A DEMAND ANALYSIS OF CANADIAN OILSEEDS IN THE JAPANESE MARKET

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ABSTRACT

A Demand Analysis of Canadian Oilseeds
in the Japanese Market

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As the largest single market for Canadian oilseeds, the Japanese oilseed market is of major interest to producers and exporters who are dependent on this outlet for the financial returns which it provides. In order that producers may make rational decisions about the volume of oilseeds which they should produce, it is necessary that some information regarding the market be available. In order that exporters recognize the factors which determine Japanese oilseed import requirements and Canadian oilseed export supplies, it is essential that information be provided on these factors governing Japanese import demand and Canadian export supply. This study is basically an anlysis of these factors. A method of regression analysis is used to estimate Japanese import demand and Canadian export supply of rapeseed and flaxseed.

This study was constructed in order to determine to what extent the price of Canadian oilseeds, the price of U.S. soybeans, the level of Japanese domestic oilseed production and the cost of transportation determine the volume of Canadian oilseed which the Japanese import. This study also considers the degree to which Canadian oilseed stocks in store, the Japanese import quota, Canadian exports of oilseeds to countries other than Japan and Canadian oilseed prices determine the supply of Canadian oilseeds available to Japanese importers and crushers. The necessity of obtaining the most accurate estimates possible required analysing those years for which exports of Canadian oilseeds to Japan moved on a regular basis. In the case of flaxseed, the years 1958 through 1968 were analysed and in the case of rapeseed, the years 1963 through 1968 were analysed.

The major results of the study are as follows:

1. The two most important factors affecting the Japanese demand for Canadian oilseed are the prices of Canadian flaxseed and rapeseed and the level of Japanese domestic production of these oilseeds. Decreased production in Japanese rapeseed and flaxseed and decreased prices in Canadian oilseeds are estimated to result in increased imports of Canadian flaxseed and rapeseed.
2. The cross elasticity of demand of soybeans for rapeseed indicates that a 1.89 percent increase in the amount of

rapeseed demanded results from a one percent increase in the price of soybeans. The same measure for flaxseed indicates that a 0.86 percent increase in the amount of flaxseed demanded results from a one percent increase in the price of soybeans.

3. With respect to rapeseed, the two most important factors governing the supplies of Canadian rapeseed to the Japanese market are; (1) the Japanese rapeseed import quota, and (2) the rapeseed stocks in store in Canada. Results indicate that both rapeseed stocks in store and the Japanese import quota were positively related to the quantity of rapeseed supplied to Japan by Canada during the period analysed. A one percent increase in the Japanese import quota resulted in a 0.71 percent increase in the amount of rapeseed supplied to Japan by Canadian exporters. A one percent increase in rapeseed stocks in store was associated with 0.48 percent increase in rapeseed supplied to Japan. In the flaxseed supply estimate, a one percent increase in the flaxseed stocks in store was associated with a 0.16 percent increase in the flaxseed supplied to Japan.

4. In both the rapeseed and flaxseed estimates of supply, the exports of oilseeds to countries other than Japan were negatively associated with exports to Japan. In the case of rapeseed, a one percent increase in exports to other

countries was associated with a 0.098 percent decrease in exports to Japan. In the flaxseed estimate, a one percent increase in flaxseed exports to countries other than Japan was associated with a 0.12 percent decrease in exports to Japan.

CHAPTER I

INTRODUCTION

(A) ISSUES TO BE EXAMINED

The Japanese market for Canadian oilseeds is of timely interest to the Western Canadian agricultural community. In 1968 this market accounted for some 40 million dollars in Western Canadian farm income.[1] Japan has become Canada's largest market for oilseeds, accounting for 75 percent of all exported rapeseed and 35 percent of all exported flaxseed.[2] It is, therefore, fitting to investigate empirically the market factors which affect supply and demand in the Canada-Japan oilseed trade in order that policy decisions, consistent with maintaining our prime position in this market, can be made. Specifically, the question to be pursued is whether we can maintain, and in fact enhance, our position solely on the basis of either a pricing policy or a merchandising policy, or some consistent combination of the two.

The Japanese oils and fats industry derives its supply of raw materials from two sources: (1) limited domestic

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[1]Dominion Bureau of Statistics, Exports By Commodity, Vol. 25 - No. 12, Catalogue Number 65-004, Ottawa, Canada, The Queen's Printer, February 1969, p. 81.

[2]Ibid.

production of soybeans, rapeseed and flaxseed, and (2) imports from numerous different countries. The imported sources are by far the most important in this market, amounting to some 4 million metric tons in 1968 worth approximately half a billion dollars.[3] Though the number of countries supplying the Japanese market is large, there exists a distinct group of major suppliers to the market which is limited in number. This group in the main is composed of the United States, China and Canada who together supply about 80 percent of the import market by value. In 1968, the United States supplied approximately 57 percent of the market, China supplied 13 percent and Canada supplied 10 percent.

An important characteristic of the supply of the oilseeds, oils and fats market in Japan is that it is dominated by a differentiated oligopoly.[4] Numerous suppliers compete in this market, but the majority of the commodity flow into Japan is derived from three countries, namely, the United States, China and Canada. Although the commodities which these countries supply are similar in many respects, they are

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[3]The Japan Oil and Fat Importers and Exporters Association, Statistics for 1968 of Oilseeds, Oils and Oilcakes, Tokyo, Japan (Mimeo), 1969, p. 5.

[4]The conclusion drawn here is not only based on the observation of a few major suppliers, but also on the mutual interdependence of their competitive actions. The type of competition alluded to here offers unique policy implications which are discussed more fully in the theoretical framework of this market.

substitutable only to a certain degree. This degree of substitutability is derived not only from the physical attributes of the imports, but also from the use which is made of the product, the degree of acceptability by the processors, and even the characteristics of the supply market. The implications of this are discussed in the concluding chapter in the light of results gained through an examination of those factors which determine Canada's position in the Japanese oilseed import market.

Expansion of market outlets for Canadian oilseeds is of major interest not only to the Canadian farmer, but to all those engaged in the formulation of agricultural policy. The basic interest is supported by the desire for an alternative crop to wheat which has historically dominated production in Western Canadian agriculture. The world wheat surpluses have severely limited the export market potential of Canadian wheat and have stimulated diversification into such crops as flaxseed and rapeseed. It appears that rapeseed has offered more potential for expansion in production than flaxseed. Views held by policymakers are reflected in such typical statements as the following:

> From a production point of view, this crop [rapeseed] has been grown primarily because of the relatively more favorable delivery quotas, the possible higher returns as opposed to cereals, the ease with which it can fit into most acceptable crop rotations, and the better

potential of this crop over cereals as a late seeded crop.[5]

With so rapid a rate of growth, rapeseed may well become an even more important crop in the future and will assist in providing alternatives to wheat production. Certainly the prospects are brighter than for wheat. But to enable this growth to take place, substantially greater research and promotion appear to be required. Assuming this, rapeseed production could occupy up to 3 million acres or more by 1980.[6]

In contrast to rapeseed, flaxseed production has declined substantially in recent years. Acreage declined from a peak of 3.4 million acres in 1957-58 (a year of record wheat surpluses), to 1.5 million acres in 1968-69. Yields are lower than for rapeseed, and prices only slightly higher, so that gross returns per acre are only comparable rather than higher than for feed grains.[7]

Almost all Canadian flaxseed is exported, with domestic utilization small and not increasing. The principle competition in export markets is flaxseed from the United States. The major revenue earner is linseed oil which is facing substitution in industrial uses from synthetics. In production, flaxseed is being replaced to some extent by other cash crops such as mustard seed and rapeseed.[8]

During recent years, much emphasis has also gone into the development of marketing programs, especially for rapeseed. In March 1967, The Rapeseed Association of Canada was set up in order to assist in the development of coordinated programs

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[5]Federal Task Force on Agriculture, Wheat, Feed Grains and Oilseeds, a paper submitted to the Canadian Agricultural Congress, Ottawa, (Mimeo), March 24-27, 1969, p. 19.

[6]Ibid., p. 21.

[7]Ibid.

[8]Ibid.

in research, production and market development. One of the prime efforts of this organization has been to increase the returns to Western Canadian farmers from expanded export sales, especially to the Japanese market. Since Canada supplies virtually all of the import requirements of rapeseed and flaxseed to Japan and is a major member of the group of countries which supplies Japan with the necessary oilseed imports, the attempt to maximize returns from this market must recognize certain possible outcomes. Although direct price cuts by exporters are not possible in the system of the oilseed pricing mechanism in Canada, any attempts by exporters to lower prices through specific contracts with the Japanese may be met with retaliatory price cuts from other suppliers to the Japan market. Such price cuts, therefore, may not result in an increased share of the market and could serve as a disincentive to growers of Canadian oilseeds and thus threaten the supply and the very ability to meet the Japanese requirements. In the case of rapeseed, the quota restriction on imports which Japan maintains would limit the effectiveness of price cuts to increase the market share.

In any event, it is reasonable to assume that the attempt by Canadian rapeseed and flaxseed exporters to gain an increased proportion of the Japanese oilseed import market, whether through pricing or merchandising policies, will be countered by some form of opposition. Each supplier who

wishes to maintain his share of the market would remain ready to defend his share by following any price decrease tactics of Canadian suppliers.[9]

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[9]Canadian oilseeds have close substitutes in the Japanese market, and if exporters should lower their prices, and prices charged by other suppliers remained unchanged, Canadian oilseeds would command a larger share of the market. If, however, the Canadian oilseed prices rose independently of other prices, exports of flaxseed and rapeseed would fall off as the Japanese shifted to cheaper substitutes. This mechanism in itself is evidence of the existence of the kinked demand curve. In the upper price ranges, demand is more sensitive to independent price changes, and in the lower reaches demand elasticity is less.

(B) SCOPE AND OBJECTIVES

As the situation exists at the present, the pattern of production in Western Canadian agriculture is undergoing certain changes which have been made necessary by changing world markets. The decreasing trend in wheat acreage has stimulated expansion in oilseed acreage. Rapeseed, because of its expanding markets, both domestic and export, has exhibited the greatest acreage expansion. Flaxseed has tended to decrease somewhat in importance due to the erosion of its markets by synthetic replacements, but is still favored by producers because of the immediate cash return it offers. Mustard seed, an oilseed crop that has also served as an alternative to traditional prairie grains, has seen some acreage expansion, but has not played as important a role as have rapeseed and flaxseed in the Japanese market. Canadian rapeseed and flaxseed, however, have been well accepted in the Japan oilseed crushing industry. In 1968, sales of flaxseed to Japan amounted to 13 million dollars and sales of rapeseed to Japan amounted to 24.6 million dollars while mustard seed sales amounted to 1.3 million dollars.[10]

In planning any further acreage expansion, it is necessary that producers are aware of the market potential

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[10]Dominion Bureau of Statistics, Exports By Commodity, Vol. 25 - No. 12, Catalogue Number 65-004, Ottawa, Canada, The Queen's Printer, February 1969, p. 81.

for their product. Since Japan is Canada's major export market for rapeseed and flaxseed, it is necessary that the major factors pertaining to the supply-demand situation in this market are delineated before any effective policy decisions are made.[11] On the basis of such information, then, specific policies with respect to production and market development can be implemented.

Some of the basic questions to which producers and exporters seek answers concern both the demand and supply sectors of the market. Specifically:

1) What factors in the Japanese market influence the demand for Canadian rapeseed and flaxseed?
2) What factors regulate the flow of supplies of rapeseed and flaxseed from Canada to Japan?
3) What direction should market development follow; should oilseed exporters engage strictly in either pricing or merchandising policies?
4) What trend can the Canadian producers expect the Japanese oilseed import market to follow?

Answers to these questions would provide direction for producers in their decisions to expand or contract oilseed acreage in Western Canada.

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[11] A logical distinction should be drawn here between selling and marketing. Selling pertains to the search for consumers of goods which have already been produced. Marketing is an integrated program of coordinating production with the determined consumer demand. Marketing, therefore, includes the act of selling.

These questions are not original nor are they a complete list of those in which producers and exporters are vitally interested. These areas have been investigated previously. In 1964, a trade mission representing the oilseeds industry of Canada visited Japan.[12] The mission was fact-finding and trade-promotional in nature with the following objectives[13]:

a) To explore the opportunities for current and long-term marketing of Canadian oilseeds in Japan.

b) To become acquainted with the market preferences, the measure of competition from other exporting countries and with the production, purchasing, handling and processing methods used in Japan.

c) To stimulate interest in Japan for Canadian oilseeds.

The following quote is an excerpt from the findings of that mission[14]:

> The Trade Mission has concluded that Japan will remain an important and growing market for Canadian flaxseed which is used for industrial purposes.
>
> Canada has been virtually the sole supplier of rapeseed to Japan in recent years and with careful development of the market, trade in rapeseed could be increased considerably.

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[12] Department of Trade and Commerce, Report on the Canadian Oilseeds Trade Mission to Japan, April 18 - May 3, 1964, Ottawa, Canada, (Mimeo), May, 1964.

[13] Ibid., p. 2.

[14] Ibid., pp. 2-3.

> ..... Japan's requirement of linseed oil is expected to increase only slightly in the foreseeable future. Canadian exports of flaxseed to Japan can therefore be expected to remain at about the same level. At present Canada supplies virtually all of Japan's requirements of flaxseed. Concern over price fluctuations and over the lack of price stability and assurance of constant supply in imported oilseeds was expressed in various segments of the Japanese oilseed industry.

In 1968, the Rapeseed Association of Canada sponsored a trade development mission to Japan[15], the main objective of which was to evaluate the prospects for increasing Canadian exports of rapeseed to Japan. More specifically, the mission investigated the following areas[16]:

1) The use of rapeseed meal as an ingredient in animal feed.

2) The present high duty on rapeseed entering Japan.

3) The quota system governing imports of rapeseed entering Japan.

Briefly, the conclusions of the mission on the specific areas of investigation were as follows[17]:

1) Rapeseed Meal

> It is the view of the mission that positive steps should be taken by the Rapeseed Association of Canada to develop more effective communication between the rapeseed industry in Canada and the industry in Japan.
>
> Views expressed by representatives of the industry in Japan emphasized the need to develop new uses for rapeseed meal and there was fairly general agreement that the use of rapeseed meal as an animal feed held the most promise.

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[15] Rapeseed Association of Canada, Report on the Rapeseed Mission to Japan, May 25 - June 9, 1968, Winnipeg Manitoba, (Mimeo), June, 1968.

[16] Ibid., p. 3.

[17] Ibid., p. 5.

2) Import Duties

> The mission is of the opinion that there exists in Japan at this time a favourable climate for at least sympathetic consideration of changes in the tariff structure.

3) Import Quotas

> There was an expression of opinion that priority should be given to encouraging the use of rapeseed meal as an animal feed since any success in this area would probably result in greater demand for Canadian rapeseed and ultimately in raising import quotas.

As is evident from the reported results of the above two missions, the path for market expansion lies in the areas of product promotion through greater available information and removal of tariff and non-tariff barriers. The missions served to emphasize that although pricing policies may be important in expanding the markets for these oilseeds, a merchandising policy should occupy a priority position with respect to the present stage of market development. This study is, in part, an attempt to examine the validity of such approaches to market expansion of Canadian oilseeds in Japan.

Furthermore, this analysis is a comprehensive examination of the major factors which determine the supply and demand relationships in the Canada-Japan oilseed trade. The empirical analysis will provide estimates of simultaneously determined demand and supply relationships for rapeseed and flaxseed. Since the demand for both of these oilseeds is derived from the Japanese oilseed crushing

industry, the empirical estimates of demand which are presented in this thesis, are in fact, estimates of demand for commodities which are used as factors of production. The oilseed crushers, as processor-buyers, demand rapeseed and flaxseed for the oil and meal markets which they supply. The oilseed crushers' demand for Canadian rapeseed and flaxseed is, therefore, a wholesale level of response to the demands of other processing industries. In short, the demand for each of the oilseeds, considered here as factors of production, is a derived demand.

The distinction between demand at the wholesale level and demand at the retail or farm level, suggests implications for the nature of the elasticity of the demand curves which are to be estimated in this study. If it is assumed that marketing costs are added at each successive stage in the market, and that the price of a commodity, therefore, increases as it moves from the farm level to the retail level, then the demand at the retail level of the market will be greater than demand at the farm level.[18] Since estimates here are based at the export level, some market costs have been involved in moving the oilseeds from the farm level to the export position. Moving the oilseeds from the export level to Japanese retail

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[18]Since price elasticity of demand = 1/slope · P/Q or $\frac{\Delta Q}{Q} / \frac{\Delta P}{P}$ and the quantity remains the same at all levels of the market, then a higher price results in a greater elasticity.

level again involves increased marketing costs. It follows, therefore, that the export or wholesale level of demand elasticity will be relatively greater than the elasticity at the farm level, but less than the elasticity at the retail level.[19]

Traditional demand theory specifies that certain factors such as population, incomes, income distribution, prices of products, prices of substitute products, and a general category of factors, known as tastes, influences consumption levels.[20] The degree to which these and several other important variables determine the demand for Canadian oilseeds will be examined in the empirical analysis. The supply equations for rapeseed and flaxseed will be explained by those variables which govern the response of producers and exporters to the Japanese demand for Canadian oilseeds.

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[19]Certain basic principles govern the elasticity of a derived demand curve whether it is at the wholesale or retail level. Most important among these are (1) the more essential the commodity to the wholesale or retail product (this relates to closeness of substitutes), the more inelastic the derived demand. (2) The more inelastic the demand for the retail product the more inelastic the wholesale demand. (3) The smaller the proportion the wholesale price is of retail price, the more inelastic the wholesale demand.

[20]This general category is often introduced into a statistical analysis as a time trend.

The theoretical analysis will assume the form of simultaneous equations in estimating the demand and supply equations for both rapeseed and flaxseed. Explicitly, calculated estimates will consist of:

1) The Japanese demand for Canadian rapeseed.

2) The Canadian supply of rapeseed to the Japanese market.

3) The Japanese demand for Canadian flaxseed.

4) The Canadian supply of flaxseed to the Japanese market.

Utilizing the estimates of quantities supplied and demanded, and estimates of prices, comparisons will be made with actual quantities and prices. As well as estimating, attempts will be made at projecting the future demand for Canadian oilseeds by allowing certain explanatory variables to fluctuate in value. Such an approach will prove valuable in suggesting implications for production and marketing policy based on the results of the empirical analysis.

In an analysis such as this, where use is made of time series data and the regression technique, certain limitations are imposed on the predicting value of the estimated functions.[21] The estimated demand and supply functions calculated by the regression technique are merely loci of points for which error terms are only minimized and not necessarily reduced to zero. The regression method,

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[21]An attempt was made in this study to analyze the market during a period of time in which stability had been secured. As the Japanese market for Canadian oilseeds is relatively new, only market generated data for the period 1963-1969 can be considered to be representative of a consistent market.

however, is valuable in that predictions can be handled by varying the values of specific independent variables. Such an approach enables estimation of the quantities of rapeseed and flaxseed which will be demanded and supplied when any or all of the explanatory variables are altered.

As was previously mentioned, it appears that Canada is a member of the international oligopoly which supplies the Japanese oilseed industry. In terms of pricing and merchandising policies characterising this form of market, specific reference will be made to the theoretical aspects of the differentiated oligopoly. The combination of this theory and the results of the empirical analysis will constitute the basis for the policy considerations in the final chapter of this thesis.

CHAPTER II

A DESCRIPTIVE ANALYSIS OF THE JAPANESE AND CANADIAN OILSEED INDUSTRIES

(A) THE JAPANESE OILSEED MARKET

(1) INTRODUCTION

The achievement of economic recovery in postwar Japan has paralleled the steady expansion in the consumption of fats and oils. With the continuous growth in consumer income[1] and the associated rising nutritional standards, the per capita annual consumption of edible oils and fats has risen from less than 4 pounds in 1951 to approximately 17 pounds in 1968. With indicators in Japan pointing to continued economic expansion, the standard of living is expected to approach that of the Western World. Consumer tastes and habits in Japan have already reflected significant changes. The westernization of the general style of living is progressing with the increased urbanization, and associated with this urbanization process is the changing dietary patterns. These advancements have

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[1] The Economic Planning Agency of the Japanese Government reports that householders' disposable income increased 141 percent over the ten year period 1959-68. See: Government of Japan, Economic Planning Agency, Economic Statistics, Vol. 12, No. 4, Tokyo, Japan, (Mimeo), April, 1969, p. 24.

resulted in increased consumption of both edible and industrial vegetable oils. This has significant implications for Western Canadian agriculture.

The limited arable land areas which are available for growing oilseeds necessitate Japanese dependence upon marine and import sources of oils, fats and oilseeds. Japan is thus one of the world's leading importers of these commodities. In the pre-World War II era, Japan relied on Manchurian soybeans and Korean fish oils for approximately 40 percent of the required imported fats and oils supply. However, the sources of imports have been altered in recent years with the bulk now being supplied by the United States, China and Canada, while numerous other countries individually supply smaller amounts to the Japanese oils and fats industry.[2] Japan is the largest single buyer of Canadian flaxseed and rapeseed, and as such contributed 40 million dollars in income to Canadian agriculture in 1968. Steadily increasing demand for edible oilseeds, a constant or slightly rising demand for flaxseed, and significant reductions in the Japanese domestic production of flas and rapeseed imply a future expansion in these markets.

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[2]The Japan Oil and Fat Importers and Exporters Association, Statistics for 1968 of Oilseeds, Oils and Oilcakes, Tokyo, Japan, (Mimeo), May 1969, pp. 1-5.

(2) OILSEED PRODUCTION IN JAPAN

One of the major sources of raw material supplies to the fats and oils industry in Japan has been the domestic oilseed production. Rapeseed and soybeans are the major vegetable oil-bearing crops grown in Japan. The most important oilseed crop grown in Japan solely for crushing purposes is rapeseed, while domestic soybeans on the other hand are used for the manufacture of food products, and vegetable oils. Since the late 1950's both domestic rapeseed and soybeans have come into competition with imported rapeseed and soybeans. The imported rapeseed is utilized solely for crushing purposes, the rapeseed oil moving into edible oil markets and the meal being used for fertilizer on tobacco and fruit crops. Imported soybeans are utilized in both the vegetable oil crushing and food industries. Small amounts of sesame seed and cottonseed are grown as well for use in the oilseed crushing industry. A considerable amount of rice bran is produced each year in Japan, but due to the nature of the widely distributed areas of rice production, the bran is not available in large enough quantities in any one area to support an economical oil-extraction industry. Therefore, most of the bran is not utilized for its oil-yielding property. Mustardseed for edible oil purposes is also grown in Japan, but its acreage

is small and production is limited. The 1964 production amounted to about 200 metric tons[3] and no change in this level has been reported.

Even though rapeseed and soybeans are the major oilseeds grown in Japan, the production of these two crops has decreased significantly over the past decade. This drastic reduction in acreages in Japan's prime oilseeds has had important implications for the oilseed import market as can be seen in Table I. During the period 1959-1968, while the production of rapeseed in Japan decreased by 74 percent, the imports of rapeseed rose by 860 percent. Likewise, the 60 percent decrease in soybean production was accompanied by a 142 percent increase in imports. The 1968 Japanese rapeseed crop of 68,000 metric tons is equivalent to approximately 3 million bushels, while the crop of 168,000 metric tons of soybeans is equivalent to 6.2 million bushels.[4] The 1968 imports of rapeseed at 250,000 metric tons is equivalent to 11 million bushels, and the soybean imports of 2,421,000 metric tons equals 89 million bushels. These

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[3]Department of Trade and Commerce, Report on the Canadian Oilseeds Trade Mission to Japan, April 18 - May 3, 1964, Ottawa, Canada, (Mimeo), p. 13.

[4]The figures in millions of bushels are based on the following conversion ratios:

1 metric ton = 2204 pounds
1 bushel rapeseed = 50 pounds
1 bushel soybeans = 60 pounds

TABLE I

DOMESTIC PRODUCTION AND IMPORTS OF OIL BEARING SEEDS

(Ministry of Agriculture and Forestry)
(Unit: Metric Ton)

	Rapeseed		Soybeans	
Year	Production	Imports	Production	Imports
1959	262,000	26,000	426,000	998,000
1960	264,000	51,000	418,000	1,128,000
1961	274,000	20,000	387,000	1,158,000
1962	247,000	37,000	336,000	1,293,000
1963	109,000	88,000	318,000	1,544,000
1964	134,000	76,000	240,000	1,607,000
1965	126,000	101,000	230,000	1,847,000
1966	95,000	211,000	199,000	2,168,000
1967	79,000	215,000	190,000	2,170,000
1968	68,000	250,000	168,000	2,421,000

Source: The Japan Oil and Fat Importers and Exporters Association, Statistics for 1968 of Oilseeds, Oils and Oilcakes, Tokyo, Japan, (Mimeo), May 1969, p. 11.

two import figures alone serve well in describing the deficit capacity of the Japanese edible oils and fats market.

Flaxseed production, while of a considerably smaller magnitude than either rapeseed or soybeans in Japan, has also undergone some acreage decrease in the past decade. The bulk of the Japanese requirements for flaxseed, however, is met by imports. Both domestically produced and imported flaxseed is purchased by the crushing industry and is producessed for its oil and meal constituents.

RAPESEED PRODUCTION

Rapeseed is grown in nearly all sections of Japan, but production appears to be most concentrated on the southern most island of Kyushu. In the southern areas rapeseed is sown as a second crop during the months of December and it is harvested in May. In the northern areas of Japan rapeseed is sown as a spring crop. It is sown in May and June in the upland areas and harvested in August and September. The continuous cropping system which is used in Japan has resulted in decreased yields of rapeseed. Table II illustrates the differences between the acreages sown as first and second crops and their respective yields. The table also reveals the steadily declining trend in rapeseed acreage from 1961 through 1968.

The size of the farming operations in Japan is quite small and most of the rapeseed is grown in small fields making mechanization of operations economically infeasible. As shown in Table III, the majority of the farmers in Japan produce rapeseed on less than half an acre. With this existing production pattern and the system of land holdings, it is conceivable that Japan will continue to meet the crushing industry requirements of rapeseed through increased imports in the future.

