibrium Model of Commodity Trade

It is possible to conceptualize the export demand for a specific commodity such as U.S. winter pears into a two-region trade model. This analytical framework, which is illustrated by static Marshallian graphics in Figure 1, is consistent with the conclusion of both the classical and neoclassical trade theories that, in a two-commodity, two-country model, the domestic price ratios between the commodities in each country must be different for trade to occur.

Referring to Figure 1, in the absence of trade, the demand schedule for a given commodity in the U.S. (D^{US}) intersects the supply schedule in the U.S. (S^{US}) at P_{US}. The demand schedule for the "rest of the world" (D^{W}) intersects the supply schedule of the rest of the world (S^{W}) at P_{W}. When trade is allowed to occur, and abstracting from transportation costs, equilibrium price will be P_e where the quantity exported from the U.S. ($q_1 - q_0$) equals the

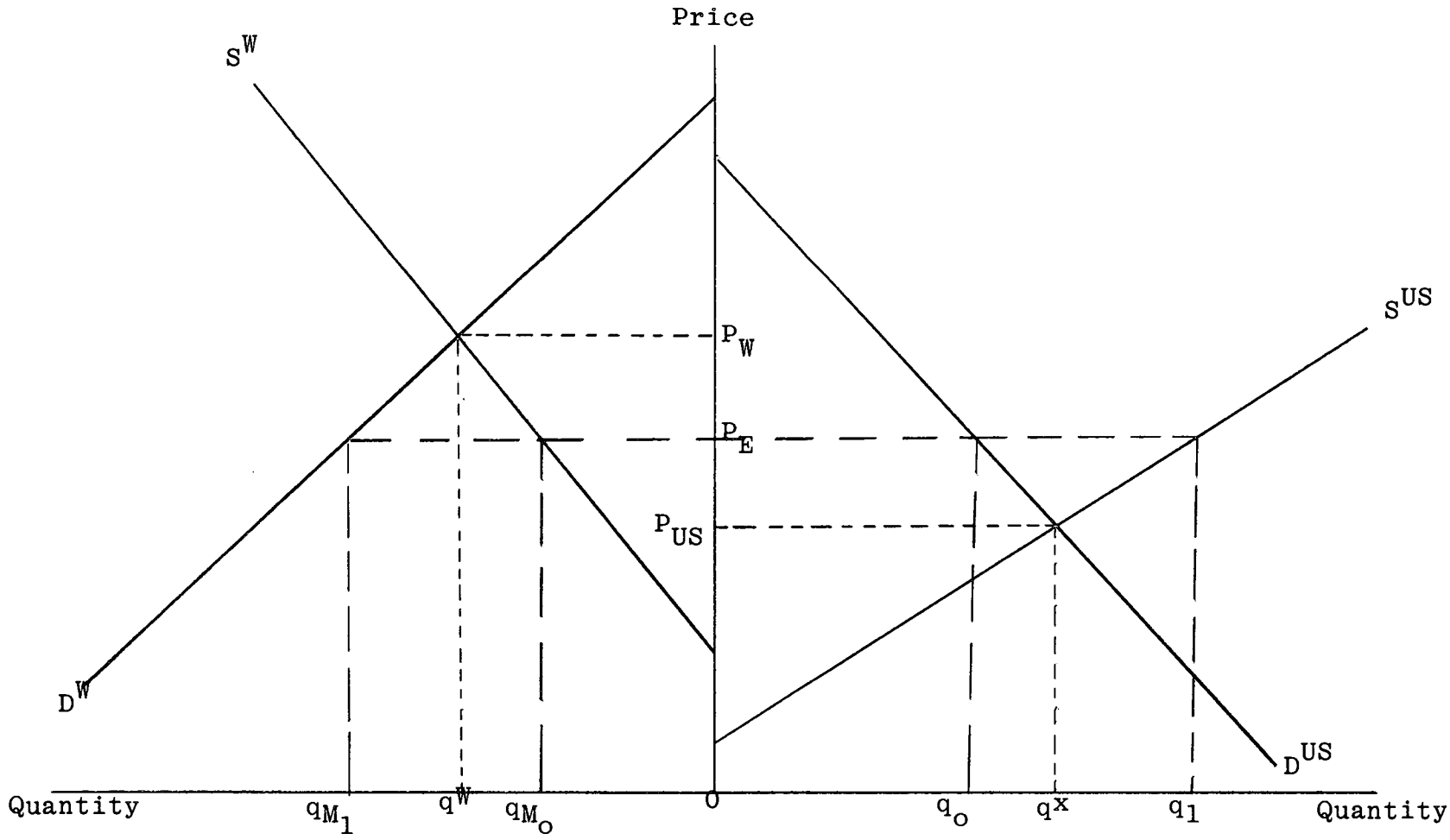


Figure 1. A two-region model of commodity trade.

quantity of the commodity imported by the rest of the world ($q_{M_1} - q_{M_0}$). U.S. exports take place as a consequence of the fact that, before trade, domestic prices for this commodity are below prices prevailing in the rest of the world. After trade, prices in the U.S. are higher than they would have been in the absence of trade (an increase of ($P_e - P_{US}$)), whereas prices in the rest of the world are lower than they would have been in the absence of trade (a decrease of ($P_w - P_e$)). The quantity of the commodity consumed in the rest of the world increases from q_w to q_{M_1}, although there is a reduction in production levels in the rest of the world from q_w to q_{M_0}. The quantity of the commodity consumed in the U.S. decreases from q_x to q_0 although total U.S. production increases from q_x to q_1.

The analysis described in Figure 1 is not fundamentally changed by relaxing the assumption of no transportation costs (Figure 2); it is only necessary to add that U.S. exports will occur if prices in the rest of the world exceed U.S. prices by more than total transportation costs per unit. Comparing the results of Figure 2 to those of Figure 1, the imposition of transportation costs per unit of T_0 reduces the volume traded from ($q_1 - q_0$) to ($q_1' - q_0'$). Other implications of the imposition of a transportation cost are that equilibrium price levels will be higher in the rest of the world and lower in the U.S., production in the U.S. will fall from q_1 to q_1', whereas production in the

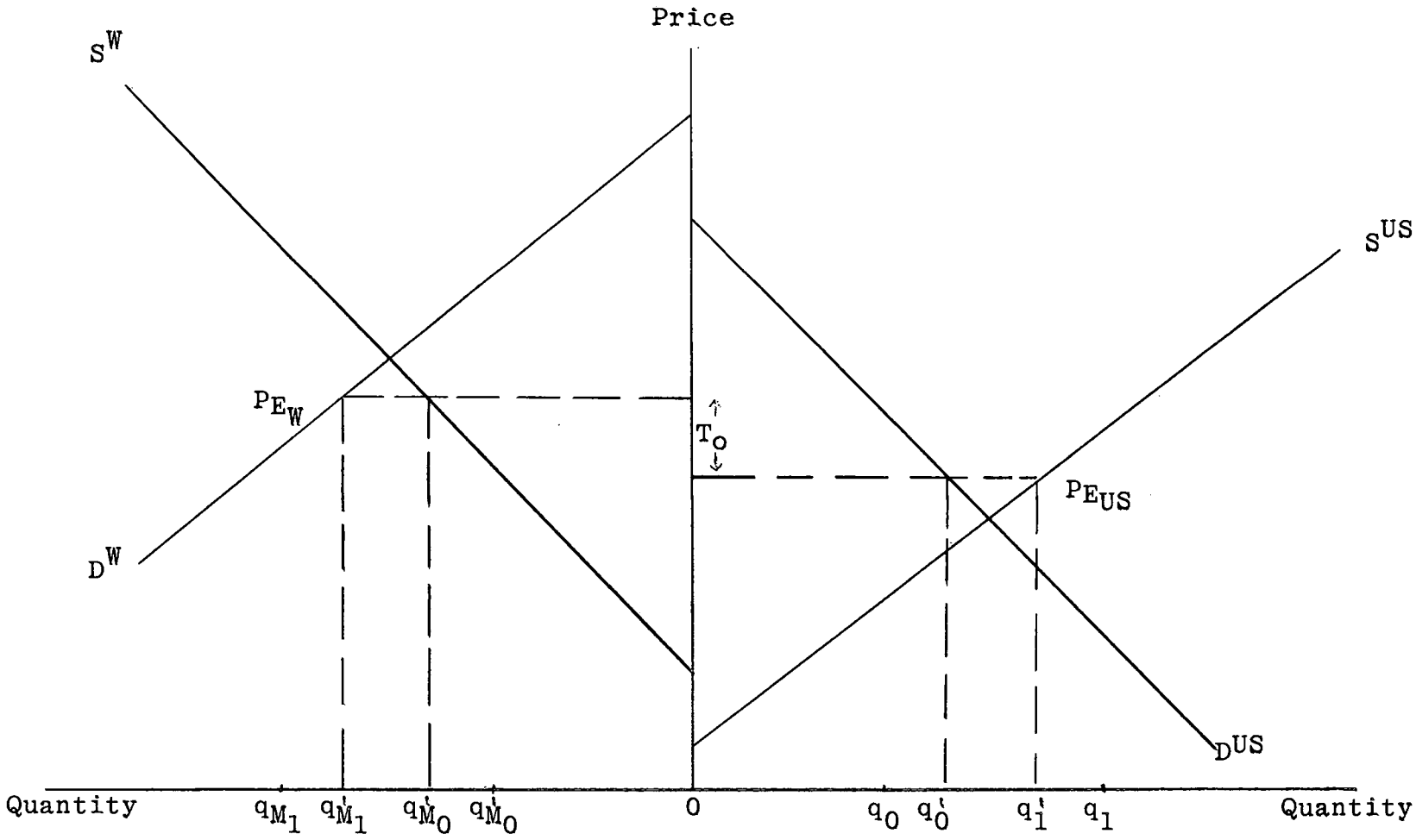


Figure 2. A two-region trade model, incorporating transportation costs.

rest of the world will increase from q_{M_0} to q'_{M_0}, and consumption in the U.S. will increase from q_0 to q'_0 whereas consumption in the rest of the world will decrease from q_{M_1} to q'_{M_1}.

If the value, T_0, is regarded as a tariff, then the analysis of Figure 2 can be used to demonstrate the effects of the imposition of a tariff upon the volume and price of U.S. exports of a specific commodity such as U.S. winter pears. In addition, the analysis illustrated in Figure 2 may be used to assess the effects of a quantitative restriction upon trade; for example, referring to Figure 2, if an import quota of $(q'_{M_1} - q'_{M_0})$ is imposed, then the implications for volume traded, price levels, consumption levels, and the distribution of production between the two regions are the same as under the assumption of a transportation cost (or tariff level) of T_0.

An alternative way of considering the determination of the quantity and price of the exports of a specific commodity is to consider export demand as a residual (Figure 3). The rest of the world will purchase the commodity only to the extent that their demand exceeds their own supplies. Referring to Figure 3, if D^W is the total demand schedule in the rest of the world and S^W is the total supply schedule in the rest of the world, then ED^W is the difference between these two schedules and is the excess demand schedule.

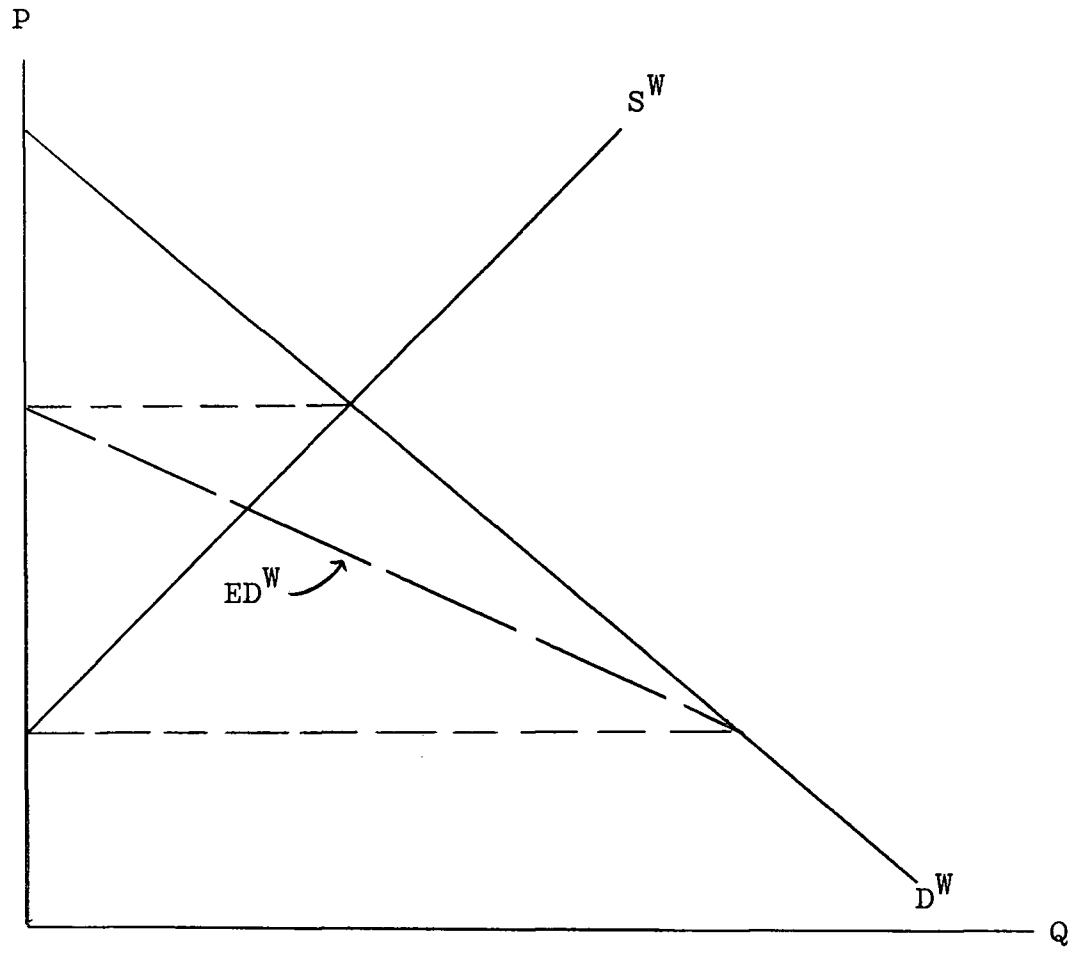


Figure 3. The excess demand schedule.

The determination of the distribution of quantities to domestic and export markets, and the determination of prices, for a specific commodity such as U.S. winter pears can be conveniently summarized by incorporating (i) domestic demand, (ii) domestic supply, and (iii) excess demand in export markets into a model such as that illustrated in Figure 4. Referring to Figure 4, the domestic demand and supply schedules are represented by D^{US} and S^{US} respectively. The introduction of an excess demand by the rest of the world (ED^{W}) causes total demand for the U.S.-produced commodity to increase. Domestic prices increase from P_{US} to P_e, total production increases from q_x to q_1, quantity supplied to the domestic market decreases from q_x to q_0, and the quantity exported is q_2 ($= q_1 - q_0$).

The theoretical framework which has been outlined in this section suggests a basis for an analysis of exports of U.S. winter pears. Specifically, in order to explain and predict quantities and prices of exports of U.S. winter pears, it is necessary to gain an understanding of those factors which influence the domestic demand and supply of U.S. winter pears, and those factors which affect the demand of the rest of the world for exports of U.S. winter pears. Three groups of factors which may influence the export demand for a specific commodity can be identified: (i) the quantity of the commodity supplied in countries other than the U.S., (ii) prices and availability

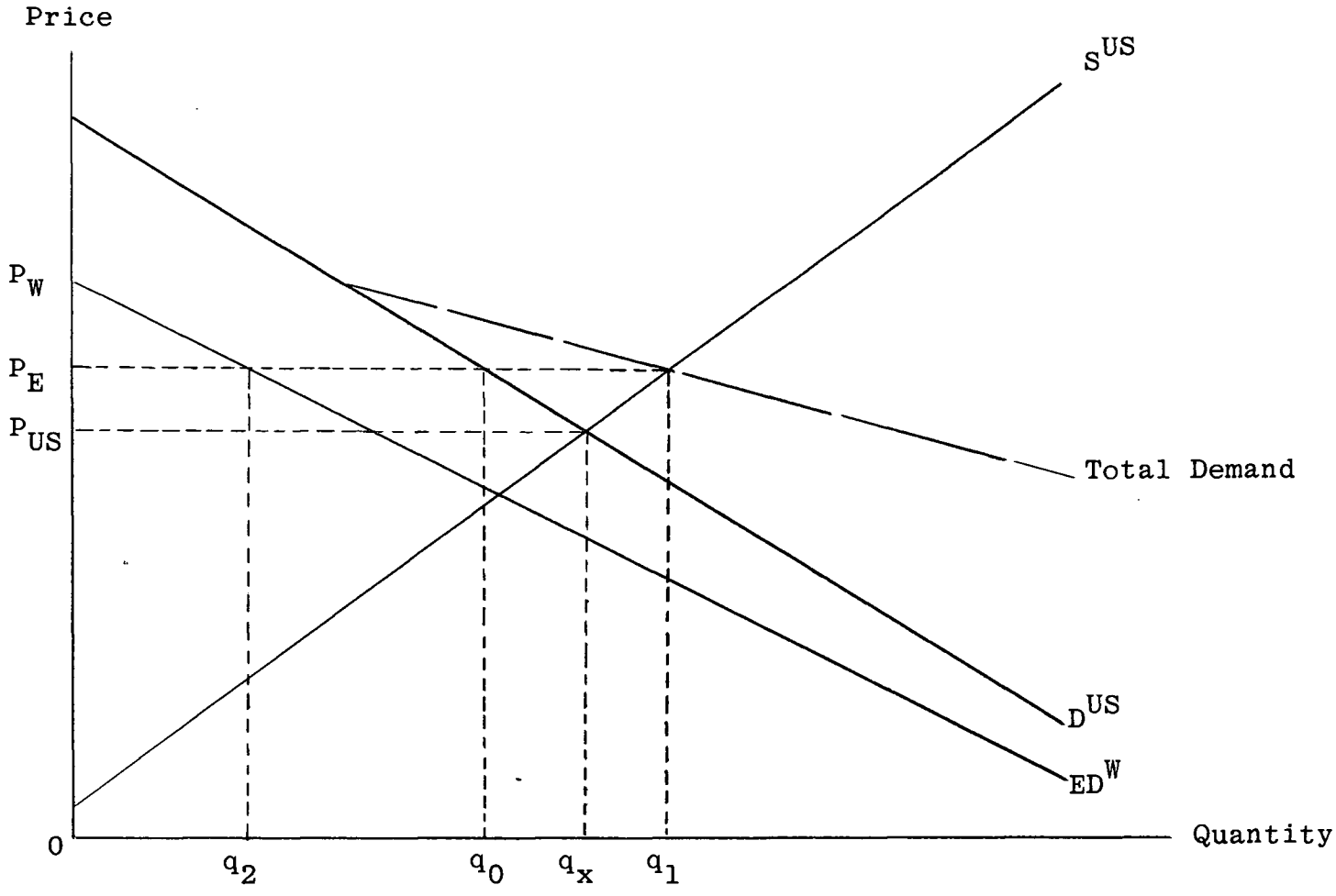


Figure 4. The determination of prices and quantities sold in the domestic and export markets for a specific commodity.

of substitute commodities in world markets, and other factors affecting market demand in consuming countries (for example, consumer income and population levels), and (iii) transportation costs, tariff barriers and other import restrictions, and levels of exchange rates between the U.S. and other countries. The significance of each of these factors in the export markets for U.S. winter pears is investigated in Chapters IV and V.

Chapter IV is concerned with the empirical analyses of specific export markets for U.S. winter pears, without regard for total demand and supply. In Chapter V, some additional analyses for the domestic market, and the results of the analyses of Chapter IV are incorporated into a simultaneous model which is similar to that illustrated in Figure 4. The methodological and empirical bases for the analyses described in Chapters IV and V are discussed in Chapter III.

III. THE EMPIRICAL FRAMEWORK

The Export Markets for U.S. Winter Pears

According to the annual publications of the Winter Pear Control Committee (80), U.S. winter pears are exported to over 20 countries. Table 4 lists the twelve principal, reported, countries to which U.S. winter pears were exported during the 28-season period, 1947/48 to 1974/75.

Table 4. Exports of U.S. winter pears, by country of destination, average of 1947/48-1974/75 seasons and of 1965/66-1974/75 seasons.

Country	Average number of boxes of U.S. winter pears, per season	
	1947/48-1974/75 Seasons	1965/66-1974/75 Seasons
Canada	133,343	229,137
Sweden	130,176	137,546
Brazil	69,689	133,370
United Kingdom	64,998	33,960
Venezuela	52,903	54,086
Norway	33,622	48,867
Finland	21,492	22,051
Netherlands	21,402	14,699
West Germany	19,292	15,577
Belgium	12,906	800
Ireland	12,448	16,000
France	6,755	1,080
Other countries and unknown	104,165	73,397

Source: (80)

Referring to Table 4, it can be seen that, taking the whole of the 28-season period, Canada and Sweden are clearly of much greater importance than all other countries while Brazil, the United Kingdom and Venezuela are also relatively important as importers of U.S. winter pears. Taking the most recent ten years of the study period, three countries (Canada, Sweden, and Brazil) are clearly of much greater significance than other countries. In the 1947/48-1974/75 period, Canada, Sweden and Brazil accounted for at least 49% of total exports (Canada-20%, Sweden-19%, and Brazil-10%). In the 1965/66-1974/75 period, these three countries accounted for at least 64% of total exports (Canada-29%, Sweden-18%, and Brazil-17%).

The estimation of demand for U.S. winter pears by individual countries seems to be a logical approach to gaining an in-depth understanding of those factors affecting export demand; the effects of the trade policies of individual countries and of variables such as consumer income can be placed in a secure theoretical and empirical framework. Also, the full extent of the margin between f.o.b. prices in the U.S. and retail prices in the importing countries can be more realistically analyzed. However, for many countries data are not available for describing even the principal influences upon demand. Also, data regarding levels of exports of U.S. winter pears by country of destination are somewhat unreliable because, although

these data probably reflect destination intentions or expectations at the time of sale at the packing-house, a number of factors may intervene to eventually change the country of destination. For example, a shipment of winter pears for Liverpool, England may be diverted to Le Havre, France, when it is only one day from port because of a recently removed ban on imports of fresh pears by the French resulting in a higher-priced offer. Another factor which may impede an accurate description of the levels of consumption of U.S. winter pears in individual countries is the process of transshipment through entrepots. The country of destination is, in these cases, often not the country of consumption; or, an unspecified quantity of U.S. winter pears are sold at retail in the transshipment country, while the rest of the shipment is transported to a neighboring country. For example, a cargo of pears is shipped to Rotterdam where it is loaded onto trucks and sold in Frankfurt. In this case, the country of destination may be quoted as the Netherlands, but the country of destination would be West Germany.

