



An economic analysis of Montana wheat exports in the Asian market  
by Gary Leonard Ochsner

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE  
in Agricultural Economics  
Montana State University  
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**Abstract:**

This study is a review of the export market for Montana wheat. It develops a procedure for determining the amounts of wheat by class that have been entering the export market, and then reviews the world export market for wheat and specifically examines Japan's market position.

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Date July 22, 1974

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IN THE ASIAN MARKET

by

GARY LEONARD OCHSNER

A thesis submitted in partial fulfillment  
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Approved:

  
Chairman, Examining Committee

  
Head, Major Department

  
Graduate Dean

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## ABSTRACT

This study is a review of the export market for Montana wheat. It develops a procedure for determining the amounts of wheat by class that have been entering the export market, and then reviews the world export market for wheat and specifically examines Japan's market position.

A market share analysis is used to look at the reasons behind the United States' changing shares of the world, Asian, and Japanese markets. This analysis defines three effects (size of market, competitive and distribution) and breaks out portions of market share changes attributable to each. Analyses included in this study showed changes in size of the markets to be the dominating effect regarding United States market share changes.

An elasticity of substitution approach was used to further analyze the Japanese wheat import market. Values of elasticities of substitution which showed price ratios of competing wheat imports to be rather important in determining the quantity ratios were found. Price elasticities of demand were derived from the elasticity of substitution values. Resultant values provided a value of -4.159 as the elasticity of Japanese demand for United States hard wheats, -3.439 as the elasticity of Japanese demand for all United States wheat, and -1.466 as the elasticity of Japanese demand for United States hard and semi-hard wheats.

## Chapter 1

### INTRODUCTION

This study is primarily descriptive in nature. It relates Montana's wheat economy with the world market for wheat and specifically with the Japanese portion of this market. The flow of wheat between Montana and Japan links dissimilar cultures divided by miles of ocean. Nearly five thousand of these miles separate Montana's vast and prolific wheat production areas and Japan's more than 103 million consumers of this wheat.

#### I. HISTORY AND OBJECTIVES

Wheat occupies a niche in the histories of both Montana and Japan, but only recently has it become a silent ambassador linking the two. The first record of wheat production in Montana was in the Bitterroot Valley near St. Mary's Mission. Father DeSmet brought the seed to Montana in 1842 and taught the Flathead Indians to plant and harvest it. In 1845 Father Ravalli imported a pair of millstones so the mission could make its own sacramental bread. The gold rush brought an influx of miners to the state and with them came a large demand for food. Since the territory lacked an agricultural base nearly all staples were imported from the east via the Missouri, or from the south by land from Utah. In 1862 flour sold for a dollar a pound in Bannack, and in 1864 a bad winter in Virginia City forced the price of flour to \$150 a hundred. By 1866 many people had begun farming in the mountain valleys of the

state. On September 15, 1866 the "Montana Post" stated that 300,000 bushels of wheat were raised in the Montana Territory during the season. This crop was primarily produced in the irrigated valleys of the Gallatin, Bitterroot, and Madison rivers. By 1870 Montana had seven flour mills, and wheat production was given as 177,535 bushels of spring and 3,649 bushels of winter wheat. Imports of flour to the state were continued until into the 1870's and in fact, the "Salt Lake Choice" flour was commonly preferred to Montana flour. Prices in 1870 were at \$11.00 per hundred for "Salt Lake Choice" and \$9-9.50 per hundred for Montana produced "Gallatin XX".<sup>1</sup>

While Bannack and Virginia City were flourishing, Japan was still trying to evolve from being an isolated feudal state. In 1854 Commodore Matthew Perry entered into an agreement with Japan providing for the beginnings of trade between Japan and the United States. It wasn't until March of 1857 that an American consul-general to Japan, Townsend Harris, signed an agreement which opened Japanese ports to international commerce for the first time since the 1630's. At about the same time that Bannack was in its first year new trading facilities were being built in the fishing village of Yokohama, which now handles over one-third of Japan's imported wheat.