TABLE II

ACREAGE AND YIELD OF RAPESEED IN JAPAN 1961-68

	Rapeseed acreage in Japan			Avg. Yield (pounds/acre)		
Year	Total	Second Crop[1]	First Crop	All Fields	Second Crop	First Crop
1961	481,598	211,270	270,327	1249	1231	1267
1962	427,730	181,124	246,606	1275	1160	1356
1963	347,760	134,422	213,247	686	446	838
1964	295,532	113,666	181,865	1008	999	1008
1965	211,023	85,496	125,527	1311	1186	1392
1966	164,321	53,126	111,422	1267	1088	1347
1967*	150,000	45,000	105,000	1133	N.A.	N.A.
1968*	130,000	32,000	98,000	1133	N.A.	N.A.

*Estimated
N.A. not available
[1]crop sown into paddy field following rice harvest.
Source: Rapeseed Association of Canada, Report on the Rapeseed Mission to Japan, May 25 to June 9, 1968, Winnipeg, Manitoba, (Mimeo), June 1968, p. 24.

TABLE III

SCALE OF RAPESEED CULTIVATION IN JAPAN

Number of Farmers	Rapeseed field - Acres
332,600	.01 or less
105,000	.01 - .02
74,300	.02 - .05
25,500	.05 - .07
20,300	.07 - .12
27,100	.12 and over

Source: Rapeseed Association of Canada, Report on the Rapeseed Mission to Japan, May 25 to June 9, 1968, Winnipeg, Manitoba, (Mimeo), June 1968, p. 25.

There are several reasons for this trend toward decreased production of rapeseed in Japan. The higher returns of competing crops such as sugar beets have led to decreased production of rapeseed in many areas. A second reason for the decline in the production was voiced by a recent Canadian trade mission to Japan[5] as "The exodus of farm labor to the cities, making it impossible for producers to plant and handle as much rapeseed during the cropping season." With the majority of rapeseed field operations being manual in nature, the inability of the small production units to finance machinery implies that this exodus of labor from agriculture is critical to production levels.

A third factor which should be taken account of in this explanation of decreasing rapeseed acreage is that of production costs. Table IV presents an idea of what factors contribute to the high cost of producing rapeseed in Japan. Although it is recognized that such a cost analysis as this will vary over time and from area to area in Japan, it is interesting to note the importance of certain factors. Evidence of the degree of labor intensiveness in the rapeseed production can be seen in Table IV by comparing the relative magnitude of the labor and implement costs.

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[5]Department of Trade and Commerce, op. cit., p. 4.

TABLE IV

RAPESEED: ESTIMATED AVERAGE PRODUCTION COSTS PER ACRE IN JAPAN

Operating Costs	Dollars per Acre
Labor	54.24
Seed and seedlings	.22
Fertilizer	36.18
Miscellaneous material	.51
Spraying and disease control	.23
Implements	2.90
Draft animals	9.86
Other	3.27
	107.41
Fixed and general costs	
Buildings	1.68
Capital and interest	3.78
Rent	4.43
Taxes	7.15
	17.04
Production cost	124.45

Statistics and Survey Division, Ministry of Agriculture, and estimates of Fukuoka Prefecture, Department of Agriculture

Source: Calvin C. Spilsbury, Japan's Oilseed and Fats and Oils Industry, Foreign Agricultural Service, U. S. Department of Agriculture, Bulletin No. FAS-M-120, Washington, U.S.A., October 1961, p. 30.

The obvious lack of capital investments in rapeseed production, as shown by this table, is yet a further indication that this industry has limited potential in Japan.

A fourth explanation for the decreasing rapeseed production in Japan lies in the government's grower subsidy policy. The rapeseed grower in Japan has long been protected in his high cost industry by government subsidization. In recent years there has been a decreasing trend in the state trading activity of subsidizing growers. This trend has served as an indicator to the farmers of Japan to reduce their rapeseed acreage and move into more profitable crops.

State trading prices for rapeseed in Japan have, in the past, been maintained above world free market prices and in 1960 the government supported the price at 4000 to 4600 yen per 60 kilograms[6] or $5.00 to $5.75 per bushel.

The subsidy on which the rapeseed growers depended prior to 1960, has been reduced since that time. In 1969, for example, the Japanese Government allocated 1 billion yen or about 2.8 million dollars for the support of rapeseed prices in Japan, as compared to 55 million dollars in 1960.[7]

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[6]Calvin C. Spilsbury, Japan's Oilseed and Fats and Oils Industry, Foreign Agricultural Service, U.S. Department of Agriculture, Bulletin No. FAS-M-120, Washington, U.S.A., October 1961, p. 30.

[7]Mr. Hajime Ohno, Chief of the Planning Section of the Grocery, Oil and Fat Division, Economic Affairs Bureau, Japanese Ministry of Agriculture and Forestry, in a personal discussion, Aug. 25, 1969.

This decreasing subsidy allotment has reportedly had a direct influence on the declining rapeseed production in Japan. At this lower level of support, it is estimated that rapeseed production in Japan in 1969 will amount to approximately 1.5 million bushels, a figure which has certain implications for Japan's rapeseed import requirements.

FLAXSEED PRODUCTION

Japanese flax production does not compare in importance with rapeseed production. Most of the requirements for this industrial crop are met by imports and a very small percentage of the supply is met by domestic sources. In 1961, the production of flaxseed in Japan amounted to about 170,000 bushels and by 1968, production had fallen to approximately 20,000 bushels. At the present, no trends in increased flax production in Japan are foreseeable and all industrial demands for linseed oil are expected to be met by the imported flax. Canada supplies almost all the import requirements of flaxseed to Japan while the United States and the Netherlands contribute a very insignificant amount to this market. Historically, Canada has been the only consistent supplier to this market, increasing exports from 600,000 bushels in 1951 to 3.8 million bushels in 1968.

(3) THE INTERNATIONAL OILSEED TRADE AND JAPAN'S IMPORT MARKET

The international oilseed trade, like all commodity markets, is complex as well as unpredictable. The indeterminate forces of nature play a strategic role annually in determining the available sources of raw material oilseeds for international trade. Since Japan relies heavily on imports from foreign sources, the agricultural policy decisions which are made in the oilseed-supplying countries, with respect to production and exports, can affect the nature and degree of competition which Canadian oilseeds face in the Japanese market.

Although the competition which the Canadian oilseeds face in the Japanese market is persistent in nature, the source and degree of this competition vary over time. Since Canadian oilseeds are interchangeable to a degree with various other oilseeds and oil-bearing products, the availability or shortages of these commodities can affect the degree of competition in any one period. Canadian flaxseed may compete not only with flaxseed from other sources, but with other oil-bearing materials, such as copra and soybeans, which are demanded by the industrial oil industry. Rapeseed might face similar competition from such raw materials as soybeans and sunflower seeds whose end products are utilized in the edible oil industry.

The world trade in oilseeds is not an isolated form of trade affected only by other competing oilseeds. The prices and quantities of oilseeds which are exported are also determined by the availability of competing substitutes such as vegetable oils, marine oils, animal fats and oils and other oil-bearing materials. In reference to this phenomenon of fluctuating prices and quantities which characterize commodity markets, the following statements[8] were made at a recent oilseed conference:

> ... [An] exception to this pattern of low prices during the year (1968) was that of lauric oils during last winter and early spring, resulting from the disastrous hurricane in the Phillipines which damaged coconut trees, and from the civil war in Nigeria which virtually halved the exports of palm kernel oil from that area. These two factors caused a sharp increase in lauric oil prices from November 1967 and it is only recently that prices have started to fall as sharply as they rose.
>
> What are the reasons for the generally low prices over this past year or so? There are, of course, several of them;
> (a) ... here in the United States another record crop of soybeans was harvested in 1967 and, although you did not quite reach the anticipated milestone of a billion bushel crop, the carry-over from the year before easily brought your total available supply to over a billion bushels by the end of last year. ...
> (b) The U.S.S.R. had a considerable influence on the liquid oil market by producing for the second successive year a huge sunflower seed crop estimated at 6.6 million tons. This was nearly half a million ton more than the 1966 crop which, in turn, had been half a million tons

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[8]Congress of the International Association of Seed Crushers, Proceedings of the Congress of the International Association of Seed Crushers, Sept. 25-27, 1968, Washington, D.C., p. 7.

higher than that of the year before. Exports of sunflower oil from the U.S.S.R. and Eastern Europe (which in 1965 had been about 200,000 tons) rose to 600,000 tons in 1966/67 and will once more have been very high in 1967/68.

(c) Thanks to the stimulus of a 20 percent rise in the support price for rapeseed grown within the E.E.C., the European rapeseed crop has been estimated to have increased to 650,000 tons in 1968 and an extra 90,000 tons of rapeseed oil has already been produced this year.

(d) Fish oil output was greatly increased: for example, the Norwegian production went up by 100,000 tons to 330,000 tons in 1967, and the Peruvian production reached a new peak of over 250,000 tons during the year. In South Africa the output has doubled, but whale oil production, which used to be such a major factor in the world oils and fats picture, once more was only 100,000 tons, much the same as the year before, and hardly significant in the total world picture any more.

These statements illustrate the extremely unstable situations which exist in the oilseed, oils and fats market annually. Beyond this, there is implied, in such primary commodity markets as these, a great range of competition from price, through commodity quality to the degree of market service provided by the supplier.

(4) THE JAPANESE OILSEED IMPORT MARKET

The increased consumption of edible and industrial oils and fats in Japan, combined with the decreasing levels of domestic oilseed production have led to significant increases in oilseed imports. Canadian flaxseed and rapeseed have been well accepted in Japan primarily for the quality of vegetable oils they yield. Flaxseed serves as

an important raw material source of linseed oil which is in demand for its value in several industrial processes. Rapeseed, on the other hand, provides Japan with its major source of a single-component edible oil.

Although the main focus of this thesis is the demand for Canadian flaxseed and rapeseed in the Japanese market, a greater perspective of the entire market is necessary before an appreciation for the Canadian share of this market can be developed.

Table V provides a twelve year observation span of of the Japanese oilseed, oils and fats import market. The phenomenal growth in this market over the 1957 to 1968 period, from 1.1 million metric tons to 3.5 million metric tons, has involved the participation of numerous suppliers, and some have gained a larger share of this market than others. By value, this total of 3.5 million metric tons represents 450 million Canadian dollars. As a Japanese oilseed industry representative put it:[9]

> ... "The annual rate of increase of demand for these products oilseeds, oils and fats has been 10 percent or higher in the past few years, but it is currently estimated that this rate of growth will be somewhat lower in the future, probably on the order of 6 to 7 percent per annum."

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[9]Mr. Mototaro Sugiyama, President, Japan Oilseed Processors Association, in a paper presented at the 1968 Congress of the International Association of Seed Crushers, Washington, U.S.A., September 1968.

TABLE V

OILSEED AND OIL-BEARING MATERIALS: JAPAN'S IMPORTS

Year	Weight (Metric Tons)
1957	1,130,425
1958	1,235,675
1959	1,502,193
1960	1,675,755
1961	1,756,600
1962	1,986,540
1963	2,215,480
1964	2,446,420
1965	2,676,363
1966	3,259,995
1967	3,251,828
1968	3,510,318

Source: Calvin C. Spilsbury, Japan's Oilseed and Fats and Oils Industry, Foreign Agricultural Service, U. S. Department of Agriculture, Bulletin No. FAS-M-120, Washington, U.S.A., October 1961, p. 34 and,
The Japan Oil and Fat Importers and Exporters Association, Statistics of Oilseeds, Oils and Oilcakes, Tokyo, Japan, (Mimeo), Editions 1965 - 1968.

Even though the growth rate may slip to an annual level of 6 to 7 percent, the absolute value of this growth represents highly potential prospects for some exporters. Indeed, this growth rate should prove attractive to many potential oilseed suppliers who will be seeking outlets for their oilseeds in the future.

The potential position for any one supplier to the Japan market will depend, among other things, on the emphasis

in demand for oil and meal, the physical attributes of the supplier's oilseed or oil-bearing material, the ability of the supplier to provide the volume required by the crushing industry, and of course, the price at which the commodity is offered.

Chief among the oilseed competitors in Japan is the soybean. Before World War II, China supplied most of Japan's soybean imports but the United States is presently the major supplier. In 1968 the U.S. exported 2 million metric tons of soybeans to Japan for a total value of 227.7 million U.S. dollars. Table VI illustrates the pattern of soybean imports from the two major suppliers to Japan. These two suppliers provide close to 100 percent of the Japanese soybean imports.

There are several factors which explain why the soybean import market is structured as it is. Americans have developed policies which have encouraged the U.S. producers to accept soybeans into their crop rotations in such volumes that the Japanese demands are assured of being fulfilled. In 1968, the American farmers produced in excess of 1 billion bushels of soybeans. This level of production is no doubt determined by the assurance given to the farmers of the price and the quantities they will be able to sell.[10] Combined

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[10]The Commodity Credit Corporation, in the United States, purchases surplus stocks of soybeans which are later sold on the open market or delivered under the P.L. 480 program. Also, a floor price for soybeans ($2.25 per bushel in 1969) tends to stabilize returns and encourage production.

TABLE VI

SOYBEANS: JAPAN S IMPORTS (METRIC TONS)

Year	China	U.S.A.
1957	199,657	605,359
1958	89,197	777,436
1959	-	951,232
1960	147	1,091,364
1961	146,539	1,166,076
1962	203,881	1,240,788
1963	261,223	1,315,500
1964	318,565	1,390,212
1965	375,908	1,464,924
1966	392,535	1,772,123
1967	391,830	1,770,522
1968	417,152	2,001,441

Source: Calvin C. Spilsbury, Japan's Oilseed and Fats and Oils Industry, Foreign Agricultural Service, U.S. Department of Agriculture, Bulletin No. FAS-M-120, Washington, U.S.A., October 1961, p. 35, and
The Japan Oil and Fat Importers and Exporters Association, Statistics of Oilseeds, Oils and Oilcakes, Tokyo, Japan, (Mimeo), Editions 1965 - 1968.

with these production policies, the American soybean producer has adopted a half cent per bushel check-off system to finance a highly market-oriented promotional campaign in Japan.

Safflowerseed is another oilseed which has offered some competition to those oilseeds, such as rapeseed, imported into Japan for use in producing edible oils. However, the Japanese crushers have recently announced that "the processing of safflowerseed will be sharply lower in the future due to

the reduced availability from the United States."[11] Whether the decreased volume of imports is due strictly to the decreased acreage in the United States or to certain other factors, is not clear, but Table VII shows a clear reversal in the Japanese import policy for safflowerseed.

TABLE VII

SAFFLOWERSEED: JAPAN'S IMPORTS (METRIC TONS)

Year	Total	U.S.A.
1965	113,440	112,675
1966	147,189	108,574
1967	126,826	112,563
1968	63,226	62,766
1969*	35,000	N.A.

*Estimated
N.A. Not available.
Source: The Japan Oil and Fat Importers and Exporters Association, Statistics of Oilseeds, Oils and Oilcakes, Tokyo, Japan, (Mimeo), Editions 1965 - 1968.

A recent threat to oilseeds in the Japan market has arisen from the Russian and East European sunflowerseed. This supply, however, is irregular in nature and as such, it does not offer the assurance of a stable supply which the Japanese crushers desire. Because of the exceedingly high

[11] Mr. M. Sugiyama, loc. cit.

oil content of Russian sunflowerseeds in recent years, [averages in excess of 40 percent], the Japanese crushers show great preference for the oilseed when it is available. Table VIII, Japanese sunflowerseed imports, shows that although supplies from Russia have been expanding, they have only recently begun moving into Japan. The other suppliers have not been consistent in supplying the oilseed.

TABLE VIII

SUNFLOWERSEED: JAPAN'S IMPORTS (METRIC TONS)

Year	Total	Russia	Rumania	China	Bulgaria
1965	3,893	-	-	3,855	-
1966	3,977	-	-	3,801	-
1967	96,445	77,603	-	5,789	13,044
1968	71,050	69,656	-	1,394	-
1969	100,000	90,000	10,000	-	-

*Estimated
Source: The Japan Oil and Fat Importers and Exporters Association, Statistics of Oilseeds, Oils and Oilcakes, Tokyo, Japan, (Mimeo), Editions 1965-1969.

Apparently the Russians and Rumanians are more interested in keeping their crushing industries operating at peak capacity in order to utilize the meal domestically while exporting the oil. A Rumanian oilseed export representative explained that, "Up to now we have exported quite small

quantities of sunflowerseeds. We do not think in terms of becoming large exporters of sunflowerseed at all."[12]

As the Japanese are also interested in full utilization of their crushing industry the Russian and Rumanian sunflowerseed oil is not expected to offer a threat to Canadian rapeseed in Japan. However, the size of the crops in Russia and Rumania is expanding and the amounts of sunflowerseed entering the market is increasing. As well, the communist oilseed pricing policy of selling below world price levels has led to great concern over competition in Japan.

Further, competition to Canadian rapeseed is becoming more evident from Polish rapeseed. The slightly higher oil content of Polish rapeseed and the lower prices are offering some competition to Canadian suppliers although its unsteady supply places it at a disadvantage in Japan. A remark made by a Canadian oilseed exporter illustrates the sensitivity which the Canadian suppliers have to the Eastern European pricing policies. He stated:[13]

> "Unfortunately, the competition is not always "fair" since subsidies and government price fixing enter into the transactions. Communist countries like Poland and East Germany seemed at times to be adopting a "sell at any price" policy. A very good example of this was the sale made last fall (1968)

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[12]Mr. A. Ciminian, General Manager of Prodexport for Rumania, in a paper presented at the 1968 Congress of the International Association of Seed Crushers, Washington, U.S.A., September 1968.

[13]Mr. T. Hoyer, Manager, James Richardson and Sons, Ltd., in a paper presented at the 1969 Annual Rapeseed Association Meeting, Saskatoon, Saskatchewan, March 1969.

> of three cargoes of rapeseed by Poland to Japan. .... The price formulas devised by the Communist bloc countries in international trading are a mystery, but they have certainly been effective in opening up new markets for their products. .... In this particular case, it was reported that the freight rate on rapeseed shipped from Vancouver to Japan was about $7 per ton below the cost of freight from Polish ports to Japan. Yet rapeseed from Poland - crossing many oceans to reach its final destination - undersold relatively low-priced Canadian rapeseed."

Flaxseed, the other major Canadian oilseed which competes in Japan, has a limited number of competitors among the oilseeds and oil-bearing products imported into Japan. Chief among these are soybeans, tung nuts and copra. However, the industrial uses to which linoil is applied are directly dependent on its unique characteristics. Recently, however, synthetics have offered some competition to linoil.

Copra, although used in the manufacture of edible oils, is also a competitor in the industrial oil market in Japan.[14] Increased production and efficiency in the Phillipine coconut industry indicates that this product could conceivably gain a greater share of the world fats and oils trade. Until this is achieved however, copra offers no real threat to flaxseed. The following table outlines the main sources of copra imports into Japan. Although total imports are increasing, a greater percentage of the commodity is expected to be used in the food industry so that the amount available for use in the industrial oils is decreasing.

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[14]Coconuts are husked, split and the meat is placed in a kiln drier. The dried product is known as copra and is used as a raw product in crushing mills to yield oil and meal.

TABLE IX

COPRA: JAPAN's IMPORTS (METRIC TONS)

Year	Total	Phillipines	Indonesia
1965	94,231	41,278	22,800
1966	107,612	47,772	33,842
1967	112,059	74,440	9,582
1968	126,066	54,150	47,650
1969*	140,000	85,000	50,000

*Estimated
Source: The Japan Oil and Fat Importers and Exporters Association, Statistics of Oilseeds, Oil and Oilcakes, Tokyo, Japan, (Mimeo), Editions 1965-1969.

(5) JAPANESE OILSEED TRADE POLICY

The limited cultivated land area in Japan has resulted in complicated production and trade policies in Japan.[15] Policies have been set up by the government to support, guide and protect Japanese agriculture. Price supports and protective policies are difficult to phase out once they are

[15]The total cultivated land area in Japan is only about 6 million hectares or 15 million acres. The average sized farm is only 1 hectare or about 2.47 acres. Over 30 percent of the land produces two crops per year. See: Hughes H. Spurlock, The Competitive Position of U.S. Farm Products in the Japanese Market, U.S. Department of Agriculture, Economic Research Service, Washington, D.C., U.S. Government Printing Office, November 1966, p. 8.

started. Efforts to change policies and programs that may no longer be in the national interest, often affect important sectors of the economy adversely and proposed changes arouse opposition.

The present-day farm policies reflect the past role which agriculture played in Japan. Agriculture has declined sharply as a percentage of overall production. Less than 8 percent of the gross national product came from agriculture in 1968 compared with 17.8 percent in 1955. Price supports are still applied extensively in Japan and government pricing policies are in effect for about 65 percent of total agricultural output.

The policies which determine import duties and quotas on oilseeds are of considerable interest to Canadian suppliers. Japan does not impose heavy import duties on food and industrial raw materials for this would not serve the economic interest of the country. With high unit cost of production and high support prices, tariffs are used, where necessary, to protect domestic producers of some farm products. As well as tariffs, import licensing and foreign exchange controls are used. In 1960, as Japan's foreign exchange position improved, some farm products are liberalized[16] although progress in this direction has been slow.

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[16]A liberalized commodity is one which is on Automatic Approval whereby no limitations are placed on the quantity of that particular commodity imported or on the source of imports.

In addition to the foreign exchange consideration, two other objectives in the Japanese control on foreign trade in oilseeds are protection of domestic agriculture and protection of the domestic fats and oils industry. Tariff and quota protection serve to maintain a certain price to the producer which would otherwise be lower if free trade existed. Japanese are also protected from the imports of processed and semi-processed materials, because such imports would tend to increase the idle capacity of local crushing plants.

Canadian flaxseed enters Japan under the Automatic Approval System and has no import tariff imposed upon it. Flaxseed, an insignificant crop in Japan, is valuable in several industrial processes and placing it under a tariff or quota system would offer no special advantage to the Japanese producer or crusher. The linseed oil, however, has a general duty which provides some protection to the crushing industry.

Rapeseed, on the other hand, enters Japan under the Import Quota (I. Q.) System with an imposed tariff as well. However, the Japanese need for rapeseed is expanding steadily and the quota is being increased. The need for rapeseed in Japan in 1969 will be 20 percent higher than in 1968.[17]

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[17]Mr. Hajime Ohno, Chief of the Planning Section of the Grocery, Oil and Fat Division, Economic Affairs Bureau, Japanese Ministry of Agriculture and Forestry, in a personal discussion, August 25, 1969.

This has led to the speculation that the import quota system for rapeseed will soon be abandoned. The increased demand for rapeseed, the increased crushing and handling facilities in on-shore plants, and the decreasing level of Japanese production, lend further weight to this speculation.

Some members of the crushing industry in Japan advocate removal of rapeseed from the I. Q. system. These are large on-shore crushers who are able to take advantage of Canadian rapeseed imports and favor the automatic approval system for two reasons. One, the crushing margin on rapeseed over soybeans is favorable to them, and two, they would be able to acquire as much rapeseed as they could sell in the form of meal and oil and would no longer be restricted to the amount allowed under their import license.[18]

The government maintains that liberalization and tariff removal would be disadvantageous for two reasons. If Japanese crushers purchased more rapeseed at lower prices, the government would have to increase subsidy payments to the farmers, and secondly, if Japan imported rapeseed freely,

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[18]Actually, some of the larger on-shore crushers already process as much as they can sell. The larger on-shore crushers purchase import licenses, which are issued semi-annually by the government, from the smaller inland processors. The smaller inland processors depend on this income from license sales to remain viable and so they favor the I. Q. system. The larger crushers favor the crushing margin of rapeseed and wish to operate their plants at capacity and so favor Automatic Approval for rapeseed. Source: Mr. Bunzo Watanabe, President, Japan Oilseed Processors Association, in a personal discussion, August 28, 1967.

the large crushers would purchase more and the crushing would be concentrated in the larger mills and the small crushers would be forced out of business.

Liberalization of rapeseed is slowly being achieved in Japan. The import quota is steadily being increased on the basis of decreasing Japanese production and the expanding preference of the crushers for rapeseed. Table X reflects this expansion over time in the Government import allocations. Import Allocation on rapeseed began in 1955

TABLE X

JAPANESE GOVERNMENT IMPORT ALLOCATION FOR RAPESEED

Fiscal year	Quantity (Metric Tons)
1957	15,000
1958	20,000
1959	47,000
1960	20,000
1961	25,000
1962	60,000
1963	80,000
1964	90,000
1965	120,000
1966	210,000
1967	220,000
1968	205,000
1969	260,000

Source: Based on Statistics in personal correspondence received from Mr. J. A. Stiles, Minister (Commercial), Canadian Embassy, Tokyo.

when 20,000 metric tons were permitted. In 1956, there was no allocation and since 1957 the allocation has increased to 260,000 metric tons in 1969. Actually, 130,000 metric tons was allocated by the government for the first half of the 1969-70 fiscal year with a view to expanding the allocation to 260,000 metric tons in the second half of the year.

Canadian rapeseed suppliers face a formidable barrier on entrance to the Japan market in the form of a tariff. Competition from soybeans and more recently from sunflowerseed is keen even without the added disadvantage which rapeseed faces. Soybeans, the major competitor, has not only been placed on Automatic Approval, but at the same time enters the market at a lower tariff rate. As well, this rate has been negotiated to be further decreased at specific intervals of time so that by 1972 it will be lowered to 2.4 yen per kilogram or about seven dollars per metric ton. The sliding rate is as follows:

Rate effective	
July 1, 1968 - Dec. 31, 1969	3.84 yen/kg
Jan. 1, 1970	3.36 yen/kg
Jan. 1, 1971	2.88 yen/kg
Jan. 1, 1972	2.40 yen/kg

Source: Mr. Mototaro Sugiyama, President, Japan Oilseed Processors Association, in a paper presented to the Congress of the International Association of Seedcrushers, Washington, D.C., September 25-27, 1968.

The present rate on soybeans of 3.36 yen/kg compares with 6.1 yen/kg which remains fixed on rapeseed. The newest competitor in this market, sunflowerseed, enters on Automatic Approval with no form of tariff. Such import policies increase the degree of competition for rapeseed in a market that is already buyer oriented.

Table XI gives some perspective to the relative position of each oilseed and oil-bearing material with respect to its entrance barrier. It shows that rapeseed and soybeans, both available in Japan, are more heavily taxed than commodities available from foreign sources only.