This study analyses the demand for U.S. winter pears by Canadian, Swedish and Brazilian sources. Despite the data limitations, this analysis is considered useful because of (i) the importance of each of these markets in the total export trade, (ii) a need to investigate the importance of trade barriers by individual countries, and

(iii) each of these markets has shown a) large annual variations in reported imports of U.S. winter pears, and b) differing trends of imports of U.S. winter pears over time.[5/] Aside from the limitations imposed by the export data, an essential difficulty in attempting to explain and predict export volume for the less important countries of import -- where the number of sales within a given season may be very small -- is that the net influence of incidental factors (i.e., other than the principal hypothesized ones), may be a non-random one. It is very difficult to assess the importance and impact of such factors which may, for example, depend upon personal relationships between individual exporters and importers, and government officials, or may relate to small changes in the institutional framework in which the process of trade occurs. These factors are difficult to quantify and are outside the scope of this study.

In order to overcome some of the difficulties faced by analyses of export demand by country, analyses were also attempted by market region. A market region may be defined as a group of countries which share certain common characteristics of demand for a commodity, but which are significantly different from countries grouped in other market

---

5/ Variations in the volumes of sales to Canada, Sweden, and Brazil are described in Figures 5, 6, and 7, respectively (Chapter IV).

regions. It is possible to define at least four market regions for U.S. winter pears: (i) Europe, (ii) Canada, (iii) South America, and (iv) the rest of the world. Significant volumes of U.S. winter pears have been sold to each of the European, Canadian and South American regions, as can be seen in Table 5. Each of these regions is geographically very distinct from the others. Also, Europe is characterized by a large volume of pear production which is harvested in the July to October period, and a large

Table 5. Exports of U.S. winter pears by market region, 1947/48-1974/75.

	Average number of boxes of U.S. winter pears exported			
	1947/48-1974/75		1965/66-1974/75	
	1000 boxes	%	1000 boxes	%
Europe	330	49	305	39
Canada	133	20	229	29
South America	134	20	201	26
Rest of the world and unknown	80	11	46	6

Source: (80)

market size with relatively high income levels. Canada is characterized by its territorial proximity to the U.S. and high consumer income, and Canadian pears are harvested in the July to October period. The South American region is characterized by a large volume of pear production, which

is harvested in the December to March period, low overall personal incomes but large high-income middle classes, and economies which have often demonstrated an acute shortage of foreign exchange. Exports to countries other than those included in Europe, Canada, and South America are defined as belonging to the region "Rest of the World."

This study also analyzes the export demand for U.S. winter pears by considering the whole of the export market as a single aggregate. Although there may be difficulties of aggregation over countries throughout the world (for example, in exchange rate changes and population changes) some influences upon exports of U.S. winter pears (for example, foreign production and trade flow factors) may be more easily expressed in larger aggregates.

In summary, a number of export markets have been identified as being useful for further consideration; these markets are Canada, Sweden, Brazil, Europe, South America, and total exports. Data considerations have been of major importance in identifying these markets.

Individual demand equations for each of the identified export markets are hypothesized and estimated in Chapter IV.

General Theoretical and Empirical Considerations

Before going on to specify particular demand equations, there remains a number of considerations of general significance to the models presented in the following chapters.

These considerations, in order of treatment, are: 1) choice of marketing level, 2) choice of time unit and years to be included, 3) choice of level of aggregation of the commodity, and 4) assumptions regarding market behavior.

The models of U.S. winter pear markets formulated in this study refer to the wholesale marketing level; for example, prices are those which are quoted f.o.b. from the packing house. Measures of quantities of U.S. winter pears used in this study are quantities which are sold from the packing house to the various market destinations. The choice of this particular marketing level is most appropriate for a number of reasons. The most complete, and probably the most accurate, historical data series on prices and quantities marketed of U.S. winter pears are available at this marketing level; this is particularly true regarding estimates of the volumes of export sales of U.S. winter pears to individual countries.[6/] Also, the packing house is that point in the marketing chain from which winter pears are moved into one or another of the various market channels; a price level which is quoted f.o.b. packing-house door applies equally to the domestic and to the various international markets.

6/ Bureau of the Census export data (73) reports monthly exports of "fresh pears" by country; however, this measure includes both Bartlett and Winter varieties of pears.

The time unit chosen for the empirical analysis is the season; therefore, price and quantity variables are expressed as seasonal aggregates. U.S. winter pear sales from the packing house are made almost daily between September and June. Price data are available for some years on a daily basis and for a long historical period on a bi-weekly basis. Volumes of shipments of winter pears to export markets are available on a monthly basis, October to May, for a long historical period. The choice of a seasonal rather than of a monthly basis for the empirical analysis was largely determined by the emphasis of this study. If this study was primarily concerned with domestic demand, then sales and shipments of U.S. winter pears on a monthly basis may be most appropriate; however, this study is concerned primarily with export markets and those factors, such as supplies of pears in other countries and international trade policies, which may have caused changes in export demand. The analysis of such factors is probably best undertaken using seasonal aggregates; empirical estimates of intra-seasonal export demand factors are difficult to obtain and the distribution of export sales to specific countries or regions within a given season may depend greatly upon the availability of cargo space, speed of handling, and other miscellaneous short-term effects on sales and shipments. An intra-seasonal analysis would possibly enhance the usefulness of this study; however, the

difficulties of data availability, and the volume of work involved compared to the limited resources available, precluded such an analysis.

One of the crucial assumptions made in the empirical analysis is that the basic structure of the markets for U.S. winter pears has not changed over the time period under consideration. The shorter the number of seasons included, the more likely is this assumption to be met; on the other hand, the total number of observations (= number of seasons) used in the analysis should be as large as possible. Continuous data series regarding prices and quantities of U.S. winter pears sold to export markets are available for the 1947/48-1974/75 period. The numbers of seasons utilized in specific market analyses in Chapter IV were the maximum possible, given the availability of data pertaining to each export market.

As described in the introduction, there are essentially six producing areas for U.S. winter pears in the Pacific Coast states. Each district is distinct from the others to a large extent; for example, there are separate producer-marketing organizations in many of the districts, a different variety mix is grown in each district, total volumes of output have trended differently over time, and marketing institutions vary from district to district. Nevertheless, there is a continuous flow of price and quantity information between districts throughout the

season. This flow of information is partly directed through (i) organizations which represent the whole industry, for example the Oregon-Washington-California Pear Bureau and the Winter Pear Control Committee, and (ii) traffic associations in the individual producing districts. There appears to have been some differences between districts in average prices obtained for winter pears (4, pages 10-24). To some extent, these price differences are due to variety, packaging, grade and size differences. This question was considered to be of lesser importance and was therefore not further investigated in this study. Further work, which might involve accounting for the difference in average prices of U.S. winter pears received between the six producing districts, between packaging types, etc., would possibly be very complementary to the present analysis. Finally, disaggregated data with regard to exports is not available on a district basis but are available on an industry basis. Consequently, an investigation into inter-district differences in demand and prices would probably not have greatly contributed to the overall thrust of this study.

Relative prices and volumes of the various subgroups of U.S. winter pears, such as the different varieties and grades, vary from season to season as availabilities and demand for specific subgroups change. It is assumed in this study that the group of commodities known as U.S.

winter pears remains homogeneous from season to season. Changes within this commodity group are considered to be random and to have had no significant effects upon demand and prices.

The structure of the market for U.S. winter pears is diverse. On the seller side, the marketing of winter pears is in the hands of a few large shippers with a handful of smaller shippers on the fringe (4, page 49). On the buyer side, the market is dominated by retail chain buyers with a number of smaller buyers and auction sales taking smaller quantities. There does not appear to be any strong coordination of marketing activities and no strong attempt to hold seasonal volume or price lines by either buyers or sellers of winter pears on the domestic market. Export sales go directly through shippers or via other international commodity brokers or handlers. U.S. winter pear prices are therefore assumed to be determined by the interplay of competitive market forces of supply and demand. Specifically, the assumption is made that prices are determined in a market composed of freely-competing buyers and sellers where the buyers are reasonably identical and the sellers deal in a reasonably homogeneous commodity.

A General Model of Export Demand for U.S. Winter Pears

It is unlikely that this study will be able to identify and analyze all of those factors which influence price

levels and quantity consumed of U.S. winter pears. However, some of the most important factors influencing the domestic and international demand for U.S. winter pears can be hypothesized with the aid of economic theory, previous empirical studies and a knowledge of winter pear markets. Several factors have been identified in Chapter II; these included (i) the quantity of winter pears supplied in countries other than the U.S., (ii) import restrictions, (iii) exchange rates, and (iv) transportation costs.

Consumer demand theory provides a basic framework for the determination of relevant variables in a demand relationship. Specifically, that theory explains demand based on the maximization of a consumer's utility subject to a budget constraint; consumption of a given commodity is related to its price, the prices of other commodities and consumer income.

Although it is generally realized that demands for all commodities are interrelated and a number of studies (for example, see 7, 19, and 20) have attempted to estimate all direct and cross price elasticities for a wide range of commodities, it is normally considered more prudent to use simpler approaches in specifying commodity interdependence within a model of commodity demand. A frequent approach is that of incorporating only several price variables into a single demand relationship. In this study, a number of commodities which may substitute for U.S. winter pears

in domestic and international markets are identified and are specified as quantity variables.

The use of quantity variables as explanatory variables is considered necessary in this study for a number of reasons. Reliable data are not available on a price basis for many of the substitute commodities; in the cases of some of the variables, the collection of such price data is outside the scope of this study. The use of quantity variables is simpler from the point of view of estimation of the model; the number of endogenous variables is reduced to a manageable level given the resources available. In consequence, the levels of interdependence between the explanatory variables and/or the need for the specification of additional behavioral relationships for substitute commodities are reduced.

In the above discussions, it has been possible to identify a number of important factors which may explain fluctuations in the volumes of sales of U.S. winter pears to specific export markets. These factors are summarized in equation (1):

$$Q_{USWP_t} = (P_{USWP_t}, Q_{1_t} \ldots Q_{j_t}, Y_t, Pop_t, G_t, Q_{WP_t}, TB_t, TC_t, ER_t, u_{1_t} \ldots u_{m_t}) \quad (1)$$

where: Q_{USWP} = quantity of export sales of U.S. winter pears

P_{USWP} = season average f.o.b. price per box of U.S. winter pears

$Q_1 \ldots Q_j$ = quantity of substitute commodities available in the export region

Y = consumer income in the export region

Pop = population in the export region

G = general price level in the export region

Q_{WP} = quantity of winter pears available in the export region

TB = trade barriers in the export region against imports of U.S. winter pears

TC = unit transportation costs for U.S. winter pears between the U.S. and the importing region

ER = exchange rate between the U.S. dollar and the currency or currencies of the export region

$u_{1_t} \ldots u_{m_t}$ = other, unspecified, variables.

Transportation costs are not further considered in this study because suitable data are not readily available, and it is considered that changes in transportation costs may have had a less significant impact upon export demand than some other hypothesized factors.

Also, available data regarding supplies of winter varieties of pears in consuming countries are very limited, so estimates of the availability of all pears in consuming countries are used instead. The only commodity substitutes to U.S. winter pears which are considered in foreign markets are other pears. Supplies of other pears result from (i) domestic production, and (ii) imports of consuming

countries. Historical data series regarding the volumes of fresh disposition of pears produced in foreign countries are generally unavailable. Consequently, changes in production levels are used to approximate changes in the volumes of fresh supplies. The analysis incorporates the effects of changes in production levels of winter pears and production levels of domestic, substitute, pears in foreign markets into a single variable by specifying the quantity "total production of pears."

In order to simplify the empirical analysis and to orient the analysis towards the most important hypothesized variables, some of the explanatory variables are estimated in combination with other explanatory, or the dependent, variables. Specifically, population changes in importing countries are included in the analysis as implicit variables by expressing the quantity of production of pears, imports of pears, exports of U.S. winter pears and consumer income variables on a per capita basis. The exchange rate is included by expressing prices of U.S. winter pears in terms of the currency of the importing country. Changes in the general price level of the country of importation are accounted for by expressing prices of U.S. winter pears in real terms as measured by indices of consumer prices in importing countries.

Empirical models of export demand in U.S. winter pear markets, which are presented and estimated in Chapter IV,

are based upon the foregoing discussion, the chosen methodology and the nature of the relevant data series. The remainder of this chapter is concerned with reviews of the methodology and of the nature and sources of the data which are used in the empirical analyses.

Methodological Considerations

Hypotheses regarding the relationships between proposed independent variables and the quantity of U.S. winter pears sold in each export market are tested using least squares multiple regression analysis. A stochastic linear model is used to describe the relationships between the variables:

$$Y_t = B_0 + B_1X_{1_t} + B_2X_{2_t} + \ldots + B_kX_{k_t} + \varepsilon_t$$

where: Y = the dependent variable

$X_1 \ldots X_k$ = the explanatory variables

ε = the stochastic disturbance

$B_0 \ldots B_k$ = the regression parameters

t = the time period of observation: a season

The mathematical form of the relationships is assumed, and the values of the parameters are estimated from the observed values of the dependent and explanatory variables. The random disturbance term, ε, implies that, for a set of observations $x_{1_t} \ldots x_{k_t}$, there is a whole probability

distribution of values of Y; the value of Y is not considered to be exactly predicted. To complete the specification of the regression model, a number of assumptions are made regarding the values of explanatory variables and the probability distribution of the random disturbances. Specifically: (i) the random disturbances are normally distributed, with an expected value of zero, and having finite and constant variance; (ii) the random disturbances are independent of one another; (iii) the random disturbances are not correlated with any of the independent variables; (iv) none of the explanatory variables are highly correlated with any other explanatory variables or with any linear combination of other explanatory variables; and (v) independent variables are observed without error.

The principle of the least squares method of regression analysis is to choose estimates of the regression parameters, $B_0 \ldots B_k$, such that the sum of the squared differences between the observed and estimated values will be minimized. Thus, the estimated equation will be the best fitting curve on the least squares criterion.

If one or more of the assumptions (i)-(v) are violated, then tests of hypotheses regarding the relationships between the dependent variable and the explanatory variables may become inapplicable. Where specific assumptions are thought to have been violated in the empirical analyses, this is mentioned in the text.

Serial correlation is considered a potential problem in the analysis because there is a possibility that the error terms may represent the influence of such omitted factors as consumer tastes and the introduction of more sophisticated types of packaging. The empirical models were estimated using variables expressed as first differences, in addition to using actual data, in order to consider the possible effects of such omitted variables.

From the theoretical considerations of this and the previous chapter, it was suggested that season average prices of U.S. winter pears and the quantity of U.S. winter pears sold to each market were simultaneously dependent upon demand factors in each of the markets and the total supply of U.S. winter pears. In Chapter IV, this simultaneity is ignored in the analysis of individual export markets as it is assumed that the influence of demand factors in any specific export market, upon average prices of U.S. winter pears, has been small. Therefore, the price variable is assumed exogenous to the equations for the purposes of the empirical analyses and, thus, is assumed to be not significantly correlated with the error terms.

In Chapter V, the simultaneous relationships in the domestic and export markets for U.S. winter pears are considered. The two-stage least squares method is used for estimating the structural form of the simultaneous model.

Several estimation methods are available for a system of simultaneous equations. However, there is no general agreement on small sample statistical properties of the various estimators. Johnston (24, page 420), surveyed several Monte Carlo studies of estimation procedures and concluded that two-stage least squares is probably the best choice.

A Review of Data Series

The availability of data inevitably places a number of constraints upon the specification of the empirical model. Some of these constraints have already been considered. Before going on to specify individual equations, it is convenient to first consider some of the data series that apply to all of the equations and models estimated in Chapters IV and V.

Data regarding the season packout of U.S. winter pears are presented in the Annual Reports of the Winter Pear Control Committee (80). Packout of U.S. winter pears is disaggregated by district and reported destination of sales for the varieties Beurre D'Anjou, Beurre Bosc, Doyenne Du Comice and Winter Nelis. The estimate of total packout of U.S. winter pears used in this study was calculated by the addition of the packout sold domestic and the packout sold export. For example, in the 1970-71 report, the estimates of the season total of U.S. winter pears reported as

exports (80, Table 16) are added to the estimates of the season total domestic distribution of U.S. winter pears (80, Table 15). Data are not available for the varieties Beurre Easter and Beurre Clairgeau. These varieties of pears constitute from 0 percent to approximately 5 percent of U.S. winter pears packed and none have been packed since the 1966-67 season.

The estimates of quantities of U.S. winter pears sold to the various importing countries which are published in the Annual Report of the Winter Pear Control Committee were used in the estimation of each of the export demand equations derived in Chapter IV. A problem which becomes more acute as one considers the more disaggregated export markets is that of the status of U.S. winter pear shipments in the "export unknown" category (Tables 4 and 5). All shipments are accounted for in the disaggregation into "domestic" and "export." But any further disaggregation involves some loss of precision of exports to a given country or area due to the inclusion of an "unknown" category. For example, the next possible disaggregation from a total export one is into "domestic," "Canada," and "export-offshore." There are a certain quantity of shipments which are reported simply "export unknown" and which have in fact been distributed between the two export markets (Canada and export offshore). Under further disaggregation, there are some shipments, for example, given as

"Europe-unknown" so there is difficulty in precisely interpreting a value for exports to a specific European country such as Sweden.

The exact composition of the "unknown" categories, from year to year, is unclear. As well as genuinely "unknown" shipments, there are likely to be shipments to armed forces personnel overseas, and small volume shipments to various countries -- the quantity of which is known but is considered too small for inclusion under a country category.

The estimates of the quantities of U.S. winter pears exported to Sweden, Brazil, Canada, Europe, and South America which are used in this study, are those reported as specifically destined for these countries and areas in the Winter Pear Control Committee Annual Reports.

F.o.b. price data are available for U.S. winter pears. A number of shippers in each district make a daily report of the volume and price of their sales to a central shippers association in the district. This information is collected and tabulated onto "daily sales reports" which are compiled throughout most of the season. The daily sales reports may be regarded as a sample of f.o.b. prices received by shippers. Approximately 50 percent of all sales during a given season are tabulated onto the daily sales reports (Table 6). Assuming that these reported prices of sales are representative of the total sales, then

Table 6. The proportions of the total packout of U.S. winter pears represented by sales reported on daily sales reports in selected years.

Year	% of Total Packout Represented in the Daily Sales Reports						
	Total U.S. Winter Pears	Anjou					Bosc
		Total	Medford	Hood River	Yakima	Wenatchee	Total
1950/51	45	51	34	50	57	79	39
1955/56	54	65	57	79	75	48	45
1960/61	56	63	46	87	60	43	45
1965/66	61	66	65	82	92	34	64
1970/71	47	49	63	53	68	32	41

Sources (80), and the Daily Sales Reports of Shippers' Associations in the Medford, Hood River, Yakima and Wenatchee districts.

it is possible to use them directly in the assessment of season average prices for U.S. winter pears.

The prices of sales entered on the daily sales reports vary according to many characteristics of the specific sale that is being made. Prices vary among other things according to: (1) the time of sale during the season, (2) the district in which the sale is made; (3) the variety, (4) the grade of pear being sold, (5) the sizes of pears sold; and (6) the type of packaging material used and the size of the total package.

The quality mix of the product changes from year to year due to production factors. The only comparable measures of quality of pears for a given season are: (i) the samples of daily sales sheets which have been compiled as a historical series according to the classifications: variety (Anjou and Bosc), type of packaging (Standard Box and L.A. Lug), and grade (Extra Fancy, U.S. #1, Fancy, Other), for each two-week period during each season; and (ii) a grade and size comparison estimate for Anjous published in October by the Winter Pear Control Committee, which attempts to estimate overall quality and quantity of packout of the crop for the rest of the season (80). From these two sources, it may be possible to incorporate a quality variable into the analysis.

There are also numerous underlying factors which may have biased the estimates of average prices of U.S. winter

pears over time. Any of the factors (1)-(6), above, may have so affected prices; for example, increases in the quality of packaging materials over time. Also, changes in the demand for specific varieties of U.S. winter pears may have occurred over time.

The effects of quality differentials and the demand for specific varieties of U.S. winter pears were not further investigated in this study.

Season average prices of U.S. winter pears were determined by (i) obtaining the season average price for each of the Anjou and Bosc varieties for each of the four main producing districts (data regarding sales in the California districts are not available as a historical series); consequently, a total of eight subaggregates of average price per season were obtained. (ii) These average prices were aggregated to produce one total season average price for U.S. winter pears by weighting them according to the volume of production by variety as estimated by the Winter Pear Control Committee in each of the four districts in each season.

Data regarding the exchange rate between the U.S. dollar and the currencies of the countries of interest were taken directly from the U.N. Statistical Yearbook (57) and the U.N. Monthly Bulletin of Statistics (56). The estimates of exchange rates are the mid-point rates for December 31st. The estimates of national income, population,

and the consumer price index were also taken from these U.N. publications. Crop-year estimates were computed by interpolation. The volumes of pear production in the various countries were obtained from the Production Yearbooks of the Food and Agriculture Organization of the United Nations (16). Information regarding other data series used in the empirical analyses is presented in the next chapter in conjunction with the analysis of individual export markets.

The original data series, as published in the various source materials, are reproduced in Appendix A.

In order to estimate the demand for U.S. winter pears in Europe, South America, and the total export market, it was necessary to construct regional indices of population, price levels, incomes, and exchange rates. The bases for, and the construction of, these indices are described in Appendix B.

IV. MODELS OF DEMAND FOR EXPORTS OF U.S. WINTER PEARS

Canadian Demand for U.S. Winter Pears

The closest substitutes for imports of U.S. winter pears into Canada are hypothesized to be domestic supplies of fresh pears and other, imported, supplies of fresh pears. U.S. winter pear imports to Canada are usually concentrated in the February to May period of the marketing season (80), when supplies of Canadian pears are probably at low levels. There has been a tariff imposed upon imports of U.S. fresh pears during the period up to March; for example, during the 1974/75 season, a tariff of 10% ad valorem was in effect from July until February, inclusive (66, page 20).