Many changes have transpired since these nearly concurrent beginnings

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<sup>1</sup>Harrison A. Trexler, Flour and Wheat in the Montana Gold Camps - 1872-1870 (Missoula: Dunstan Printing and Stationery, 1918), pp. 4-11.

of Montana wheat production and Japanese foreign trade. Japan's economy is now nearly totally dependent on foreign commerce, of which Montana's wheat shipments make up only a small portion. In Montana wheat production has moved from the irrigated mountain valleys to the dryland plains areas of the state and has grown from the 181,000 bushels in 1870 to over 104 million bushels in 1973. Millers in Salt Lake City now import Montana's hard wheats to blend with their local production to strengthen their flours. Montana, far from the early position of a net wheat importer, now ships over 75 percent of its production out of the state.

Wheat exports have become very important to Montana. Since 1965 increased amounts of wheat have moved from this state to the West Coast export facilities. Data collected for this study indicates that during the 1972 crop year over 95 million bushels of wheat moved westward out of the state with about 21 million bushels moving into domestic milling channels while the remaining 75 million bushels moved into the export market. This amounts to over 75 percent of the 1972 crop year production which is being exported.

Because of this importance, wheat exports from Montana receive major emphasis in this study. Specifically, the objectives of this study are:

- (1) To determine the amounts of Montana spring and winter wheat which are entering the export market.
- (2) To review the world market for wheat exports.

- (3) To examine the United States position in the Japanese wheat import market by means of an elasticity of substitution approach.

Accomplishment of the first objective involved data collection from both primary and secondary sources to arrive at an estimate of Montana's wheat exports. The fulfillment of the second objective included a general description of the world wheat market, and utilization of a market share analysis of United States exports. To determine the elasticity of substitution between wheat exports from the United States and exports from competing exporters in the Japanese market, least squares linear regression was run using quantity ratios as dependent variables, and price ratios as independent variables.

Since much of this study concerns Japanese wheat importation, the remainder of this chapter will review the history and procedures of Japanese wheat imports.

## II. THE JAPANESE MARKET FOR WHEAT

Japan constitutes a major market in world wheat trade. In 1972, the only country which imported more wheat than Japan was the U.S.S.R. Since 1950 Japanese wheat imports have grown from around 60 million bushels to over 180 million bushels in 1972. Over the last ten years, Japanese imports have grown by over 50 million bushels. In 1972 Japan's imports accounted for 8.3 percent of the total world trade in

wheat and wheat flour. This is a larger percentage than was imported by all of North and Central America (3.5 percent) and is close to the percentages imported by all of South America (9.4 percent) and Africa (10.5 percent). Unlike many importers of United States wheat, Japan's purchases are entirely for cash. The last United States concessional sales to Japan occurred in 1959.

Japanese wheat imports have shown a changing composition both in terms of source of imports and types of wheat purchased. The United States, Canada, and Australia have been the major suppliers of wheat to Japan, together accounting for over 95 percent of the total. In the late 1950's and early 1960's, Canada was the major exporter, accounting for 45 to 55 percent of Japan's import needs. Since 1962 the United States has provided the most wheat with 40 to 60 percent of the market. Canada's share has dropped as low as 22 percent with Australia providing from 10 to 30 percent of Japan's import needs.

Recent policy adopted by the Japanese government regards attempts to diversify sources of imports. Other countries which have sold wheat to the Japanese include France, Bulgaria, U.S.S.R., Argentina, and South Africa. At most the combined exports of these countries have accounted for only 2.3 percent of any one year's total purchases. In 1972, purchases from Argentina and South Africa amounted to 1.8 percent of the total. In late 1972, Japan and Australia agreed to attempt to stabilize

wheat trade at a level of 44 million bushels per year.<sup>2</sup> This will probably lead to a loss in market share for Australia.