However, the tariff rates in Japan do not affect Canadian flaxseed. The future for this commodity in Japan is more dependent on the availabilities of competing oilseeds, oil-bearing materials and synthetics. Canadian rapeseed, although facing these rather stringent policies at the present, should expect to find more relaxed policies in the future due to its increasing acceptance in the role it plays in yielding an edible oil and livestock feed.

TABLE XI

JAPANESE IMPORT DUTIES ON OILSEEDS, OILS AND FATS FOR 1968 FISCAL YEAR

	Import System	General Duty
Oilseeds		
Linseed, cottonseed, sunflowerseed, sesameseed	Automatic Approval (A.A.)	Nil
Soybeans	A.A.	3.84 yen/kg
Rapeseed	Import Quota (I.Q.	6.10 yen/kg
Oils and Fats		
Soybean, sunflower, rapeseed, safflower, corn	I.Q.	28 yen/kg
Olive	A.A.	Nil
Linseed	A.A.	10%
Margarine	I.Q.	35%
Lard and other animal fats	A.A.	15%

Source: International Association of Seed Crushers, Proceedings of the Congress of the International Association of Seed Crushers, London, England, (Mimeo), September 1968, p. 26.

(B) CANADIAN OILSEED MARKETING

(1) INTRODUCTION

Although it is not the purpose of this study to analyse the production of rapeseed and flaxseed in Canada, the necessity for a discussion of oilseed production arises from the importance of available stocks in meeting the demands of export markets. Canada's past success in the Japanese oilseed market suggests that Canadian producers can meet the import requirements of the Japanese crushing industry. The following is a discussion of oilseed production, transportation and storage as it relates to the Japanese market.

As the central objective of this thesis is to empirically estimate the parameters of a model reflecting the demand-determining forces in the Japanese import market for rapeseed and flaxseed, it is necessary to develop an appropriate statistical model which accounts for the interrelationships which characterize this market. So far, little work has been done on developing a demand structure for rapeseed and flaxseed as they relate to the Japan market.

As well as the Japan market, Canadian domestic consumption and other foreign markets each exert an influence on the prices of the commodities under consideration.

Although Japan represents the major price determining force in this market, each of the other market outlets have partial influence. The discussion of certain aspects of Canadian oilseed marketing will, however, be directed specifically to the Japanese market in this section.

(2) FLAXSEED PRODUCTION

Flaxseed is a traditional crop in Canadian agriculture, when compared with rapeseed. Prior to the First World War, acreage under this crop was limited. However, with the substantial increases in demand for fats and oils stimulated by the War, acreages began to climb. The inter-war period saw considerable acreage reduction, but this situation was reversed during World War II. Increased industrial uses for linseed oil stimulated domestic consumption and exports with a resulting rise in linseed prices in the late 1940's. This, in turn, encouraged further expansion in acreage. Since the mid-1950's, acreage has decreased somewhat, but the production has been sufficient to satisfy export markets. Synthetic replacements have tended to erode a great portion of the linseed oil markets in Canada and in export markets.

In reference to production, Table XII summarizes the trend which flaxseed has followed over the past 20 years.

TABLE XII

FLAXSEED-CANADA

ESTIMATED ACREAGE, YIELD AND PRODUCTION

Crop Year	Seeded acreage	Avg. yield per acre (bu)	Production ('000 bu)
1951-52	1,158,500	8.2	9,478
1952-53	1,109,500	10.5	11,660
1953-54	956,400	10.2	9,748
1954-55	1,178,000	9.3	10,998
1955-56	1,836,000	10.3	18,990
1956-57	3,040,000	11.5	34,991
1957-58	3,486,000	5.5	19,205
1958-59	2,551,100	8.8	22,342
1959-60	2,051,500	8.4	17,191
1960-61	2,513,400	9.0	22,571
1961-62	2,086,000	6.9	14,478
1962-63	1,445,000	11.1	16,042
1963-64	1,685,400	12.6	21,176
1964-65	1,977,000	10.3	20,305
1965-66	2,315,000	12.6	29,176
1966-67	1,918,000	11.5	22,020
1967-68	1,023,000	9.2	9,378
1968-69	1,524,270	11.9	18,200

Source: Dominion Bureau of Statistics, Agricultural Division, Handbook of Agricultural Statistics, Catalogue No. 21-507, Ottawa, Canada, The Queen's Printer, 1969, p. 108.

The bulk of the crop is grown in the three prairie provinces, but Manitoba and Saskatchewan together produce well over half of the total crop.

Acceptance of flaxseed as an alternative crop to others in the crop rotations of Western Canadian agriculture is stimulated by the ready market which is available to the farmer. As a cash crop the producer receives payment in full at the time of delivery to the grain elevator. Although the grain delivery quota[19] may regulate the volume which can be marketed at any one time, domestic and export sales of this crop have historically resulted in a fairly continuous flow of flax from the farm to the elevator.

Virtually all of the flaxseed that moves into the commercial marketing channels in Canada flows either into position for the domestic crushing mills or into export position in terminal elevators. The volume available for export may or may not lie in a terminal position at any time in the crop year and, therefore, accessibility to an export terminal position becomes important when servicing foreign markets.

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[19]In periods of congestion in country grain elevators the Canadian Wheat Board establishes the grain delivery quotas. The quotas serve as an attempt to allocate among producers equitable delivery opportunities during period when there is not sufficient space available to take delivery of all the grain which they wish to market.

Flaxseed harvesting is generally completed throughout September on the prairies and delivery to the marketing channels continues throughout that same crop year as the quotas so regulate. Movement of flax into export position occurs entirely within the grain elevator system. In total, the export markets for flaxseed are more important than the domestic consumption and in recent years Japan has emerged as the major export market. Table XIII shows the consistency of demand which has prevailed in the Japanese market over the past decade.

(3) RAPESEED PRODUCTION

The rapeseed production picture appears to be somewhat more optimistic than that for flaxseed. Unlike flaxseed, the markets for this Canadian oilseed are in a stage of development. Therefore, the market potential of this crop offers, relatively more promise to Western Canadian agriculture than does flax.

Rapeseed was first produced in Canada during World War II under a government subsidy for use as an industrial lubricant. At the end of the war, acreage decreased until the mid-1950's when a new processing technique was developed to extract edible oil from rapeseed. Since then, production has increased and estimates place the present crop year output at 37.1 million bushels. The production statistics,

TABLE XIII

EXPORTS OF CANADIAN FLAXSEED: TOTAL AND MAJOR MARKETS

Crop Year	Total	Japan	Britain
58-59	14,276,255	2,516,812	6,948,942
59-60	12,494,273	2,682,331	5,293,131
60-61	13,603,333	4,039,126	7,301,968
61-62	11,987,594	3,119,833	4,642,877
62-63	12,565,941	3,785,163	5,060,887
63-64	13,638,472	3,830,106	4,544,813
64-65	14,346,118	4,051,085	4,775,696
65-66	18,935,830	4,307,568	5,118,879
66-67	16,568,065	4,745,050	3,546,299
67-68	12,610,558	3,800,892	2,604,987
68-69	13,251,699	4,890,562	2,144,495

Source: Dominion Bureau of Statistics, Agricultural Division, Grain Trade of Canada, Catalogue No. 22-201, Ottawa, Canada, The Queen's Printer, Editions 1958-59 ... 1967-68.

presented in Table XIV shows the dynamic expansion of this crop in the past two decades.

Rapeseed has become a very acceptable crop to producers in Western Canada as an alternative to other grains. In past years the farm price of rapeseed was evidently critical in the producers' decision to grow this

TABLE XIV

RAPESEED-CANADA

ESTIMATED ACREAGE, YIELD AND PRODUCTION

Crop Year	Acreage	Yield (bu/acre)	Production (bu)('000)
1950-51	400	5.0	2
51-52	6,500	18.5	120
52-53	18,500	15.0	278
53-54	29,500	16.6	491
54-55	40,000	14.4	578
55-56	138,000	11.3	1,559
56-57	351,900	17.0	5,996
57-58	617,500	14.0	8,661
58-59	626,000	12.4	7,762
59-60	213,500	16.7	3,560
60-61	763,000	14.6	11,120
61-62	710,000	15.8	11,220
62-63	371,200	17.5	5,860
63-64	478,000	16.7	8,360
64-65	791,000	15.7	13,230
65-66	1,435,000	18.4	22,600
66-67	1,525,000	15.2	25,500
67-68	1,620,000	17.8	24,700
68-69	1,052,000	17.6	18,725
69-70*	2,012,000	-	38,000

*Estimated

Source: Dominion Bureau of Statistics, Agricultural Division, Grain Trade of Canada, Catalogue No. 22-201, Ottawa, Canada, The Queen's Printer, Editions 1950-51 ... 1968-69.

crop and one study estimated that "at $2.00 per bushel or over, the crop is interesting to producers. At less than this price acreage fades out quickly."[20] However, it should be noted that this statement was made during a period of buoyant wheat markets. It is quite conceivable that the present limited market prospects for wheat, which competes with rapeseed for the same production acreage, and the ready markets for rapeseed mean that the above statement is no longer valid. Producers may now be willing to supply rapeseed more on the basis of the available market for it than because of any set price of $2.00 or over. It is not possible to substantiate such statements, however, because of the complexity of recent occurrences. Rapeseed markets have been strong and prices have remained at or near the $2.00 per bushel mark. The wheat markets, on the other hand, have weakened and prices have fallen so that farmers planted the 1969 rapeseed crop under extremely different market conditions than in 1966.

In comparison to flaxseed, rapeseed has experienced expansion in both domestic and export markets in recent years. Table XV shows the yearly disposition of rapeseed into the major export markets.

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[20]The Winnipeg Grain Exchange, The Production and Marketing of Rapeseed in Canada, prepared by Hedlin, Menzies and Associates Ltd., Winnipeg, Manitoba, June 1966, p. 2.

TABLE XV

EXPORT CLEARANCES OF RAPESEED

Year	Total exports	Japan	Italy
60-61	8,089,468	877,403	2,948,841
61-62	6,919,190	1,230,940	3,320,067
62-63	5,709,813	3,080,059	1,358,002
63-64	5,308,407	4,436,014	188,832
64-65	9,276,497	3,724,481	1,461,824
65-66	13,632,267	6,985,737	2,804,155
66-67	13,817,739	8,403,903	3,162,792
67-68	12,308,678	10,197,380	323,701
68-69	14,803,686	11,189,050	183,702

Source: Dominion Bureau of Statistics, Agricultural Division, Grain Trade of Canada, Catalogue No. 22-201, Ottawa, Canada, The Queen's Printer, Editions 1960-61 ... 1968-69.

As with flaxseed, all of the rapeseed which moves into the commercial marketing channels, moves into domestic crushing position or export position. The flow of rapeseed is also controlled by the delivery quota system in the grain elevators of Western Canada.

Rapeseed marketing has been anchored to a Pacific Coast movement thus far, primarily because the major volume of rapeseed is exported to Japan. This market, and others,

can best be serviced through the West Coast because of the year round exporting opportunity and because of the geographical advantage over the Lakehead. As a result of the predominant movement of rapeseed through the West Coast, the futures market delivery point was based in Vancouver.

(4) OILSEED MOVEMENT THROUGH THE WEST COAST

Flaxseed and rapeseed which are exported to Japan, move through the West Coast terminals and are thus involved in the transportation and handling procedures for moving grain from the prairies. One of the most serious problems in the West Coast Terminal system has been the fluctuations of stocks of grain in store over a period of time. The unpredictability of vessel arrivals and difficulties in the shipping order system on the prairies have, at times, resulted in grain shortages. In other periods, a congested terminal system has limited the ability of the port to handle those grains which are in demand for export.

On a throughput basis, the factors which limit the capacity of the port are such factors as car unload capacity, cleaning capacity and the available space. In order to maximize the grain throughput at the West Coast, it is, therefore, necessary to control the available space within

the limits that will allow the movement of those grains which are in demand.[21]

Rapeseed and flaxseed, which move through the West Coast terminals, account for a relatively small portion of the total movement. These oilseeds are thus moved to the Coast under a strict control system, ensuring that storage space, which is needed for wheat, oats and barley, does not become blocked.

Over the past several years, however, this controlled system of moving oilseeds to the Coast has been overly restrictive. Several factors have been instrumental in this development.

First, the increased movement of oilseeds from the West Coast to export markets has taxed the ability of the port to meet commitments. Due to the cleaning regulations that are imposed under the Canada Grain Act, exported oilseeds must be cleaned to comply with designated export standards.[22] The increased receipts of oilseeds necessitates that the terminals restrict their handling of other grains in order to meet vessel arrivals with oilseeds which are in export condition. The size of individual shipments, and the irregular nature of vessel arrival are factors which have forced the terminals to request that larger stocks of

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[21]It is the responsibility of the Canadian Wheat Board to control the movement of all grains from country elevator points to the terminal facilities.

[22]Government of Canada, Canada Grain Act, Ottawa, Canada, The Queen's Printer, 1952, pp. 691-692, and
Grain Transportation Technical Group, Movement of Grain Through West Coast Ports, Winnipeg, Manitoba, (Mimeo), 1968, pp. 31-61.

oilseeds be allowed to be carried at Vancouver in order that export orders can be filled.

A second factor, which has recently restricted the rapeseed movement only, concerns the volume of "free" stock which can be maintained at the port. The Canadian Wheat Board limit of one and one-half million bushels of rapeseed is, apparently, inadequate to meet the requirements of the export trade. The exporters, who may have a potential market for rapeseed, might have difficulties in acquiring the "free" stock because it has already been commited for a sale.

The system of handling rapeseed at the West Coast is further restricted by the method of machine separations. Rapeseed is binned according to the type of dockage it contains, thus limiting available storage space at the port. Rapeseed containing wheat is binned separately from rapeseed containing barley. The space necessary to accommodate this method of handling, and the time necessary to treat such a commodity tends to limit the port handling facilities.

As the Japanese demand for oilseeds increases, the throughput in Vancouver must increase, implying a need for increased available stocks in store. This increased demand must be met with either increased available storage at the West Coast, or through a highly coordinated transportation system designed to place these oilseeds in position as soon as space becomes available in the terminals and before ocean tonnage is again available. When oilseed vessel shipments

are made by large vessels, stock problems arise because of the conflict between the volume which is necessary for such shipments and the limits which are allowed in store.

The steady growth in Japan and in other export markets, which are serviced through Vancouver, emphasizes the importance of storage and transportation in the marketing link between farm production of oilseeds and export sales. The degree of success in maintaining adequate available export stocks of rapeseed and flaxseed will, in part, determine the degree of success which these Canadian oilseeds will enjoy in the Japanese import market.

(5) AN INDUSTRY FLOW CHART

A convenient and simple way to exhibit the major economic relationships which influence any economic system is to construct a flow chart which is derived from the postulates of economic theory and a knowledge of the industry. The flow chart enables representation of all the factors which are interrelated in the industry and has an advantage over an econometric model in which it is usually not possible to quantitatively specify every variable in the relationship. Data availability, aggregation problems, inability to specify behavioral relationship and statistical management problems all represent factors which restrict detail in the model. For these reasons a model is usually an incomplete representation

FLOW CHART of the CANADIAN FLAXSEED INDUSTRY

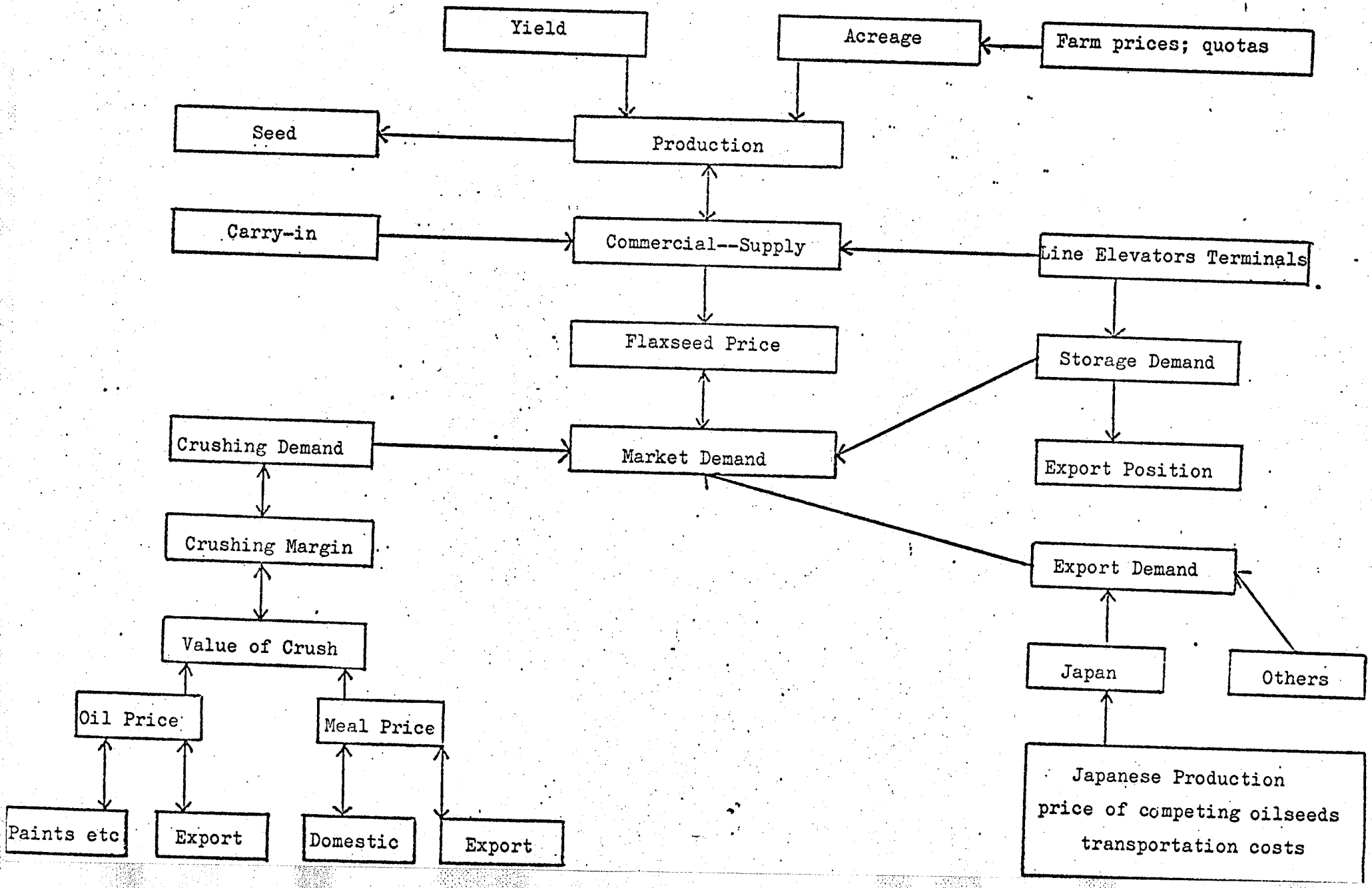
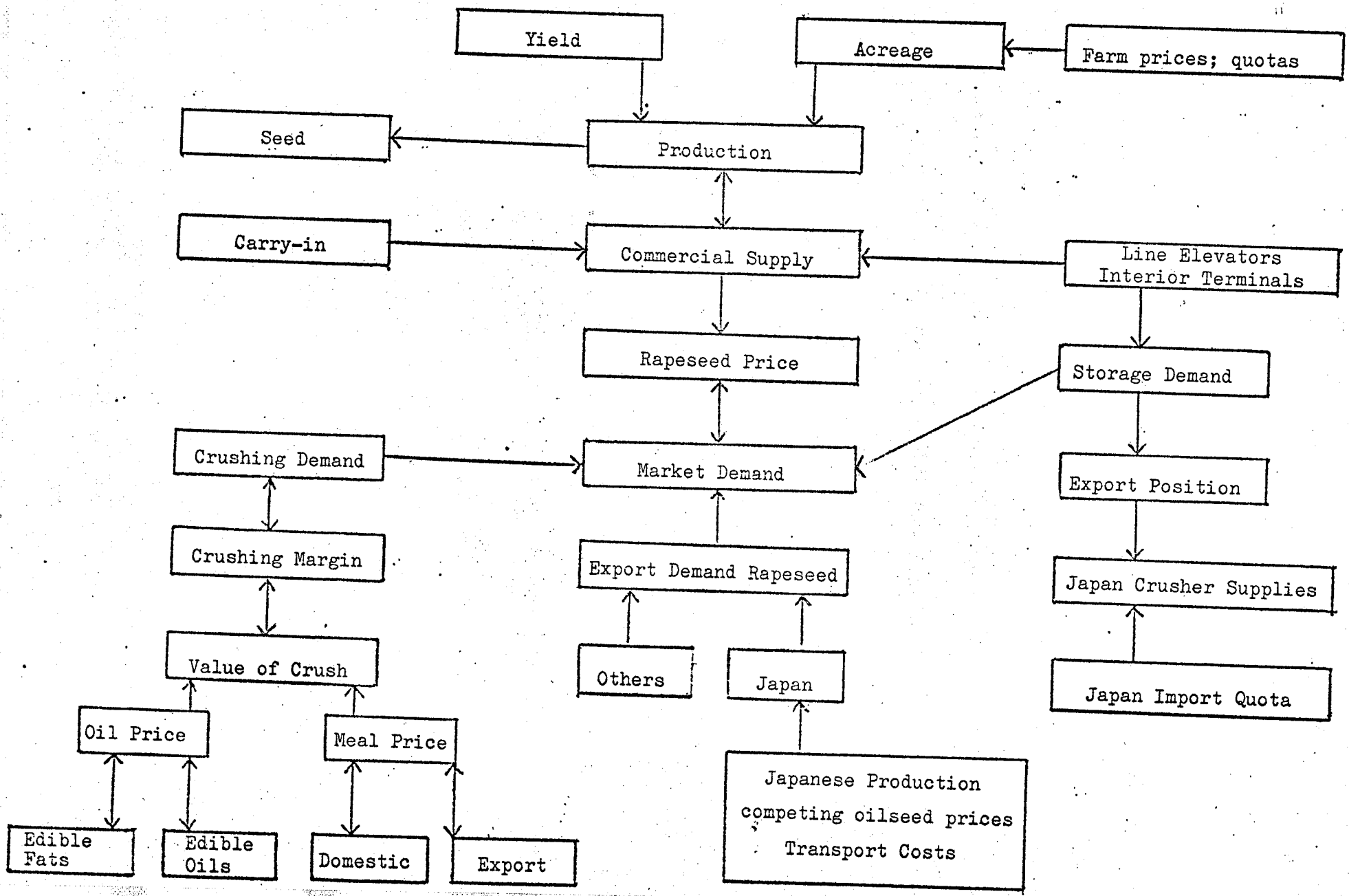


FIGURE 2.2

FLOW CHART of the CANADIAN RAPESEED INDUSTRY



of an industry flow chart, but nevertheless it is the flow chart from which the major statistical relations are derived.

The preceding flow charts outline schematically the Canadian rapeseed and flaxseed markets from production through handling to consumption. In the figures, the arrows serve to indicate the hypothesized direction of influence, where simultaneous relationships are represented by two-directional arrows and a single causal relationship by single directional arrows.

The flow charts so depicted represent complete models in the sense that all forces determining supply and demand for the commodities are represented.

Distinction can be made between several markets represented in the flow charts. Spatial differentiation exists between the individual export markets themselves as well as between the export and domestic markets. Markets for meal and oil can be separated on the basis of product form, and inventories of meal, oil and whole seed for domestic consumption and export can be differentiated on the basis of time. Models presented in this study attempt to explain only the flow of rapeseed and flaxseed to Japan.

CHAPTER III

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

(A) THE THEORETICAL ANALYSIS OF CANADIAN OILSEEDS IN THE JAPANESE MARKET

The theory of demand provides a framework for analysing consumer behavior under certain conditions. It directs emphasis towards certain variables which explain market relationships. According to theory, the concept of market demand is actually an expression of a relationship between the amount of a commodity demanded and such variables as are revealed by the theoretical framework to determine this quantity. An attempt to construct an economic model of the Japanese demand for Canadian rapeseed and flaxseed thus involves the interpretation of the theoretical framework of the market. In short, the model should reflect empirically, those relationships which are described within the theoretical confines.

The foundation of demand theory consists of several basic considerations or assumptions, which are considered necessary in order to show certain quantitative relationships.[1] These relationships are the very essence of a demand analysis

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[1] G. Stigler, The Theory of Price, New York, Macmillan Co., 1947, p. 63.

in that they relate quantitatively the variations in the demand for a commodity in response to given changes in those factors which determine the demand.

The first assumption on which the theory of demand is constructed states that consumers have a perfect knowledge of the wants which they desire to satisfy. In estimating the Japanese import demand for Canadian oilseeds, the assumption is, therefore, being made that Japanese importers possess complete information concerning the nature of their desires. The distinction can be made here between demand at the consumer level and demand at the wholesale level on the basis of the wants which are satisfied at each level in the market. The Japanese consumer demands Canadian rapeseed and flaxseed for the satisfaction they may derive from the respective oils and meals which these commodities yield. The importers on the other hand demand these oilseeds for the income which they derive from selling the imported oilseeds to the crushers and processors. Since this study deals with demand at the wholesale level, this assumption deals with the goal which the importer attempts to satisfy.

The second assumption of demand theory stipulates that consumers are aware of changes within the market which may affect their ability to achieve maximum satisfaction. Relative to the Japanese oilseed importers, this implies that they are aware of rapeseed and flaxseed prices as well

as the prices that the Japanese crushers are willing to pay for the imported oilseeds. In essence, the assumption is that the importer is aware of the effects that price changes can have on his handling margin.

The third assumption in demand theory stipulates that consumers attempt to utilize their information in a rational method of maximizing their wants. This is a reasonable assumption to use in analysing the Japanese import demand for Canadian oilseeds. The profit oriented basis on which the importers in Japan scrutinize oilseed markets has historically revealed that the most price competitive supplier succeeds in supplying that market.

As logical and as acceptable as these assumptions may seem, it can be justifiably maintained that the Japanese importers on the one hand can be misinformed and uninformed about certain commodities and on the other hand exhibit irrationality in the market place. As much strength as these objections hold, it can be strongly argued that the regularity and consistency of the Japanese import market for oilseeds refutes any suggestion of inadequately informed consumers. Irrationality of purchases on behalf of the Japanese importers can be dismissed on the basis of their observed response to those markets which exhibit the greatest degree of quality and service while remaining price competitive.