Supplies of fresh pears from Southern Hemisphere producers begin to arrive in Canada in February or March, and continue into the late summer (41). British Commonwealth suppliers[7/] of fresh pears are exempt from the tariff charges; however, this fact is usually not of particular significance for U.S. winter pears, because U.S. pears are themselves exempt from the tariff from the beginning of March. The level of Southern Hemisphere imports prior to March, when British Commonwealth suppliers would tend to

---

7/ Australia, New Zealand, and, formerly, South Africa.

have a competitive advantage over U.S. winter pears, is usually very low (41).

Early in the marketing season, the principal substitutes for U.S. winter pears in Canada are hypothesized to be domestic supplies of fresh pears. In the absence of data regarding the packout of summer, fall and winter varieties of pears in Canada, values of the total production of pears in Canada are used as estimates of domestic supplies. Later in the season, the principal substitutes for U.S. winter pears are Southern Hemisphere supplies of fresh pears. Canadian imports of fresh pears from sources other than the U.S. were estimated by subtracting the total volume of U.S. exports of fresh pears to Canada (73) from the total volume of imports of fresh pears into Canada (58).

In the light of this discussion and of the discussion presented in previous chapters, an empirical model describing the effects of the principal hypothesized factors upon the volume of exports of U.S. winter pears to Canada was constructed; factors included in the analysis were (i) f.o.b. prices of U.S. winter pears, (ii) personal disposable income in Canada, (iii) volume of production of pears in Canada, (iv) volume of imports of fresh pears to Canada from sources other than the U.S., (v) the population of Canada, (vi) the general level of prices in Canada, and (vii) the exchange value of the U.S. dollar in terms of Canadian dollars. The relationships between changes in the

volume of sales of U.S. winter pears to Canada and changes in each of the demand factors are expected to be inverse ones except in the cases of changes in population, personal disposable income and the general price level in Canada.

Numerous factors which may have an important influence upon Canadian demand for U.S. winter pears are not considered in the empirical analysis; these factors include changes in transportation costs, small changes in trade barriers against U.S. winter pears from season to season, changes in consumer preferences, and changes in the prices and availabilities of substitute commodities such as fresh apples, other fresh fruit and canned fruit.

Time series data covering the whole period 1949/50-1974/75 were used in the empirical analysis. Calendar year estimates of personal disposable income were taken from the Canada Yearbook (53) and the "Historical Statistics of Canada" (78). Annual estimates of population and the Canadian consumer price index (the measure of the general price level which was chosen) were obtained from the Canada Yearbook. The empirical variables were converted, where necessary, from calendar year to season estimates by interpolation.

The population of Canada is included in the model as an implicit variable by expressing the quantity variables on a per capita basis. The exchange rate and the general level of prices in Canada are included as implicit variables

by expressing prices of U.S. winter pears and Canadian incomes in terms of real Canadian dollars.

The empirical model was estimated using least squares regression analysis. The results are presented in equation (2):[8/]

$$\hat{Y}_t = 9.2718 - \underset{(2.18)**}{2.5085}(X_1) - \underset{(3.56)***}{4.6662}(X_2) - \underset{(1.66)}{.004422}(X_3)_t + \underset{(6.19)***}{.012125}(X_4)_t + \hat{e}_t \qquad (2)$$

$$R^2 = .82$$

$$D\text{-}W = 1.91$$

where: $\hat{Y}$ = the predicted volume of exports of U.S. winter pears to Canada expressed in number of boxes per thousand of population in Canada

X_1 = season average f.o.b. price per box of U.S. winter pears, sales to all destinations, expressed in real (1961 = 100) Canadian dollars

X_2 = quantity of production of pears in Canada expressed in metric tons per thousand of population in Canada

X_3 = volume of Canadian imports of fresh pears from Southern Hemisphere countries, expressed in pounds per thousand of population in Canada

X_4 = real (1961 = 100) personal disposable income, per capita, in Canada

$\hat{e}$ = the estimated value of the random disturbance term

t = the marketing season for U.S. winter pears

[8/] The values in parentheses in this and subsequent equations are the calculated t values of the regression coefficients; *** are significant at the 99% level, ** are significant at the 95% level and * are significant at the 90% level.

The four independent variables explain approximately 82% of the changes in the seasonal volumes of export sales of U.S. winter pears to Canada during the 1949/50 to 1974/75 period. The estimated coefficients, all of which exhibit the correct signs, are large relative to their standard errors except in the case of variable X_3. Nevertheless, variable X_3 was retained in the equation as it was considered to be a theoretically important factor. Serial correlation does not appear to be present. The economic interpretation of the empirical results can be summarized as follows: assuming that other variables remain unchanged,

1. An increase of one dollar in the season average f.o.b. price per box of U.S. winter pears expressed in real Canadian dollars will effect a decrease in the volume of exports to Canada of 2.51 boxes of U.S. winter pears per thousand of population in Canada.[9/]
2. An increase in the quantity of production of pears in Canada, expressed as one metric ton per thousand of population in Canada, will effect a decrease in sales of U.S. winter pears to Canada of 4.67 boxes per thousand of population in Canada.
3. An increase in the quantity of imports of fresh pears into Canada from sources other than the U.S.,

---

[9/] Under average conditions prevailing during the 1949/50 to 1974/75 period, a price elasticity of demand (computed at mean values) of -1.36 is implied.

expressed as one pound per head of population in Canada, will effect a decrease in sales of U.S. winter pears to Canada, of 4.42 boxes per thousand of population in Canada.

4. An increase of 100 dollars in per capita personal disposable income in Canada, expressed in real Canadian dollars, will effect an increase in export sales of U.S. winter pears to Canada of 1.21 boxes per thousand of population in Canada.

The predicted levels of export sales of U.S. winter pears to Canada which are implied by the model are compared to actual levels in Figure 5.

The results suggest that prices of U.S. winter pears, levels of production of pears in Canada and the growth of personal incomes in Canada have all been influential in the determination of export sales of U.S. winter pears to Canada. It appears that changes in the volume of imports to Canada from Southern Hemisphere countries may also have been an important demand influence.

Swedish Demand for U.S. Winter Pears

The principal substitutes for U.S. winter pears in Sweden are hypothesized to be (1) Swedish supplies of fresh pears, (2) other European supplies of fresh pears, and (3) imports of fresh pears from Southern Hemisphere countries. Significant quantities of Southern Hemisphere supplies do not reach the Swedish market until March or April (9). The

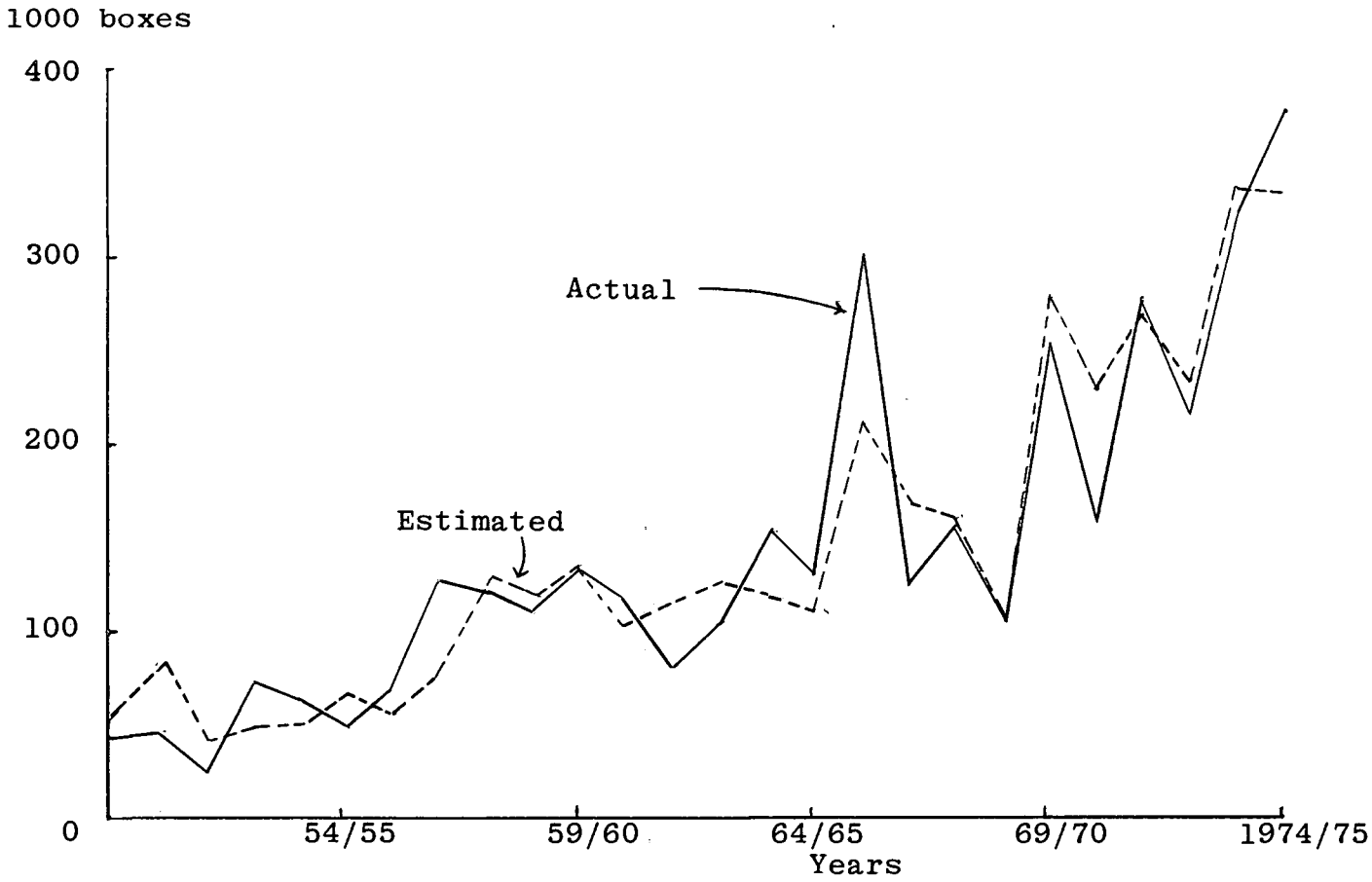


Figure 5. Actual and estimated exports of U.S. winter pears to Canada, season totals for the period 1949/50-1974/75.

majority of U.S. winter pear sales to Sweden are made in the September to November period (80) and are probably consumed in Sweden, in competition with European supplies, before the arrival of most of the Southern Hemisphere pears.

Italy has been by far the biggest producer and exporter of fresh pears in Europe. More recently, Spain and France have become large volume producers and exporters of pears to other European countries (41, pages 21-39). All those European countries which produce and/or trade significant quantities of pears were included in the analysis: specifically the United Kingdom, West Germany, Denmark, Finland, Norway, Sweden, Ireland, The Netherlands, Belgium, France, Austria, Switzerland, Italy, Greece, Yugoslavia, Portugal and Spain. Data pertaining to changes in the volume of European imports of fresh pears from Southern Hemisphere producers were not readily available; this factor was therefore not further considered in the empirical analysis.

Sweden has been a significant producer of pears for fresh consumption (41, Statistical Annex, page 14); however, domestic stocks have usually been reduced to low levels by December (63, October 1961, page 7).

Data regarding Swedish trade barries against U.S. winter pears were assembled from various sources (61, 62, 63, 64, 66). Tariff levels are usually set at moderate levels; for example, during the 1971/72 season, imports up

to December 31st were subjected to a tariff of 21.9% ad valorem and imports after December 31st were allowed to enter free (66, page 22). In practice, effective control of imports of fresh pears to Sweden is achieved by a system of "import calendars." Import licenses for fresh pears are granted only during the open period of the season, which usually begins in November when most of the domestic production has been marketed. Import licenses are issued freely during the open season, and no discrimination is made with regard to source country. Moreover, opening dates are liberally administered in the sense that the earliness of the opening date is directly influenced by the level of domestic production of pears (63, October 1961, page 7). There is no explicit incorporation of the timing of opening into the empirical model as this is implicitly accounted for in the estimates of levels of Swedish production of pears.

The Swedish import policies described above stem from import regulations effective from October 1, 1954. Prior to that date, all private imports of dollar commodities into Sweden were subject to strict exchange controls (64, October 3, 1954). Assuming that the levels of exchange controls in existence prior to the 1954/55 season significantly restricted imports of U.S. winter pears over what they otherwise would have been, a binary variable was introduced into the empirical equation in order to describe the

influence of the relaxation of import controls, beginning in the 1954/55 season.

An empirical model of Swedish demand for U.S. winter pears, based upon the preceding theoretical, methodological, and data considerations, was developed and estimated. Some of the data were unavailable prior to the 1950/51 season, so the period of study extends from the 1950/51 season to the 1974/75 season, inclusive.

The results of the empirical analysis are presented in equation (3):

$$\hat{Y}_t = 41.35 - \underset{(.50)}{.33365}(X_1)_t - \underset{(1.66)}{1.8405}(X_2)_t - \underset{(2.68)**}{3.9151}(X_3)_t + \underset{(2.54)**}{11.596}(X_4)_t + \underset{(.61)}{.86895}(X_5)_t + \hat{e}_t \quad (3)$$

$$R^2 = .56$$

$$D.W. = 1.92$$

where: $\hat{Y}$ = predicted volume of export sales of U.S. winter pears to Sweden, expressed as number of boxes per thousand of population in Sweden

X_1 = season average f.o.b. price per box of U.S. winter pears, expressed in real (1963 = 100) Swedish Krone.

X_2 = quantity of production of pears in Sweden, expressed in number of metric tons per thousand of population in Sweden

X_3 = quantity of production of pears in 16 European countries, expressed in number of metric tons per thousand of population in the 16 countries

X_4 = a binary variable; a value of unity is assigned to those seasons (i.e., seasons 1954/55-1974/75 inclusive) in which relatively liberal import policies were in operation

X_5 = real (1963 = 100) per capita National Income, expressed in Krone

$\hat{e}$ = the estimated value of the random disturbance term

Although there appears to be a significant relationship between the dependent variable and the five independent variables, only 56% of the variation in the dependent variable is explained by changes in the values of the independent variables. All estimated coefficients exhibit the expected signs but the estimated coefficients for the adjusted price and income variables are small relative to their standard errors. The results suggest that annual fluctuations in pear production in Europe and the relaxation of import controls during, and since, 1954 were of greatest importance in influencing sales of U.S. winter pears to Sweden during the 1950/51-1974/75 period.

The predicted levels of export sales of U.S. winter pears to Sweden which are implied by the model are compared to actual levels in Figure 6. Referring to Figure 6, it appears that the volumes of exports during the 1954/55 and 1955/56 seasons were grossly over-estimated. Accordingly, it can be hypothesized that, although some import restrictions in Sweden were apparently lifted in 1954, the effects

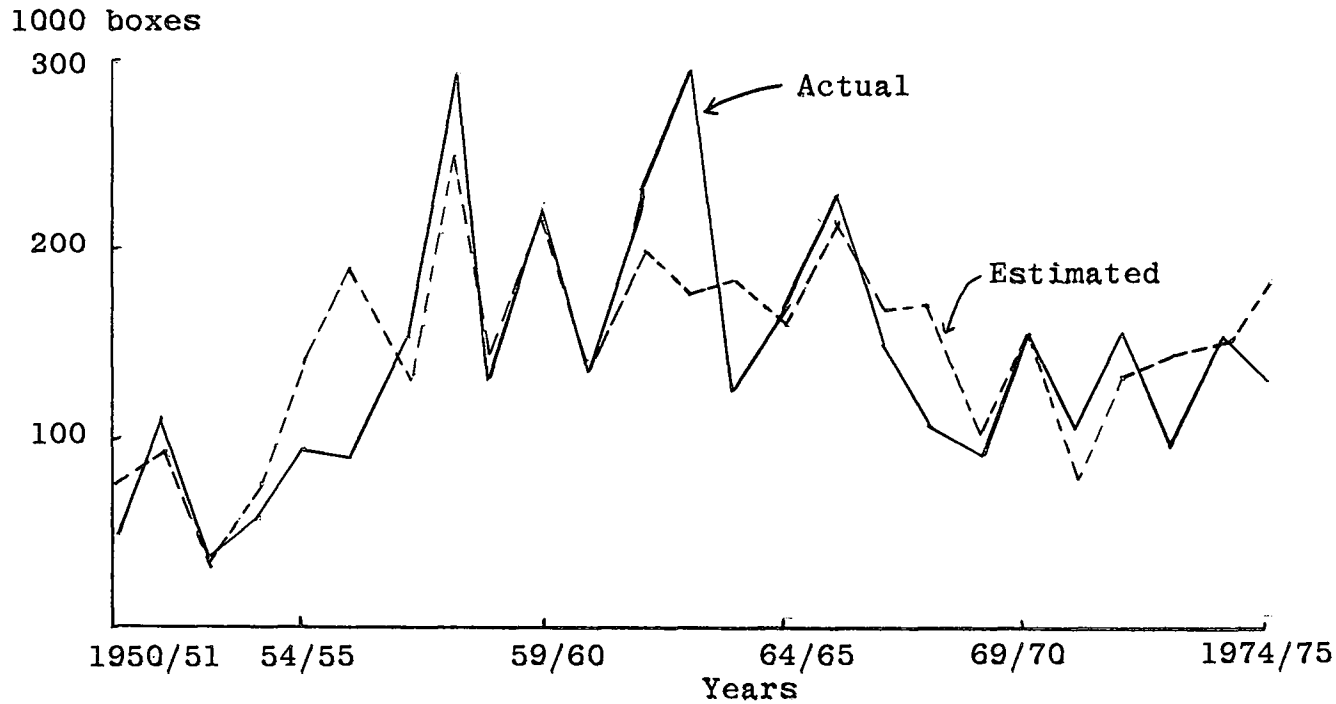


Figure 6. Actual and estimated exports of U.S. winter pears to Sweden; season totals for the period 1950/51-1974/75.

of this change in trade policy upon sales of U.S. winter pears were delayed until the 1956/57 season.[10/]

Brazilian Demand for U.S. Winter Pears

The closest substitutes for U.S. winter pears in Brazil are considered to be fresh pears produced in Brazil and other countries in South America. Almost all of the South American production is concentrated in Argentina with smaller quantities produced in Chile and Brazil. Most supplies of fresh pears in Brazil originate from Argentina (10; 63, Nov. 1974). The U.S. has been the only significant Northern Hemisphere supplier of fresh pears to Brazil (58; 63, Nov. 1974). Exports of U.S. winter pears to Brazil are concentrated in the earliest part of the marketing season, i.e. August to November, when stocks of fresh pears in South America are likely to be at low levels. There do not seem to be any significant alternative supplies of fresh pears in Brazil until mid-December when the Southern Hemisphere harvest season for pears begins. Production levels of pears in Brazil were not considered separately from total South American production in the empirical analysis because accurate estimates of pear production in Brazil are not available over much of the study period, and Brazilian production levels have been small.

10/ In fact, the newly-liberalized trade regulations may not have been actually used until 1956.

Exports of U.S. winter pears to Brazil in any one season may have been influenced by South American production levels in two South American seasons. Total production of South American pears in the January to April period may affect the availability of South American supplies of pears later in the South American marketing season, and therefore import demand for U.S. winter pears in the August to November period of the same year. On the other hand, it might be expected that imports of U.S. winter pears for consumption in Brazil from December onwards will be influenced by the level of production of the harvest beginning in December and January of the same U.S. winter pear marketing season. In a preliminary empirical analysis, both of these hypothesized production effects were considered; no relationship between current season production levels of pears in South America and current levels of imports of U.S. winter pears to Brazil was found. In other words, considering a specific U.S. winter pear marketing season, production levels of pears harvested in South America in the December to March period of that season do not appear to influence the level of export sales of U.S. winter pears to Brazil. This particular influence was therefore not considered further. There are at least two possible reasons for this situation; (i) South American supplies of fresh pears to Brazil have usually been adequate in the December to April period, and (ii) Argentinian

supplies of pears have obtained preferential treatment to U.S. winter pears because of the participation of Brazil and Argentina in the Latin American Free Trade Association.

Data regarding import restrictions were obtained from a number of sources (60, 62). For many seasons, no information is available; however, it is thought that the principal changes in import restrictions over the period of study have been utilized in the empirical analysis. Two "unusual" types of season were identified: (i) those seasons during which severe import restrictions were in effect, and (ii) those seasons when relatively liberal import regulations for U.S. winter pears were experienced.

A number of foreign trade restrictions which might affect export sales of U.S. winter pears to Brazil are, and have been, in effect; restrictions include a licensing system, government control of the disposition of foreign exchange, and changes in tariff levels (65, 1959, page 12). The basic law under which imports have been controlled is No. 262 of February 25, 1948 authorizing control over all imports (62, January 1954, page 9). This law has been modified from time to time by regulations and legislation of such a nature as to make it more or less restrictive to trade, the modifications depending upon the exchange position and, occasionally, upon the availability of domestic supplies.

It was reported (62, January 1954, page 10) that the foreign exchange situation eased in late 1949, leading to a more or less liberal policy of import licensing in 1950 and 1951. However, by 1952, foreign exchange reserves had been greatly depleted, mainly because of the need to import wheat from countries requiring payment in foreign currency (Brazil's traditional supplier, Argentina, had had a crop failure), and a more restrictive policy was adopted. Despite these measures, foreign exchange difficulties became much worse, leading to Regulation No. 70 of October 9, 1953 which modified the exchange and import control system in such a way as to virtually prohibit any imports of non-essential foodstuffs such as fresh pears from the U.S. This regulation was not enforced for U.S. fruit until 1954 (62, December 1955, page 250), but continued until November, 1965 when less severe regulations were introduced in response to a substantial foreign trade surplus for the second successive year (60, page 39). In addition, the ad valorem tariff on fruit imports from countries outside the Latin American Free Trade Association was substantially reduced in July 1966 from over 100% to 40% (62, September 4, 1967, page 6). Two other, more recent, tariff changes are considered to be of importance: (i) as a result of an improved balance of payments position in 1972 and 1973 and as a result of more limited supplies from Argentina, a further drop in Brazil's ad valorem duty on pears was made in 1973

(62, March 3, 1975). Finally, the tariff on pear imports was raised to 137% ad valorem in December 1974 as a result of balance of payments difficulties stemming mainly from the increased costs of oil imports.