Soft wheats were the primary types purchased in the late 1950's, but since have been replaced by the hard wheat types. Most recently, Japanese wheat imports have consisted of approximately 50 percent hards, 35 percent softs, 12 percent semi-hards, and 1 percent durums. This can be seen in Table I which shows the percentages of each type of wheat purchased by Japan for the last fifteen years. The hards increased in usage over the period, but have not shown appreciable growth lately. Purchases from the United States have also shown some change in makeup. Purchases of hard red winter ordinary protein wheat have decreased in proportion while there has been some increase in purchases of the higher protein content hard red spring. Table II shows percentage breakdowns by protein content of United States hard and semi-hard wheat exports to Japan for the fifteen year period from 1958 to 1972. Though high protein wheats have gained increased usage lately, the 11.5 and 13.0 percent protein hard winters still are most in demand.

The Japanese have used wheat for cakes and noodles since ancient times but only recently has it rivaled rice as a major staple food. Japan's domestic wheat production consists of soft to semi-hard wheat and is

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<sup>2</sup>United States Department of Agriculture, The Agricultural Situation in The Far East and Oceania - Review of 1972 and Outlook for 1973, Economic Research Service - Foreign 353 (Washington: Government Printing Office, 1972), p. 9.

TABLE I

## COMPOSITION OF TOTAL JAPANESE WHEAT IMPORTS

(Numbers are percentages of total Food Agency imports)

<u>Year/Type</u>	<u>Durum</u>	<u>Hard</u>	<u>Semi-Hard</u>	<u>Soft</u>
1958	_____	33.5	21.2	45.5
1959	_____	39.0	19.1	41.9
1960	_____	38.1	24.7	37.2
1961	_____	42.2	21.8	36.0
1962	_____	39.2	25.8	35.0
1963	_____	38.9	22.8	38.2
1964	_____	42.4	24.9	32.6
1965	2.6	46.9	22.5	28.0
1966	0.6	50.0	20.4	29.0
1967	0.7	44.2	21.5	33.6
1968	0.6	52.8	12.9	33.8
1969	1.0	52.8	12.8	33.4
1970	1.0	50.9	12.0	36.1
1971	1.0	52.9	10.9	35.2
1972	0.9	50.8	12.2	36.0

Source: Calculated from figures released by the Japanese Food Agency.

TABLE II

PROTEIN CONTENT OF UNITED STATES HARD AND SEMI-HARD  
EXPORTS TO JAPAN BY PERCENT FOR 15 YEARS

(Numbers are percentages of United State hard and semi-hard exports)

Year/Type	DNS(14.0)	DNS(13.0)	DNS	HW(13.5)	HW(13.0)	HW(11.5)	HW ORD.
1958	—	—	—	—	—	60.6	39.4
1959	—	—	42.1	—	—	57.9	—
1960	—	—	5.4	—	3.1	91.5	—
1961	—	—	—	—	21.7	63.9	14.4
1962	—	—	—	—	17.0	47.4	35.7
1963	—	—	—	0.3	35.5	37.9	26.3
1964	—	—	0.1	—	34.7	35.6	29.5
1965	—	—	14.2	—	36.5	31.6	17.7
1966	—	—	11.7	—	41.9	24.9	21.5
1967	—	—	24.5	—	30.9	22.0	22.6
1968	—	—	25.6	—	30.1	26.3	18.0
1969	—	—	32.5	—	32.1	22.4	13.0
1970	—	—	38.4	—	32.0	19.4	10.1
1971	—	—	29.1	—	38.8	23.5	8.7
1972	32.3	1.7	—	—	35.2	19.0	11.8

Source: Calculated from figures released by the Japanese Food Agency.

primarily used for making Japanese noodles. Nearly all of this wheat is red winter, but a small amount of spring wheat is also produced. Total production is decreasing and in 1972 was only 10 million bushels compared to about 60 million bushels ten years ago. The sharp decrease in wheat production reflects a lower rate of return for wheat than for rice and cash crops, and a high rate of labor migration from farms to cities and from agriculture to industry.

All wheat is grown under a contract system with the government. Wheat production has been under some type of government control since 1939 when the economy began gearing itself for war. Since 1952 an indirect control system has been in effect whereby the government purchases all production without restriction as to total amount in response to applications from producers. About 60 percent of the domestic production is purchased by the government while the remainder is retained for home consumption. The government then resells the wheat at a loss to the millers. For example, in 1967 the government purchased domestic wheat for \$3.96 per bushel and resold it for \$2.45 per bushel. Even with this price support Japanese farmers claim that costs of production are not being met.