The concept of the demand schedule itself has its source in the theory of the utility curve or the indifference map. Either of these approaches lead to the theory of demand, although the basic approach taken by each differs considerably. Rather than discussing each of these approaches, it is sufficient for our purposes to discuss several features of demand which are relevant to the market under study in this thesis.[2]

In terms of economic theory, reference to the demand for a particular commodity relates to the maximum amount of that commodity which consumers will purchase, ceteris paribus, at certain different prices. In other words, the demand schedule represents consumer choices at one specific point in time. In reality, this is a hypothetical definition which would have limited applicability to most market places. Most organized commodity markets attain only one price at any one time and in fact, this is the major function of the market place.[3] The structural form of the market, however, may have an effect on the degree to which this is achieved. In this regards, the futures market

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[2]See for example G. Stigler, The Theory of Price, New York, Macmillan Co., 1947, pp. 46-70. M. J. Brennan, Theory of Economic Statics, Englewood Cliffs, Prentice-Hall Inc., 1965, pp. 45-111.

[3]For a more complete discussion of this concept, see: T. A. Hieronymous, "Effects of Futures Trading on Prices", Futures Trading Seminar, Vol. 1, 1960, pp. 121-161.

will be discussed in another section of this chapter, as it relates to the oilseed pricing mechanism.

As discussed in Chapter II, the structure of the Japanese oilseed import market is classed as oligopolistic. This statement was made partially on the basis of the degree of supplier concentration which exists in this market. According to Bain,[4] however, there are other dimensions of structure which appear to have some importance in determining market structure. The degree of product differentiation, which measures the extent to which a buyer distinguishes among competing products, is an influential factor in the competitive relationship which exists between competitors in an industry. In effect, product differentiation is a measure of the degree of substitutability of various commodities. Commodities supplied by the same industry, but by different firms, have a high degree of substitutability and, therefore, a small amount of differentiation. The cross-elasticity of demand for products of the same industry, therefore, may necessarily be infinite in value.[5]

In the Japanese oilseed import market, many of the oilseeds are close, but not perfect substitutes and it would,

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[4]Joe S. Bain, Industrial Organization, New York, John Wiley and Sons, 1959, p. 210.

[5]Ibid., p. 212.

therefore, be reasonable to assume that the degree to which the oilseeds substitute for each other determines their cross-elasticities.

A second factor which determines market structure is the condition of market entry for potential suppliers. This factor refers to those barriers which a new supplier must cross in order to compete within the market. Various types of barriers exist, but one of the most important is the product-differentiation advantage which an established supplier may have over a new supplier. Where the commodity of an established supplier is preferred over the commodity of the new supplier, it may be necessary for the new supplier to secure a selling price lower than that of his competitor.

A second barrier to entry may result from the fact that the established supplier has developed economies of distribution which permit him to supply the entire market at a lower cost than is possible for the new supplier.

Both of these barriers to entry exist for Canadian oilseeds and especially for rapeseed. The established degree of acceptance of the American soybean in Japan has presented a form of a barrier to rapeseed. The established distribution system which the soybean has enjoyed in the Japanese meal and oil industries, also places Canadian oilseeds at a disadvantage in this market.

The Japanese oilseed import industry consists of numerous suppliers, but the bulk of the amount imported is supplied by four or five countries. The nature of the competition which exists in this industry is unique in that all the suppliers to this market react to more than just the impersonal market forces. Economic theory describes such an industry as oligopolistic because firms or suppliers individually react to each others policies directly.[6] Such a description however, considers only one aspect of industry conduct, namely, supplier concentration. Although it may be adequate in that it rules out the existence of perfect competition and monopoly, the term oligopoly covers a broad spectrum of industry organization. Each industry which is categorized as an oligopoly may differ from all others falling within this group more so than those classed as perfectly competitive or monopolistic.

The theory of oligopoly is in actuality a theory of behavior within a group of firms. Mass, or individual behavior, is precluded in this approach because of the fact that mutual interdependence, upon which oligopoly theory is built, is not present. Because of this mutual inter-dependence and the broad range of competition which can

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[6]Richard Caves, American Industry: Structure, Conduct and Performance, Englewood Cliffs, N.J., Prentice-Hall Inc., 1967, p. 39.

occur in this form of industry, no single satisfactory theory of oligopoly pricing and output has been developed. Instead, there exist several theories which attempt to explain pricing and output under oligopoly.[7] Each of the theories of oligopoly and even a conglomeration of such theories may be useful in explaining different markets under the general heading of oligopoly. It is not likely that any one market will strictly correspond to the postulates of any one theory.

To say that Canada operates as an oligopolistic firm in the Japanese oilseed market is tenable on the basis that the degree of success which Canada achieves in selling rapeseed and flaxseed in that market is determined in part by the existing competition from oilseeds of other sources. In other words, the sales policies of other countries affect the demand which is faced by Canadian oilseed exporters.

The amounts of rapeseed and flaxseed which Canada sells to Japan are also in part affected by sales promotion efforts of exporters to increase sales. In essence, Canada's ability to increase her share of the market at the expense of another supplier implies some degree of market control.[8]

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[7]D. S. Watson, Price Theory and Its Uses, Boston, Mass., Mifflin Co., 1963, p. 350.

[8]Perfect competition assumes that each competitor produces such a small proportion of the total supply that he has no effective market control. A monopolist, on the other hand, supplies the entire market himself.

The demand for Canadian oilseeds in Japan is in fact affected by competition from other oilseeds and efforts to promote their use in Japan have met with some degree of success. A theoretical explanation of the demand for Canadian oilseeds can be found, therefore, within the realm of oligopoly theory.

On the concept of demand, economists are agreed that the usual interpretation is inapplicable to the oligopolistic market structure. Conventionally, the demand curve predicts what amounts would be sold at given prices, but under the oligopoly situation the demand curve cannot be interpreted as such. Instead, the term "imagined" demand curve is used by oligopolists who attempt to estimate what the demand for their product is on the basis of competitors reactions to their output and pricing policies.[9] The demand situation, therefore, which is faced by any one firm is determined by the market activities of other firms in the industry and vice versa.

The Japanese market, being international by nature of supply, purchases raw material inputs for its oilseed market on the basis of domestic supply, price and quality of imports and other factors. The degree to which suppliers to this market can optimally influence the price and quality

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[9]Paul M. Sweezy, "Demand Under Conditions of Oligopoly", American Economic Association, Readings in Price Theory, G. Stigler and K. Boulding, Vol. VI, Chicago, Richard D. Irwin, Inc., 1952, pp. 404-409.

of their commodity to their advantage does, in turn, have a repercussion on the demand for Canadian oilseeds. Recent Eastern European pricing policies for rapeseed and sunflowerseed have created preference for these commodities over Canadian rapeseed. The decisions of these countries have, in essence, altered the Japanese demand for Canadian oilseeds. It is this interdependency of the policies of one supplier and another which results in the lack of precission in estimating the demand situation facing the competitor in an oligopoly as opposed to the situation facing the perfect competitor or the monopolist.

Economic theory explains that basically three types of oligopoly have been classified according to the degree of collusion achieved among the firms. The degree of collusion which exists in an industry is the key in explaining pricing and output policies since the demand situation facing a competitor is determinate or indeterminate depending on whether or not collusion exists. A competitor in a collusive arrangement usually faces a determinate demand curve, and can actually predict rival reaction to his activities.

The first type of oligopoly is an organized collusive arrangement commonly referred to as a cartel. Within this classification, there exists a spectrum of strategies ranging from complete control over member firms to the more loosely-

organized market sharing approach.

A second type is generally described as an unorganized collusive oligopoly. In this type of organization, firms attempt to informally establish prices and outputs. Such tacit organization often gives rise to the price leadership arrangement.

A third type is the unorganized noncollusive oligopoly. This is characterized by independent action of individual firms. Competitors in this form of oligopoly find the demand situation which they face to be highly indeterminate. The result of this form of organization ranges from recurrent price wars to price rigidity.

As to which form is characteristic of the Japanese oilseed import market, one can only assume that because of the differences between exporters which compete in this market, and their geographical separations, any form of organized arrangement is both difficult and unlikely. Political control of pricing and exports of some countries make organization with other suppliers infeasible. It would be realistic to assume, therefore, that each of the major suppliers to the Japanese market faces an indeterminate demand situation. At the same time, however, because of the proportion of this market which it holds, the American soybean can be said to exert some degree of price leadership. Canadian oilseed prices may, therefore, be partly determined

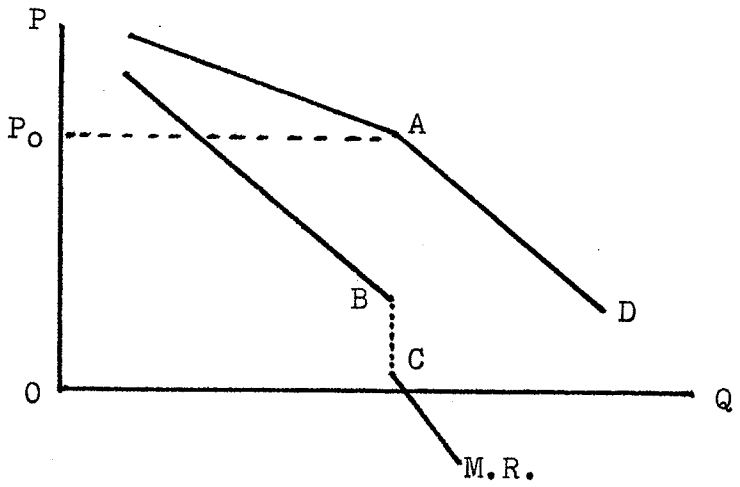
tacitly according to the prices of U.S. soybeans. Other factors such as quality and oil and meal content, however, are also instrumental in maintaining price differentials between the oilseeds.

In the indeterminate demand situation, price wars arise from the interdependence of sellers. Each seller attempts to maximize his portion of the market and through lowering his price he may at first gain a larger share of the market but rivals soon retaliate with lower prices also. In the oilseed markets, such price cuts could originate from surplus stocks and the necessity for the exporters to move the grain through to the final market position. Limited storage facilities and cash at the producer level may induce exporters to initiate price wars to alleviate an internal problem and in so doing, create a series of price cuts in the markets. Such price wars usually arise from surplus situations or from relatively new exporting countries who are attempting to gain a larger share in the market.

Non-price competition, however, occurs in more mature industries among firms attempting to increase their market share. In such instances, price rigidity becomes the rule while advertising and the creation of product differentiation are the means by which products are promoted.

An analytical device which explains the oligopolistic price rigidity is the kinked demand curve. Figure 3.1 exhibits a kink at point A in the demand curve where the

FIGURE 3.1 The Kinked Demand Curve



marginal revenue curve is discontinuous, (at point B). This concept assumes that an acceptable market price has been established and that if one firm lowers its price, other firms will follow suit in order to maintain their market share. If, however, one firm raises its price, other firms will be reluctant to follow suit and they will, therefore, increase their market share as consumers now purchase from the lower priced firms who maintain their price at P_o. Either raising or lowering price, therefore, is of no benefit to any firm since it cannot maintain its market share at a higher price and it cannot increase its market share at a lower price. The result, therefore, is

the kink, which occurs at some set price, such as A, which is acceptable to all the firms. Below this price, rival firms are very responsive to price decreases, and above this price they are not responsive to price increases.

The Japanese oilseed import market has been faced with price fluctuations from time to time in certain oilseeds but this occurrence can have two sources. First, it could result from the efforts of some countries to gain a larger share of this market by lowering price. Eastern European countries, in fact, have adopted some pricing policies which have resulted in prices substantially lower than Canadian prices. As part of the non-price competition, however, Canada has been able to offer consistent supplies of oilseeds and greater assurance of delivery to the Japanese. Secondly, the price fluctuations may be the result of world surpluses or shortages of oilseeds which generally have effects on prices despite the policies of exporting countries.

Also characteristic of the Japanese oilseed import market is the attempt by several countries to increase their share of the market through non-price competition. Advertising and product promotion is generally carried out by competitors selling differentiated products. In Japan the American soybean is promoted by the American Soybean

Association, in an attempt to expand the sales of U.S. soybeans. Canadian rapeseed is promoted through the Rapeseed Association of Canada. Suppliers of both these oilseeds are attempting not only to expand the demand for their respective oilseeds in total, but also to capture a greater share of the existing market at the expense of each other. Rapeseed and soybeans, however, are not perfect substitutes and although they are close, they can be differentiated on the basis of physical characteristics. Owing to some differentiation between soybeans and rapeseed, price cuts by the U.S. soybean exporters do not completely deprive the Canadian exporters of all sales of their oilseeds.

Differentiated products, therefore, imply that, in the same market, prices do not have to remain equal in order for each competitor to maintain his share of the market. However, the degree of differentiation will dictate how great a spread may lie between the prices of the two competing commodities. The better one product substitutes for another, the less differentiation there is and the smaller will be the price spread which competitors will be able to effectively maintain. As economic theory suggests through the kinked demand curve, however, effective competition in an unorganized noncollusive oligopolistic type of industry will not generally be waged through price wars.

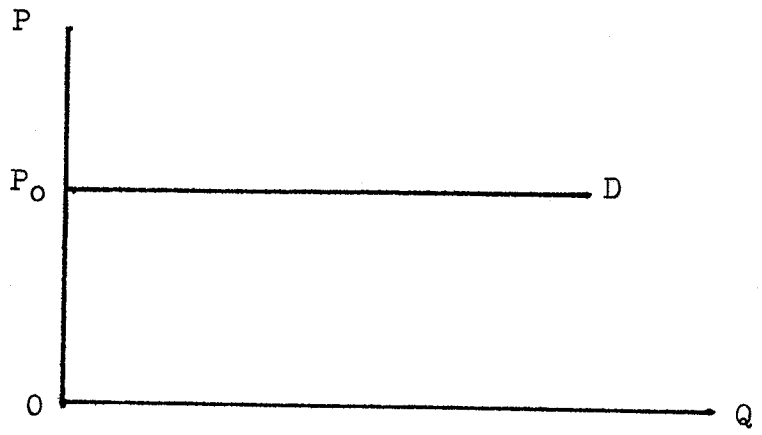
Non-price competition can assume a variation of activities. Canadian rapeseed and flaxseed exporters compete not only on the basis of price but on the basis of promotion through trade missions as well. Even the maintenance of adequate stocks of oilseeds available for export can be interpreted as a non-price competitive manoeuver. Although it appears removed from any competitive type policy, the assurance that stocks will be available for export is an important factor which the Japanese consider when deciding to purchase from Canada. Several of the Communist bloc countries who are able to sell oilseeds to Japan at prices below Canadian prices cannot assure the market of available supplies from year to year. In such a situation, assurance of supply is a non-price competitive tactic and Canadian exporters are increasingly aware of the necessity of maintaining adequate Vancouver stocks. Interior oilseed stocks and the railway transportation system to the West Coast take on an increasing significance in the available export stock situation when the free stocks of oilseeds permitted in Vancouver are limited. Assurance of supply of flaxseed and rapeseed as a non-price competitive factor thus assumes importance in the form of available stocks in store in Western Canadian grain elevators.

As a member of this imperfectly competitive market,

which operates in Japan, Canada can expect to face a demand curve which exhibits some degree of slope. This implies that, as the sole supplier of rapeseed and flaxseed to Japan, Canadian exporters have an effect on the market which is considerably stronger than that of a supplier under perfect competition. However, the competitors which supply Japan with the substitutes for Canadian rapeseed and flaxseed maintain enough control in the industry in total to limit the market control which Canadian oilseeds have. In other words, although rapeseed and flaxseed can be differentiated from other oilseeds in the Japanese market, the total portion of the market which these oilseeds occupy implies that the demand curve for these oilseeds will exhibit considerable elasticity.

The demand condition for the perfect competitor can simply be exhibited as a horizontal straight line, as shown in figure 3.2.

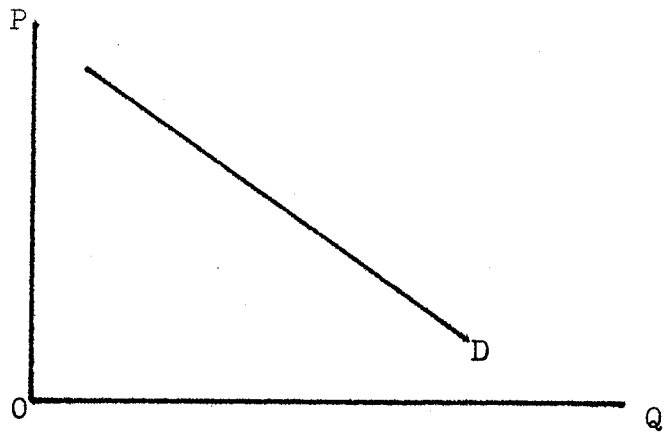
FIGURE 3.2 Demand Curve for the Firm in Perfect Competition



This implies that the competitor can market all he can produce without affecting the price. He produces such a small amount of the total industry output that he has no market control and his product cannot be differentiated from that of the other firms in the same industry.

The imperfect competitor on the other hand supplies an influential portion of the market. As shown in figure 3.3, the competitor faces a downward sloping demand curve, the elasticity of which is determined by the competitive position of his product.

FIGURE 3.3 A Demand Curve Facing the Imperfect Competitor



Canadian rapeseed and flaxseed face competition in Japan from the American soybean and other oilseeds. The Japanese oilseed industry demand is, therefore, not the same

as the demand for rapeseed and flaxseed. An alternative commodity to these oilseeds exists. However, the amount of soybeans and other oilseeds supplied is not so great that rapeseed and flaxseed have no market influence. Because soybeans and the other oilseeds supplied to this market do constitute well over 85 percent of the market by value, it can be hypothesized that the demand for both rapeseed and flaxseed is elastic.

In the Japanese oilseed market, Canadian rapeseed and flaxseed compete with oilseeds which can be used as substitutes to various degrees. As substitutes, these commodities have cross-demands for rapeseed and flaxseed and generally the better a substitute one product is for another, the greater will be its cross-elasticity of demand. The American soybean appears to be a good substitute for Canadian rapeseed in Japan and an estimate of its cross elasticity of demand can be expected, therefore, to be large. Although soybeans are the best oilseed substitutes for flaxseed in Japan and have been used increasingly as a substitute, the synthetics appear to be the best overall substitutes. As soybeans substitute for both rapeseed and flaxseed to a limited extent, the demand for both of these Canadian oilseeds will be affected by soybean prices. Generally, the elasticity of demand for a commodity depends

on the existence of substitute products and the greater the substitutability, the greater the elasticity of demand for that commodity. On this account, therefore, the elasticity of demand for rapeseed can be hypothesized to be greater than that for flaxseed.

(B) A Review of Literature

Many demand analyses of commodity markets have been conducted. One such study carried out by Houck,[10] involved the computation of empirical estimates of the parameters in a simultaneous-equation model of the U.S. soybean market. The model constructed by Houck, was an eight equation linear model, and the parameters were estimated by least squares and two-stage least squares. He expressed the farm level of demand for soybeans by linking the oil and meal demand with the export and storage demand. Houck established the price of soybeans by allowing the total farm level to interact with the farm supply function. In essence, his model explained all the outlets for soybeans and soybean products.

In his export equation, Houck assumed that the entire demand for U.S. soybeans for export was determined by the price of soybeans at the farm level and by such factors as world production and prices of competing fats, oils and oilseeds, foreign consumers incomes and trends in feeding practices.

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[10]James P. Houck, Demand and Price Analysis of the U.S. Soybean Market, Technical Bulletin 244, St. Paul Minnesota, University of Minnesota, Agricultural Experiment Station, June, 1963.

In actuality, Houck's model used only the farm price of U.S. soybeans and the supply of fats and oils in other countries in explaining export demand. He assumed that the supply of fats and oils in other countries was adequate to indicate the availability of substitutes for soybeans. He also assumed that proper data series which represented consumer income were not available for use in estimating export demand. In his model, Houck treated the farm price as a jointly determined variable and the supply of fats and oils in other countries as a pretermined variable.

The results of the estimated export demand for U.S. soybeans were not entirely what Houck had expected. The negative relationship between farm price and the quantity of soybeans exported was as expected. However, his results showed that a competitive demand relationship did not exist between world supplies of oil and fats, and the quantity of soybeans exported. Houck concluded that the positive relationship between the world supply of fats and oils, and the quantity of soybeans exported was the result of trends and other factors not accounted for in the model.

In a study by Houck and Mann,[11] the Japanese demand for U.S. soybeans was estimated by a single-equation technique. In this analysis, the quantity of soybeans

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

exported was assumed to be a function of national income and the average farm price of U.S. soybeans. An alternative form of the same equation replaced the nationak income variable with a measure of the livestock units in Japan. The results of both of these versions showed that national income and the number of livestock units were positively related to the exports of U.S. soybeans to Japan.

In the above studies, no consideration was paid to the form of competition which existed in the markets for U.S. soybeans. This was not unexpected, however, because the purpose of both of the studies was only to provide general expressions of the price making forces within the market and not to provide guidelines for future marketing policies.

In a study carried out for the Rapeseed Association of Canada in 1968, some policy implications were discussed.[12] This study assumed that the price of soybeans is a major determinant affecting the Japanese demand for Canadian rapeseed. The study also claimed that the degree of product differentiation between U.S. soybeans and Canadian rapeseed places Canadian rapeseed in a disadvantageous position. The study claimed market promotion, in an attempt

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[12]Coral Inc., A Study of the Japan Market For Rapeseed and Rapeseed Oil Meal, Winnipeg, (Mimeo), Nov. 1968, pp. 55-58.

to inform Japanese importers about the meal and oil characteristics, would serve to decrease the barrier to entry which rapeseed has experienced in this market.

This study, however, does not empirically assess the oilseed market in Japan and does not estimate the demand for rapeseed on the basis of the structural characteristics of the market.

Few commodity studies, including those discussed above, consider the role of the futures market as it reflects the supply and demand situation in the market place. Although this study does not include a detailed discussion of the futures market, this form of market is instrumental in the pricing mechanism of Canadian oilseeds. Both flaxseed and rapeseed are traded in a futures market in Canada.

In a paper on futures trading and its affect on prices, Hieronymus[13] claims that it is not possible to say conclusively whether or not futures trading decreases or increases prices and price variations of a commodity. He does claim, however, that a futures market results in increased average prices to the producer, and decreased average prices paid by consumers. Hieronymus also claims that a futures market operates to the advantage of a processor because it assumes more of the risk than the individual processor could afford. Further, he

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[13]T. A. Hieronymus, "Effects of Futures Trading on Prices", Futures Trading Seminar, Vol. I, 1960, pp. 121-161.

claims that it is possible to develop better merchandising programs for a commodity which can be traded on the futures market because of the greater stability of price. The futures market, in stabilizing prices, allows for increased market sizes, he states, because the cost of assuming price variations decreases and more processors will thus purchase the commodity.

With respect to the length of time over which the stabilizing forces of the futures market will function, Hieronymus states, that the futures market is more effective in reducing price fluctuations over shorter periods of time. He claims that the futures market is more stabilizing on a day to day basis than on a month to month basis. Further, he adds that there is no stabilizing influence on seasonal pricing patterns.

The effect of the futures market on the Japanese oilseed trade is not considered in this study, but, nonetheless, it must be considered to have an important role in this market.

CHAPTER IV

ECONOMETRIC ANALYSIS OF THE JAPANESE DEMAND FOR CANADIAN OILSEEDS

The econometric models which are developed in this chapter have their source in the economic theory as presented in the last chapter and in figures 2.1 and 2.2. Although it can be argued that the models represented here do not immediately and logically follow from a discussion on the unorganized noncollusive oligopoly, the lack of a satisfactory model for dealing quantitatively with the oloigopolistic market structure necessitates this approach.[1] It may seem, in fact, that the model presented in this study more closely resembles that of a purely competitive type of market than a market in which an indeterminate demand curve is assumed to exist. However, although the models presented for rapeseed and flaxseed do not include such indeterminate factors as competitors' expected reactions, they do include all those factors which can be quantitatively assessed.

The hypotheses, which form the bases for the models, concern the Canadian supply of and the Japanese demand for rapeseed and flaxseed. The estimates of the parameters of

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[1] R. L. Gustafson, "Firm Price Output Behavior in Imperfectly Competitive Markets," Agricultural Market Analysis, Vernon L. Sorenson, Menasha, Wisconsin, George Banta Co., 1964, p. 118-119.

these models represent the central aim of this thesis. However, in view of the difficulties which surround the attempts at obtaining the empirical estimates of the theoretical relations, some consideration should be paid to the problems of model construction.

(1) CONSIDERATIONS IN MODEL FORMULATION

The theoretical explanation of demand and the approach to demand under the oligopolistic market structure, which were presented in the previous chapter, set the basis for the hypotheses about the nature of the demand which faces Canadian exporters in the Japanese market. Several qualifications are necessary to understand the shortcomings of empirically estimated relations when compared with those postulated by economic theory.

Among the foremost restrictions in empirical analysis is that of available data. The entire concept of demand is built upon the assumption that the market-generated data, which is analysed, is derived from a single point in time. In practice, however, in one market at any one point in time, only one equilibrium price and quantity are available. The empirical analysis, therefore, must rely on time series data and so deviate from the theoretical conditions. Consequently, the estimated relations must be interpreted in the context of a changing market structure over the intervening market period analysed.

Closely associated with this problem is that of data availability. Although the theoretical analysis may imply the model which is to be specified, data restrictions result in the estimation of a relation which is not entirely representative of the market. Involved in this last restriction is the problem of obtaining market-generated data over a sufficient time period in order to allow valid estimates.

Another of the major difficulties which can be resolved only through repeated empirical testing is that of the form of the relations. Theory may specify the relation which is representative of the market to be analysed, but it says nothing of the specific form which the relation should assume.

Although these problems exist in empirical analysis, reasonably valid estimates are still possible, if they are based on relations which are adequately specified. As Foote claims, industry flow charts are important in this procedure as they (1) help the analyst think through basic factors and relationships involved, (2) aid in the preparation of a logical description of the economic structure of the industry, and (3) assist the reader in following fairly complex relationships and discussions.[2]

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[2]R. J. Foote, Analytical Tools for Studying Demand and Price Structures, Agricultural Handbook No. 146, AMS, USDA, Washington, D.C., U.S. Government Printing Office, Aug. 1958, p. 1.

The first major step in an economic analysis is the specification of the system of relationships that is believed to have generated the observed market data.[3] This involves a combined knowledge of economic theory and the relationships which hold for the particular commodity under investigation. The decision to use the single-equation or the simultaneous equation method requires that several questions are clearly answered. This implies adequate background information on the market.