From this survey of import restrictions in Brazil, two binary variables designed to describe the effect of import restrictions against U.S. winter pears during the 1948 to 1975 period are proposed. Assuming that: (i) the introduction of Regulation No. 70 did not significantly affect U.S. winter pear imports until the 1954/55 season, (ii) tariffs and exchange controls were eased too late in the 1965/66 season to have a significant effect upon imports of U.S. winter pears, and (iii) the increased tariff imposed in December 1974 was too late to significantly affect U.S. winter pear trade in the 1974/75 season, then the total period 1954/55 to 1965/66 would represent those seasons between 1948 and 1975 during which severe import restrictions were in effect against U.S. winter pears; this situation is represented in the empirical model by the binary variable (X_2) of equation (4). More tentatively, seasons of more relaxed import restrictions are identified from the available data as 1950/51, 1951/52, 1973/74 and 1974/75; this situation is represented by the binary variable (X_3) of equation (4).

The results of the empirical analysis which covers the whole period for which data are available (1948/49-1974/75)

are presented in equation (4):

$$\hat{Y}_t = \underset{}{.42016} - \underset{(2.43)**}{.37729}(X_1)_{t-1} - \underset{(13.46)***}{.95369}(X_2)_t + \underset{(8.24)***}{.89029}(X_3)_t + \underset{(9.21)***}{.0079491}(X_4)_t + \hat{e}_t \qquad (4)$$

$$R^2 = .98$$

$$D.W. = 1.73$$

where: $\hat{Y}$ = estimated volume of exports of U.S. winter pears to Brazil expressed in number of boxes per thousand of population in Brazil

X_1 = production of pears in South America expressed in metric tons per thousand of the combined population of Argentina, Chile, Brazil and Venezuela[11/]

X_2 = a binary variable; a value of unity is given to the seasons during which rigid exchange control and import licensing were in effect

X_3 = a binary variable; a value of unity is given to those seasons during which it appeared that very liberal import policies were in operation

X_4 = real (1963 = 100) per capita income in Brazil, expressed in cruzeiros.

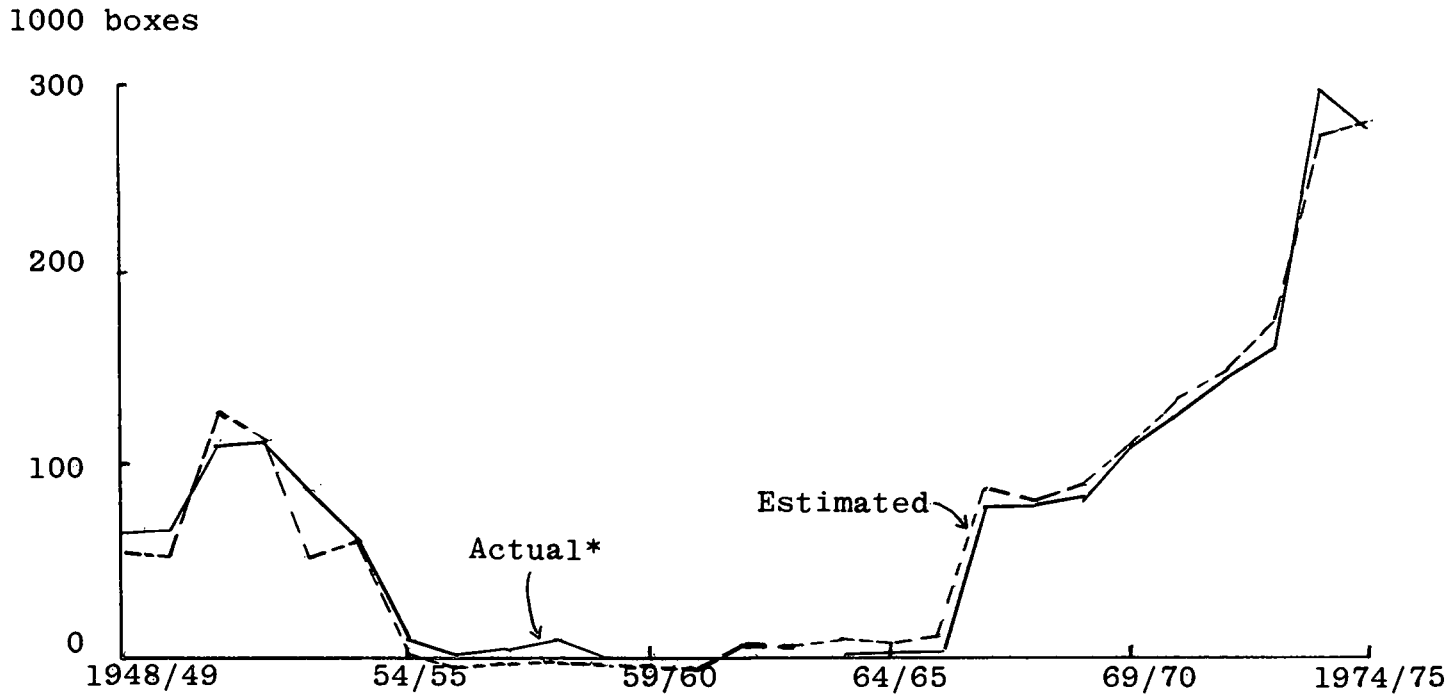
The coefficient of the adjusted price variable assumed an incorrect (positive) sign in a preliminary analysis and so was omitted from the final equation.

Other than data inaccuracies, there are a number of possible reasons for the failure of the coefficient of the price variable to retain a significant negative sign.

11/ Almost all of the South American consumption of fresh pears occurs in these countries.

Likely causes are (i) changes in the other variables have been of much greater significance for import fluctuations; for example, it would appear that the seasonal changes in tariff rates have influenced import prices of U.S. winter pears to a much greater extent than seasonal changes in f.o.b. export prices of U.S. winter pears; (ii) the quoted exchange rate values for Brazil are misleading because of the profusion of exchange restrictions such as import deposits which may be enforced to a different degree from week to week as well as from season to season; (iii) the observed changes in the consumer price index for Brazil may not adequately represent real price levels for consumers of U.S. winter pears.

Referring to equation (4), 98% of the variation in the dependent variable is explained by variations in the values of the independent variables. All of the variables included in the equation retained highly significant coefficients and the level of serial correlation appears to be low. The results suggest that trade policies, the rapidly rising levels of incomes in Brazil, and production levels of pears in South America were important causes of fluctuations in export sales of U.S. winter pears to Brazil. The predicted levels of export sales of U.S. winter pears to Brazil which are implied by the estimated model are compared to actual levels in Figure 7. The crucial impact of



*No exports of U.S. winter pears to Brazil were reported during the seasons 1958/59-1964/65.

Figure 7. Actual and estimated exports of U.S. winter pears to Brazil; season totals for the period 1948/49-1974/75.

the imposition of import restrictions during the 1954/55 to 1965/66 period can readily be observed.

European Demand for U.S. Winter Pears

The principal substitutes for U.S. winter pears in Europe are thought to be European supplies of fresh pears during the September to May period, and imports of Southern Hemisphere pears in the February to May period. In accordance with the discussions of Chapters II and III, supplies of European fresh pears are represented empirically by total production levels of pears in Europe.

Data regarding trade barriers against U.S. winter pears in Europe were assembled from various sources (9, 12, 61, 62, 63, 64, 65, 66). The nine most significant importing countries for U.S. winter pears in Europe (identified in Table 4) were selected for detailed study. Data for some countries were unavailable but it is believed that the principal changes in trade policies affecting trade in U.S. winter pears in Europe have been identified. The countries selected for study were Finland, Norway, Sweden, the United Kingdom, West Germany, France, Belgium, Ireland, and The Netherlands. The status of import controls in Europe since 1950/51 is discussed by country and finally summarized in Table 7.

Care has been taken to distinguish changes in trade policies into two types: (i) those which appear to follow

Table 7. Summary of import controls against U.S. winter pears in nine European countries for the 1950 to 1974 period.

Season Beginning	U.K.	W.G.	Sweden	Norway	Finland	Ireland	France	Belgium	Netherlands
1950	x	x	x	-	-	-	x	-	x
1951	x	x	x	-	-	-	x	-	x
1952	x	x	x	-	-	-	x	-	x
1953	x	x	x	-	-	-	x	-	x
1954	x	x		-	-		x	-	x
1955		x		-	-		x	-	x
1956		x		-			x	-	x
1957							x	-	
1958							x	x	
1959							x	x	
1960							x	x	
1961							-	x	
1962							-	x	
1963								x	
1964								x	
1965								x	
1966		x					-	x	
1967		x					-	-	
1968		x					-	-	
1969		x					-	-	
1970		x					-	-	
1971		x					-	-	
1972		x					-	-	
1973		x					-	-	
1974		x					-	-	

x = the available data indicates that relatively severe restrictions against imports of U.S. winter pears were in effect.

- = precise data regarding import restrictions are unavailable, but it is assumed that severe restrictions against imports of U.S. winter pears were in effect.

changes in domestic production levels of pears, and (ii) those which are almost entirely independent of changes in domestic production levels. The following discussion is concerned with identifying changes in trade policies of the latter type. Changes in trade policies of type (i) are not of interest here as they are assumed to be accounted for in another empirical variable, which describes changes in production levels of pears in Europe.

It was shown in a previous section that the only significant changes in Swedish policies regarding imports of U.S. winter pears occurred from the 1954/55 season when a more liberal trade policy was adopted. Other changes in Swedish policies appear to have occurred as a direct result of changes in levels of production of pears in Sweden.

Controls against U.S. winter pear imports by Finland have been effected by the imposition of differential rates of import duty. Normally, there is a high duty period for imports of fresh pears from August 1 until November 30, equivalent to 40% ad valorem. A lower rate of duty of 8% ad valorem applies during the December 1 to July 31 period. The date of opening of the low duty period is varied, at least to some extent, according to the domestic availability of pears; for example, in the 1965/66 season, opening dates were brought forward to November 8 as domestic supplies were almost exhausted (63, October 1961, pages 7-8). Data regarding Finnish import controls prior to

1960 are not available; however, it may be assumed that strict controls were placed on imports during the early 1950's in unison with other European countries. The only indication that such controls may have affected sales of U.S. winter pears to Finland is provided by the fact that no exports of U.S. winter pears to Finland were reported during the 1950/51 to 1956/57 period.

Norway maintains the same type of controls on pear imports as Sweden, but Norway always begins its open season at a later date. Norway, in deciding opening dates, apparently does not consider the domestic supply level to be an important factor; for example, in the 1959/60 and 1960/61 seasons, Norway didn't allow pear imports until January and February, respectively, despite the fact that domestic supplies were exhausted early in December in both years (63, October 1961, pages 7-8). Data are unavailable regarding the status of Norway's import controls in the early 1950's; however, it can be suggested that, due to the fact that no reported imports of U.S. winter pears occurred into Norway prior to the 1957/58 season (except for the 1953/54 season), severe import restrictions may have been in effect.

The historical status of import controls in the United Kingdom has been well documented. An embargo upon U.S. pear imports lasted until the 1955/56 season; since that time, imports of U.S. pears have been subject to a

more or less constant quota. In accordance with the terms of entry of the United Kingdom into the European Community, quotas are being replaced by import levies from February 1, 1975.

Historical import controls by West Germany have also been well documented. Prior to the 1957/58 season, exchange controls appear to have severely restricted imports of U.S. winter pears. During the 1957/58 to 1965/66 period, West German imports of U.S. winter pears were controlled by an import tender system; issuance of tenders for pears was liberal when domestic production was low (63, July 1961, page 3). Then, from the 1966/67 season, imports of U.S. winter pears were curtailed because of a decision by the German Federal Ministry of Health which prohibited imports of apples and pears treated with certain post-harvest chemicals (62, December 1966, page 10).

In The Netherlands, restrictions on U.S. pears were first lifted for the 1957/58 season (62, December 1957, page 31). Since that time, imports of U.S. pears to The Netherlands have been completely liberalized. There has been a large re-export trade to other countries in Europe (63, July 1961, page 3).

In the June 13, 1955 issue of the U.S.D.A. Foreign Agricultural Service "Foreign Agriculture Circular" (64), France was reported to have not participated in the widespread moves towards liberalization and removal of

quantitative restrictions against imports from the dollar area. Import controls remained strict during succeeding seasons; for example, during the late 1950's, France did not allow imports of U.S. pears until so late in the season as to be of no practical value (63, October 1961, page 10). A small pear quota was allotted to the U.S. and Canada in the 1963/64 season; this quota was increased for the 1964/65 and the 1965/66 seasons. The 1965/66 season was the last season of reported exports of U.S. winter pears to France. The greatly increased production of pears in France during the last decade possibly resulted in import controls being strictly enforced.

Belgium, except in rare instances, has traditionally not opened its frontiers to imports of U.S. pears before February 16. Consequently, U.S. winter pear exports to Belgium have been limited. Ireland has maintained a liberal import policy towards fresh pears, at least since the 1950's. The absence of exports of U.S. winter pears to Ireland prior to the 1954/55 season may indicate that prohibitive exchange controls were in effect during the 1950/51 to 1953/54 seasons.

In addition to trade restrictions employed by individual European countries, it is possible that collective trade restrictions among some European countries may impede exports of U.S. winter pears to Europe. It would appear that of the diverse trade barriers and agreements

that have been, and are, in effect among European countries and between European countries and the U.S., the only trade policy which has been of potentially great significance for trade in U.S. winter pears is the Reference Price policy of the European Community. Since January 1, 1962, the six members of the European Economic Community (West Germany, France, Italy, The Netherlands, Belgium and Luxembourg) have operated a common system of Reference Prices against imports of commodities such as fresh pears.[12/]

The Reference Price is a computed minimum import price based upon market prices within the European Community. Reference prices for U.S. winter pears vary monthly, and imports found to be selling at less than the Reference Price may be subject to an offsetting compensatory tax. In actuality, it appears that the Reference Price has never been used against U.S. winter pears; at least for the period prior to 1973, prices of imports of U.S. winter pears have always been in excess of the Reference Price. Thus, the compensatory tax has never been invoked (61, December 1972, page 10).

In formulating empirically testable variables for changes in the levels of European import restrictions

---

17/ The European Economic Community expanded to include the United Kingdom, Ireland and Denmark in the early 1970's, and became known as the European Community. From February 1, 1973 the three new entrant members began to incorporate the Reference Price system into their foreign trade policies.

against U.S. winter pears, special consideration was given to those countries which were thought to, potentially, have the greatest demand. During the 1950/51-1974/75 period, West Germany, the United Kingdom and Sweden have been clearly the largest net importers of fresh pears in Europe. West Germany normally enjoys a large volume of domestic production but nonetheless remains the largest importer of fresh pears; for example, during the 1961-64 period, an average of 160 thousand metric tons were imported compared to 67 thousand metric tons and 18 thousand metric tons for the United Kingdom and Sweden, respectively (41, page 45).

In accordance with the foregoing discussion, two binary variables were formulated in order to describe changes in the levels of import restructions against U.S. winter pears in European countries.

Binary variable X_3. Values of unity are assigned to those seasons in which relatively liberal import restrictions were in effect in West Germany; specifically, seasons 1957/58 to 1965/66 inclusive. It is hypothesized that this variable will also reflect changes in reported imports of U.S. winter pears into other European countries (specifically, Belgium and The Netherlands), which appear to act as important transshipment points for the West German market.

Binary variable X_4. Values of unity are assigned to those seasons in which relatively liberal import policies were in effect in the United Kingdom; specifically, seasons

1955/56 to 1974/75. It is hypothesized that this variable will also reflect the general liberalization of import restrictions in many European countries during the middle 1950's; particularly in Sweden, Norway, Finland, and Ireland.

The results of the empirical analysis are summarized in equation (5):

$$\hat{Y}_t = 395.68 - \underset{(.32)}{31.391}(X_1)_t - \underset{(2.64)**}{67.947}(X_2)_t + \underset{(3.26)***}{216.61}(X_3)_t + \underset{(1.69)}{168.51}(X_4)_t + \underset{(1.01)}{197.55}(X_5)_t + \hat{e}_t \quad (5)$$

$$R^2 = .75$$

$$D.W. = 2.23$$

where: $\hat{Y}$ = estimated volume of export sales of U.S. winter pears to Europe, expressed in thousand boxes per unit of population (where 1950/51 = 100)

X_1 = season average f.o.b. price per box of U.S. winter pears, expressed in real (1951/52 = 100) European currency

X_2 = quantity of production of pears in 17 European countries expressed in number of metric tons per thousand of population

X_3 = a binary variable; a value of unity is assigned to those seasons when relatively liberal import policies towards U.S. winter pears were in effect in West Germany

X_4 = a binary variable; a value of unity is assigned to those seasons when relatively liberal import policies towards U.S. winter pears were in effect in the United Kingdom

X_5 = index number of real (1950/51 = 100) National Income in Europe.

Referring to equation (5), 75% of the variation in exports of U.S. winter pears to Europe is accounted for by variations in the values of the independent variables. The level of serial correlation appears to be low and all of the estimated coefficients retain the correct signs. The adjusted price of U.S. winter pears did not appear to have been an important factor in the determination of export volume; changes in pear production levels in Europe and changes in trade policies in Europe appeared to be the most significant factors influencing changes in export volume of U.S. winter pears to Europe. The predicted levels of export sales of U.S. winter pears to Europe which are implied by the model are compared to actual levels in Figure 8.

South American Demand for U.S. Winter Pears

Exports of U.S. winter pears to South America have been confined almost exclusively to Brazil and Venezuela.[18/] Venezuela has been a reliable source of demand during the 1948/49-1974/75 period, whereas Brazil has shown a rather erratic pattern of import volume. Most probably, the differences between Brazil and Venezuela in their patterns of imports of U.S. winter pears reflect the basic

---

18/ Of the total exports of U.S. winter pears to South America during the 1947/48 to 1974/75 period, 52% were reported to be shipments to Brazil and 40% to Venezuela.

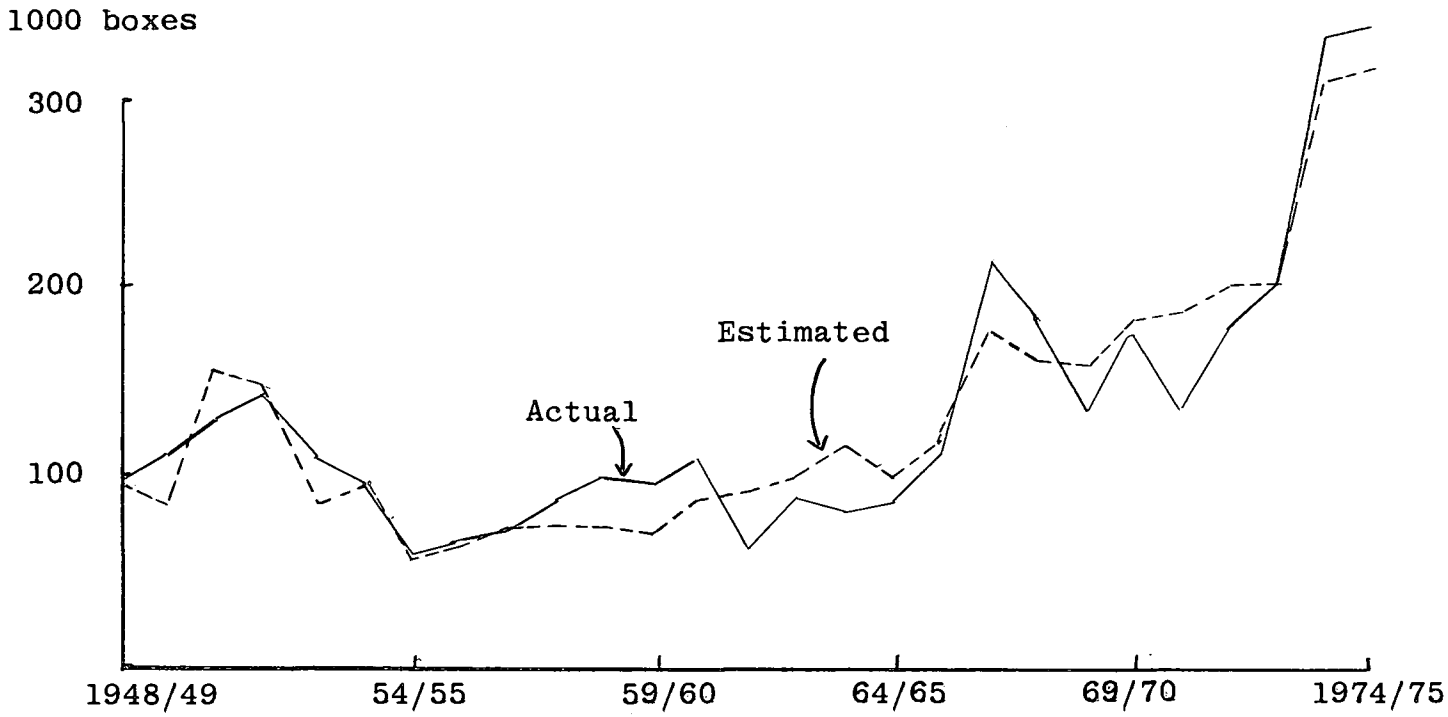


Figure 9. Actual and estimated exports of U.S. winter pears to South America; season totals for the period 1948/49-1974/75.

characteristics of their economies. Venezuela has been an economically stable country during the period of study; particularly, foreign exchange does not appear to have been a limiting factor in development due to adequate oil export revenues. On the other hand, Brazil has been a relatively unstable country and there have been periods of both large balance of payments deficits and balance of payments surpluses during the period of study.

Much of the trade policy data pertaining to imports of U.S. winter pears by Venezuela were unavailable. It was hypothesized for the purposes of the empirical analysis that changes in Venezuelan import restrictions which were independent of changes in the levels of pear production in South America were insignificant during the study period. However, Venezuela does appear to have made minor changes in its levels of import restrictions from time to time; for example, during the 1970 to 1974 period, Venezuela was reported to have raised import duties on U.S. pears from 10% to 30% ad valorem (12, page 5). Consequently, changes in trade policies in South American countries are represented solely by changes in Brazilian import policies in the empirical model. The latter changes have been discussed in a previous section.