Wheat was supplied to the Japanese people in post war days as a semi-compulsory substitute for rice. Until 1957 wheat consumption fluctuated according to the rice supply. However, since 1957 wheat consumption has been increasing on both a per capita basis and in terms of total demand. Wheat flour was introduced into their school lunch

program in 1950 in the form of bread with the donation of wheat by the United States. Continuation of this lunch program with purchased wheat has helped familiarize a whole generation of Japanese children with bread usage. Present Japanese wheat flour usage consists of 38 to 40 percent noodles, 30 to 32 percent bread, 14 to 15 percent confectionery and 14 to 15 percent other uses including industrial and home usage. Flour for bread, confectionery and miscellaneous use is showing some increase, while flour used for noodles is decreasing. Table III shows the recent flour usage trends in Japan.

The increasing consumption coupled with the decreasing domestic production has resulted in increased imports. Wheat imports are restricted and completely controlled by the government. Under the law, the Japanese Food Agency controls the purchases and sales of all wheat including domestic production with the exception of a small amount imported under the improvement trade system. Purchases under the improvement trade system (also known as 'Free Wheat' purchases) are all processed and re-exported. The purpose of the system is to promote exports and contribute to improvement of the balance of payments. Free wheat purchases generally amount to less than 5 percent of Food Agency import purchases.

The Food Agency grants import permission to approved importers who actually negotiate with the exporters. As of April 1, 1971 there were 31 such importing companies. Each importer is allotted a share which may be increased each half year if the importer can sell wheat to the Food Agency at a cheaper price than expected. At the beginning of

TABLE III

## JAPANESE OUTPUT OF WHEAT FLOUR FOR SPECIFIC USE

(Numbers are percentages of total usage)

<u>Fiscal Year</u>	<u>Bread</u>	<u>Noodles</u>	<u>Confectionery</u>	<u>Industry</u>	<u>Other Uses</u>
1955	32.1	42.0	13.3	<u>12.6</u>	
1960	32.5	43.2	13.3	3.5	7.5
1965	33.5	39.2	13.5	3.3	10.5
1966	32.0	40.0	14.0	3.3	10.7
1967	33.8	38.5	14.1	2.8	11.3
1968	32.2	39.8	14.3	2.7	11.0
1969	33.7	38.3	14.2	3.4	10.4
1970	33.0	38.3	13.7	3.1	11.0

Source: Wheat Associates USA, Wheat Importation and Marketing in Japan,  
National Food Life Improvement Association, 1971, p. 43.

each month the Food Agency announces the classes of wheat it expects to purchase in terms of hard, semi-hard, and soft types for food and feed and the quantity of each class it expects to purchase. These quantities are estimated in advance by the Agency. Each year the Agency estimates trends in domestic wheat consumption and determines the imports necessary to cover the shortages between domestic production and consumption. Monthly revisions are made, and decisions as to necessary imports by type are made from the revised projections. Purchase is made each month in order that the amount will match the monthly demand plus a determined amount of reserve stocks, usually the equivalent of the demand for two or three months.

The importing companies, each armed with a knowledge of the month's requirements, then obtain price quotations from the various exporters. These prices are then relayed to the Agency. The Food Agency examines the offers presented and studies those that fall within a preset confidential purchase price range. After comparing the purchase prices with the government selling prices for each class, the Food Agency decides to purchase those wheats whose price is most favorable to them. In some cases, the Agency makes its purchase decisions on the basis of domestic demand for wheat of the respective classes.