The single-equation technique may not be adequate when the purpose is to estimate the elasticity of demand and other structural coefficients.[4] The simultaneous equations approach is, therefore, a necessary, but not sufficient requirement towards obtaining valid estimates. This method is used where it is assumed that current supply of the commodity under consideration is affected by price. Johnston states[5] that the reason that the single-equation technique is not adequate in this situation is that coefficient estimates are biased and inconsistent.[6] The least squares

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[3]Karl A. Fox, The Analysis of Demand for Farm Products, Technical Bulletin No. 1081, USDA, Washington, D.C., U.S. Government Printing Office, Sept. 1953, p. 8.

[4]Ibid., p. 9.

[5]J. Johnston, Econometric Methods, New York, McGraw-Hill Book Co. Inc., 1963, pp. 231-234.

[6]An estimator $\hat{\theta}$ is said to be biased if the expected value of $\hat{\theta}$ is not equal to the parameter value of the population, $E(\hat{\theta}) \neq \theta$. An estimator is inconsistent if $\hat{\theta}$ does not converge stochastically to θ as the sample size tends towards infinity, $N \rightarrow \infty$; That is, $\lim_{N \rightarrow \infty} \hat{\theta} \neq \theta$
An estimator is efficient if, as $\hat{\theta} \rightarrow \theta$, it is $N(0, \sigma^2)$

approach yields biased estimates because the disturbance term and an explanatory variable are correlated. Even as the same size becomes infinitely large, this bias persists. The estimates by the least squares approach are thus inconsistent. Where this situation arises, it becomes necessary to use a method of estimation which does not possess these properties.

In a demand analysis, when the assumption is made that the supply of a commodity is affected by current price there is an implied existence of a second structural equation in which supply is expressed as a function of price and other certain predetermined variables. Instead of treating supply as predetermined, therefore, a simultaneous equation technique of estimating supply and demand relations is used.[7]

A second question which can be asked in an effort to determine whether a single equation is adequate for valid estimation is whether the consumption of a given commodity is significantly affected by the current price or by the demand for export or storage. Supply of the commodity

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[7]A variable is considered as predetermined if its current value is not affected by current values of other variables in the same structure, but by factors operating beyond the supply-demand structure. When a variable is predetermined, it can be used as an independent variable in a least-squares function or in the reduced-form equations of a simultaneous model. A variable not predetermined and used as such leads to biased estimates when used in least-squares equations.

entering the market system may not be affected by current market price so that the amounts supplied by producers is exactly equal to the amount which reaches the consumer in the current period. In this case only one market demand curve exists and the single equation technique is adequate. However, where a domestic and export market exist, a more complicated situation arises in that each outlet possesses an individual supply and demand function. The demand and supply situation in each market is determined by variables unique to that market.

Basically, the necessity for using simultaneous equations arises because the line of causation between the dependent and independent variables is not unilateral. When two variables are jointly determined such that quantity is affected by price and price is affected by quantity, a scatter diagram of equilibrium price-quantity transactions will yield neither a supply curve nor a demand curve but a mixture of both.

FIGURE 4.1 Scatter Diagram

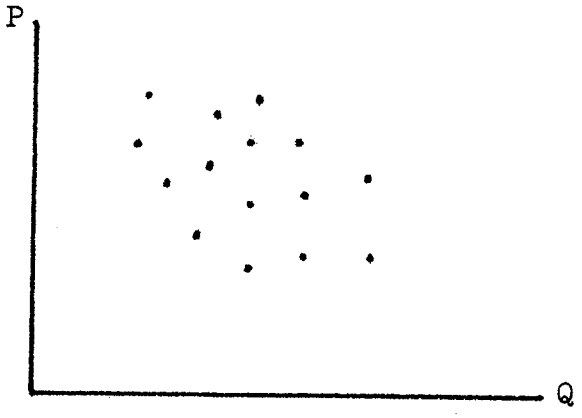

Figure 4.1 represents a series of demand and supply curve intersections, but the elasticities of the curves shown are hypothetical because neither curve can be determined from the data.[8] There is no way of deciding if the demand curve is shifting and the supply curve is stable or vice versa, or if both the demand and supply curves are unstable. The simultaneous equations approach represents an alternative method which will permit the estimation of the coefficients of both the supply and demand functions.

As mentioned, the system of ordinary least squares is seen to give biased and inconsistent results when applied to functions with current endogenous variables which are assumed to be predetermined.[9] The simultaneous equations approach is basically the same as the single equation analysis except that a number of variables are assumed to be determined simultaneously by a common set of economic forces. The system of equations is solved so as to give statistically consistent estimates of the structural coefficients of the several jointly-dependent variables.

Since the problem of biasedness in the single equation approach arises from correlation between the

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[8]Geoffrey S. Shepherd, Agricultural Price Analysis, Ames, Iowa, The Iowa State College Press, 1957, p. 144.

[9]Endogenous variables are those that are determined within the system of equations or model which is hypothesized to explain the phenomena under investigation.

disturbance term and the explanatory or dependent variable, the method of simultaneous equations must resolve this difficulty. The method of reduced form equations offers such a solution. Basically, the reduced form equation is a transformation of the original system of equations by expressing the current values of endogenous variables as functions of all other exogenous variables in the system and thereby expressing each equation with only one current endogenous variable.[10] Applying least squares to this form results in estimates which, though not unbiased estimates of the structural parameters, are consistent and efficient.

(2) THE MODELS

The models in this analysis are formulated to determine the degree to which certain variables affect the amounts of rapeseed and flaxseed which are demanded by the Japanese and supplied by Canadian exporters. A supply and demand equation is, therefore, presented for both rapeseed and flaxseed.

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[10] J. Johnston, op. cit., p. 234.

THE RAPESEED MODEL

(a) DEMAND

In the case of the Japanese demand relation for rapeseed, the quantity demanded and the price of rapeseed are considered as jointly determined. Each of these two variables is assumed to influence the other, and are thus both endogenous within the system. The export price of Canadian rapeseed is considered dependent on the quantity demanded by Japan on the basis that this market is responsible for the consumption of 75 percent of the exports. The assumption that the quantity of rapeseed demanded by the Japanese is dependent on its export price is tenable on both theoretical and empirical grounds.

The American soybean price is assumed to have a major influence on the price of oilseeds in the Japanese market. Since it is the major competitor to rapeseed, the quantity of rapeseed demanded by the Japanese importers is hypothesized to be positively associated with the price of soybeans. An increase in the price of soybeans would result in an increase in the Japanese demand for rapeseed.

Another variable which appears to influence the Japanese demand for Canadian rapeseed is the Japanese domestic supply of rapeseed. For purposes of this analysis, the Japanese domestic rapeseed supply is considered as

predetermined. The assumption here is that decreasing rapeseed production in Japan has in part been responsible for their increased demand on Canadian supplies.

A variable representing consumer income is not used in the demand equation for rapeseed. Because the wholesale level or importer level of demand is being considered, only those factors which directly affect the importer's decision to purchase rapeseed are considered. Rapeseed at the importer level of the market place is still several steps from the retail level. Rapeseed meal, in fact, never moves to the retail or consumer level of the market. Rapeseed oil does move to the consumer from the importer, but only after it is processed. On this basis, therefore, a relationship between consumer income and the importer level of demand for rapeseed would not be meaningful.

Finally, increases in transportation charges for shipping rapeseed to Japan are assumed to result in a decreased demand for Canadian rapeseed. Since Japan imports virtually all of her rapeseed from Canada, it is valid to assume that the geographical location of Canada, when compared to that of other possible rapeseed sources, may function as an effective factor in favor of Canada.

The Japanese demand for rapeseed can, therefore, be formulated in the following stochastic relationship:[11]

$$(4.1) \quad Q_{RD} = f\ (P_S,\ Q_{RP},\ T_R,\ P_R,\ U_1)$$

where Q_{RD} = total quarterly exports of Canadian rapeseed to Japan.

P_S = U.S. average quarterly wholesale price of soybeans.

Q_{RP} = Japanese rapeseed production.

T_R = a measure of transportation costs.

P_R = average quarterly price of Canadian rapeseed exported to Japan.

U_1 = random disturbance.

(b) SUPPLY

The supply equation, as introduced into this model, is intended to determine those factors which have an influence on the rapeseed supplied to the Japanese market. This involves delineating those factors which govern the flow of rapeseed into the marketing channels for export to Japan.

In the supply relation, the assumption is made of a jointly determined relationship between the quantity of

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[11]A random variable is sometimes referred to as a stochastic variable and in this case a random disturbance is assumed to exist. A basic assumption of the simultaneous equation approach is that economic data are generated by systems of relations that are in general stochastic in nature. The U's merely reflect the random influence of all other unspecified variables on individual equations.

rapeseed supplied and the export price. Each of these two variables is assumed to influence the other and both are, therefore, classified as endogenous within the system. On the basis of economic theory, it is valid to assume that the amount of rapeseed supplied by the exporters is positively related to price.

Another variable which exerts influence on the available rapeseed for export shipment to Japan is the total rapeseed stocks in store. Both stocks in store at export terminal points and at interior points are influential in this variable because both have a direct relationship with export stocks.

A variable which exerts significant influence on the supply of Canadian rapeseed is the import quota which faces Canadian exporters. As this barrier has been decreasing over the period analysed and exports to Japan have been increasing, a positive relationship between the two variables is used. The quota variable is used in the supply equation because it serves to govern the amount of foreign rapeseed which is available to the Japanese importers. The quota is an import restriction set by the Food Agency and, therefore, does not necessarily reflect actual importer demand.

Exports of rapeseed to other countries can be assumed to influence the available supply of rapeseed for export to

Japan by placing limitations on the transportation and storage facilities which are instrumental in servicing foreign markets. As foreign markets, other than Japan, increase their demands for Canadian rapeseed, the throughput of the transportation and storage system must necessarily be increased in order to serve the Japan market.

The supply equation can thus be written stochastically as:

$$(4.2) \quad Q_{RS} = f\ (S_{RT},\ Q_T,\ Q_{RO},\ P_R,\ U_2)$$

where Q_{RS} = total quarterly exports of rapeseed to Japan.

S_{RT} = total stocks in store of rapeseed in export position and interior position.

Q_T = Japanese import quota on rapeseed.

Q_{RO} = total quarterly exports of rapeseed to countries other than Japan.

P_R = average quarterly price or rapeseed exported to Japan.

U_2 = a random disturbance.

Since the model contains two jointly determined variables and two equations, the system is considered complete. In completing the model, a market clearing identity can be specified as:

$$(4.3) \quad Q_{RD} = Q_{RS}$$

THE FLAXSEED MODEL

(a) DEMAND

A similar type of jointly determined relationship between quantity demanded and price is assumed to exist in the flax model. Therefore, the export price of flaxseed to Japan and the quantity exported are assumed to be jointly related.

The price of soybeans is included as an explanatory variable in the flaxseed demand equation. Soybeans substitute to some degree for flaxseed in industrial products and the major price-determining force which soybeans exert on the market influences the price of all oilseeds to some extent.

The limited flaxseed production in Japan serves as a supplementary source of this oilseed to the Japanese industry. In part, the supply from this source is assumed to affect the amount which is demanded from Canadian stocks.

As in the rapeseed model, a measure of transportation costs is also included as a factor which affects the demand for flaxseed. In this model, a trend variable is also included to represent the total effects of those variables which individually were not significant in explaining the Japanese demand for flax. Time is frequently introduced in such a manner as a measure of sources of continuous

systematic variation for which no data is available.

The Japanese demand for Canadian flaxseed can, therefore, be expressed in the following stochastic relationship:

$$(4.4) \quad Q_{FD} = f\ (P_S,\ Q_{FP},\ E_t,\ T_F,\ P_F,\ U_3)$$

where Q_{FD} = total quarterly exports of Canadian flaxseed to Japan.

P_S = U.S. average quarterly wholesale price of soybeans.

Q_{FP} = a measure of Japanese flaxseed production.

E_t = a trend variable.

T_F = a measure of transportation costs.

P_F = average quarterly price of Canadian flaxseed exported to Japan.

U_3 = a random disturbance.

(b) SUPPLY

An equation representing the supply of Canadian flaxseed, as in the rapeseed model, is not intended to explain the supply of flax at the producer level, but to delineate those factors governing the supply of Canadian flaxseed at the export level of the market. The export supply considered here is that which is available to the Japanese oilseed industry.

The relationship between the flaxseed supplied and the export price of flax is assumed to be jointly dependent. Again, this assumption accounts for the simultaneous nature of the model and necessitates the use of the two-stage least squares estimating technique.

The total stocks of flaxseed in store are assumed to have an effect on the quantity of flaxseed available for export to Japan. This is not unlikely since stocks in export position are dependent on interior terminal and country elevator stocks. Similarly, the quantity of flaxseed available for export to Japan is determined in part by the amounts exported to other countries.

A trend variable is included in the flaxseed supply equation as well. The supply model for flaxseed in stochastic form can, therefore, be expressed as:

$$(4.5) \quad Q_{FS} = f\ (S_{FT},\ E_t,\ Q_{FO},\ P_F,\ U_4)$$

where Q_{FS} = total quarterly exports of Canadian flaxseed to Japan.

S_{FT} = total stocks of flaxseed, export and interior position.

E_t = a trend variable.

Q_{FO} = total quarterly exports of Canadian flaxseed to countries other than Japan.

P_F = average quarterly price of Canadian flaxseed exported to Japan.

(4.6) $Q_{FD} = Q_{FS}$

As in the rapeseed model, a market clearing identity for the flaxseed model is specified in equation 4.6.

ESTIMATION OF THE MODEL

The statistical problem existing in this analysis involved the estimation of the unknown parameters in the stochastic equations of both the rapeseed and flaxseed models. With the predetermined or exogenous variables represented by 'Y' and the jointly determined or endogenous variables represented by 'X', the rapeseed and flaxseed models can be written as follows:

(4.7) $Y_1 = a_1 + a_2Y_2 + a_3X_1 + a_4X_2 + a_5X_3 + U_1$
(rapeseed demand)

(4.8) $Y_1 = b_1 + b_2Y_2 + b_3X_4 + b_4X_5 + b_5X_6 + U_2$
(rapeseed supply)

(4.9) $Y_3 = c_1 + c_2Y_4 + c_3X_7 + c_4X_8 + c_5X_9 + c_6X_{10} + U_3$
(flaxseed demand)

(4.10) $Y_3 = d_1 + d_2Y_4 + d_3X_{11} + d_4X_{12} + d_5X_{13} + U_4$
(flaxseed supply)

The endogenous variables are:

$Y_1 = Q_{RD} = Q_{RS}$ = total quarterly exports of rapeseed to Japan (millions of pounds).

$Y_2 = P_R$ = average quarterly price of rapeseed exported to Japan; F.O.B. Vancouver (cents per pound).

$Y_3 = Q_{FD} = Q_{FS}$ = total quarterly exports of flaxseed to Japan (millions of pounds).

$Y_4 = P_F$ = average quarterly price of flaxseed exported to Japan; F.O.B. Vancouver (cents per pound).

The exogenous variables are:

$X_1 = P_S$ = U.S. average quarterly wholesale price of soybeans; Basis, Chicago (cents per pound).

$X_2 = Q_{RP}$ = average estimated quarterly flow of domestically produced rapeseed to Japanese crushing mills (millions of pounds).

$X_3 = T_R$ = a measure of rapeseed transportation cost from the West Coast to Japan (Japan C.I.F. price less export price).

$X_4 = S_{RT}$ = total Western Canadian stocks in store of rapeseed (beginning quarter stocks, millions of pounds).

$X_5 = Q_T$ = Japanese import quota on rapeseed (quarterly average, millions of pounds).

$X_6 = Q_{R_o}$ = total quarterly exports of rapeseed to countries other than Japan (millions of pounds).

$X_7 = Q_{FP}$ = average estimated quarterly flow of domestically produced flaxseed to Japanese crushing mills (millions of pounds).

$X_8 = E_t$ = a trend variable of Japanese demand for flaxseed.

$X_9 = T_F$ = a measure of flaxseed transportation costs from the West Coast to Japan (Japan C.I.F. price less export price).

$X_{10} = S_{FT}$ = total Western Canadian stocks in store of flaxseed (beginning quarter stocks, millions of pounds).

$X_{11} = E_t$ = a trend variable of Canadian supply of flaxseed to Japan.

$X_{12} = Q_{F_o}$ = total quarterly exports of flaxseed to countries other than Japan (millions of pounds).

The individual equations 4.7 to 4.10 are the structural equations of this analysis and the coefficient of Y_2, Y_4 and X_1 to X_{12} are the structural parameters. The parameters, the equations and the disturbances are known as the structure. The term model refers to all the a priori information which has been acknowledged concerning the form of the equations and the variables included in each. It is, therefore, possible that many structures may be associated with a particular model. The problem of estimation is to develop the most acceptable structure based on the available sample data.

In this analysis, each stochastic equation was estimated by the single-equation least squares procedure and the dependent variables are those shown on the left side of the equality signs in equations 4.7 through 4.10. According to statistical theory, these estimates are biased because the values of those jointly determined variables, designated as endogenous for the purposes of single-equation least squares estimation, depend on the values of the disturbances. In spite of this restriction, the single-equation least squares estimates of the parameters were

computed for a comparison with those estimated through treating the system on a simultaneous basis. This comparison was done in an effort to determine the difference, if any, in estimates computed with the use of the reduced form and those computed with only a single equation.

Using reduced form equations, it is possible to express each of the jointly-determined variables as a function of all the predetermined variables. This method was used to obtain unbiased estimates of reduced form parameters for both the rapeseed and flaxseed models. The approach taken thus far would be adequate if the major purpose of the analysis were to predict values of only the jointly-determined variables. However, as in this investigation, when the necessity to estimate the structural parameters arises, the question of identifiability arises. The estimation of reduced form equations by least squares does not require consideration of restrictions in the structure. The question of identifiability involves the feasibility of estimating structural parameters, once least squares reduced form parameters have been estimated.

Identifiability of an equation can be determined by application of the order condition for identification. This criterion specifies that to be identifiable a particular

relation must include at least one less variable than the number of exogenous variables which appear in the system.[12] Where unique estimates of the structural parameters are obtained, the equation is just-identified and $K^{**} = G_{\Delta} - 1$ where K** is the number of exogenous variables in the system but not in the equation to be estimated and G_{Δ} is the number of endogenous variables in the equation. A relation is over-identified if $K^{**} > G_{\Delta} - 1$ and under-identified if $K^{**} < G_{\Delta} - 1$. Where an equation is over-identified, inconsistent parameter estimates for the reduced form equations are obtained and where under-identified, an infinite number of estimates are derived. Usually the order condition is correct in determining whether estimates of an equations' structural parameters can be derived directly from reduced form coefficients.

Examination of the model shows that all of the equations are over-identified and that it is therefore not possible to derive unique estimates from the reduced form parameters. Another method must therefore be used to develop unique estimates of structural parameters.

An alternative method which is used to estimate structural parameters in this case is the two-stage least

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[12] J. Johnston, Econometric Methods, New York, McGraw-Hill Book Co., 1963, p. 250.

squares technique.[13] Although this method, like that of the ordinary least squares and the limited information approach, yields biased estimates in small samples, it is asymptotically consistent and efficient. Asymptotic properties, however, provide small comfort where only small samples are available.[14] Estimations of the structural parameters are made in this analysis with the two-stage least squares approach as well as the ordinary least squares approach.

The use of two-stage least squares involves the application of ordinary least squares twice. The first application involves the estimation of the reduced form with Y_2 as the dependent variable in the rapeseed system and Y_4 as the dependent variable in the flax system. The prices of rapeseed and flaxseed are thus estimated on the basis of reduced form. These estimates are used as data in the structural equations which are estimated in the second application of ordinary least squares.

(3) DATA SOURCES

Much of the data used in this analysis was derived from government publications on grain storage and grain

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[13]The two-stage least squares method is closely related to the generally accepted limited information method but the computation involved is much simpler.

[14]Johnston claims that the results of the Monte Carlo studies enable one to conjecture the small-sample properties of such estimators by comparing bias, variance, and mean-square error. See: Johnston, op. cit., pp. 275-278.

exports. The data on exports of rapeseed and flaxseed to Japan was derived from Trade of Canada - Exports, as were the export prices. Because of the relatively short time period for which a functioning market has existed in Japan for Canadian oilseeds, the availability of market generated data restricted the use of aggregated annual data in the analysis. In order to estimate meaningful relationships, therefore, it was necessary to use data generated over a smaller period of time and from years which depicted a regular functioning market. In order to reflect the response of demand and supply to price changes, quarterly data was used. The use of gross annual data, it was felt, would not permit this relationship to show up in the results. The time period analysed was 1963 to 1969 for rapeseed, and 1958 to 1969 for flaxseed. The market for flaxseed was established in Japan long before that for rapeseed and for this reason there is more market-generated data available.

The soybean price used in the analysis was taken from The Soybean Digest - Blue Book Issue. Although data on the exact export price of beans to Japan was not available, the average monthly Chicago cash price was considered to be a relatively accurate estimate. The monthly average prices were converted to prices in Canadian dollars and the simple quarterly averages of these prices were used in the analysis.

Japanese rapeseed and flaxseed production data was obtained from Statistics of Oilseeds, Oils and Oilcakes published by The Japan Oil and Fat Importers and Exporters Association. Simple quarterly averages of the production figure were computed as estimates for the quarterly flow of Japanese domestic oilseeds to their crushing industry. In fact, this approach may not be accurate in estimating this quarterly flow, but the fact that Japan imports rapeseed and flaxseed to supplement this volume implies that total annual production does flow from the producer to crusher.

An estimate of the cost of transporting oilseeds to Japan was obtained by computing the difference between the Canadian export price and the Japanese import price. This transportation estimate, therefore, includes a measure of insurance and freight. The C.I.F. price was obtained through the Commercial Division of the Canadian Embassy in Tokyo.

The variable designated as the Japanese import quota on rapeseed was estimated on a quarterly basis to conform with the use of quarterly export data. This data on the allocation of imports was also obtained from the Canadian Embassy in Tokyo.

Total stocks in store of both rapeseed and flaxseed at the beginning of each quarter were considered as representative of the amounts of each oilseed available for

export in each quarter. Storage limitations at the West Coast limited the use of stocks in store in that position as an independent variable in the supply equations. Exports in any one quarter can exceed the regulated supply of oilseeds in storage at the West Coast and so some measure of interior stocks was necessary. This data was derived from the Dominion Bureau of Statistics, Grain Statistics Weekly and Coarse Grains Quarterly.

The variable which represents exports of rapeseed and flaxseed to other countries is included in order to exhibit its effect on the amounts of these oilseeds available for export to Japan. As large quantities of the rapeseed and flaxseed, which are exported to countries other than Japan, also move through West Coast ports, any increase in their flow will result in slower Port Throughput and thus an impeded flow of oilseeds from Canada to Japan. Data representing exports of flaxseed and rapeseed to countries other than Japan was obtained from Trade of Canada - Exports and Grain Trade of Canada. (The tables of the data used in this analysis are in the appendix on page 153.)

CHAPTER V

RESULTS OF THE STATISTICAL ESTIMATION

The results of the statistical estimation were generally satisfactory. The statistical fits which were obtained by ordinary least squares and two-stage least squares were good and most of the signs on the structural coefficients were consistent with the theoretical framework.

In the presentation of the results, the hat ($\hat{}$) symbol accompanies the second stage endogenous variables in the equations estimated by two-stage least squares. Because logarithmic data is used in the analysis, the coefficients preceding the designated variables are direct elasticity measures and the statistics beneath each coefficient in parenthesis represent the standard error of estimate. The Durbin-Watson statistic for serial correlation among the calculated residuals is represented by the letter 'd'. Acceptable values of this statistic do not reject the hypothesis that the disturbances are random, while inconclusive values fall within the upper and lower bounds calculated by Durbin and Watson.[1]

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[1] J. Durbin and G. S. Watson, "Testing for Serial Correlation in Least Squares Regression," Biometrica, Vol. XV, Aug. 1950, p. 175.

A measure of the goodness of fit of the linear relationship between the dependent variable and the set of explanatory variables is the coefficient of determination which is referred to here as R^2. Generally, as the R^2 value approaches 1.0, a relation is considered more complete in that explanation of the dependent variable is more complete. However, significant 't' values must also be considered in deciding the accuracy of a relation.

The estimated coefficients can be interpreted from equations 5.1 to 5.8, but complete reliability on the estimations may not be possible because of the fact that all trends and variables which can affect this market cannot be accounted for.

RAPESEED DEMAND

Relations 5.1 and 5.2 represent the two-stage least squares and the ordinary least squares estimation of the Japanese demand for Canadian rapeseed.[2]

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[2]The estimated coefficients with a two-asterisk superscript are statistically significant at the 1 percent level, those with one asterisk are significant at the 5 percent level and those with no asterisk are significant at the 10 percent level.

The absence of an asterisk on the Durbin-Watson test statistic d, indicates no serial correlation.

$$(5.1)\quad Q_{RD} = 3.920 + \underset{(1.030)}{1.891}\ P_S - \underset{(0.471)}{1.667}^{**}\ Q_{RP} - \underset{(0.110)}{0.181}\ T_R - \underset{(0.709)}{1.432}^{*}\ \hat{P}_R + U_1$$

(2 SLS) $\quad d = 2.41 \quad R^2 = 0.810$

$$(5.2)\quad Q_{RD} = 3.958 + \underset{(0.991)}{1.792}\ P_S - \underset{(0.462)}{1.539}^{**}\ Q_{RP} - \underset{(0.109)}{0.172}\ T_R - \underset{(0.621)}{1.283}^{*}\ P_R + U_1$$

(OLS) $\quad d = 2.38 \quad R^2 = 0.792$

The two-stage least squares and ordinary least squares estimates of rapeseed demand are similar in sign and magnitude.[3] This results from the fact that the structural equation contains only one jointly determined variable as an independent variable, namely P_R. This closeness of results can be accounted for also by the reduced form estimates of P_R which are not greatly different from the original observations. Figure 5.1 shows the relationship between the actual prices used in the analysis and those estimated by the reduced form equation.

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[3]The abbreviations 2 SLS and OLS represent two-stage least squares and ordinary least squares.