The results of the empirical analysis are presented in equation (6):

$$\hat{Y}_t = 144.52 - \underset{(1.13)}{8.0107}(X_1)_t - \underset{(.27)}{6.3869}(X_2)_t$$

$$- \underset{(1.19)}{19.957}(X_2)_{t-1} - \underset{(3.18)***}{26.332}(X_3)_t + \underset{(3.76)***}{51.689}(X_4)_t \quad (6)$$

$$+ \underset{(.99)}{13.734}(X_5)_t + \hat{e}_t$$

$$R^2 = .82$$

$$D.W. = 1.38$$

where: $\hat{Y}$ = estimated volume of exports of U.S. winter pears to South America, expressed in thousand boxes per unit of population index (where 1950/51 = 100)

X_1 = season average f.o.b. price per box of U.S. winter pears, expressed in real (1951/52 = 100) South American currency

X_2 = quantity of production of pears in South America expressed in number of metric tons per thousand of population of Argentina, Chile, Brazil and Venezuela

X_3 = a binary variable; a value of unity is assigned to those seasons in which severe exchange controls were enforced in Brazil

X_4 = a binary variable; a value of unity is assigned to those seasons during which very liberal import policies are known to have been in operation in Brazil

X_5 = index of real (1950/51 = 100) per capita National Income in South America

The results show that the empirical model explains 82% of the variation in export sales of U.S. winter pears to South America. In order to test the possibility of autocorrelation among the error terms of the estimated equation, the Durbin-Watson test was used, but proved inconclusive at the 95% significance level. Many of the estimated

coefficients were not large relative to their standard errors. The results suggest that Brazilian import policies have been very influential in the determination of variations in exports of U.S. winter pears to the South American region; price and income changes, and the level of production of pears in South America in the previous marketing season may also have influenced exports. The predicted levels of exports to South America which are implied by the empirical model are compared to actual levels in Figure 9.

The Total Export Demand for U.S. Winter Pears

In formulating an empirical model of total export demand for U.S. winter pears, those factors which were hypothesized as being of importance for the analysis of demand in each of the Canadian, European and South American markets were considered. The theoretical and empirical bases for the selected variables have been discussed in earlier sections.

The results of the empirical analysis are presented in equation (7):

$$\begin{aligned}\hat{Y}_t = {} & 1353{,}1 - \underset{(,74)}{56{,}278}(X_1)_t - \underset{(1.15)}{.15101}(X_2)_t - \underset{(4.82)***}{107.71}(X_3)_t \\ & + \underset{(3{,}41)***}{260{,}20}(X_4)_t + \underset{(2{,}71)**}{273{,}23}(X_5)_t - \underset{(1.82)*}{252{,}88}(X_6)_{t-1} \\ & - \underset{(3{,}01)***}{303{,}46}(X_7)_t + \underset{(1{,}57)}{264{,}37}(X_8)_t + \hat{e}_t\end{aligned} \qquad (7)$$

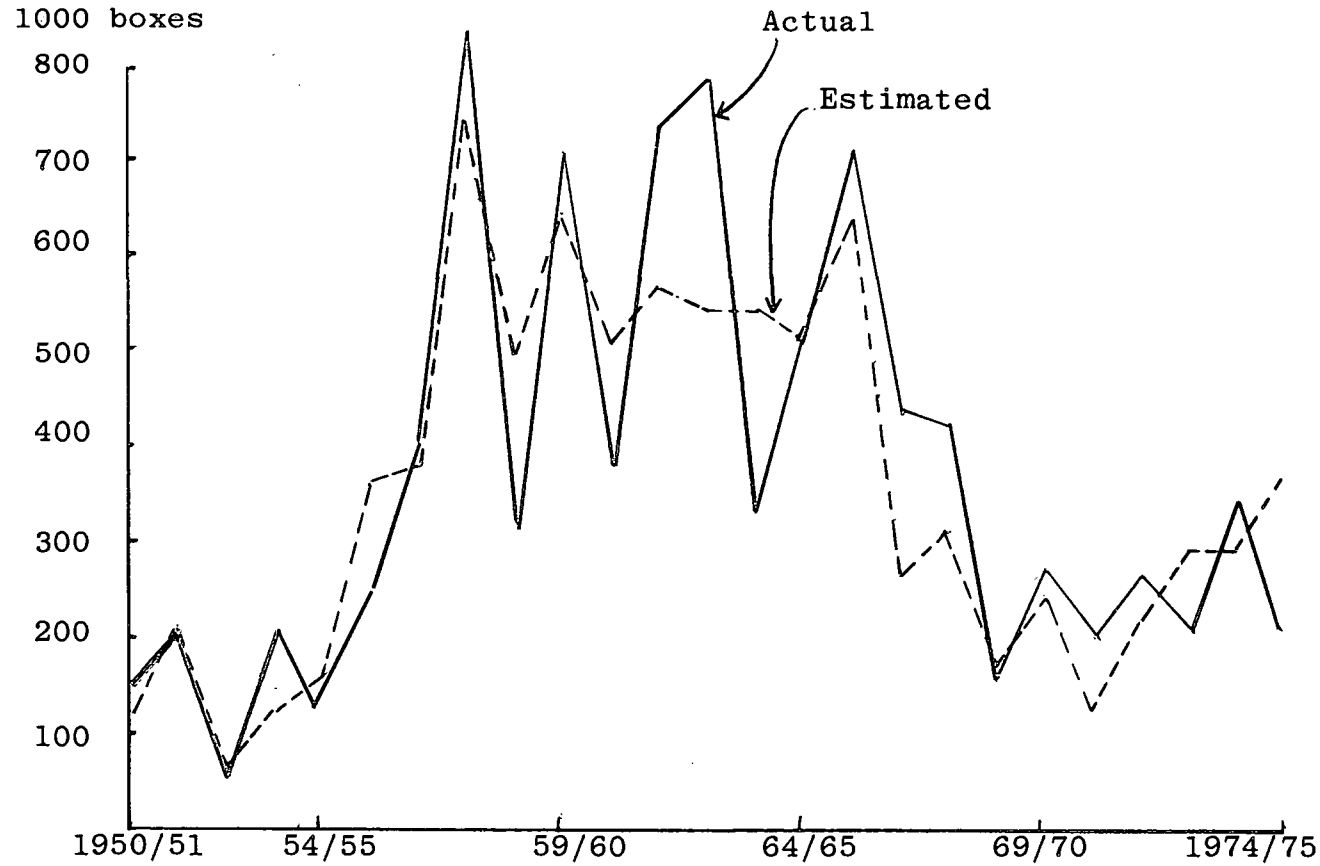


Figure 8. Actual and estimated exports of U.S. winter pears to Europe; season totals for the period 1950/51-1974/75.

$R^2 = .81$

D.W. = 2.66

where: Y = estimated volume of export sales of U.S. winter pears, expressed in thousand boxes per unit of population (where 1950/51 = 100)

X_1 = quantity of production of pears in Canada expressed in number of metric tons per thousand of Canadian population

X_2 = volume of Canadian imports of fresh pears from Southern Hemisphere countries, expressed in pounds per thousand of population in Canada

X_3 = quantity of production of pears in 17 European countries expressed in number of metric tons per thousand of population

X_4 = a binary variable; a value of unity is assigned to those seasons during which relatively liberal policies towards U.S. winter pears were in effect in West Germany

X_5 = a binary variable; a value of unity is assigned to those seasons when relatively liberal import policies towards U.S. winter pears were in effect in the United Kingdom

X_6 = quantity of production of pears in South America expressed in number of metric tons per thousand of population of Argentina, Chile, Brazil and Venezuela

X_7 = a binary variable; a value of unity is assigned to those seasons in which severe exchange controls were in effect in Brazil

X_8 = index number of real (1950/51 = 100) per capita National Income of those countries which import U.S. winter pears

The results indicate that variations in the values of the independent variables explain 81% of the variations in total export sales during the 1950/51-1974/75 period. In

order to test the possibility of autocorrelation among the error terms of the estimated equation, the Durbin-Watson test was used, but proved inconclusive at the 95% level of significance. The values of the estimated coefficients for those variables representing changes in the level of demand in the Canadian market were not large relative to their standard errors. Nevertheless, as has been illustrated in Figure 5, export sales of U.S. winter pears to Canada have shown a marked increasing trend during the latter part of the study period.

Variables representing: (i) changes in prices of U.S. winter pears, and (ii) the relatively relaxed levels of import restrictions in Brazil during the 1950/51, 1951/52, 1973/74 and 1974/75 seasons were omitted from the empirical model as the signs exhibited by the estimated coefficients of these variables were found to be contrary to theoretical expectations in preliminary analyses.

The results presented in equation (7) suggest that trade policies of foreign countries and the production levels of pears in foreign countries have been particularly important in explaining changes in the export volume of U.S. winter pears during the 1950/51 to 1974/75 period; specifically, changes in the level of production of pears in Europe, changes in the trade policies of West Germany, the moves towards liberalization of trade in Europe and particularly in the United Kingdom and Scandinavia, and severe

import restrictions imposed by Brazil are shown to be of particular importance in explaining changes in the volume of exports of U.S. winter pears. The level of production of pears in South America and the general increases in incomes of consumers in the export area may also be important factors. It, therefore, appears that changes in demand factors in the European and South American regions have been more important than changes in the Canadian market in the explanation of variations in total export sales of U.S. winter pears. However, exports of U.S. winter pears to Canada have taken an increasingly larger share of the total export market over the study period (see Tables 4 and 5) and fluctuations in Canadian demand have been somewhat subdued, compared to other important importing countries. This may be due to a number of factors including the absence of severe fluctuations in trade restrictions against U.S. winter pears in Canada.

The predicted levels of total exports of U.S. winter pears which are implied by the empirical model are compared to actual levels in Figure 10.

Summary

The empirical analyses of this chapter have suggested that (i) changes in the international trade policies of important importing countries, particularly Brazil, West Germany, the United Kingdom and Sweden, and (ii) changes in

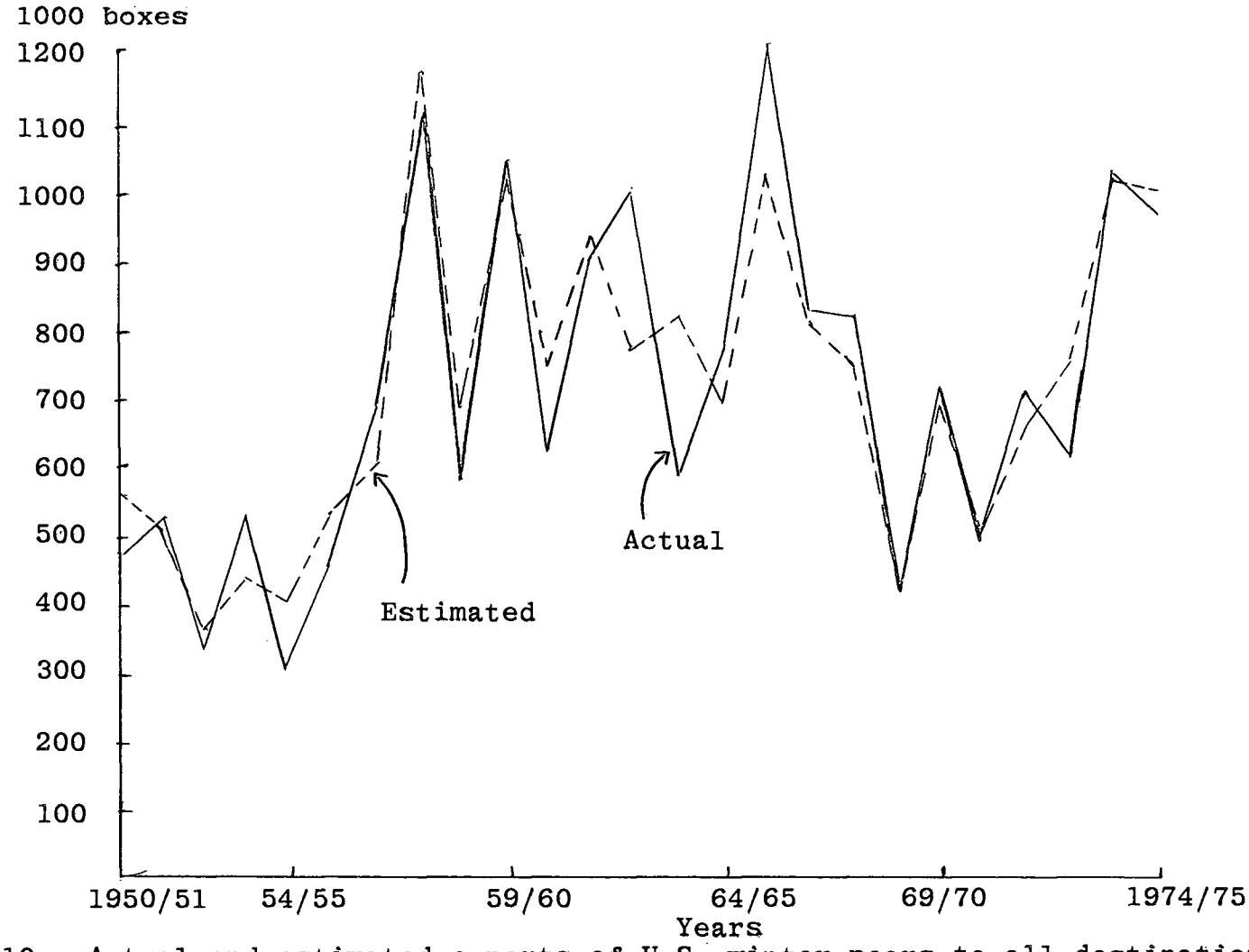


Figure 10. Actual and estimated exports of U.S. winter pears to all destinations; season totals for the period 1950/51-1974/75.

the production levels of pears in consuming regions have been of principal importance in the determination of the volumes of export sales of U.S. winter pears during the 1948/49-1974/75 period.

A marked increasing trend of exports to Canada (Figure 5) appears to be particularly associated with increasing levels of consumer income and no significant increases in levels of pear production in Canada since the early 1960's (average levels of Canadian production of pears during the five-year periods 1960-64, 1965-69,and 1970-74 were 28 thousand metric tons, 35 thousand metric tons, and 38 thousand metric tons, respectively).

The greatly-increased levels of exports to Sweden beginning in the 1956/57 season (Figure 6) appear to have been caused by a relaxation of import restrictions. The gradual decline in exports of U.S. winter pears to Sweden since the 1962/63 season may have been caused by increased competition from European pears; average levels of pear production in the seventeen principal producing countries in Europe during the five-year periods 1960-64, 1965-69, and 1970-74 were 2,397 thousand metric tons, 2,956 thousand metric tons, and 3,529 metric tons, respectively.

The historical pattern of the volumes of pear exports to Europe (Figure 8) closely resembles that of Sweden. The greatly increased levels of exports beginning in the 1956/57 season appear to have been caused by the lessening of

import restrictions against U.S. winter pears in West Germany, the United Kingdom, Sweden and other European countries. The strong downward trend of exports since the 1962/63 season appears to be associated with greatly increased levels of pear production in Europe and the reimposition of severe import controls on U.S. pears by West Germany from the 1966/67 season.

The major factor causing fluctuations in exports to Brazil (Figure 7) appears to have been changes in import restrictions. This is particularly true in the explanation of the very limited volumes of exports during the 1954/55 to 1965/66 period. Increases in consumer income in Brazil and fluctuations in pear production in South American countries also appear to have been important in explaining levels of exports to Brazil. In the apparent absence of any significant changes in import restrictions against U.S. winter pears in Venezuela, it was found that the most significant factors influencing the volumes of exports of U.S. winter pears to South America (Figure 9) have been changes in import restrictions by the Brazilian authorities.

Total export volume (Figure 10) has been generally much greater during the 1956/57 to 1974/75 period than during the period 1950/51 to 1955/56. The results of the empirical analysis of the total export market suggests that this is primarily due to changes in the trade policies of

important importing countries and changes in levels of pear production in Europe.

The distribution of exports of U.S. winter pears between export markets has changed considerably during the period of study. The total study period may be divided into three sub-periods in order to compare demand changes in individual markets; these periods are: (i) 1950/51 to 1955/56, (ii) 1956/57 to 1965/66, and (iii) 1966/67 to 1974/75 (Table 8).

Prior to the 1956/57 season, total exports were at relatively low levels because of severe import restrictions in Europe. Export sales increased substantially during the 1956/57 to 1965/66 period, mainly as a result of less severe import restrictions in Europe and despite the imposition of severe import controls in Brazil. Export sales were at slightly lower levels during the 1966/67 to 1974/75 period; reduced levels of exports to Europe, considered to be caused by the re-imposition of severe import controls in West Germany and increasing competition from European pear supplies, were largely offset by increased sales to Canadian and South American outlets. The results of the empirical analyses suggest that increased sales to the Canadian and South American markets during the 1966/67 to 1974/75 period were caused primarily by a relaxation of import restrictions in Brazil, a lack of any long-term growth of Canadian pear production, and increases in consumer income.

Table 8. The distribution of export sales of U.S. winter pears between individual markets for three time periods, 1950/51-1974/75.

Destination	Average Volume of Sales of U.S. Winter Pears during the Periods					
	1950/51-1955/56		1956/57-1965/66		1966/67-1974/75	
	1000 boxes	% of Total Exports	1000 boxes	% of Total Exports	1000 boxes	% of Total Exports
Total Exports	438	100	855	100	732	100
Canada	51	12	136	16	221	30
Europe	150	34	558	65	262	36
South America	103	23	91	11	210	29

Source: (80)

Significant inverse relationships between prices of U.S. winter pears and volumes of export sales to identified export markets were not found except in the case of the Canadian market. This result may be due to a number of factors, including (i) price changes have been relatively unimportant in the determination of demand fluctuations when considered relative to other hypothesized factors, (ii) the simultaneous nature of the determination of average prices, supplies of U.S. winter pears, and the quantities of sales to domestic and export markets, and (iii) inadequate data.

The significance of price in U.S. winter pear markets is further investigated in Chapter V by introducing domestic supply and demand considerations.

V. COMPLETE MODELS OF DEMAND FOR U.S. WINTER PEARS

The discussions of Chapters II and III demonstrated the possible simultaneous effects of demand and supply factors upon average prices, quantities sold to domestic customers, and quantities sold to export markets, for a specific commodity such as U.S. winter pears. In the ordinary least squares analyses of export markets for U.S. winter pears described in Chapter IV, it was assumed that, because the proportion of the total packout which has been sold in export markets has been small, fluctuations in demand in specific export markets did not have significant effects upon average prices of U.S. winter pears (sales to all domestic and export destinations).

This chapter is concerned with the analysis of total export demand in the context of an investigation into the simultaneous effects of all demand and supply factors upon prices and quantities sold. The basic theoretical model which is used for the investigation has been described in Chapter II and is illustrated in Figure 4. In the first part of this chapter, two major components of the simultaneous analysis, the supply of and the domestic demand for U.S. winter pears, are considered. The latter part of this chapter is concerned with the simultaneous analysis of all hypothesized demand and supply factors in the markets for U.S. winter pears.

The Supply of U.S. Winter Pears

The supply variable of interest in this study is total season quantity of U.S. winter pears supplied as packed output from the packing house, aggregated over the whole industry (i.e., over the six producing districts). Of principal concern here is the question of how to incorporate this supply variable into the model of demand for U.S. winter pears. There are two main alternatives: (i) assume that supply is an exogenous factor to the model, or (ii) construct a behavioral relationship for supply. Examples of both approaches are given by past studies (8, 18, 36).

The total packout of U.S. winter pears can be defined as the difference between the level of production and the total wastage of the crop. Annual fluctuations in the level of production appear to be primarily caused by the influence of weather conditions upon average yields (3). Longer term changes in average levels of production are primarily caused by changes in bearing acreage; it can be hypothesized that growers will attempt to adjust bearing acreage according to expectations of costs and returns in future seasons.

Total wastage of the fruit can be categorized as (i) farm wastage due to unharvestable fruit, to cullage of unsaleable fruit, and to farm disposition of the fruit, (ii) wastage at the packing house due to cullage of fruit

unsuitable for selling as the packed product either because of low quality or because of lower prices in the fresh market than in the markets for alternative uses of the pears, and (iii) wastage which is designed to reduce the total volume supplied of the crop by the failure of packers to pack all suitable, available, pears. An earlier study (4) concluded that virtually all suitable output is packed as the fresh product and that there does not seem to have been any significant attempt to restrict available supplies in heavy production years. Consequently, it appears that wastage has not been a significant factor in the determination of the volume of packout of U.S. winter pears.

From this discussion, it would appear that current supply of U.S. winter pears does not depend upon current price. Consequently, behavioral supply relationships are not developed in this study. Nevertheless, it is expected that the supply of winter pears in any given season depends to some undefined extent upon prices of winter pears in previous seasons.

Domestic Demand Factors

A model of the domestic demand for U.S. winter pears may be constructed with the aid of economic theory, past empirical studies and a knowledge of the operation of the markets for U.S. winter pears.

A number of studies of the U.S. demand for winter pears and some related commodities have been undertaken. A report by Sindelar (51) suggested that f.o.b. prices of U.S. winter pears were related to domestic supplies of winter pears, fresh sales of eastern apples, shipments of Washington Delicious apples, fresh sales of California Bartlett pears, and consumer income. Pubols (44) found that farm prices of fresh Pacific Coast Bartlett pears were affected by the total production of Pacific Coast Bartletts, total production of Pacific Coast pears other than Bartlett, stocks of canned pears and disposable income. A study by George and King (20) suggests that the consumption of apples at the retail level in the U.S. is affected by the prices of apples, bananas, oranges and canned pineapple, and disposable incomes.

The closest substitutes for U.S. winter pears are thought to be other fresh pears which are available at the same time of year. U.S. winter pears are normally available from August of the year of harvest to the end of June of the following year. U.S. Bartlett pears are available from the middle of June until December of the year of harvest. Imported pears originate from (i) Northern Hemisphere producers, particularly Canada, and (ii) Southern Hemisphere producers. Most imports from the Northern Hemisphere normally occur in the July to December period. As the Southern Hemisphere harvesting season for pears is normally from

January until April, Southern Hemisphere pears appear on the U.S. market from the end of January and compete with U.S. winter pears which were harvested in the previous fall.

The most important deciduous fruit in the U.S. is apples, which can be considered to be the closest fresh fruit substitute for pears. Supplies of winter varieties of fresh apples are particularly important for the U.S. winter pear market as both commodities are marketed throughout the same period of the year.

From this and earlier discussions, a number of important factors affecting the demand for winter pears in the U.S. can be suggested; specifically, prices of U.S. winter pears, the availability of apples, U.S. Bartlett pears, and imported pears, and levels of consumer income. All of these hypothesized variables, except for consumer income, are expected to be negatively related to the quantity of domestic sales of winter pears. The availability of other fresh fruit and canned fruit may also affect the demand for U.S. winter pears, but probably to a lesser degree.