The Food Agency resale price is usually 10 to 20 percent above the import price. The resale price differentials between classes have recently been adjusted to reflect the price differentials in the international market. In 1967, the Food Agency purchased hard winter (11.5)

for \$2.19 per bushel and resold it to the Japanese millers for \$2.65 per bushel. This amounted to approximately a 13 percent markup. This process of selling wheat to the millers above the import price is known as "skimming." It has the same effect on government revenue as would the levying of an import tariff. The amount received from "skimming" is equivalent to a tax which the processors must pay when they purchase foreign wheat. Despite the financial gains to the government with imported wheat the total wheat transactions (purchases and sales of both imports and domestic production) result in a net loss.

There has been some talk of liberalizing the wheat import system in Japan. If this liberalization resulted in direct purchasing by the flour mills, and elimination of the Food Agency resale prices, increased wheat imports would probably result. But, even without this hypothesized liberalization, Japan will remain an important market for United States and hence, Montana wheat.

## Chapter 2

### EXPORTS OF MONTANA WHEAT

Montana's abundant production of wheat has resulted in heavy exports of this valuable commodity. Wheat moves from the state to market facilities to the east and to the west. There are major grain market facilities located in Minneapolis and Duluth and in Seattle and Portland which receive Montana wheat destined for export. The ports to the west of Montana are of greatest importance to the state's wheat industry. Wheat movement studies showed that in the 1966 crop year 77 percent of the wheat which moved from the state was destined for West Coast ports, while only 17 percent went to the east. The two latest "Montana Wheat Summaries" show that for the full year of 1973, 96.2 percent of Montana's out of state wheat shipments went west while only 3.3 percent went east.<sup>1</sup>

Due to the major importance of the West Coast market to Montana's wheat exports and the lack of data on eastward shipments, this study is concerned only with the westward movement of Montana wheat and the amounts of this movement which eventually reach the export market. To obtain these figures an estimation procedure was used which provides for a breakdown between hard red spring and hard red winter wheats.

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<sup>1</sup> Montana Department of Agriculture, Montana Wheat Commission and Statistics Reporting Service, USDA, Montana Wheat Movement Summary, December 3, 1973, March 27, 1974, pp. 10-13.

Most studies, though acknowledging the basic non-homogeneity of wheat, plead lack of data as the reason they proceed to treat wheat as a homogeneous commodity.

Montana wheat production is made up of hard red winter and hard red spring but also is composed of some white and durum production. Table IV shows Montana wheat production by class since 1957. Though white wheat is not separated in these figures there is some produced west of the Continental Divide in Montana, and this production is included in hard red winter figures.

The most reliable estimate of white wheat production in Montana is approximately 1 million bushels in 1972. Seeded acreage of white wheat was larger by 4,000 acres in 1973 than in 1972, but reliable yield estimates are not yet available for 1973.<sup>2,3</sup> Since white wheat production is relatively small, and reliable records are not available, the export estimation procedure did not attempt to determine Montana exports of white wheat. What little there may be will be included in hard red winter export estimates.

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<sup>2</sup> Montana Crop and Livestock Reporting Service, Montana Wheat Varieties - 1972 Crop, Helena, MT, August 1, 1972, p. 4.

<sup>3</sup> \_\_\_\_\_, Wheat Varieties - 1973, Helena, MT, August 9, 1973, p. 2.

TABLE IV

WHEAT PRODUCTION IN MONTANA BY CLASS  
(million bushels)

<u>Year</u>	<u>Hard Red Spring</u>	<u>Hard Red Winter</u>	<u>Durum</u>	<u>Total</u>
1957	29.0	46.2	8.7	83.8
1958	36.5	64.5	0.8	101.9
1959	32.0	44.3	1.7	78.0
1960	29.7	45.9	3.7	79.4
1961	13.5	39.1	1.4	54.0
1962	35.2	37.1	7.0	79.3
1963	39.6	49.2	3.6	92.3
1964	37.3	52.3	4.2	93.7
1965	34.8	67.5	3.0	105.3
1966	31.7	64.3	3.7	99.7
1967	30.4	84.2	4.6	119.1
1968	31.5	86.6	7.7	125.9
1969	29.8	60.1	6.9	96.8
1970	40.2	41.8	3.1	85.2
1971	53.5	54.8	3.7	112.0
1972	46.3	48.3	4.2	98.8
1973	41.9	58.1	4.1	104.2

Source: United States Department of Agriculture. Montana Department of Agriculture and Statistical Reporting Service, Montana Agricultural Statistics. Vols. XI-XIV.