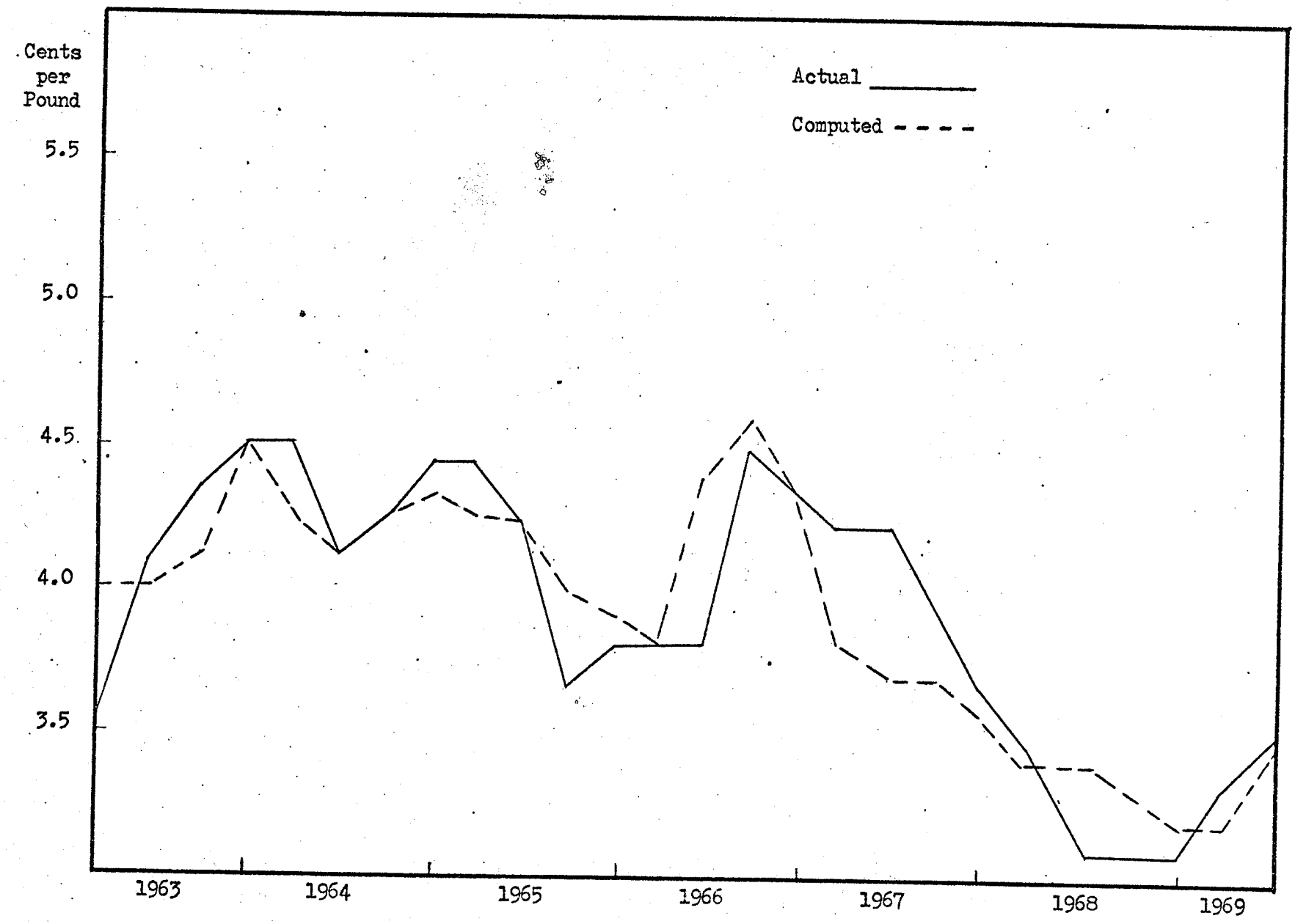

FIGURE 5.1 Price of rapeseed exported to Japan, actual and computed from 2SLS reduced form estimates, 1963-1969.

Both equations 5.1 and 5.2 fit the data fairly closely and exhibited residuals which contained little evidence of serial correlation. The signs on the coefficients are those which were expected from the theoretical approach. An increase in the Japanese demand for Canadian rapeseed was expected to be associated with increases in the price of U.S. soybeans because of the competitive relationship between the two oilseeds. The magnitude of the coefficient on the soybean price variable supports the hypothesis that soybeans and rapeseed are quite substitutable. The 2 SLS estimate of the cross-elasticity of demand for rapeseed and soybeans over the period analysed was 1.89, which means that a 1 percent increase in the price of soybeans was associated with a 1.89 percent increase in the quantity of rapeseed demanded by the Japanese.

The results of the analysis, using the 2 SLS estimating technique, show that a one percent decrease in Japanese rapeseed production results in a 1.67 percent increase in Canadian rapeseed exports to Japan. The negative relationship between the production of rapeseed in Japan and the Japanese demand for Canadian rapeseed indicates that Japan is becoming increasingly dependent on Canada for her rapeseed supply. At -1.67, coefficient on the Japanese

domestic rapeseed production variable indicates substantial growth in this market. It further indicates that Canadian exports of rapeseed to Japan are more than replacing the decrease in Japanese production.

The negative signs on the transportation variable and on the rapeseed price variable are consistent with theory. Higher transportation rates are expected to be associated with decreased exports of rapeseed to Japan. The negative sign on the price variable was hypothesized from basic demand theory. At -1.432 in the 2 SLS estimate, and -1.283 in the OLS estimate, the demand for Canadian rapeseed is price elastic. The size of the coefficient also supports the evidence of the observed growth in this market from 1963 to 1969. In the 2 SLS estimate, this coefficient reveals that during this period a one percent decrease in the price of rapeseed resulted in a 1.432 percent increase in the amount demanded.

In figure 5.2, the estimated values of the jointly determined variable, rapeseed exports to Japan, as computed from the solved reduced form of the 2 SLS estimates of the Japanese demand for Canadian rapeseed, are compared with actual values for the period sampled. Figure 5.3 presents the least squares estimates of this same jointly determined variable.

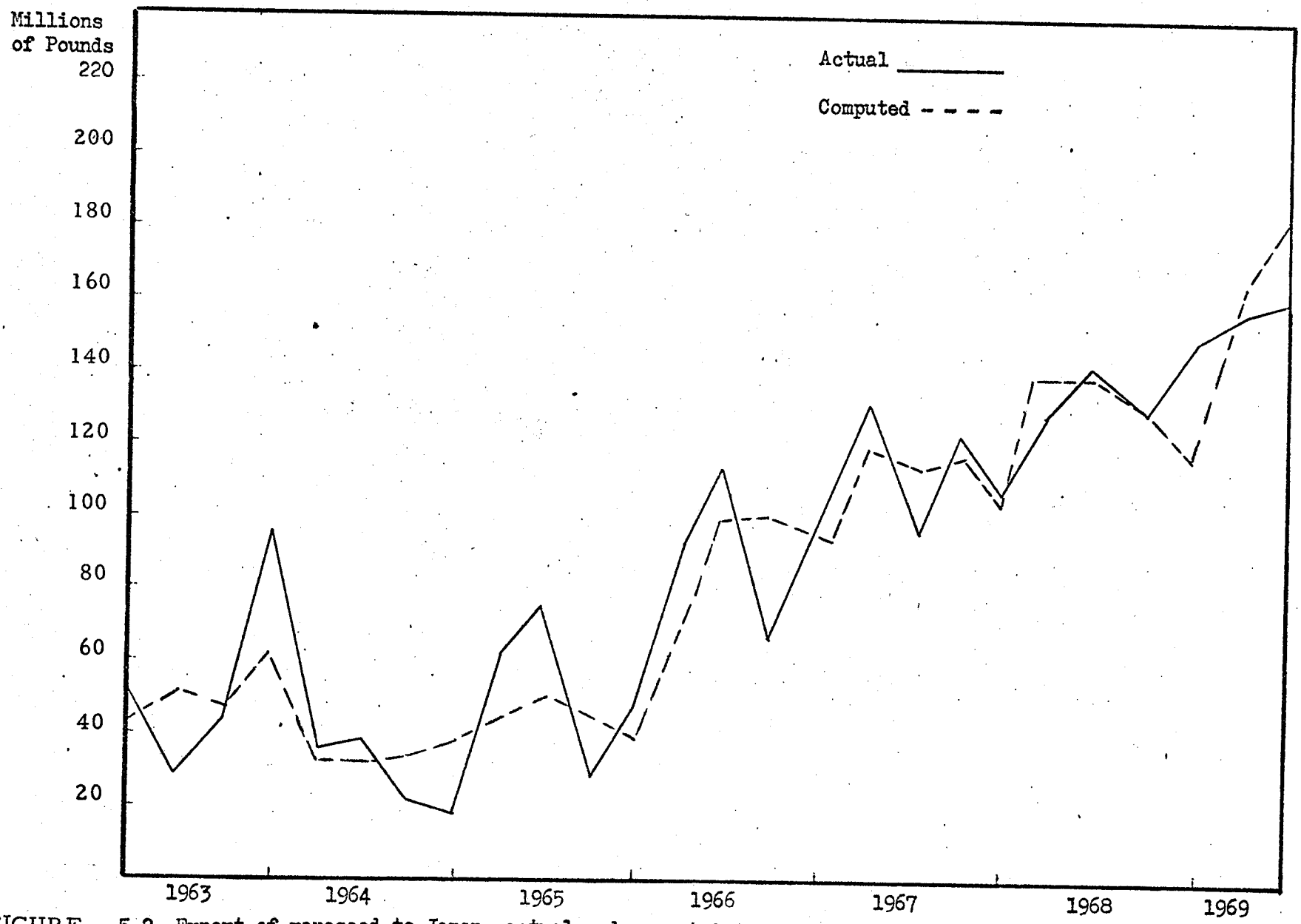

FIGURE 5.2 Export of rapeseed to Japan, actual and computed from 2SLS structural estimates of Japanese demand equation 5.1, 1963-1969.

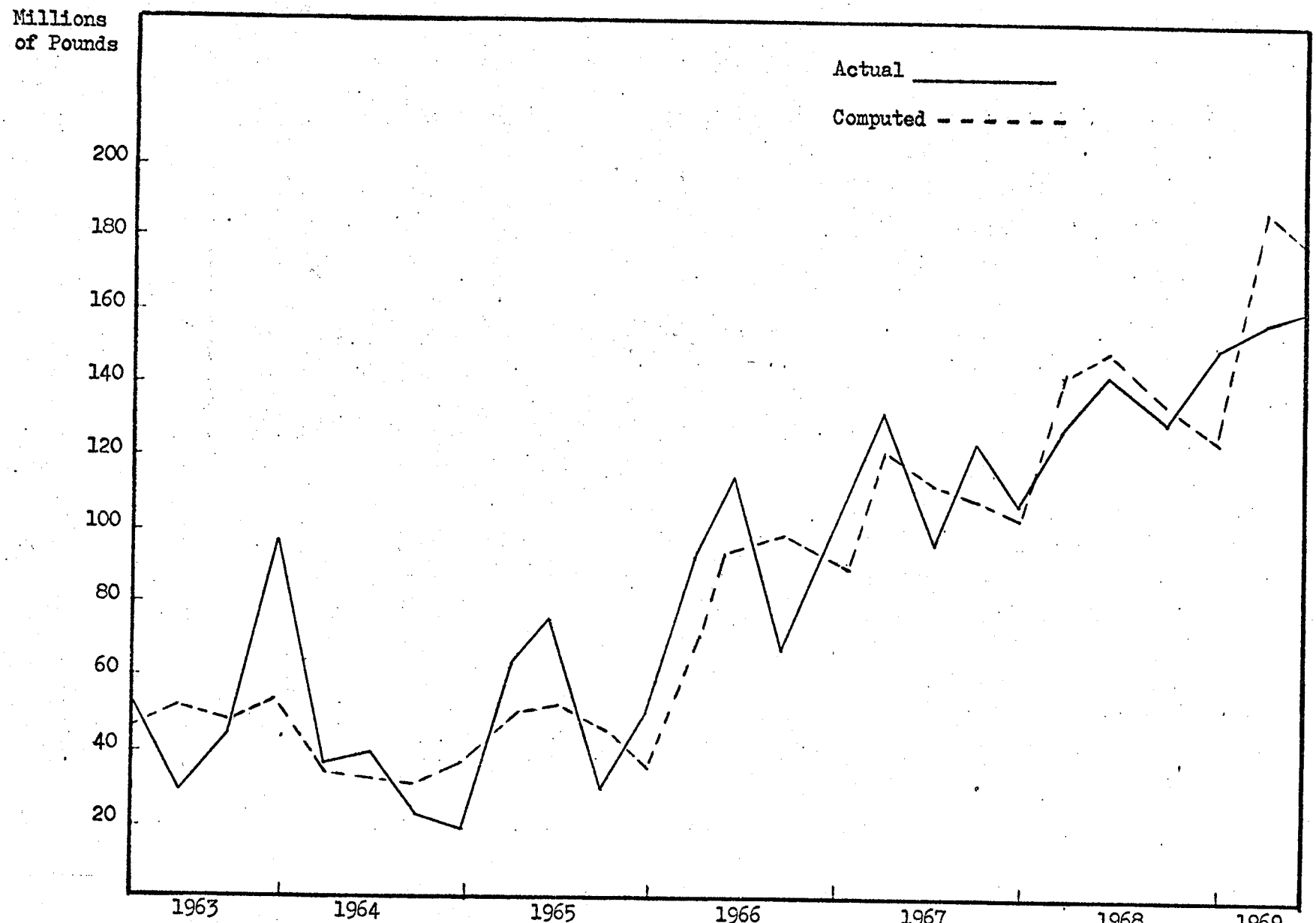

FIGURE 5.3 Exports of rapeseed to Japan, actual and computed from OLS estimates of Japanese demand equation 5.2, 1963-1969.

The estimated values of the rapeseed exports were generally close to the actual values, but the fluctuations in exports in the 1963 to 1965 period were not accurately accounted for in the model. The decrease in exports to Japan, as predicted for the final quarter of 1968, did not come about. The over-estimation of rapeseed exports in this time period is, no doubt, due to the decrease in soybean prices in that period.

RAPESEED SUPPLY

The estimated relations 5.3 and 5.4 represent two-stage least squares and ordinary least squares estimates of the supply of rapeseed to the Japanese oilseed industry.

$$(5.3)\quad Q_{RS} = 0.647 + \underset{(0.170)}{0.481^{**}}\ S_{RT} + \underset{(0.308)}{0.713^{*}}\ Q_T - \underset{(0.051)}{0.098}\ Q_{RO} - \underset{(0.055)}{0.121}\ \widehat{P_R} + U_2$$

(2 SLS) $\quad d = 2.37 \quad R^2 = 0.836$

$$(5.4)\quad Q_{RS} = 0.740 + \underset{(0.177)}{0.601^{**}}\ S_{RT} + \underset{(0.320)}{0.734^{*}}\ Q_T - \underset{(0.600)}{0.103}\ Q_{RO} - \underset{(0.059)}{0.100}\ P_R + U_2$$

(OLS) $\quad d = 2.40 \quad R^2 = 0.804$

Both the 2 SLS and OLS estimates of the supply equation are similar for the reasons which apply to the demand equation. Both equations provide close estimates to the observed data as is evident in figures 5.4 and 5.5.

The positive signs on the total rapeseed stock variable, estimated to be +.481 in the 2 SLS equation and +.601 in the OLS equation, were expected on the basis that supplies of rapeseed available for export to Japan are derived from those stocks in terminal and interior positions. Increasing the exports of rapeseed to Japan requires maintenance of the buffer stock in Vancouver and increased interior stock of rapeseed that is available for shipment to Vancouver as the rate of export increases. The coefficient for the stocks in storage variable, in both the 2 SLS and OLS estimation is less than one, indicating that only a portion of the rapeseed which goes into storage in Western Canada is available for export to the Japanese market.

Estimates of the parameter on the quota variable were +.713 in the 2 SLS equation and +.734 in the OLS equation. The sign on the Japanese rapeseed import quota coefficient was positive as expected from the theoretical analysis. Because Canada is the major supplier of rapeseed to Japan, the total effect of the quota is to regulate the amount of rapeseed which flows into Japan from Canada. An

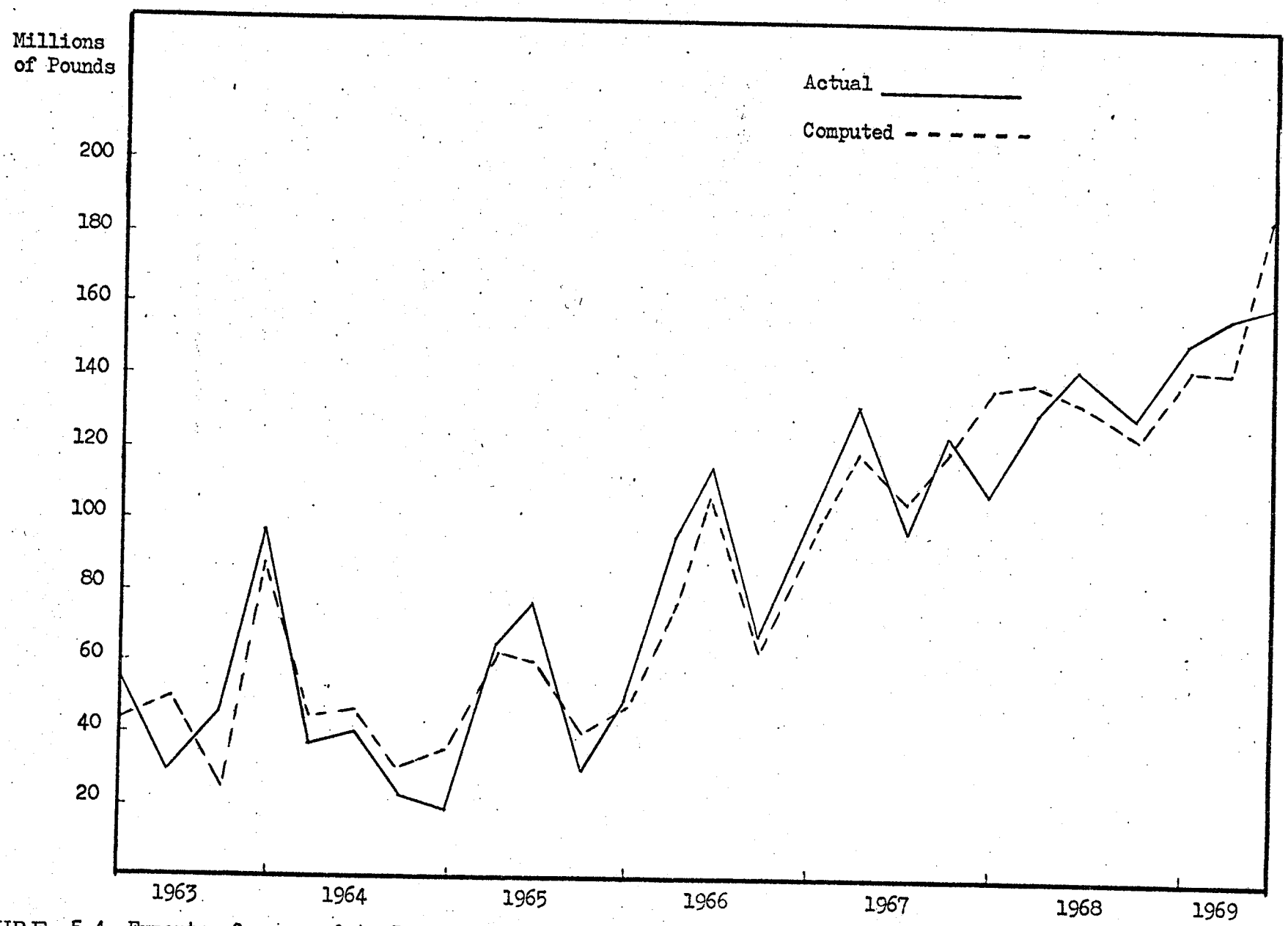

FIGURE 5.4 Exports of rapeseed to Japan, actual and computed from 2SLS estimates of rapeseed supply equation 5.3, 1963-1969.

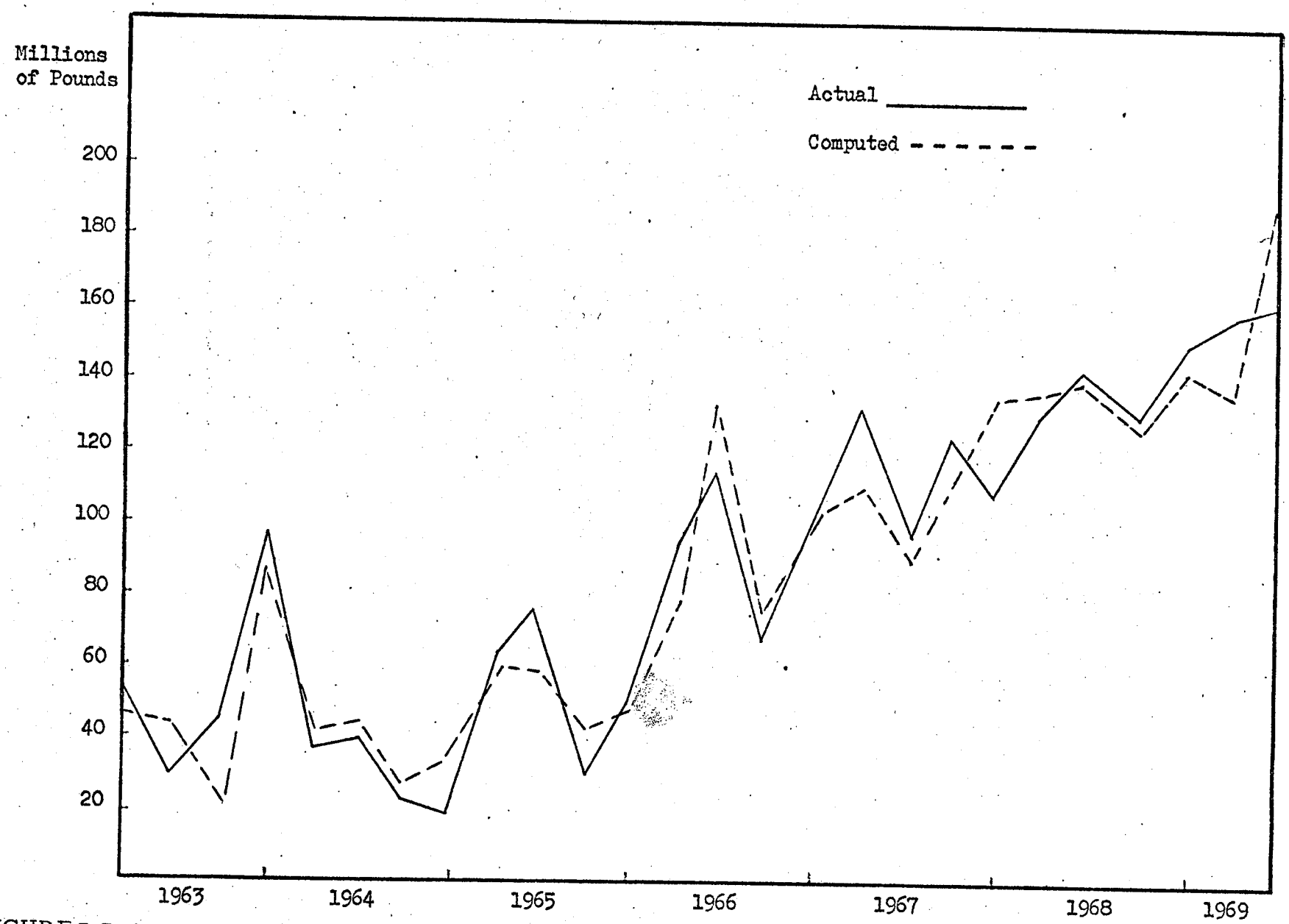

FIGURE 5.5 Exports of rapeseed to Japan, actual and computed from OLS estimates of supply equation 5.4, 1963-1969.

increase in the quota level is expected to result in increased levels of rapeseed which would be available to Japanese crushers. As equation 5.3 estimates, a one percent increase in the amount of rapeseed which Japanese crushers are able to import is associated with a .713 percent increase in the exports of Canadian rapeseed to Japan. An increase in the Japanese import quota does not always correspond to a similar increase in the exports of Canadian rapeseed to Japan because in some quarters of the year other suppliers fulfill the Japanese crushing requirements. In some periods the crushers do not commit themselves to the maximum allowable rapeseed because they feel prices are out of line or their own stocks are adequate.

The negative value of the coefficient on the variable representing exports of rapeseed to other countries was also expected. In the 2 SLS estimate, the value of this coefficient is -0.098 and in the OLS estimate it is -0.103. The relationship suggested here is that in periods when heavy export shipments are being made to countries other than Japan, the supply of rapeseed exported to Japan is decreased. On the basis that only limited facilities are available for transportation to and storage at the West Coast, this relationship is acceptable.

In contrast to economic theory, the negative sign on the price variable indicates that supplies of rapeseed increase when prices decline. On the basis of theory, Canadian exporters would be expected to supply less rapeseed. However, this relationship may not be illogical on the basis that the quantity of rapeseed supplied by the exporters is the amount actually shipped to Japan. As was shown in the demand equation, increased exports to Japan occur when the prices fall. This is the relationship, then, that is showing in the supply equation.

As this study does not analyse producer response to market prices, but only those quantities of rapeseed which are shipped to Japan from Canada, it is conceivable that the price-quantity response, as estimated in the supply equation, is strongly influenced by the demand relationship. It may, therefore, not be realistic to expect a positive price-quantity relationship in the supply estimation here.

Figures 5.4 and 5.5 represent the estimated and observed values of the rapeseed supplied to Japan. The computed values followed the observed market data fairly closely except for some discrepancies in the second quarter of 1963 and the first quarter of 1968. The over estimates of the quantities supplied in these periods may have been the results of increased Japanese quota levels which were not filled in those particular quarters of the year.