With regard to the above discussion and considerations of data availability, an empirical model of the domestic demand for U.S. winter pears was developed. The derivations of each of the empirical variables are discussed below.

Quantity of Production of Winter Varieties of Apples

Approximately 90% of the total production of apples in the U.S. consists of winter varieties. Also, production is concentrated into a small number of states, and a small number of varieties make up most of the total production. The principal consuming areas are the eastern centers of population, the Chicago area and California. Most apples are produced and consumed in the eastern states. However, most interstate shipments of apples originate in the Pacific Northwest (particularly in the state of Washington) and in the Appalachian states (the Shenandoah Valley sections of Virginia, West Virginia, Maryland, and Pennsylvania).

Over 50% of the apple crop produced in the eastern region goes for processing, approximately 40% in the central region, approximately 25% in Washington, and approximately 75% in California. A sample survey made by the Economic Research Service of U.S.D.A. (59) in the 1969/70 marketing year suggests that the principal winter varieties of apples packed for the fresh market in the U.S. are Delicious, Golden Delicious and McIntosh. Consequently, the influence of changes in the availability of fresh apples upon the demand for U.S. winter pears are described in the empirical analysis by the sum of the U.S. production levels of Delicious, Golden Delicious, and McIntosh varieties. These

data were obtained from a number of U.S.D.A. publications (67, 69, 70, 71).

Other Supplies of Fresh Pears

Alternative supplies of fresh pears in the U.S. consist largely of Bartlett varieties sold after October 1st, and imports of pears. Figure 11 summarizes these flows with some empirical illustrations for the 1970/71 marketing season. The quantification of the flows in Figure 11 are approximate, but probably generally reflect the relative importance of the different sources of fresh pears which enter the U.S. market. Of the approximately one hundred thousand tons of fresh pears which were consumed in the U.S. between October 1970 and May 1971, approximately 72% were U.S. winter pears, 15% were imports from Southern Hemisphere countries, 2% were imports from Northern Hemisphere countries and 11% were U.S. supplies of Bartlett varieties. Changes in the supplies of pears from each of these sources might be expected to influence the demand for U.S. winter pears.

Total supplies of U.S. Bartlett pears after October 1st were approximated by estimates of total California Bartletts, cold storage holdings for fresh consumption in packed standard boxes on October 1. This series was obtained from the Federal-State Market News Service, Sacramento, California (15), and was the only series

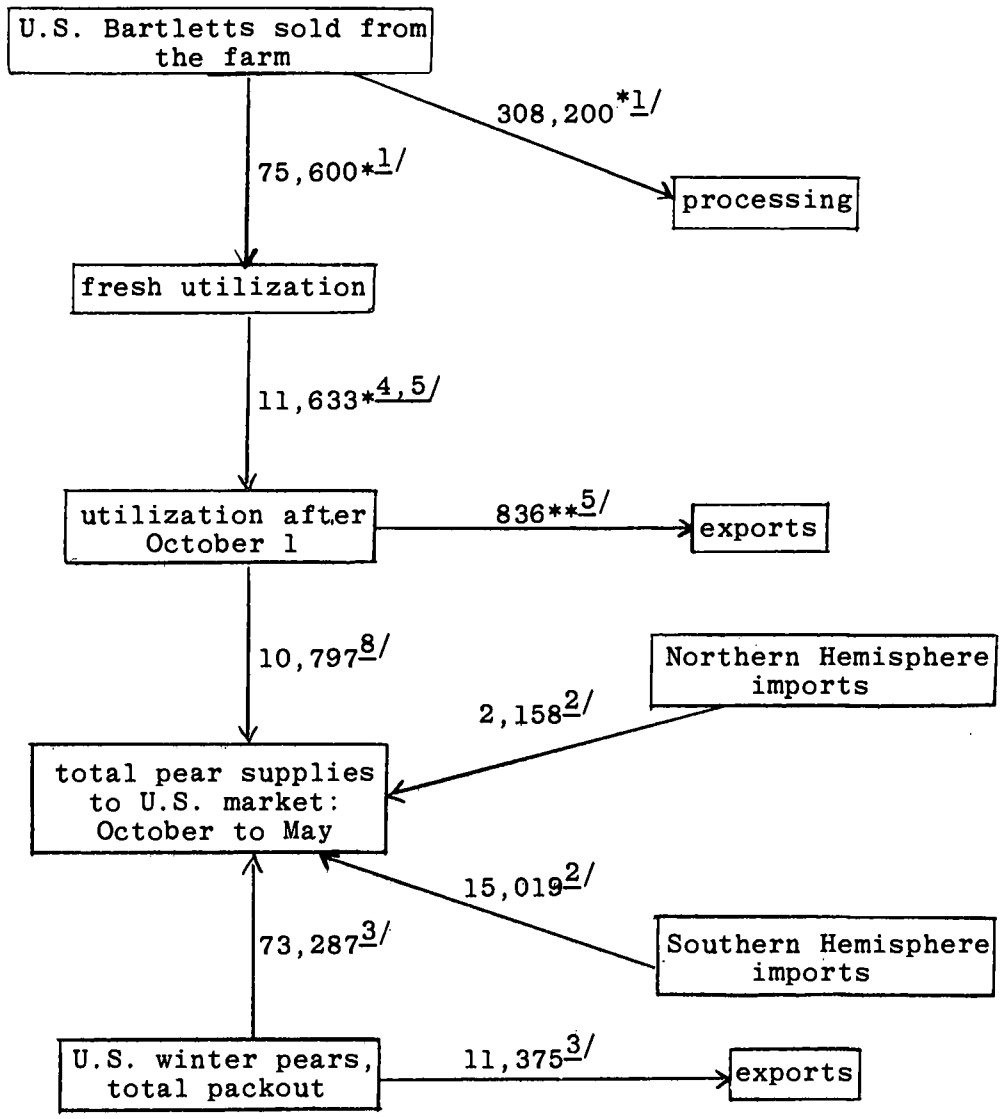


Figure 11. Flows of pears into consumption in the U.S,, 1970/71 season (volumes in tons).

*California, Washington and Oregon only; **Oregon and Washington only.

Sources: 1/ (70); 2/ (74); 3/ (80, 1971 Report); 4/ (15); 5/ (37)

describing supplies of Bartletts for fresh consumption which was available for the whole study period.

Normally, imports from Southern Hemisphere countries begin in February, peak in April or May and continue until July. There are two main considerations with regard to the effects of such imports upon the market for U.S. winter pears: (i) the total volume of imports in the October-May period, and (ii) the earliness of the distribution of imports in the season. The greater the volume of imports or the earlier a given volume of imports reaches the U.S. market, then it is expected the more the reduction in demand for U.S. winter pears. An empirical variable was constructed by weighting the total volume of imports of fresh pears from Southern Hemisphere countries according to the month of importation. Imports during the January to March period were assigned a weight of 1.0 while imports during April and May were assigned weights of 0.5 and 0.25 respectively. Small quantities of imports of pears from Northern Hemisphere countries are included in some years. Monthly import data, as published by the U.S. Bureau of the Census, were used (74).

Other Variables

The Consumer Price Index as published by the U.S. Department of Labor was used as a measure of changes in the general price level in the U.S. (77). Estimates of U.S.

population and of U.S. personal disposable income were also obtained from U.S. government publications (72, 75, 76).

Complete Models of U.S. Winter Pear Markets

Using the theoretical framework presented in Chapter II, the theoretical and empirical discussions of Chapters III and IV, and the domestic supply and demand considerations of this chapter, a simultaneous model of the markets for U.S. winter pears was specified and estimated. The model consisted of two behavioral equations and one identity:

$$Q^d_{USWP} = f(P_{USWP}, X^d_1 \ldots X^d_j)$$

$$Q^x_{USWP} = f(P_{USWP}, X^x_1 \ldots X^x_j)$$

$$Q^d_{USWP} + Q^x_{USWP} = Q^s_{USWP}$$

where the endogenous variables are:

Q^d_{USWP} = volume of sales of U.S. winter pears on the domestic market

Q^x_{USWP} = volume of sales of U.S. winter pears on all export markets

P_{USWP} = the season average f.o.b. price of U.S. winter pears

and the exogenous variables are:

Q^s_{USWP} = the total sales of U.S. winter pears to all destinations

$X_1^d \ldots X_j^d$ = exogenous factors affecting domestic demand for U.S. winter pears

$X_1^x \ldots X_j^x$ = exogenous factors affecting export demand for U.S. winter pears

The theoretical and empirical specifications of all of the variables have been discussed previously. The demand relationships were estimated using two-stage least squares; a positive coefficient was obtained for the variable representing the relationship between price and the total volume of export sales. If the price variable was omitted from the export demand equation, then the specification of the equation would be exactly as that used in Chapter IV.

It may be concluded, therefore, that changes in the total season export sales of U.S. winter pears do not appear to have been influenced by price changes during the 1950/51-1974/75 seasons. In that case, the determination of season average prices of U.S. winter pears is not simultaneous with the determination of the volumes of sales to the domestic and export markets. Taking into account these results, a revised model is illustrated in Figure 12; price (P) is determined by changes in demand factors, the volume of export sales (Q^x) is determined independently of price, and the volume of domestic sales (Q^d) is determined as a residual (S') once the volume of export sales is subtracted from the total sales of packed winter pears (S).

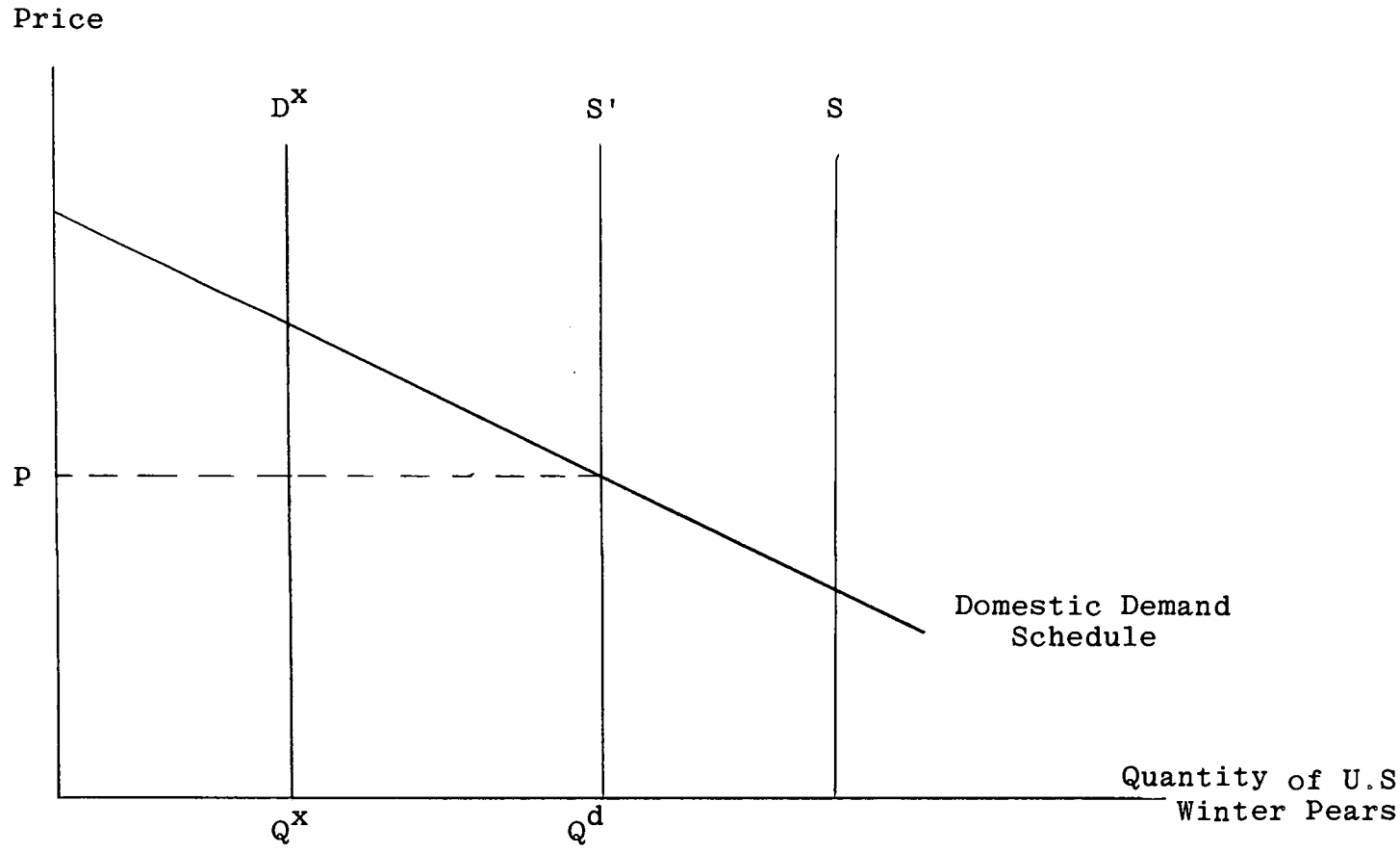


Figure 12. The determination of price in the markets for U.S. winter pears.

In the context of the model illustrated in Figure 12, ordinary least squares analysis of the major hypothesized factors affecting prices of U.S. winter pears were undertaken. The independent variables of the analysis were empirical estimates of total sales of U.S. winter pears, total export sales of U.S. winter pears, consumer income in the U.S., and the availability of close substitutes (imported pears, fresh U.S. Bartletts and fresh apples). Inverse relationships between the independent variables and price are expected except in the cases of changes in export volume and changes in consumer income.

The following results were obtained, with all variables expressed in terms of first differences:

$$\hat{Y}_{1_t} = -.17922 - \underset{(4.63)***}{.084127}(X_1)_t - \underset{(4.41)***}{.19469}(X_2)_t - \underset{(2.19)**}{.00028329}(X_3)_t + \underset{(2.06)*}{3.7179}(X_4)_t + \underset{(2.38)**}{.00067271}(X_5)_t \quad (8)$$

$$+ \hat{e}$$

$$R^2 = .84$$

$$D.W. = 1.95$$

where: $\hat{Y}_1$ = season average f.o.b. price per box of U.S. winter pears, expressed in real (1967 = 100) dollars

X_1 = total sales of U.S. winter pears expressed in boxes per thousand of population in the U.S.

X_2 = quantity of production of Delicious, Golden Delicious, and McIntosh varieties of apples in the U.S., expressed in number of pounds per head of U.S. population

X_3 = quantity of stocks on October 1 of packed standard boxes of California Bartlett pears for fresh disposition, expressed in number of boxes per million of U.S. population

X_4 = real (1967 = 100) per capita personal disposable income in the U.S.

X_5 = quantity of export sales of U.S. winter pears, expressed in thousand boxes

Preliminary analyses of the model of price determination showed that similar results (R^2 = .67) were obtained when variables were expressed in terms of the actual data, rather than first differences. Also, the variable reflecting changes in the volume and timing of imports of Southern Hemisphere pears into the U.S. was found to be positively related to price, and so was not considered further.[19/]

The results of the analysis presented in equation (8) suggest that changes in the total supply of U.S. winter pears, changes in the supply of fresh apples, changes in the supply of fresh Bartlett pears, changes in consumer income, and changes in the volume of exports of U.S. winter pears have been primarily responsible for changes in season average prices of U.S. winter pears during the 1950/51 to 1974/75 period. The analysis indicates that an increase in the volume of exports of U.S. winter pears of one hundred thousand boxes will, ceteris paribus, result in an increase

---

19/ This is not an entirely unexpected result; ceteris paribus, it can be hypothesized that higher U.S. price levels will attract higher volumes of imports.

in the season average price per box of U.S. winter pears of approximately seven cents, expressed in real terms.

In conclusion, the results of the empirical analyses of the complete models of demand proposed in this chapter support the contention that price fluctuations have been relatively unimportant in causing fluctuations in the volume of export sales of U.S. winter pears. However, it appears that fluctuations in export volume have significantly influenced prices of U.S. winter pears during the 1950/51-1974/75 period.

VI. SUMMARY AND CONCLUSIONS

A number of factors thought to be of importance in the determination of the volume of exports of a specific commodity were hypothesized in Chapter II by reference to a two-region partial equilibrium model of trade. These factors included: the price of the exported commodity, the supply of the commodity of interest in importing countries, the prices of substitute commodities, consumer income, population and the general price level in importing countries, transportation costs in international trade, import restrictions against the commodity of interest, and fluctuations in exchange rates between the currency of the exporting country and the currencies of importing countries.

This theoretical model was applied to the analysis of export markets for U.S. winter pears. In Chapter III, specific export markets were chosen for study; these were (i) the countries, Canada, Sweden and Brazil; and (ii) the regions, Europe, South America, and the total export area. The theoretical model was reformulated in terms of an empirical model for each of the identified export markets. The parameters of the empirical models were estimated using least squares regression analysis in Chapter IV. Domestic demand and supply factors were discussed in Chapter V in order to analyze a simultaneous demand model. Finally, the

effects of changes in export volume and in domestic demand and supply factors upon prices of U.S. winter pears were examined.

Implications of the Analysis for Past Market Performance

The results of the empirical analysis of Chapters IV and V suggest that a number of hypothesized demand factors have been particularly important in causing fluctuations in export sales of U.S. winter pears. In the Canadian market, prices of U.S. winter pears, production levels of pears in Canada and consumer income were shown to be the most important factors affecting demand. The most significant factors which have influenced the quantity of winter pear exports to Sweden were shown to be pear production levels in Europe and the liberalization of Swedish trade policies during and after 1954. In the Brazilian market, annual fluctuations in demand for U.S. winter pears seem to have been caused by changes in the international trade policies of Brazil, consumer income in Brazil and levels of pear production in South America in the previous Southern Hemisphere harvest season. In the South American region, U.S. winter pears have been imported into Brazil and Venezuela, almost exclusively; in the absence of data regarding import restrictions against U.S. winter pears in Venezuela, changes in the trade policies of Brazil were found to be most influential in causing fluctuations in export volume to this

region. The most important factors affecting demand for U.S. winter pears in Europe during the 1950/51 to 1974/75 period appear to have been: (i) changes in import restrictions against U.S. winter pears in West Germany, (ii) the general liberalization of trade from approximately 1955 in many European countries, particularly the United Kingdom and the Scandinavian countries, and changes in the levels of pear production in Europe.

Changes in total export sales of U.S. winter pears were found to be associated with: (i) changes in the level of pear production in Europe, (ii) changes in the international trade policies of West Germany, the United Kingdom and of the Scandinavian countries, (iii) the imposition of strict foreign exchange controls in Brazil during the 1954 to 1966 period, and (iv) changes in the production levels of pears in South America in the previous Southern Hemisphere harvest season.

The results of the analyses of U.S. winter pear exports by regional aggregate are broadly consistent with the results for the individual countries; for example, the imposition of strict foreign exchange controls in Brazil during the 1954 to 1966 period, which has been an important factor in the determination of the volume of export sales to Brazil, was also found to have been significant in the analyses of demand for U.S. winter pears in both the South American and the total export regions.

In summary, of all the identified and unidentified factors which have influenced export demand for U.S. winter pears during the period of study, it appears that changes in the international trade policies of important importing countries, particularly Brazil, West Germany, the United Kingdom and Sweden, and changes in the production levels of pears in consuming areas were the most significant. Changes in consumer income and price fluctuations appear to have been of relatively minor importance in explaining seasonal fluctuations in export volume.

Important factors in the domestic market for U.S. winter pears were found to be fresh U.S. supplies of winter varieties of apples, supplies of fresh U.S. Bartlett pears after October 1, and consumer income in the U.S. Eighty-four percent of the variation in real season average f.o.b. prices of U.S. winter pears was explained by changes in these demand factors, changes in the total season packout of winter pears, and changes in the quantity exported. It appears from the analysis of Chapter V that changes in export demand for U.S. winter pears have resulted in significant variations in U.S. winter pear prices, and consequently have influenced industry revenues.

Future Prospects in Export Markets

It is possible to suggest likely future demand conditions in export markets on the basis of recent experience

and probable future changes. Export volume cannot, however, be accurately predicted for specific future seasons as, according to the results of the analyses of Chapter IV, a major cause of the large fluctuations in demand for exports of U.S. winter pears from one season to the next has been variations in levels of pear production in foreign countries, levels of pear production in foreign countries for specific future seasons, which depend upon such factors as weather conditions at the fruit setting stage, cannot be reasonably estimated on the basis of the information available.

The results of the empirical analyses have suggested that past trends in volumes of export sales have been primarily caused by changes in the international trade policies of important importing countries and changes in levels of pear production in foreign countries over many years.

The results of this study do not seem to represent a reasonable basis upon which to predict future changes in levels of trade restrictions against U.S. winter pears in important importing countries. Such changes in the past appear to have been caused by a host of factors including changes in the availability of exchange currency in foreign countries (for example, Brazil), changes in hygiene regulations (for example, West Germany), and the need to protect developing domestic pear production (for example, France).

Information regarding possible future trends in pear production in foreign countries is available in a number of publications (10, 38, 47, 48, 62). Pear production in the European Community can reasonably be expected to decline until the mid-1980's. This decline, which probably began in 1971, is due principally to heavy grubbings and a sharp reduction in plantings on Italian specialized orchards; the non-bearing acreage in Italian specialized orchards in 1974 had already fallen to approximately 5% of the total area under pear trees, from a peak of 31% in 1964 (10, page 31). Also, no further increases in pear production in France are expected as the bearing acreage has stabilized since 1967 and the total area under pears has declined since 1969. Levels of pear production in other European countries are not expected to change substantially during the next decade. Two additional factors, which have not been considered in the empirical analyses, may also affect the demand for U.S. winter pears in Europe; these factors are the level of storage capacity, and the proportion of total output which consists of winter pear varieties.

An important recent development, which may continue until at least 1980, is the increasing proportion of the total output of pears in Italy and France consisting of the winter variety Passa Crassana; this is a large russetted pear which stores well and can be marketed until late spring of the year following harvest. Storage capacity

in Europe has been increasing, largely as a result of increases in controlled atmosphere storage facilities. No significant increases in storage capacity are expected in Europe in the immediate future (10, page 33). It is not clear to what extent these developments may influence the demand for U.S. winter pears; for example, there may be only limited substitutability between russetted and clear pears.20/

In South America, levels of pear production have not changed significantly since the mid-1960's. Information regarding possible future production levels is not available, but two recent developments, if they persist, may tend to reduce future demand for U.S. winter pears in South America; these developments are: (i) increasing levels of pear production in Brazil, and (ii) shipments of pears from Europe to Brazil and Venezuela.21/

Abstracting from changes in import restrictions against U.S. winter pears, it may be concluded from the limited information available that export demand in the late 1970's will probably not change very significantly from levels

---

20/ Almost all exports of U.S. winter pears in Europe have consisted of clear varieties, particularly Beurre D'Anjou.

21/ It is reported that ocean freight rates for fresh pears from France to Brazil and Venezuela were substantially lower than equivalent rates from Portland or Seattle (38, pages 38-39). Also, French exporters have been shipping greatly increased volumes of fresh pears to Brazil and Venezuela aince the 1970/71 season (60, November 1974, page 43).

prevailing in the early 1970's. However, there is no reason to believe that the crucial effects of changes in international trade policies upon export sales of U.S. winter pears will not continue into the future. Consequently, it is not possible to make reasonable predictions of future levels of export demand for U.S. winter pears.[22/]

Concluding Remarks

Through the analyses which have been undertaken in this study, it is considered that some primary determinants of fluctuations in the volume of sales of U.S. winter pears to export markets have been established. The analysis has focused upon the effects on export volume of changes in prices of U.S. winter pears, changes in consumer income, changes in levels of pear production in consuming areas, and changes in the international trade policies of important importing countries. The results indicate that changes in levels of pear production in consuming areas and changes in the international trade policies of important importing countries have been crucial in explaining total season sales of exports of U.S. winter pears.

22/ For example, if severe import restrictions imposed by Brazil in December 1974 continue, then future levels of exports to Brazil are expected to be dramatically curtailed. On the other hand, if the Japanese authorities would lift the ban on imports of fresh pears from countries affected by codling moth, then this potentially lucrative market may be able to absorb large quantities of U.S. winter pears.

In attempting to obtain such an overview of export markets, a number of important points of detail have, of necessity, been overlooked. It is thought that a number of possible refinements and additional considerations to the present study may contribute to the further understanding of the operation of the markets for U.S. winter pears. For example, the varietal pattern of pear production in foreign countries and developments in the storage of pears have not been considered in the empirical analysis. Also, there are a number of other substitute commodities in foreign markets which would need to be investigated in a more detailed study; such commodities include supplies of fresh pears from Southern Hemisphere countries sold in Europe and supplies of fresh apples in all foreign markets. Much work remains to be done regarding the analysis of prices of U.S. winter pears in international trade; the influences of changes in tariff rates and changes in transportation costs upon import prices are in particular need of investigation.

The explanatory power of the analysis could also possibly be improved by: (i) investigating sales volumes on a monthly or bi-weekly basis, (ii) undertaking separate analyses for the two principal varieties (Beurre D'Anjou and Beurre Bosc), (iii) incorporating changes in sizes, grades and packaging between seasons, and (iv) analyzing variations in prices and destinations of sales between the four principal producing districts. Another fruitful

avenue of further research might be to make a detailed analysis of the basis for changes in import restrictions against U.S. winter pears in individual countries; this would appear to be particularly relevant for the forecasting of changes in export demand.

In the analysis of the markets for a specific commodity such as winter pears where the total quantity of a commodity demanded or supplied is not resolved within the domestic market, volumes of imports or exports are commonly determined on the basis of identities. In this study, because of the orientation towards the export market, behavioral equations are utilized to analyze export sales of U.S. winter pears. Where the emphasis of an analysis of the market demand for a specific commodity is upon export rather than upon domestic outlets, then a frequently-used method of obtaining an insight into future market conditions has been by the use of spatial equilibrium models.[23/] A spatial equilibrium analysis was the principal alternative to the method of analysis used in this study. In the case of spatial equilibrium models, the emphasis is upon

---

23/ A spatial equilibrium model generally describes an economic system of a competitive nature, utilizing a set of equations that include the aggregate demand and supply for one or more commodities, the distribution of activities over space, and the equilibrium conditions. In the explanation of commodity trade, equilibrium price and quantities, and levels of trade flows, are determined by a programming algorithm that attempts to optimize the flow allocation according to some objective function.

simulating future commodity flows under various assumptions of demand and supply, and particularly under various trade policies. A spatial equilibrium model was not specified in this study because of the orientation towards the explanation of changes in export demand through an investigation of historical events.

A number of questions of concern to the winter pear industry were identified in Chapter I. This study has attempted to answer at least some of these questions by concentrating upon an explanation of fluctuations in total season sales of U.S. winter pears to foreign countries. A greater number of questions remain unanswered and a more detailed analysis of export markets would probably greatly complement the present work. Nevertheless, the central questions involving past changes in export demand for U.S. winter pears appear to have been answered by this study. Both annual fluctuations in export volume and longer-term trends in export volume tend to be associated with changes in levels of pear production in foreign countries and changes in the international trade policies of foreign countries. Regarding future export prospects, it appears that there will be no respite in the immediate future from past unstable and unpredictable conditions in export markets; year-to-year fluctuations in export volume will continue principally as a result of fluctuations in levels of pear production in foreign countries, while unpredictable

fluctuations in the average volume of export sales over longer periods will be caused primarily by changes in import restrictions against U.S. winter pears in important importing countries.

Finally, it is hoped that the approach to the analysis of the international flows of U.S. winter pears which is described in this study will serve as a useful basis for the investigation of other, similar, commodities which enter international trade. In particular, the analysis of the effects of changes in international trade policies has added further evidence to support the proposition that not only do the imposition of import restrictions by foreign countries have a crucial impact upon international trade in U.S. farm products, but that they also significantly contribute to the uncertainty with regard to future commodity price levels.

BIBLIOGRAPHY

1. Adler, F. Michael. 1970. The relationship between the income and price elasticities of demand for United States exports. Review of Econ. and Statistics L11(3):313-319.

2. Allen, William R. 1967. International Trade Theory: Hume to Ohlin. Random House, New York.

3. Baquet, A.E., A.N. Halter, and Frank S. Conklin. 1976. The value of frost forecasting: A Bayesian appraisal. American Jour. of Agr. Econ. 58(3):511-520.

4. Bennet, Thomas A. 1972. A Review of the Winter Pear Industry. American Farm Bureau Federation.

5. Bonnen, James T. 1973. Implications for agricultural policy. American Jour. of Agr. Econ. 55(3):391-398.

6. Brandow, G.E. 1973. The food price problem. American Jour. of Agr. Econ. 55(3):385-390.

7. _____. 1961. Interrelationships Among Demands for Farm Products and Implications for Control of Market Supply. Pennsylvania Agricultural Experiment Station Bulletin #680. University Park, Pa.

8. Carman, Hoy F. and David E. Kenyon. 1969. Economic Aspects of Producing and Marketing California Apples. California Agricultural Experiment Station. Giannini Foundation of Agricultural Economics. Giannini Foundation Research Report #301.

9. Commonwealth Secretariat. 1972. Fruit. Commonwealth Secretariat, London.

10. Curran, W.R. and I.M. Roberts. 1974. Australian Apples and Pears: Developments Affecting Major Export Markets. Bureau of Agricultural Economics. Australian Government Publishing Service. Canberra.

11. Dean, Gerald W. and Normal R. Collins. 1967. World Trade in Fresh Oranges. California Agricultural Experiment Station. Giannini Foundation of Agricultural Economics, Giannini Foundation Monograph #18.

12. Desmarteau, David. 1975. Progress Report on Non-Tariff Trade Barriers Affecting Speciality Pacific Northwest Agricultural Products. Oregon Department of Agriculture. Agricultural Development Division.

13. Farrell, Kenneth R. (chairman). 1974. U.S. policies for food, agriculture and trade. American Jour. of Agr. Econ. 56(2):351-376.

14. Federal-State Market News Service. Annually, 1956-1974. Marketing California Pears for Fresh Market. Sacramento, California.

15. Federal-State Market News Service. 1976. Personal communication with Hugh E. Myers. Sacramento, California.

16. Food and Agriculture Organization of the United Nations. Annually, 1950-1975. Production Yearbook. Rome.

17. Freebairn, J.W. and Gordon C. Rausser. 1975. Effects of changes in the level of U.S. beef imports. American Jour. of Agr. Econ. 57(4):676-688.

18. French, Ben C. and Jim L. Matthews. 1971. A supply response model for perennial crops. American Jour. of Agr. Econ. 53(3):478-490.

19. Frisch, R. 1959. A complete scheme for computing all direct and cross-demand elasticities in a model with many sectors. Econometrica 27:177-196.

20. George, P.S. and G.A. King. 1971. Consumer Demand for Food Commodities in the United States with Projections for 1980. California Agricultural Experiment Station. Gianni Foundation of Agricultural Economics. Giannini Foundation Monograph #26.

21. Houck, J.P. and J.S. Mann. 1968. An Analysis of Domestic and Foreign Demand for U.S. Soybeans and Soybean Products. University of Minnesota Agricultural Experiment Station Technical Bulletin #256.

22. Houthakker, H.S. and S.P. Magee. 1969. Income and price elasticities in world trade. Review of Econ. and Statistics L1(2):111-125.

23. Hu, Teh-Wei. 1973. Econometrics, An Introductory Analysis. University Park Press. Baltimore.

24. Johnston, J. 1972. Econometric Methods. Second edition. McGraw-Hill, Inc. New York.

25. Kindleberger, Charles P. 1973. International Economics. Fifth Edition. Richard D. Irwin. Homewood, Illinois.

26. Kmenta, Jan. 1971. Elements of Econometrics. The MacMillan Company. New York.

27. Korzan, Gerald E. 1968. Oregon's Food and Fiber Industry. Oregon State University Agricultural Experiment Station Special Report #266.

28. Kreinin, M. 1967. Price elasticities in international trade. Review of Econ. and Statistics XLIX(4):510-516.

29. Labys, Walter C. 1973. Dynamic Commodity Models: Specification, Estimation and Simulation. Lexington Books. D.C. Heath and Co. Lexington, Mass.

30. Leamer, Edward E. and Robert M. Stern. 1970. Quantitative International Economics. Allyn and Bacon. Boston.

31. Linder, S.B. 1961. An Essay on Trade and Transformation. John Wiley and Sons, Inc. New York.

32. Marshall, Alfred. 1879. The Pure Theory of Foreign Trade. Augustus M. Kelley. Sentry Press. New York, 1974.

33. Mayer, Leo V. and Gary L. Seevers. 1974. Food policy issues in the United States. American Jour. of Agr. Econ. 56(2):359-363.

34. Meade, J.E. 1952. A Geometry of International Trade. George Allen and Unwin, Ltd. London.

35. Mill, John Stuart. 1848. Principles of Political Economy with Some of Their Applications to Social Philosophy. Longmans, Green and Co., Ltd. London, 1926.

36. Nerlove, Marc and Kenneth L. Buchman. 1960. The analysis of changes in agricultural supply: Problems and approaches. Journal of Farm Economics 42(3):531-551.

37. Northwest Fresh Bartlett Marketing Committee. Periodically, 1966-1975. Crop Reports. Portland, Oregon.

38. Northwest Horticultural Council. 1973. Report of Survey of European Apple and Pear Production and Marketing. Yakima, Washington.

39. Ohlin, Bertil. 1933. Interregional and International Trade. Harvard University Press. Cambridge, Mass.

40. Organization for Economic Co-operation and Development. 1968. Production, Consumption and Foreign Trade of Fruits and Vegetables in O.E.C.D. Member Countries, Present Situation and 1970 Prospects: Apples. O.E.C.D. Publications. Paris.

41. _____. 1968. Production, Consumption and Foreign Trade of Fruit and Vegetables in O.E.C.D. Member Countries, Present Situation and 1970 Prospects: Pears. O.E.C.D. Publications. Paris.

42. Paarlberg, Don. 1974. The world food situation in perspective. American Jour. of Agr. Econ. 56(2): 351-358.

43. Plaxico, James S. and Daryll E. Ray. 1973. Implications for agricultural economists. American Jour. of Agr. Econ. 55(3):399-403.

44. Pubols, Ben H. 1959. Factors affecting prices of pears. Agricultural Economics Research 6:16-22.

45. Ricardo, David. 1817. On the Principles of Political Economy and Taxation. Cambridge University Press Edition. 1951.

46. Ricks, Donald J. 1964. An Appraisal of Future Economic Conditions Affecting the Pacific Coast Bartlett Pear Industry. Unpublished Ph.D. Thesis. Oregon State University.

47. Roberts, I.M. and A.G. Cuthbertson. 1972. The market for Australian apples in the United Kingdom. Quarterly Review of Agricultural Economics XXV(2): 131-146.

48. Roberts, I.M. and K.C. Dundas. 1972. Markets for Australian fresh pears. Quarterly Review of Agricultural Economics XXV(4):292-306.

49. Schmitz, Andrew and D. Lee Bawden. 1973. The World Wheat Economy: An Empirical Analysis. California Agricultural Experiment Station. Giannini Foundation of Agricultural Economics. Giannini Foundation Monograph #32.

50. Schuh, G. Edward. 1974. The exchange rate and U.S. agriculture. American Jour. of Agr. Econ. 56(1): 1-13.

51. Sindelar, Gilbert E. 1960. A Study of Winter Pear Prices. Talk given at the annual meeting of the Oregon-Washington-California Pear Bureau. Portland, Oregon. May 25, 1960.

52. Smith, Adam. 1776. An Inquiry into the Nature and Causes of the Wealth of Nations. The Modern Library Edition. New York, 1937.

53. Statistics Canada. Information Division. Annually, 1960-1975. Canada Year Book. Canadian Ministry of Industry, Trade and Commerce, Ottawa.

54. Tontz, Robert L. (Chairman). 1966. Foreign market prospects and potentials. Journal of Farm Economics 48:1348-1378.

55. Tweeten, Luther and James Plaxico. 1974. U.S. policies for food and agriculture in an unstable world. American Jour. of Agr. Econ. 56(2):364-371.

56. United Nations Department of Economic and Social Affairs. Statistical Office. Monthly, 1950-1975. Monthly Bulletin of Statistics. New York.

57. United Nations Department of Economic and Social Affairs. Statistical Office. Annually, 1956-1974. Statistical Yearbook. New York.

58. U.S. Department of Agriculture. Annually, 1949-1975. Agricultural Statistics. U.S. Government Printing Office. Washington D.C.

59. U.S. Department of Agriculture. Economic Research Service. 1973. Harvesting, Storing and Packing Apples for the Fresh Market: Regional Practices and Costs. Marketing Research Report #1009. Washington D.C.

60. U.S. Department of Agriculture. Economic Research Service. 1966. The Western Hemisphere Agricultural Situation. Foreign Agriculture Report #154.

61. U.S. Department of Agriculture. Foreign Agricultural Service. Periodically, 1972-1976. Agricultural Trade Policy. U.S. Government Printing Office. Washington D.C.

62. U.S. Department of Agriculture. Foreign Agricultural Service. Periodically, 1949-1976. Foreign Agriculture. U.S. Government Printing Office. Washington D.C.

63. U.S. Department of Agriculture. Foreign Agricultural Service. Periodically, 1950-1974. Foreign Agriculture Circular: Deciduous Fruits. U.S. Government Printing Office. Washington D.C.

64. U.S. Department of Agriculture. Foreign Agricultural Service. Periodically, 1959-1972. Foreign Agriculture Circular: Foreign Agricultural Trade Policy. U.S. Government Printing Office. Washington D.C.

65. U.S. Department of Agriculture. Foreign Agricultural Service. Periodically, 1951-1962. Foreign Crops and Markets. Washington D.C.

66. U.S. Department of Agriculture. Foreign Agricultural Service. 1976. Fresh Apples, Pears and Grapes: Section III - Foreign Systems. Personal communication with Gilbert E. Sindelar, p. 19-50.

67. U.S. Department of Agriculture. Statistical Reporting Service. Crop Reporting Board. 1956. Fruits - Noncitrus. Statistical Bulletin #192. Washington D.C.

68. U.S. Department of Agriculture. Statistical Reporting Service. Crop Reporting Board. 1961. Fruits - Noncitrus. Statistical Bulletin #292.

69. U.S. Department of Agriculture. Statistical Reporting Service. Crop Reporting Board. 1967. Fruits - Noncitrus. Statistical Bulletin #407. Washington D.C.

70. U.S. Department of Agriculture. Statistical Reporting Service. Crop Reporting Board. 1973. Fruits - Noncitrus. Statistical Bulletin #505. Washington D.C.

71. U.S. Department of Agriculture. Statistical Reporting Service. Crop Reporting Board. Annually, 1970-75. Non-citrus Fruits and Nuts Annual. Washington D.C.

72. U.S. Department of Commerce. Bureau of the Census. Periodically, 1947-1975. Current Population Reports: Population Estimates and Projections. U.S. Government Printing Office. Washington D.C.

73. U.S. Department of Commerce. Bureau of the Census. Monthly, 1947-1975. U.S. Exports: Schedule B - Commodity by Country. U.S. Government Printing Office. Washington D.C.

74. U.S. Department of Commerce. Bureau of the Census. Monthly, 1947-1975. U.S. Imports for Consumption and General Imports. U.S. Government Printing Office. Washington D.C.

75. U.S. Department of Commerce. Bureau of Economic Analysis. Monthly, 1970-75. Survey of Current Business. U.S. Government Printing Office. Washington D.C.

76. U.S. Department of Commerce. Office of Business Economics. 1966. The National Income and Product Accounts of the United States, 1929-1965. Supplement to the Survey of Current Business. U.S. Government Printing Office. Washington D.C.

77. U.S. Department of Labor. Bureau of Labor Statistics. 1947-1973. The Consumer Price Index. U.S. Government Printing Office. Washington D.C.

78. Urquhart, M.C. (editor). 1965. Historical Statistics of Canada. Cambridge University Press.

79. Vandenborre, Roger J. 1966. Demand Analysis of the Market for Soybean Oil and Soybean Meal. Journal of Farm Economics 48(4):920-934.

80. Winter Pear Control Committee. Annually, 1948-1975. Annual Statistical Report, Portland, Oregon.

APPENDICES

APPENDIX A

THE DATA

Appendix Table A-1. Prices and sales of U.S. winter pears to Canada, Sweden, Brazil, Europe, South America, the total export market and total sales, on a seasonal basis for the period 1947 to 1974.

Season Beginning	Season Average f.o.b. Price per box[1]	Total Sales[2]	Total Export Sales[2]	Sales to Canada[2]	Sales in Number of Boxes to Sweden	Europe	Brazil	South America
1947	3.051	5,823	592	23	77,308	307,908	79,652	106,330
1948	2.876	4,078	246	0	0	74,204	63,956	100,352
1949	2.709	4,270	328	40	0	33,555	65,864	113,115
1950	3.223	4,272	471	42	49,614	134,062	114,210	133,014
1951	3.564	3,995	527	21	112,609	188,063	114,700	142,552
1952	3.786	4,037	346	70	37,515	39,415	86,925	112,909
1953	3.206	4,740	534	60	58,836	193,095	61,471	99,445
1954	3.763	4,100	301	46	94,185	108,130	9,880	59,537
1955	3.631	4,372	452	65	91,298	235,672	2,370	68,461
1956	4.048	5,125	690	124	153,498	393,353	4,700	71,902
1957	3.839	4,849	1,115	118	291,047	824,290	13,454	88,465
1958	3.673	3,988	581	109	126,513	308,523	400	100,245
1959	4.135	4,457	1,049	129	220,065	692,418	0	99,077
1960	4.332	3,882	627	116	135,530	371,319	0	110,430
1961	4.385	3,506	907	77	233,623	724,275	0	64,925
1962	3.990	4,883	1,002	100	296,329	767,321	0	91,176
1963	4.409	3,486	592	152	125,101	316,745	0	82,450
1964	4.280	3,885	779	131	166,764	493,978	0	87,301
1965	4.042	4,760	1,213	301	226,928	692,393	1,520	114,212
1966	4.267	4,917	829	125	151,168	418,651	77,629	215,264
1967	5.162	4,440	820	157	105,832	403,787	78,421	183,020
1968	6.100	3,766	417	102	93,125	146,761	81,019	135,096
1969	4.719	5,477	714	255	155,648	254,632	105,792	176,105
1970	5.901	3,681	495	159	107,468	184,439	122,551	136,192
1971	5.029	5,857	708	276	155,620	249,438	144,348	178,805

Appendix Table A-1 (continued)

Season Beginning	Season Average f.o.b. Price per box[1]	Total Sales[2]	Total Export Sales[2]	Sales to Canada[2]	Sales in Number of Boxes to Sweden	Europe	Brazil	South America
1972	6.771	4,421	619	215	95,901	189,300	159,466	203,213
1973	6.831	6,312	1,027	322	152,659	324,787	291,354	331,206
1974	6.602	6,680	963	379	131,108	181,683	271,607	333,585

Source: (80)

[1] Compiled from the daily sales reports of shippers' associations in the Medford, Hood River, Yakima and Wenatchee districts.

[2] Sales in 1,000 boxes.

Appendix Table A-2. Estimates of the mid-year population of those foreign countries included in the empirical analysis; 1947 to 1974, in millions.