FLAXSEED DEMAND

Equations 5.5 and 5.6 are the 2 SLS and OLS estimates of the Japanese demand for Canadian flaxseed.

$$(5.5)\quad Q_{FD} = 5.286 + 0.861\ P_S - 0.442^*\ Q_{FP} + 0.413^{**}\ E_T$$
$$(0.521) \qquad (0.201) \qquad (0.112)$$
$$-0.180\ T_F - 0.897^*\ \widehat{P_F}$$
$$(0.104) \qquad (0.423)$$

(2 SLS) $\qquad d = 2.01 \qquad R^2 = 0.812$

$$(5.6)\quad Q_{FD} = 6.556 + 0.822\ P_S - 0.510^*\ Q_{FP} + 0.471^{**}\ E_T$$
$$(0.505) \qquad (0.249) \qquad (0.171)$$
$$-.210\ T_F - 0.812^*\ P_F$$
$$(0.121) \qquad (0.400)$$

(OLS) $\qquad d = 1.96 \qquad R^2 = 0.801$

As in the rapeseed model, the 2 SLS and OLS estimates are similar in sign and magnitude. Figure 5.6 presents the relationship between the actual flaxseed prices used in the analysis and those estimated by the reduced form demand and supply equations.

Both the 2 SLS and OLS estimates of flaxseed demand fit the data quite closely and the signs on the coefficients

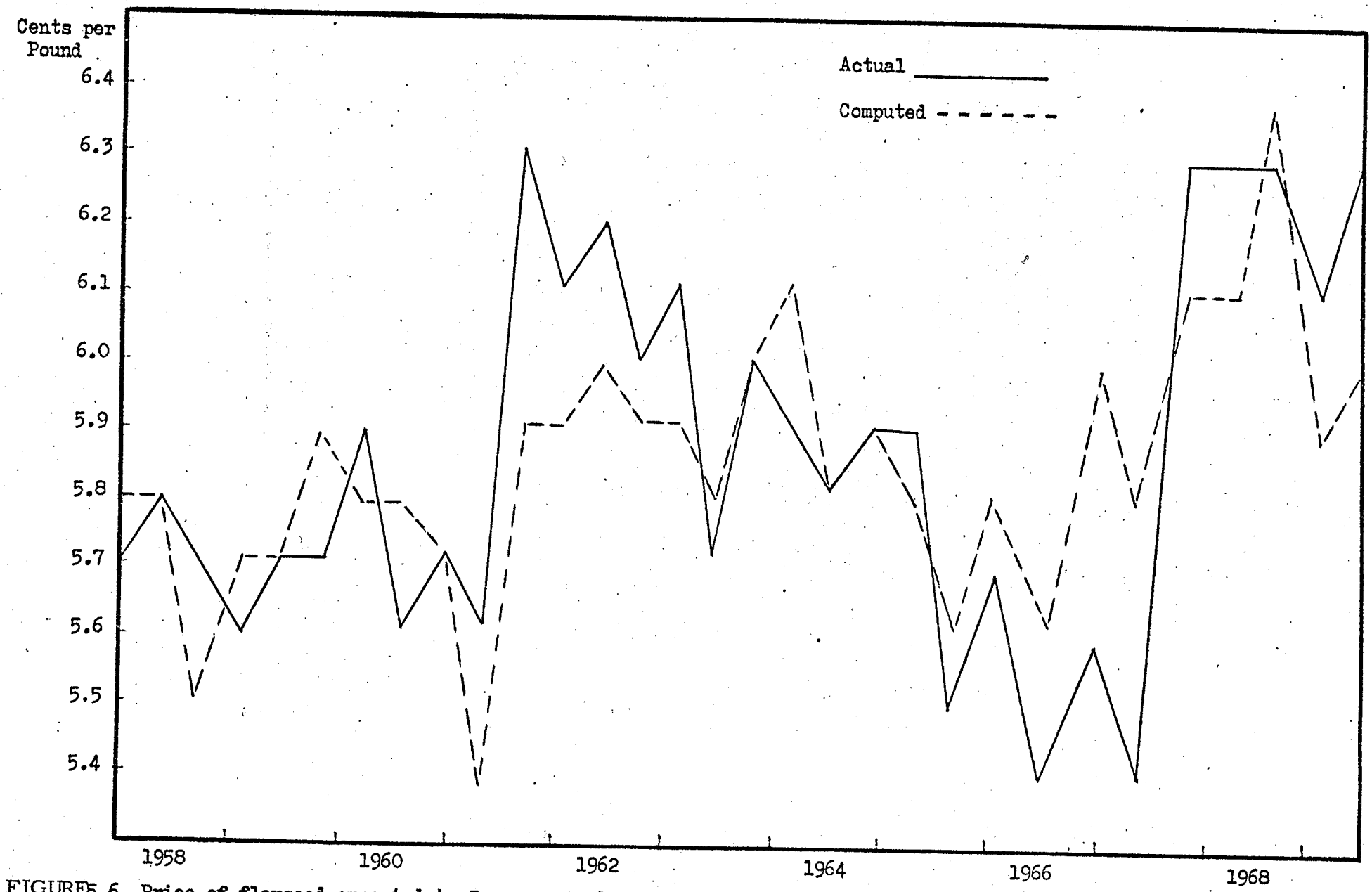

FIGURE 5.6 Price of flaxseed exported to Japan, actual and computed from 2SLS reduced form estimates 1958–1969.

are those which were expected. Soybean price increases, as in the rapeseed demand equations, can be expected to produce some increase in the quantity of flaxseed demanded. The magnitude of the coefficient value of the soybean price variable, however, suggests that the substitutability between flaxseed and soybeans is not as great as that between rapeseed and soybeans.

As the estimate in equation 5.5 shows a one percent increase in the price of soybeans result in a 0.861 percent increase in the quantity of flaxseed demanded. In equation 5.6, the OLS estimate, this value is +0.822. The lesser degree of interchangeability between flaxseed and soybeans than between rapeseed and soybeans, supports this result.

The negative sign for the Japanese flaxseed production variable suggests that a supplementary relationship does exist between Japanese domestic production and imports from Canada. As expected,further decreases in Japanese flax production will lead to some increases in imports from Canada. The Japanese demand for Canadian flaxseed is not as responsive to decreases in Japanese domestic production to the same extent that exists for rapeseed. The estimates in equations 5.5 and 5.6 place the increase in demand for flaxseed between .4 and .5 percent for every one percent decrease in flax production.

The positive sign on the trend variable supports the evidence of the increases in demand for flaxseed in Japan over the period 1958 to 1969. As well as indicating the growing demand, this variable reflects omissions of other explanatory variables. Such variables in this case could be prices of other close competitors in the industrial oil market. These are prices which are not instrumental in explaining the rapeseed demand.

The negative signs on the transportation and price variables were expected on the premise that increases in either the price of the flaxseed or the cost of transporting the commodity would decrease the amount demanded. The magnitude of the coefficient on the price variable indicates that the demand for flaxseed is not quite as responsive to price changes as is the demand for rapeseed. The nature of the demand as estimated here suggests that a one percent increase in price results in a decreased demand by less than one percent. This lends support to the fact that there are fewer substitutes for flaxseed, in the processes for which it is now used, than for rapeseed. The crushing industry in Japan, therefore, is less responsive to flaxseed price changes than it is to changes in rapeseed prices.

Figures 5.7 and 5.8 represent the 2 SLS and OLS estimated values of flaxseed exports compared with the actual values over the period sampled. Fluctuations in the market-generated observations appear to be fairly closely predicted by the estimated data.

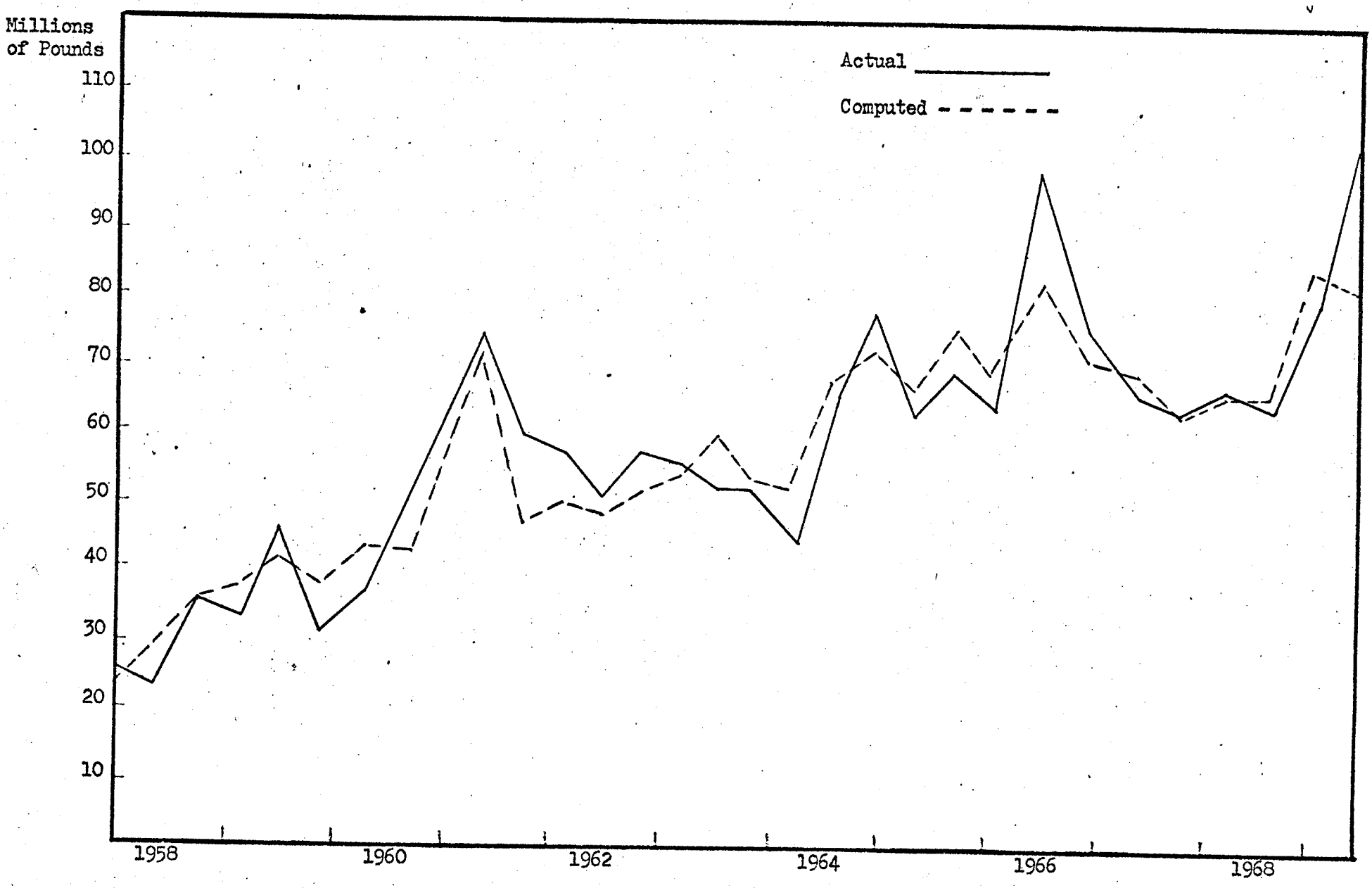

FIGURE5.7 Exports of flaxseed to Japan, actual and computed from 2SLS estimates of Japanese demand equation 5.5, 1958-1969.

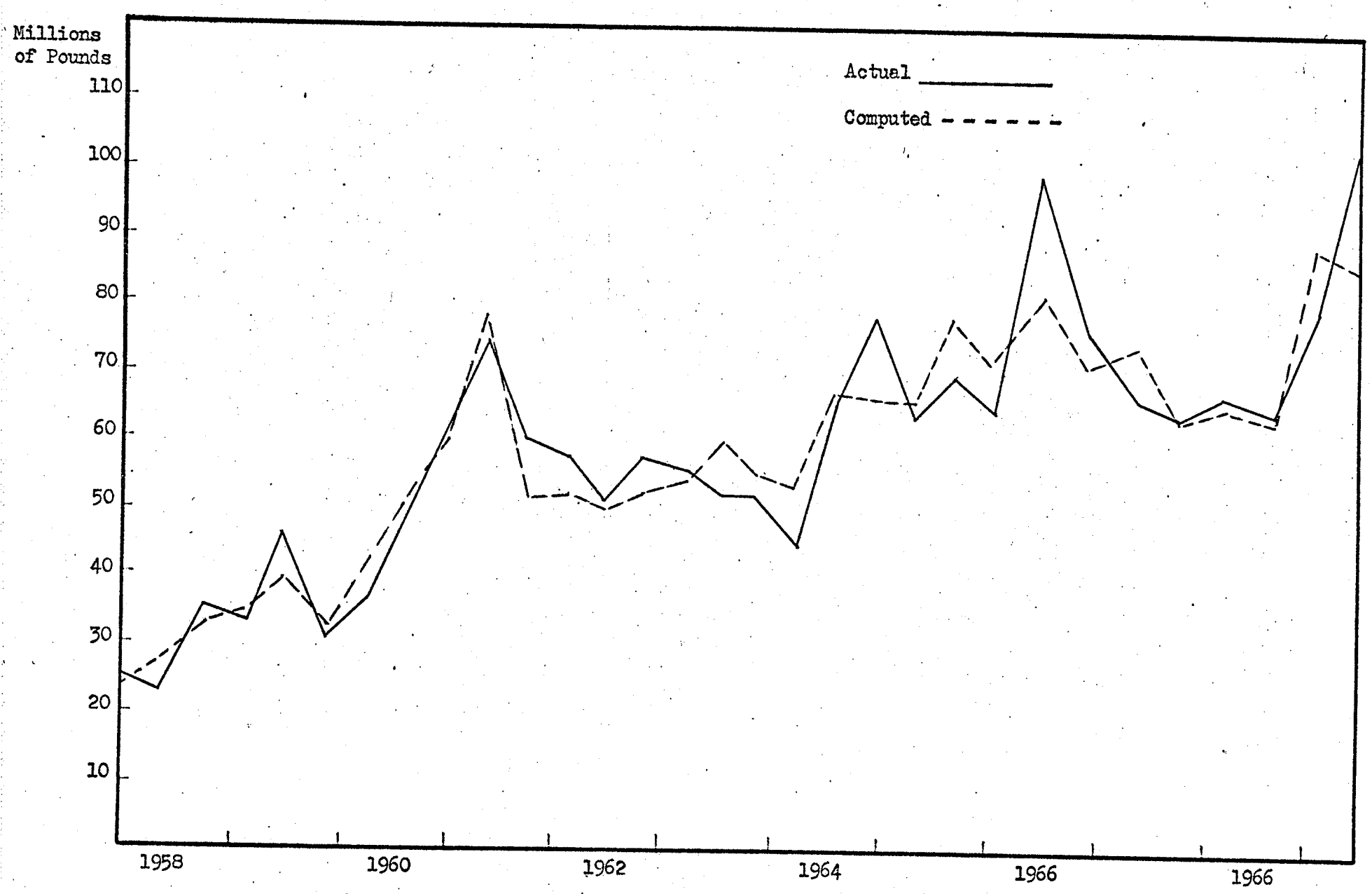

FIGURE 5.8 Exports of flaxseed to Japan, actual and computed from OLS estimates of Japanese demand equation 5.6, 1958-1969.

FLAXSEED SUPPLY

The estimated relations 5.7 and 5.8 represent the supply of flaxseed to the Japanese market.

$$(5.7)\quad Q_{FS} = 1.344 + 0.161^{*} S_{FT} + 0.450^{**} E_T - 0.121 Q_{FO} - 0.093 \widehat{P_F} + U_4$$

$$\qquad\qquad\qquad\quad (0.080) \qquad\quad (0.147) \qquad\quad (0.070) \qquad\qquad (0.049)$$

2 SLS $\qquad$ $d = 2.20$ $\qquad$ $R^2 = 0.825$

$$(5.8)\quad Q_{FS} = 1.552 + 0.142^{*} S_{FT} + 0.392^{**} E_T - 0.099 Q_{FO} - 0.088 P_F + U_4$$

$$\qquad\qquad\qquad\quad (0.091) \qquad\quad (0.104) \qquad\quad (0.056) \qquad\qquad (0.051)$$

(OLS) $\qquad$ $d = 1.99$ $\qquad$ $R^2 = 0.820$

The 2 SLS and OLS estimates are similar with respect to signs and coefficient sizes. As in the supply of rapeseed, the sign on the flax price variable is not consistent with economic theory. Again, however, this may be the result of the demand relationship showing up in the supply equation. The sign on the flaxseed stocks in store variable is positive as was expected according to the theoretical analysis. Like the rapeseed model, this implies that the available stocks

in store positively influence the stocks which are available for export to Japan in that same quarter.

Because only a percentage of those increased stocks flow to Japan, any increase in the total flax stocks will be associated with a smaller increase in stocks available for shipment to Japan. As estimated in equation 5.7, a one percent increase in the flaxseed storage is associated with a .16 percent increase in exports to Japan.

The sign on the trend variable is positive which indicates the increased amounts of exports which have flowed to Japan during this period. As mentioned, this variable is also used in this equation to remove any bias which may have resulted from omitted variables.

Similar to the rapeseed model, the negative sign of the variable representing flaxseed exports to countries other than Japan supports the explanation that in periods of increased exports to other countries, the exports to Japan are decreased because of limited storage and transportation facilities. Since these facilities are in fact fixed, this result is acceptable.

In equation 5.7, the coefficient of the variable representing exports to other countries infers that a one percent increase in exports of flaxseed to countries other than Japan is associated with a .12 percent decrease in exports to Japan.

The flaxseed exports to Japan as estimated by the 2 SLS and OLS supply equations are shown in figures 5.9 and 5.10. The estimates values appear to approximate the variations in the actual export data.

Although there are no studies on the Japanese demand for Canadian oilseeds, the study by Houck and Mann[4] included estimates of the Japanese demand for U.S. soybeans which are worthy of reference here. In their study it was assumed that the exports of soybeans to Japan were a function of the Japanese national income and the U.S. farm price of soybeans. The results showed that the variable representing national income was significant at the one percent level and the soybean farm price variable was significant at the five percent level.

In an effort to establish the degree of influence that Japanese income has in determining Japanese demand for rapeseed, an estimate of demand was made with a measure of Japanese income included. The results were as follows:

$$(5.9)\quad Q_{RD} = 4.585 + \underset{(1.403)}{2.370}\ P_S - \underset{(0.575)}{2.684}\ Q_{RP} + \underset{(0.920)}{0.421}\ I_N - \underset{(0.622)}{1.212}\ P_R$$

$$(\text{OLS}) \qquad d = 1.712 \qquad R^2 = 0.71$$

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

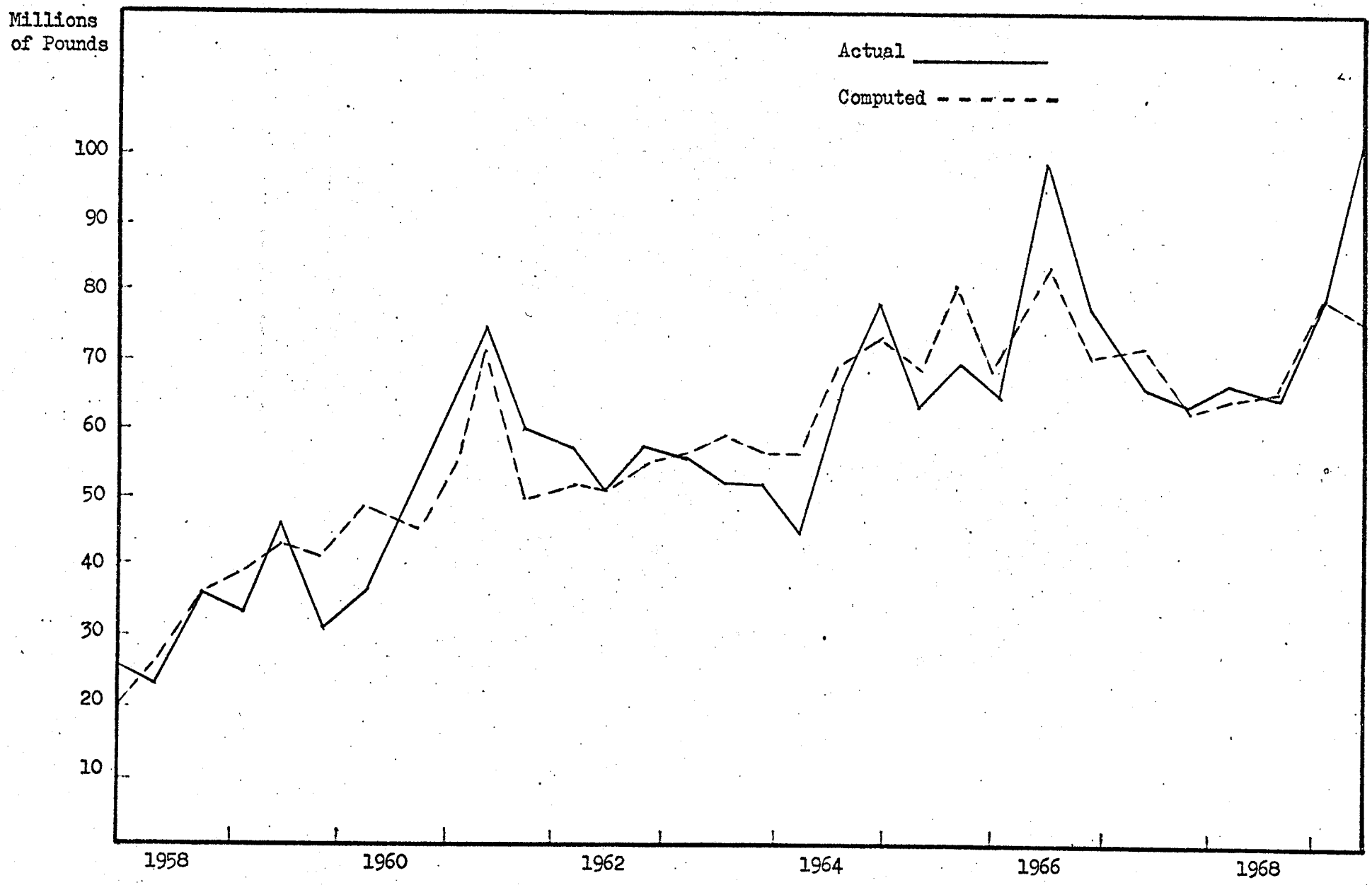

FIGURE 5.9 Exports of flaxseed to Japan, actual and computed from 2SLS estimates of supply equation 5.7, 1958-1969.

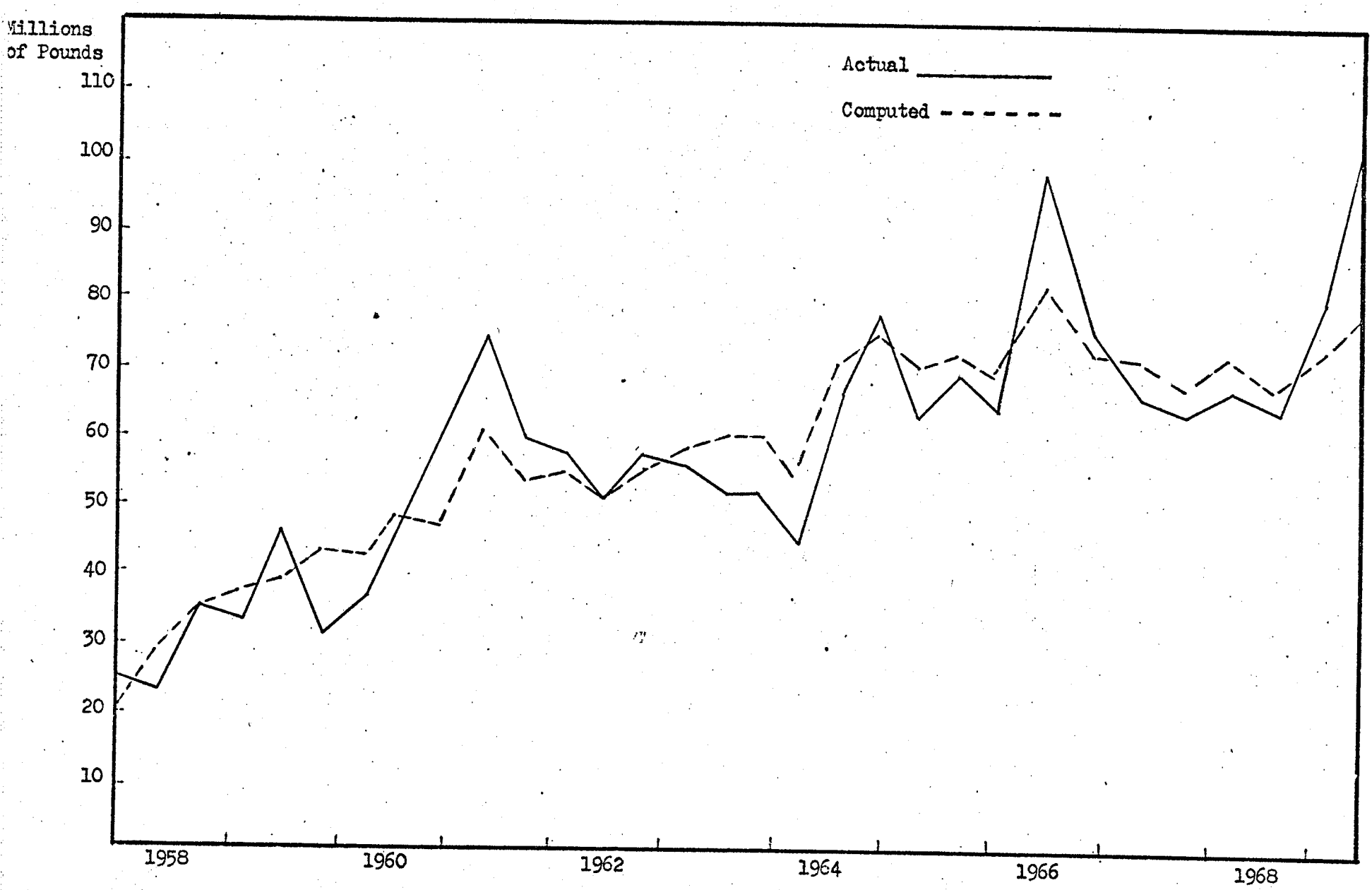

FIGURE 5.10 Exports of flaxseed to Japan, actual and computed from 2SLS estimates of supply equation 5.8, 1958-1969.

where: Q_{RD} = total quarterly exports of Canadian rapeseed to Japan (millions of pounds).

P_S = U.S. average quarterly wholesale price of soybeans (cents per pound).