	Europe								
Year	Austria	Belgium	Denmark	Finland	France	Greece	Ireland	Italy	Netherlands
1947	6.92	8.45	4.15	3.86	40.64	-	2.97	45.66	9.63
1948	6.95	8.56	4.19	3.91	41.04	-	2.98	46.00	9.80
1949	6.94	8.61	4.23	3.96	41.40	7.48	2.98	46.31	9.96
1950	6.94	8.64	4.27	4.01	41.74	7.57	2.97	46.60	10.11
1951	6.93	8.68	4.30	4.05	42.06	7.65	2.96	47.00	10.26
1952	6.95	8.73	4.33	4.09	42.36	7.73	2.95	47.32	10.38
1953	6.96	8.78	4.37	4.14	42.65	7.82	2.95	47.53	10.49
1954	6.97	8.82	4.41	4.19	42.95	7.89	2.94	47.80	10.62
1955	6.97	8.87	4.44	4.24	43.28	7.97	2.92	48.06	10.75
1956	6.95	8.92	4.47	4.28	43.84	8.03	2.90	48.47	10.89
1957	6.97	8.99	4.49	4.32	44.31	8.10	2.88	48.74	11.02
1958	6.99	9.05	4.52	4.36	44.79	8.17	2.85	49.04	11.19
1959	7.01	9.10	4.55	4.39	45.24	8.26	2.85	49.36	11.35
1960	7.05	9.15	4.58	4.43	45.68	8.33	2.83	49.64	11.48
1961	7.09	9.18	4.61	4.47	46.16	8.40	2.81	49.90	11.64
1962	7.13	9.22	4.65	4.51	47.00	8.45	2.83	50.24	11.80
1963	7.17	9.29	4.08	4.54	47.82	8.48	2.85	50.64	11.97
1964	7.22	9.38	4.72	4.58	48.31	8.51	2.86	51.12	12.13
1965	7.25	9.46	4.76	4.56	48.76	8.55	2.88	41.99	12.29
1966	7.29	9.53	4.80	4.58	49.16	8.61	2.88	52.33	12.45
1967	7.32	9.58	4.84	4.61	49.55	8.72	2.90	52.67	12.60
1968	7.35	9.62	4.86	4.63	49.91	8.74	2.91	52.99	12.72
1969	7.37	9.65	4.89	4.62	50.32	8.77	2.93	53.33	12.87
1970	7.39	9.66	4.93	4.61	50.77	8.79	2.95	53.66	13.03
1971	7.46	9.67	4.96	4.62	51.25	8.83	2.98	54.01	13.19
1972	7.49	9.71	4.99	4.64	51.70	8.89	3.01	54.41	13.33
1973	7.53	9.76	5.02	4.66	52.13	8.93	3.03	54.90	13.44
1974	7.53	9.80	5.05	4.68	52.51	8.96	3.09	55.36	13.54

Appendix Table A-2 (continued)

Year	Europe (continued)							
	Norway	Portugal	Spain	Sweden	Switzerland	U.K.	W.G.	Yugoslavia
1947	3.16	8.19	27.22	6.80	4.82	49.53	46.94	15.68
1948	3.20	8.26	27.44	6.88	4.58	50.03	48.30	15.90
1949	3.23	8.33	27.65	6.96	4.64	50.72	49.19	16.13
1950	3.26	8.41	27.87	7.01	4.69	50.33	49.99	16.35
1951	3.30	8.48	28.09	7.07	4.75	50.30	50.53	16.59
1952	3.33	8.55	28.31	7.13	4.82	50.44	50.84	16.80
1953	3.36	8.62	28.53	7.17	4.88	50.61	51.38	17.05
1954	3.39	8.69	28.75	7.21	4.93	50.78	51.87	17.32
1955	3.43	8.76	28.98	7.26	4.98	50.97	52.36	17.59
1956	3.46	8.65	29.30	7.32	5.05	51.41	52.99	17.69
1957	3.47	8.68	29.55	7.36	5.13	51.63	53.65	17.86
1958	3.52	8.73	29.80	7.41	5.20	51.84	54.28	18.02
1959	3.55	8.78	30.05	7.45	5.26	52.13	54.88	18.21
1960	3.58	8.83	30.30	7.48	5.36	52.35	55.42	18.40
1961	3.61	8.89	30.56	7.52	5.50	52.82	56.23	18.61
1962	3.64	8.97	30.82	7.56	5.66	53.34	56.95	18.84
1963	3.67	9.04	31.07	7.60	5.77	53.68	57.61	19.07
1964	3.69	9.11	31.34	7.66	5.87	54.07	58.29	19.28
1965	3.72	9.20	32.06	7.73	5.86	54.18	59.04	19.43
1966	3.75	9.30	32.39	7.81	5.92	54.45	59.68	19.64
1967	3.79	9.38	32.73	7.87	5.99	54.75	59.87	19.84
1968	3.82	9.46	33.08	7.91	6.07	55.05	60.17	20.03
1969	3.85	8.75	33.43	7.97	6.14	55.27	60.84	20.21
1970	3.88	8.66	33.78	8.04	6.19	55.41	60.65	20.37
1971	3.90	8.63	34.13	8.10	6.23	55.61	61.29	20.57
1972	3.93	8.59	34.49	8.12	6.39	55.80	61.67	20.77
1973	3.96	8.56	34.86	8.14	6.43	55.93	61.97	20.96
1974	3.99	8.74	35.22	8.16	6.48	55.97	62.04	21.16

Appendix Table A-2 (continued)

Year	South America				Canada
	Argentina	Brazil	Chile	Venezuela	
1947	15.94	48.44	5.75	4.55	12.89
1948	16.31	49.59	5.85	4.69	13.17
1949	16.74	50.77	5.96	4.83	31.45
1950	17.19	51.98	6.07	4.97	13.71
1951	17.63	53.21	6.18	5.13	14.01
1952	18.04	54.48	6.19	5.28	14.46
1953	18.27	55.77	6.44	5.44	14.84
1954	18.61	57.10	6.60	5.61	15.29
1955	18.97	58.46	6.76	5.78	15.70
1956	19.32	61.98	6.94	6.39	16.12
1957	19.69	63.83	7.12	6.64	16.68
1958	20.06	65.74	7.32	6.88	17.12
1959	20.41	67.70	7.48	7.12	17.52
1960	20.67	69.73	7.69	7.35	17.91
1961	21.01	71.81	7.81	7.61	18.27
1962	21.35	73.95	8.03	7.87	18.60
1963	21.69	76.16	8.22	8.14	18.92
1964	22.02	78.43	8.39	8.43	19.27
1965	22.18	81.01	8.51	8.71	19.60
1966	22.49	83.34	8.68	9.01	20.05
1967	22.80	85.95	8.85	9.31	20.41
1968	23.11	88.22	9.03	9.62	20.73
1969	23.43	90.77	9.20	9.94	21.03
1970	23.75	93.32	9.36	10.28	21.32
1971	24.07	95.99	9.54	10.61	21.60
1972	24.39	98.69	9.72	10.94	21.85
1973	24.72	101.43	9.81	11.28	22.13
1974	25.05	104.24	10.08	11.63	22.40

Source: (56)

Appendix Table A-3. Production of pears in foreign countries, annually, 1947-1974 in thousands of metric tons.

	Europe								
Year	Austria*	Belgium	Denmark	France*	Greece	Italy	Netherlands	Norway	Portugal
1947	43	150	20	148	28	251	136	3	--
1948	27	105	27	105	22	215	71	7	20
1949	31	250	26	149	41	343	183	2	40
1950	49	125	29	143	19	303	105	10	--
1951	39	100	24	123	32	368	88	6	--
1952	41	250	24	177	35	397	172	7	38
1953	33	250	15	153	40	412	138	4	32
1954	36	200	26	148	39	352	152	7	28
1955	46	180	16	188	29	489	104	9	35
1956	40	140	27	173	43	440	98	7	13
1957	22	50	17	129	55	356	40	7	43
1958	118	125	22	223	38	515	134	11	20
1959	28	66	15	176	58	581	128	8	37
1960	93	65	31	278	68	622	134	16	51
1961	65	55	11	256	113	791	120	5	50
1962	78	52	11	309	95	875	92	9	42
1963	59	50	8	324	94	962	110	7	58
1964	68	70	11	331	107	1,081	144	6	48
1965	44	45	9	314	92	962	80	8	62
1966	54	30	101	331	108	1,590	116	9	43
1967	56	50	11	362	123	1,317	72	5	22
1968	61	100	14	446	131	1,395	180	12	69
1969	55	60	11	452	104	1,634	90	12	55
1970	54	100	15	484	122	1,906	100	10	56
1971	48	60	11	531	116	1,705	110	8	41
1972	26	51	12	418	128	1,538	95	13	57
1973	53	30	10	474	125	1,570	55	5	60
1974	53	78	10	386	92	1,430	105	10	41

Appendix Table A-3 (continued)

Year	Europe (continued)						South America	Canada
	Spain	Sweden	Switzerland*	U.K.*	W.G.	Yugoslavia		
1947	45	18	19	39	297	70	77	22
1948	60	21	10	32	142	69	118	18
1949	68	40	11	40	271	64	120	24
1950	70	21	20	23	584	42	160	20
1951	80	33	10	31	266	107	140	28
1952	72	36	15	47	543	62	130	30
1953	77	27	14	36	445	98	100	33
1954	76	43	11	35	403	48	140	29
1955	78	24	16	51	360	56	140	34
1956	96	60	22	63	328	40	150	32
1957	105	25	10	43	123	60	160	25
1958	108	24	55	78	683	87	150	34
1959	92	18	29	65	242	86	160	29
1960	92	32	40	69	646	68	131	36
1961	125	11	40	52	360	93	171	33
1962	124	18	40	53	471	101	158	39
1963	158	13	35	66	415	80	171	38
1964	159	18	40	70	476	96	154	45
1965	169	15	20	71	278	40	146	24
1966	175	12	40	37	338	84	210	47
1967	119	19	40	24	393	87	204	40
1968	226	19	48	77	600	99	198	38
1969	276	11	45	62	381	111	193	24
1970	240	23	45	76	542	112	188	37
1971	418	15	28	69	414	112	205	43
1972	457	22	23	49	344	91	130	41
1973	471	16	41	44	414	141	208	30
1974	452	20	29	48	332	93	198	40

*Dessert and cooking varieties only. Source: (16)

1/ Most of the production is harvested in the hear following that shown; for example, the production of pears of 77,000 metric tons in 1947 is that harvested in the South American harvest season of December 1947 to April 1948.

Appendix Table A-4. National income at market prices of selected countries in Europe and South America, 1947 to 1974. Source: (56)

	Europe						South America	
Year	Finland mill. Markka	Ireland mill. Pounds	Norway mill. Krone	Sweden mill. Krona	U.K. mill. Pounds	W.G. mill. DM	Brazil mill. new Cruzeiro	Venezuela mill. Bolivar
1947	2,230	318	10,977	24,060	9,336	62,300	140	--
1948	3,055	334	11,890	23,621	9,605	52,000	158	--
1949	3,213	352	11,362	28,030	10,466	64,500	180	7,080
1950	4,130	337	12,632	26,758	10,710	74,510	213	8,607
1951	6,125	358	15,308	32,826	11,720	90,300	253	9,547
1952	6,102	393	16,274	36,207	12,686	103,770	293	10,236
1953	6,130	428	16,524	36,469	13,609	112,130	357	10,903
1954	6,796	430	17,863	38,891	14,447	121,080	451	12,154
1955	7,678	448	18,914	41,626	15,360	139,460	573	13,057
1956	8,654	444	21,395	45,122	16,753	154,370	727	14,712
1957	9,033	458	22,567	49,500	17,900	168,290	868	16,782
1958	9,613	473	21,926	51,600	18,600	180,140	1,190	18,279
1959	10,175	502	23,087	54,700	19,600	193,973	1,400	19,742
1960	14,200	618	28,000	65,100	23,600	276,600	2,600	21,200
1961	15,760	664	30,569	71,000	25,145	303,300	3,800	22,131
1962	16,907	713	33,046	77,000	26,379	326,600	6,200	23,945
1963	18,400	763	35,700	82,600	28,100	346,800	11,300	26,400
1964	21,184	867	39,709	93,000	30,572	379,700	21,800	29,363
1965	23,242	927	43,893	102,300	32,831	414,200	34,600	31,222
1966	25,060	974	47,755	111,300	34,878	440,000	50,600	32,627
1967	27,200	1,062	51,200	119,600	36,800	441,700	67,200	34,500
1968	30,800	1,199	54,300	126,900	39,600	482,600	94,000	37,300
1969	34,800	1,371	59,300	138,500	42,200	541,300	125,300	39,100
1970	38,700	1,537	68,000	154,300	46,200	610,800	194,500	44,200
1971	42,600	1,748	75,900	165,400	51,300	676,800	258,200	47,800
1972	49,200	2,075	83,700	179,100	56,800	740,400	338,000	53,300
1973	59,700	2,491	94,900	197,300	64,300	823,800	449,500	63,900
1974	73,600	2,698	108,600	222,900	--	878,300	--	102,300

Appendix Table A-5. Indices of consumer prices in Canada and in selected countries in Europe and South America, 1947 to 1975.

Year	Europe						South America		
	Finland	Ireland	Norway	Sweden	U.K.	W.G.	Brazil	Venezuela	Canada
1947	35	60	55	54	55	66	3	72	66
1948	43	62	55	56	58	76	4	78	75
1949	46	62	55	57	59	81	3	85	77
1950	57	63	58	58	60	76	4	86	80
1951	63	67	67	67	67	82	4	92	88
1952	66	74	73	72	73	84	5	93	90
1953	67	78	75	73	75	82	6	92	89
1954	67	78	78	74	76	82	7	92	90
1955	65	80	79	76	79	84	9	92	90
1956	72	83	82	80	84	85	10	93	91
1957	80	87	84	83	87	87	13	90	94
1958	86	91	88	87	90	89	15	95	97
1959	87	91	90	87	90	90	20	99	98
1960	90	91	90	91	91	96	27	97	99
1961	91	94	93	93	94	94	38	100	100
1962	95	98	98	97	98	97	58	99	101
1963	100	100	100	100	100	100	100	100	103
1964	110	107	106	103	103	102	187	102	105
1965	116	112	110	109	108	106	302	104	107
1966	120	115	114	116	112	110	443	106	111
1967	127	119	119	120	115	111	574	106	115
1968	139	125	123	123	121	113	714	107	120
1969	142	134	127	126	127	116	879	110	125
1970	146	145	140	135	135	120	1,047	112	130
1971	155	158	149	145	148	127	1,268	116	133
1972	167	172	160	154	159	134	1,405	120	140
1973	186	191	171	164	173	143	1,623	124	150
1974	219	224	187	180	200	152	2,027	134	167
1975	258	263	205	198	-	163	-	-	185

Sources: (56) and (53, 1972)

Appendix Table A-6. Rates of currency exchange; units of national currency per U.S. dollar, December 31st estimates of the mid-point rate for Canada and selected countries in Europe and South America, 1947-1974.

	Europe					South America		
Year	Finland	Norway	Sweden	U.K. and Ireland	West Germany	Brazil	Venezuela	Canada
1947	1.35	4.96	3.59	.2481	3.33	.0265	3.35	1.0000
1948	1.35	4.96	3.59	.2481	3.33	.0265	3.35	1.0025
1949	2.30	7.14	5.17	.3571	4.25	.0307	3.35	1.0825
1950	2.30	7.14	5.17	.3571	4.20	.0320	3.35	1.0605
1951	2.30	7.14	5.17	.3571	4.20	.0300	3.35	1.0770
1952	2.30	7.14	5.17	.3571	4.20	.0365	3.35	.9710
1953	2.30	7.14	5.17	.3571	4.20	.0550	3.35	.9740
1954	2.31	7.15	5.18	.3591	4.20	.0760	3.35	.9660
1955	2.31	7.15	5.18	.3567	4.21	.0670	3.35	.9990
1956	2.31	7.15	5.18	.3591	4.20	.0660	3.35	.9600
1957	3.21	7.15	5.18	.3560	4.20	.0910	3.35	.9850
1958	3.20	7.15	5.18	.3569	4.18	.1390	3.35	.9640
1959	3.20	7.16	5.18	.3572	4.17	.2040	3.35	.9530
1960	3.20	7.15	5.18	.3567	4.17	.2050	3.35	.9960
1961	3.22	7.14	5.18	.3562	4.00	.3190	3.35	1.0430
1962	3.20	7.14	5.19	.3568	4.00	.4750	3.35	1.0778
1963	3.20	7.14	5.20	.3578	3.97	.6200	3.35	1.0809
1964	3.20	7.14	5.15	.3584	3.98	1.850	4.50	1.0741
1965	3.20	7.14	5.18	.3568	4.01	2.220	4.50	1.0750
1966	3.20	7.14	5.18	.3584	3.99	2.220	4.50	1.0838
1967	4.20	7.15	5.16	.4156	4.00	2.715	4.51	1.0806
1968	4.20	7.15	5.18	.4194	4.00	3.830	4.50	1.0728
1969	4.20	7.15	5.17	.4165	3.69	4.350	4.50	1.0728
1970	4.20	7.14	5.17	.4178	3.65	4.950	4.50	1.0112
1971	4.15	6.71	4.86	.3918	3.27	5.635	4.40	1.0022
1972	4.18	6.64	4.74	.4259	3.20	6.215	4.40	.9956
1973	3.85	5.73	4.59	.4304	2.70	6.220	4.30	.9958
1974	3.55	5.21	4.08	.4655	2.81	7.435	4.28	.9912

Source: (56)

Appendix Table A-7. Additional U.S. and Canadian data, 1947-1975.

Year	1/ Personal Disposable income, U.S. (millions of current dollars)	2/ U.S. Consumer Price Index (1967=100)	3/ U.S. Population on July 1st (thousands)	4/ Production of Delicious, Golden Delicious, and McIntosh Varieties of apples in U.S (million pounds)	5/ U.S. Imports of Fresh Pears in the Jan.-May period (1000 pounds)	6/ Calif. Bartletts Cold Storage Holdings on Oct. 1 (number of packed standard boxes)	7/ Imports into Canada Imports of Pears from Countries other than the U.S. (1000 bushels)	8/ Canadian Personal Disposable Income (millions of current dollars)
1947	169,833	66.9	144,698	1,782.3	-	17,628	-	9,584
1948	189,138	72.1	147,208	1,412.0	920	91,500	-	11,079
1949	188,585	71.4	149,767	2,204.2	14,276	15,679	119	11,849
1950	206,940	72.1	152,271	2,129.6	9,064	11,599	358	12,688
1951	226,583	77.8	154,878	1,655.6	8,632	171,255	179	14,794
1952	238,312	79.5	157,533	1,524.9	11,705	105,517	383	16,072
1953	252,564	80.1	160,184	1,789.3	10,420	157,344	348	16,904
1954	257,445	80.5	163,026	1,857.0	2,705	99,446	459	16,984
1955	275,348	80.2	165,931	2,012.3	5,487	58,500	395	18,329
1956	293,179	81.4	168,903	1,670.9	11,381	273,550	471	20,153
1957	308,524	84.3	171,984	2,325.5	10,376	229,330	560	21,274
1958	318,826	86.6	174,882	2,519.8	11,901	187,980	462	22,880
1959	337,315	87.3	177,830	2,338.4	10,796	96,900	694	23,948
1960	350,044	88.7	180,671	2,066.6	12,125	183,890	536	25,075
1961	364,424	89.6	183,691	2,313.3	5,426	205,620	497	26,011
1962	385,267	90.6	186,538	2,494.6	12,763	241,200	547	28,243
1963	404,604	91.7	189,242	2,772.2	10,806	92,740	301	30,018
1964	436.575	92.9	191,889	2,862.2	13,391	255,960	500	31,725
1965	469.092	94.5	194,303	2,936.2	6,649	2,860	596	35,149
1966	511,600	97.2	196,500	2,908.5	5,365	41,540	721	38,579
1967	546.300	100.0	198,712	2,791.5	9,354	64,200	371	42,792
1968	591,000	104.2	200,706	2,677.2	19,093	14,130	592	46,427
1969	634,200	109.8	202,677	3,632.3	26,609	165,290	1,193	50,911
1970	691,700	116.3	204,878	3,342.4	12,027	91,880	772	54,009
1971	746,000	121.3	207,053	3,360.5	30,641	266,660	809	59,482
1972	802,500	125.3	208,846	3,308.4	12,396	82,720	1,046	66,740
1973	903,700	133.1	210,410	3,637.1	22,521	148,689	1,310	75,977
1974	979.700	147.7	211,894	3,901.2	7,625	121,479	-	-
1975	-	-	-	-	10,572	-	-	-

1/ Sources: (75, 76)
2/ Source (77)
3/ Source: (72)
4/ Sources: (67, 68, 69, 70, 71)
5/ Source: (74)
6/ Source: (15)
7/ Sources: (58, 73)
8/ Sources: (53, 78)

APPENDIX B

The Derivation of Regional Indices

In comparing price levels, incomes and exchange rates between countries in Europe, South America and in the total export area, in order to obtain regional estimates of these variables, the following procedure was used:

1. The more important countries in each of the regions were identified by comparing average volumes of their imports of U.S. winter pears as published in the annual reports of the Winter Pear Control Committee (80). Those countries which averaged significant levels of imports of U.S. winter pears during the 1947/48-1974/75 period are identified in Appendix Table B-1. The countries chosen to represent Europe are Finland, Norway, Sweden, the United Kingdon, West Germany and Ireland. The Netherlands and Belgium were excluded because they are important Entrepot countries, so their relative domestic importance is probably much less than that shown. France was excluded because it has a low average level of imports and has not, apparently, imported U.S. winter pears since the 1965/66 season. The six countries chosen were the largest European importers of U.S. winter pears during the last decade (Table 4).

Appendix Table B-1. Weights used in the calculation of regional indices.

Country or Region	Average Import Volumes of U.S. Winter Pears 1947/48-1974/75 1000 boxes	Weights Used in the Calculation of Aggregate Variables for:		
		Europe	South America	Total Exports
Finland	21	.076		
Norway	34	.119		
Sweden	130	.463		
United Kingdom	65	.230		
West Germany	19	.068		
Ireland	12	.044		
France	7			
Belgium	13			
Netherlands	21			
Europe	330			.553
Canada	133			.223
South America	134			.224
Venezuela	53		.432	
Brazil	70		.568	

2. Weights were assigned to each of the chosen countries according to each country's average import volume of U.S. winter pears during the 1947/48-1974/75 period (Appendix Table B-1).

3. Aggregate estimates for real national income, population (for use as the divisor for quantity of export sales of U.S. winter pears), the general price level, and currency exchange rates were computed on a regional basis, as follows.

Procedure for the Computation of an index of real National Income in Europe:

a. Estimates of per capita National Income in Market Prices for each of the six countries were computed by dividing estimates of annual National Income for each country by the mid-year estimates of population.

b. Estimates of real per capita National Income for each country for each year were computed by dividing the Consumer Price Index into per capita National Income in Market Prices.

c. The estimates of real per capita National Income were converted to a crop-year basis by interpolation.

d. Index numbers of the estimates of real per capita National Income on a crop-year basis were computed using a common base year for all of the six countries.

e. An aggregate index of European real per capita National Income on a crop-year basis was constructed by weighting the indices of individual countries according to their importance in the market.

A similar procedure was used to compute other aggregate variables for the European region. An aggregate weighted population estimate for Europe was derived by utilizing the mid-year estimates of population and following steps c. to e. above. An aggregate weighted exchange rate estimate was computed by taking the December 31st mid-point rates and following steps d. and e. above. An aggregate weighted estimate of the general price level in Europe was computed by the annual Consumer Price Index for each country (1963 = 100) and following steps c. and e. above.

Regional estimates for South America and total exports were computed exactly as above. Weights for Brazil and Venezuela (the two important U.S. winter pear importing countries in South America) are presented in Appendix Table B-1. The total export region was divided up into the three important sub-regions of Europe, Canada, and South America, as indicated in Appendix Table B-1.