Q_{RP} = average estimated quarterly flow of domestically produced rapeseed to Japanese crushing mills (millions of pounds).

I_N = estimate of Japanese National Income based on quarterly statistics (F.A.O.)

P_R = average quarterly price of rapeseed exported to Japan (cents per pound).

These results indicate that an increase in national income in Japan results in an increase in the demand for rapeseed. But the value of the coefficient indicates that it is not significant even at the fifty percent level. The signs and coefficient values on the other variables are similar to those of equations (5.1) and (5.2). A similar estimate was made of the demand for flaxseed. The results were also similar to those for the rapeseed demand equation.

$$(5.10)\quad Q_{FD} = 7.676 + \underset{(0.471)}{0.767}\ P_S - \underset{(0.168)}{0.388}\ Q_{FP} + \underset{(0.102)}{0.363}\ E_T + \underset{(0.477)}{0.281}\ I_N - \underset{(0.313)}{0.676}\ P_F$$

(OLS) $\quad d = 1.671 \quad R^2 = 0.72$

In this estimate, each of the signs and coefficients are somewhat similar to those in equations (5.5) and (5.6).

Each of the variables are designated as follows:

Q_{FD} = total quarterly exports of Canadian flaxseed to Japan (millions of pounds).

P_S = U.S. average quarterly wholesale price of soybeans (cents per pound).

Q_{FP} = average estimated quarterly flow of domestically produced flaxseed to Japanese crushing mills (millions of pounds).

I_N = estimate of Japanese National Income based on F.A.O. quarterly statistics.

P_F = average quarterly price of rapeseed exported to Japan (cents per pound).

As in equation 5.9, an increase in national income in Japan results in an increased flaxseed demand. However, the coefficient is not significant even at the fifty percent level, implying that the Japanese income does not significantly explain the Japanese demand for flaxseed.

Attempts were also made in this thesis to estimate a model including a distributed lag variable. In this case the variable lagged was the price of rapeseed in the rapeseed demand equation and the price of flaxseed in the flaxseed demand equation. The results of these estimations are shown in the appendix. Correlation matrices for the estimated equations are also in the appendix.

CHAPTER VI

CONCLUSIONS AND IMPLICATIONS

This chapter presents conclusions and policy implications based on the results of the statistical analysis. Since the major objective of this study was to establish those factors which govern Canada's position as an oilseed supplier to the Japanese market, the discussion centres largely on the implications for an oilseed marketing policy with respect to Japan. The discussion is based on the empirical results discussed in the previous chapters.

(A) SUMMARY

As the empirical analysis has shown, the level of oilseed production in Japan appears to be the chief determinant in the Japanese demand for Canadian oilseeds. Over the market period analysed, a 10 percent reduction in Japanese rapeseed production is associated with approximately a 17 percent increase in Canadian rapeseed exports to Japan. Such a relationship is indicative of the expanding market for Canadian rapeseed in Japan. Exports from Canada are more than replacing the decreases in Japanese domestic production. A similar reduction in Japanese flaxseed

production results in only a 4 to 5 percent increase in Canadian flaxseed exports to Japan. The market expansion for flaxseed in Japan has not followed the same rate of growth as has the rapeseed market.

As a determinant of oilseed exports to Japan, price is significant in explaining the quantity of both rapeseed and flaxseed which the Japanese demand. The price-quantity relationship for rapeseed reveals a demand curve which is somewhat more elastic in nature than that for flaxseed. This difference in elasticity can be accounted for by the greater expansion in exports of rapeseed than of flaxseed to Japan. Over the periods analysed, the Japanese demand for rapeseed was more responsive to price changes than their demand for flaxseed. The source of this responsiveness can be directly related to the degree of substitutability of flaxseed and rapeseed with other oilseeds. It is logical that rapeseed, with a greater number of substitutes in the Japanese oilseed market, should, therefore, be more vulnerable to price changes. A small rise in the price of rapeseed would result in an increased demand for those oilseeds which substitute for rapeseed. The demand for flaxseed, which has fewer substitutes, is therefore not as responsive to price changes.

Statistically, price does not appear as significant in explaining Canadian oilseed exports to Japan as does the

decreasing Japanese domestic production. The results show, in fact, that the decrease in Japanese domestic production resulted in increased Canadian exports of oilseeds to Japan. When this is associated with the fact that most of Japan's imported rapeseed and flaxseed came from Canada, it is evident that Canadian oilseed prices have been competitive. Therefore, although price cannot be assumed to be unimportant in this market, as the Japanese oilseed production has decreased, the importers looked to that market which could guarantee supplies.

In the oilseed market, however, substitutes do exist, and in Japan the soybean is the chief competitor to Canadian oilseeds. Under the premise that soybeans are more interchangeable with rapeseed than with flaxseed, any price changes in soybeans would be expected to affect rapeseed exports to Japan more so than flaxseed exports. The results of the analysis show that Canadian rapeseed exports to Japan are, in fact, more responsive to soybean price changes than are flaxseed exports. The estimates of the cross elasticity of demand for rapeseed and soybeans in this analysis is more than twice that for flaxseed and soybeans.

On the supply side, the estimated relationships of rapeseed and flaxseed show that the most important factor which governs the supply to the Japanese market is the total

stocks in store of each oilseed. As increased exports of oilseeds require increased available stocks, the positive relationship between stocks in store and exports to Japan is logical. The implication which must be drawn from this relationship is, that as future exports of oilseeds to Japan increase in volume, it will be necessary to provide increased available export storage space. In the case of rapeseed, the Japanese import quota regulates the supply which can flow to Japan. Over the time period involved in this study, as this restriction was lifted, increased supplies of Canadian rapeseed were available to Japanese processors.

The use of the trend variable in the demand equation for flaxseed can be interpreted to indicate the increasing preference which oilseed crushers have had for Canadian flaxseed over the 1958 to 1969 period. This increasing preference is derived from the industrial processes which utilize the linseed oil as a raw material input. The results obtained from using the trend variable can, in part, also be attributed to errors in the variables which were consistent over the period analysed.

The results of using a trend in the flaxseed supply equation is representative of the increased flow of flax through the Western Canadian storage and transportation facilities. As in the demand equation, the effects of errors

in the variables can also be picked up by the trend variable. The use of a trend variable in the demand and supply equations for rapeseed did not yield significant results and it is, therefore, assumed that those variables which are included are all of the major determinants of rapeseed demand and supply.

In the estimated supply relations for both flaxseed and rapeseed, the sign on the variable representing exports of each of these crops to countries other than Japan was negative. Such a relationship suggests that, over the periods analysed for both oilseeds, increasing exports to countries other than Japan were associated with decreasing exports to Japan. This, in turn, implies that storage and transportation facilities may not have been adequate to service all areas during these periods. If this conclusion is tenable, it can be argued that transportation and storage facilities which exist at the West Coast, are not adequate to service the expanding demands of the oilseed export markets.

The estimated demand relationships also show that the increasing costs of transportation are associated with a decreasing demand for both flaxseed and rapeseed. Although the relationship is not statistically significant, the implication which can be drawn is an important factor in explaining the Japanese demand for Canadian oilseeds.

It can be argued that the geographical proximity of Canadian oilseed supplies to the Japanese market has been an important factor in the Japanese decision to purchase these oilseeds from Canada. The increased freight charges of moving rapeseed and flaxseed from alternative sources may have been an important factor in the Japanese decision to import oilseeds from Canada.

On the whole, the results achieved by estimating the demand and supply relationships with the OLS estimating technique and the 2 SLS estimating technique were not different. First, the reduced form estimates or price in the 2 SLS estimating technique are similar to the actual prices used so that this may account for the similarity of the 2 SLS results to the OLS results. Further, it might be assumed that a joint relationship between price and quantity do not exist. In other words, the price of Canadian oilseeds determine, in part, the amount demanded by the Japanese market. The quantity of oilseeds demanded by the Japanese market, on the other hand, may not be as significant in determining Canadian oilseed prices as it was assumed when the model was constructed.

(B) POLICY IMPLICATIONS

As was outlined in the descriptive and theoretical analysis, the structural characteristics of the Japanese oilseed import market reveal that Canada operates as a member supply country to an oligopolistic-like market. In that discussion, it was also mentioned that Canadian oilseeds face some barriers to entry in this market. This is especially the case for rapeseed, as this commodity faces a quota and tariff schedule unlike that of its major competitor, the U.S. soybean. The degree of product differentiation between rapeseed and soybeans does also serve as somewhat of a barrier in that soybeans are a much more widely accepted commodity within Japan.

The estimates of cross-elasticity of demand show that rapeseed is easily substitutable for soybeans in the Japanese market. Thus, although the degree of product differentiation favors soybeans, it is reasonable to conclude that removal of import quotas and market promotion programs could enhance the position of rapeseed in the Japanese oilseed market.

As producers of oilseeds, the Western Canadian farmer is interested in Japan because of this ever expanding outlet for his product. As was estimated in the demand equations for rapeseed and flaxseed, the major determinant involved in

the Japanese decision to import these oilseeds is the level of production of these commodities in Japan. Annual observation of the production schedule of these oilseeds in Japan would thus provide guidelines to the producers in Canada as to what volume of the rapeseed and flaxseed crops this market would be expected to consume. Such a market-oriented production policy can assist in eliminating the over or under-production situations which are respectively responsible for decreased returns to the farmer due to increased storage costs or lost markets due to the inability to meet export demands. Information on the estimated Japanese annual production would also benefit the storage and transportation sector of the Canadian grain industry in so far as it would allow them to estimate the volume of these two oilseeds which are to be moved to Japan during that crop year.

As mentioned, rapeseed exports to Japan are inhibited because of the Japanese imposed import quota which is inversely related to Japanese production. As Japan is a major market for Canadian rapeseed, this quota can significantly affect producer decisions to grow rapeseed in Canada. Liberalization of rapeseed imports into Japan could result in the entire crushing demands of the Japanese rapeseed crushers being met by imports. Since Canada supplies the major portion of these imports to Japan, this

could represent a considerable opportunity for Western Canadian producers to expand production with the assurance that their commodity has a market.

Though the import quota system for rapeseed is maintained by the Food Agency as a means of protecting the producers and inland crushers, the larger on-shore crushers are in favor of its removal. Negotiation with the Food Agency for the removal of this quota may prove mutually beneficial to Japanese processors, the Japanese consumers and the Canadian producers.

Associated with this import quota and the Japanese domestic production of oilseeds, prices are an important factor in the Japanese oilseed import market. As Canadian oilseeds appear to be price competitive in this market, the expansion of the Japanese demand for Canadian oilseeds could be pursued through certain non-price policies. These could assume the form of promotional campaigns aimed at the oilseed crushers, vegetable oil processors and meal manufacturers.

A competitive pricing policy aimed at under-pricing other oilseeds supplied to Japan may prove to be of limited value in attempting to erode that market share held by other oilseeds. Due to the competitive structure of the market, any price reduction in Canadian oilseeds would risk the precipitation of a price war. As mentioned in the descriptive and theoretical analysis, the oligopolistic

nature of this market implies that competitors would be reluctant to follow prices upwards but would stand ready to maintain their own market share through competitive price reductions.

Promotion of rapeseed and flaxseed in Japan through the use of non-pricing tactics would appear to be a more acceptable means of expanding the market share. Such programs as that sponsored by the Rapeseed Association of Canada could be enlarged and carried out for both rapeseed and flaxseed with the financing set up on the basis of a check-off system. Since the Japanese decisions to purchase flax and rapeseed are made partially on the basis of quality, research programs to maintain the standards, which the Japanese emphasize, would be of more benefit than mere price reductions. Promotion of these quality characteristics could form an important part of the non-pricing competitive policies.

In meeting the Japanese demand for both Canadian flaxseed and rapeseed, the results of the analysis showed that stocks in store were a critical factor. Since storage for these oilseeds at the West Coast is limited, the stocks in store at interior points become more important in servicing this export market. As the rate of export of these oilseeds increases, the all-important transportation link between the interior storage and the West Coast becomes

increasingly significant in meeting supply requirements. It appears that more storage at the West Coast might solve the bottleneck problem.

As the Japanese have made the decision to rely on Canada for their oilseed supply, it is logical to suggest that they provide some incentive for the Canadian oilseed industry to provide the assured supply that they demand. One such program which might supply incentive to both producers and handlers could take the form of long term contracts. The long term contracts would assure the Japanese crushing industry of receiving its crushing requirements and would also provide incentive to both the Canadian producer and the Japanese crusher by providing some degree of price stability.

As it has already been shown that the limited storage space at the West Coast is a detrimental factor in supplying the increased volume of exports to Japan, a logical decision would be to increase the storage space. This, however, requires funds which investors in the grain industry may not be willing to put into a project where uncertainty is involved. If long term contracts were agreed upon between Canadian producers and Japanese importers, there would be an assured need for the storage and cleaning facilities at the West Coast. Construction of a specialty house at the West Coast which would handle only oilseeds to

Japan would be economically justifiable under the assured business of contract supplies. Further, it would be logical that Japan provide the funds for the investment. Such a scheme of investment in a Canadian grain terminal is not unlike the investments in West Coast mineral exploration projects for which the Japanese have already established contracts.

It would thus be necessary to develop an integrated system of transportation which would provide for an open channel to the coast for those oilseeds most in demand by the Japanese. A system of close contact between Japanese importers and the Wheat Board would prove valuable in order that systematic requests can be filled. This scheme of movement to the Japanese terminal would fit into the Block System of grain transportation in which only those grains in demand for export are moved out of the country elevator system. Such a system would further increase the confidence of the Japanese importers in the Canadian exporters' ability to meet their needs.

If Canada expects to participate in the future expansion of the Japanese oilseed market it is, therefore, necessary that adequate preparations be made now. A comprehensive examination of those above mentioned factors which govern the volumes of oilseeds which the Japanese require could lead to the establishment of guidelines for Canadian producers in their decision to provide flaxseed and rapeseed for this market.

(C) RECOMMENDATIONS FOR FURTHER STUDY

Since this study was an examination of only one portion of the Canadian rapeseed and flaxseed industries, a complete representation of these markets was not developed. A model designed to portray all the supply and demand relationships would be an important extension of this analysis. Such an approach would include a more detailed supply equation for each of the oilseeds involved and thus perhaps eliminate the shortcomings of the supply equations in this study.

Development of more complete models of the supply and demand markets for rapeseed and flaxseed would include the domestic market and all export markets. A more thorough investigation such as this would be more valuable in its ability to predict the results of any changes within the market. As well, the information of a more comprehensive study would be more valuable in providing guidelines to producers and exporters.

This study revealed that storage, and thus transportation, were important factors in servicing export markets through the West Coast. It did not however, closely consider the West Coast as a bottleneck in the marketing system. A closer look at the transportation and storage system at this point would be valuable in suggesting certain

alternatives which would reduce the complications of moving commodities through this point to export markets. Logical extensions of this study could include the rationalization of elevator facilities in the country and the unit train concept for moving oilseeds to the West Coast in an exportable condition.

APPENDIX A

Data Series Used in Estimation 1963-1969

Year	Q_{RD} mill. lbs.	P_S cents lb.	T_R cents lb.	P_R cents lb.	S_{RT} mill. lbs.	Q_{RO} mill. lbs.
1963	54.801	4.6	0.7	3.6	148.85	30.199
	31.007	4.6	0.9	4.1	98.05	50.578
	46.214	4.8	1.2	4.3	31.05	1.077
	97.455	4.9	1.0	4.5	162.20	9.204
1964	37.580	4.8	1.3	4.5	148.20	14.339
	38.624	4.8	1.2	4.1	110.60	20.480
	26.222	5.3	1.3	4.3	49.40	.080
	22.556	5.7	1.4	4.4	112.10	22.202
1965	65.555	5.9	0.9	4.4	323.95	169.797
	78.750	5.8	0.8	4.3	169.55	82.163
	28.931	5.6	1.1	3.7	68.10	9.220
	55.876	5.3	1.0	3.8	146.85	42.136
1966	94.992	5.6	1.2	3.8	289.75	158.162
	120.398	6.1	1.5	3.8	337.85	83.807
	70.609	6.0	1.8	4.5	167.00	43.996
	102.997	6.4	1.6	4.3	274.00	22.912
1967	133.165	5.3	1.4	4.2	322.75	101.086
	95.258	5.3	1.6	4.2	219.50	125.193
	126.234	5.6	1.3	3.9	210.60	18.901
	114.434	5.9	1.2	3.7	302.50	27.808
1968	128.311	5.8	1.2	3.5	290.30	17.940
	146.154	5.9	1.2	3.2	285.90	45.200
	130.966	6.2	1.5	3.2	202.50	47.350
	150.375	5.6	1.1	3.2	325.60	58.228
1969	160.002	5.8	1.3	3.3	300.50	63.320
	165.763	5.6	1.4	3.5	265.75	65.230

Data Series Used in Estimation 1958-1969

Year	Q_{FD} mill. lbs.	T_F cents lb.	P_F cents lb.	S_{FT} mill. lbs.	Q_{FO} mill. lbs.
1958	25.22	1.0	5.70	487.2	170.7
	22.30	1.0	5.75	324.8	195.8
	29.03	1.0	5.80	257.6	96.1
	35.66	1.2	5.70	380.8	269.1
1959	31.00	1.1	5.60	280.0	183.2
	45.40	0.9	5.67	285.6	119.3
	37.73	0.7	5.70	246.4	130.4
	30.52	0.6	5.72	425.6	158.6
1960	33.46	0.5	5.90	414.4	132.6
	45.62	0.7	5.78	308.0	127.3
	51.37	0.5	5.60	218.4	197.8
	60.26	0.5	5.70	380.8	196.6
1961	74.36	0.5	5.62	425.6	94.9
	67.25	1.0	5.75	425.6	121.3
	69.55	1.1	6.00	347.2	118.3
	58.15	1.2	6.32	464.8	203.4
1962	55.76	1.2	6.15	268.8	143.8
	51.37	1.2	6.20	240.8	42.0
	52.85	1.2	6.22	196.0	132.1
	56.55	0.9	6.05	453.6	156.7
1963	54.00	1.0	6.12	352.8	114.1
	51.25	1.0	5.75	246.4	79.0
	51.25	1.0	5.90	196.0	103.8
	48.67	1.1	6.05	386.4	127.1
1964	45.00	1.1	5.98	397.6	158.8
	50.12	0.9	5.85	341.6	150.1
	59.25	0.8	5.88	285.6	137.7
	65.56	0.7	5.90	571.2	127.7
1965	77.62	0.6	5.90	515.2	113.1
	63.45	1.0	5.80	403.2	135.3
	68.75	1.1	5.55	257.6	207.7
	66.50	1.1	5.75	386.4	197.7
1966	63.22	1.0	5.56	476.0	177.4
	77.55	0.9	5.40	509.6	180.3
	98.85	1.0	5.50	470.4	221.2
	75.60	1.2	5.60	554.4	271.7
1967	69.46	1.2	5.50	476.0	281.4
	64.55	1.0	5.40	504.0	102.6

Data Series Used in Estimation 1958-1969 (Cont d)

Year	Q_{FD} mill. lbs.	T_F cents lb.	P_F cents lb.	S_{FT} mill. lbs.	Q_{FO} mill. lbs.
	62.77	1.0	5.82	565.6	138.5
	67.35	0.9	6.30	610.4	119.5
1968	70.65	0.9	6.30	470.4	175.9
	67.42	1.1	6.25	504.0	70.7
	64.30	1.2	6.20	201.6	147.0
	74.66	1.0	6.15	347.2	38.3
1969	80.50	0.9	6.20	431.2	127.1
	112.55	1.0	6.30	453.6	98.6

Data Series Used in Estimation

1958-1969		1963-1969		
Year	Q_{FP} mill. lbs.	Year	Q_{RP} mill. lbs.	Q_T mill. lbs.
1958	2.204	1963	59.950	33.060
1959	2.204	1964	73.700	44.080
1960	2.000	1965	69.300	49.590
1961	1.653	1966	52.250	66.120
1962	2.350	1967	43.450	115.710
1963	1.670	1968	37.400	121.220
1964	1.100	1969	32.200	180.555
1965	1.120			
1966	0.551			
1967	0.385			
1968	0.275			
1969	0.100			

APPENDIX B

Predictability of the Model

The equations estimated for rapeseed and flaxseed demand were utilized in calculating exports to Japan in the third and fourth quarters of 1969. The coefficients used in calculating the estimated exports were those estimated by the 2 SLS method. Consideration was given to the altered level of soybean prices, rapeseed and flaxseed prices, transportation costs and the estimated Japanese domestic production.

Results obtained using the rapeseed demand equation were slightly higher for both the third and fourth quarters of 1969. Actual exports of rapeseed to Japan during the third quarter of 1969 amounted to 183.150 million pounds. The calculations using the estimated model predicted that approximately 195,000 million pounds was exported. Actual fourth quarter exports of rapeseed in 1969 were 149.100 million pounds. Results of the model calculations for the fourth quarter exports predicted 165.000 million pounds.

Actual flaxseed exports to Japan during the third and fourth quarters of 1969 were 69.888 million pounds and 80.304 million pounds. Again, the estimates using the model were slightly high with results of 75.500 million pounds

predicted in the third quarter and 88.304 million pounds predicted in the fourth quarter.

The overestimates of exports may be due in large part to the falling level of the Japanese domestic supply which were not completely replaced by imports from Canada.

Statistical Results of a Distributed Lag Model

An attempt was made in this study to test the results of using a lagged variable in the model. Specifically, price in the demand equations was lagged by one quarter of a year in one test and by two quarters in another test. The results which were obtained indicated that prices lagged by one or two quarters were not acceptable in explaining Japanese demand for both rapeseed and flaxseed. The coefficient of adjustment γ exceeded the unitary value in both attempts. To be acceptable the coefficient must lie between the values 0 and 1. A value of 0 indicates that the adjustment would be limited to a single time period whereas, a value of 1 indicates that there would be no adjustment at all in the dependent variable.

The results of the estimations using lagged variables is as follows:

Rapeseed Demand

$$Q_{RD} = f\ (P_S,\ Q_{RP},\ T_R,\ P_{R_{T-1}},\ U_1)$$

where Q_{RD} = total quarterly exports of Canadian rapeseed to Japan.

P_S = U.S. average quarterly wholesale price of soybeans.

Q_{RP} = Japanese rapeseed production.

T_R = a measure of transportation costs.

$P_{R_{T-1}}$ = average quarterly price of Canadian rapeseed exported to Japan, lagged one quarter.

U_1 = a random disturbance.

$$Q_{RD} = 4.120 + 1.820\ P_S - 1.255^{**}\ Q_{RP} - 0.190\ T_R - 2.330\ P_{R_{T-1}} + U_1$$
$$(1.002) \quad (0.333) \quad (0.101) \quad (1.255)$$

(2 SLS) $d = 2.15$ $R^2 = 0.671$

The results of the estimation where the rapeseed price is lagged two quarters is as follows:

$$Q_{RD} = 4.155 + 1.442\ P_S - 1.301^{**}\ Q_{RP} - 0.185\ T_R - 2.115\ P_{R_{T-2}} + U_1$$
$$(0.880) \quad (0.355) \quad (0.995) \quad (1.243)$$

(2 SLS) $d = 2.12$ $R^2 = 0.667$

Flaxseed Demand

$$Q_{FD} = f\ (P_S,\ Q_{FP},\ E_T,\ T_F,\ P_{F_{T-1}},\ U_2)$$

where Q_{FD} = total quarterly exports of Canadian flaxseed to Japan.

P_S = U.S. average quarterly wholesale price of soybean.

Q_{FD} = Japanese flaxseed production.

T_F = a measure of transportation costs.

$P_{F_{T-1}}$ = average quarterly price of Canadian flaxseed exported to Japan, lagged one quarter.

$$Q_{FD} = 5.511 + 0.881\ P_S - 0.441^*\ Q_{FP} + 0.420^{**}\ E_T$$
$$\qquad\qquad (0.601) \qquad (0.200) \qquad (0.111)$$

$$- 0.170\ T_F - 1.232^*\ P_{F_{T-1}} + U_2$$
$$\quad (0.105) \qquad (0.488)$$

(2 SLS) $\qquad d = 1.98 \qquad R^2 = 0.680$

The results of the estimation where the flaxseed price is lagged two quarters is as follows:

$$Q_{FD} = 5.224 + 0.875\ P_S - 0.441^*\ Q_{FP} + 0.403^{**}\ E_T$$
$$\qquad\qquad (0.609) \qquad (0.202) \qquad (0.155)$$

$$- 0.172\ T_F - 1.185^*\ P_{F_{T-2}} + U_2$$
$$\quad (0.122) \qquad (0.475)$$

(2 SLS) $\qquad d = 1.98 \qquad R^2 = 0.655$

Correlation Matrices of the Estimated Models

The following matrices are those obtained from the 2 SLS estimations of the rapeseed and flaxseed demand and supply equations.

Rapeseed Demand

	Q_{RD}	P_S	Q_{RP}	T_R	P_R
Q_{RD}	1.0000				
P_S	0.2798	1.0000			
Q_{RP}	-0.7475	-0.0996	1.0000		
T_R	-0.1723	-0.0223	0.0432	1.0000	
P_R	-0.2389	-0.2763	-0.3556	0.4551	1.0000

Rapeseed Supply

	Q_{RS}	S_{RT}	Q_T	Q_{RO}	P_R
Q_{RS}	1.0000				
S_{RT}	0.7272	1.0000			
Q_T	0.7581	0.7270	1.0000		
Q_{RO}	0.4861	0.5658	0.8003	1.0000	
P_R	-0.2389	-0.0304	-0.2159	-0.1488	1.0000

Flaxseed Demand

	Q_{FD}	P_S	Q_{FP}	E_T	T_F	P_F
Q_{FD}	1.0000					
P_S	0.7921	1.0000				
Q_{FP}	-0.6795	0.5020	1.0000			
E_T	0.8263	0.3022	0.2563	1.0000		
T_F	-0.1317	-0.2231	-0.1521	0.1102	1.0000	
P_F	-0.1015	-0.1563	-0.2325	0.1005	0.0121	1.0000

Flaxseed Supply

	Q_{FS}	S_{FT}	E_T	Q_{FO}	P_F
Q_{FS}	1.0000				
S_{FT}	0.8563	1.0000			
E_T	0.6213	0.6963	1.0000		
Q_{FO}	-0.4351	-0.3251	-0.2586	1.0000	
P_F	-0.1491	-0.1251	-0.1260	0.1560	1.0000

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