## I. METHOD OF ESTIMATION

That Montana wheat was entering the export market has been known for quite some time, but the actual value and amount of these exports has until recently been hard to pinpoint. The Economic Research Service of the United States Department of Agriculture publishes value figures for the export of Montana wheat. These are developed by means of total value of United States exports and really give no indication of the true amount of Montana wheat exports. The Montana Department of Agriculture and the Statistical Reporting Service, USDA, have only recently tried to estimate Montana wheat exports. Their estimates are of total bushels exported and do not separate wheat by class.

The estimation procedure used in this study relies heavily on the fact that hard red spring wheat production is rather localized. North Dakota, South Dakota, and Montana are the three largest producers of hard red spring wheat and together with Southern Idaho account for substantially all of the hard red spring supply to the Pacific Northwest. By subtracting the hard red spring wheat shipments to the West Coast originating in South Dakota, North Dakota, and Southern Idaho from the total West Coast hard red spring export figure, the hard red spring export amount attributable to Montana can be estimated. A sample of the procedure used is shown in Table V. All shipments from South Dakota, North Dakota and Southern Idaho can be assumed to be entering

TABLE V

SAMPLE PROCEDURE FOR ESTIMATING MONTANA WHEAT EXPORTS  
FOR THE 1970 CROP YEAR  
(million bushels)

Total West Coast hard red spring exports	54.44
(-) North Dakota hard red spring shipments to West Coast	(-) 16.30
(-) Idaho hard red spring shipments to West Coast	(-) 5.90
(-) South Dakota hard red spring shipments to West Coast	(-) 4.64
<hr/>	
Estimated Montana hard red spring exports	<u>27.60</u>
*****	
Total Montana shipment to Pacific Northwest	58.49
(+) Total Montana shipment to California	(+ ) 3.96
<hr/>	
Total Montana West Coast wheat shipments	<u>62.45</u>
(-) Estimated Montana hard red spring exports	(-) 27.60
(-) Montana wheat milled in Washington, Oregon, Idaho, California, Montana, and Utah	(-) 29.80
(+) Montana wheat milled in Montana	(+ ) 6.47
(+) Montana wheat milled in Utah	(+ ) 4.55
<hr/>	
Estimated Montana hard red winter exports	<u>16.07</u>

the export market and not being milled domestically, since they are moved under special rail export freight rates. Thus, the hard red spring exports from Montana are determined.

With the exception of discrepancies caused by possible time lags between shipping reports from the originating states and the actual dates of export, these estimates of the yearly amounts should be reliable. Another source of error could include unreliable data from the originating hard red spring sources, but this should not be a major factor in this case.

Estimates of hard red winter wheat exports from Montana are obtained by subtracting from total Montana wheat shipments to the Pacific Northwest and California the derived hard red spring export total and the domestic milling use of Montana wheat.<sup>4</sup> The following table (Table VI) shows the Montana hard red winter and hard red spring export estimates obtained by using this procedure.

Hard red winter estimates are subject to more error than hard red spring estimates since all of the derived hard red spring figures are used to estimate the hard red winter amounts. The early figures used to represent milling of Montana wheat for flour in the

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<sup>4</sup>Exports from the Pacific Northwest and California are included in the United States Department of Agriculture classification of Pacific exports. The specific terminal locations included are: Portland, Kalama, Longview, Astoria, Vancouver, Seattle, Tacoma, Stockton, Sacramento, Long Beach, and San Francisco.

TABLE VI

ESTIMATES OF MONTANA WHEAT EXPORTS  
(million bushels)

<u>Year</u>	<u>Total</u>	<u>Hard Red Spring</u>	<u>Hard Red Winter</u> (1)
1960-61	14.91	1.71	13.20
1961-62	6.00	0.80	5.20
1962-63	20.82	0.83	19.99
1963-64	22.46	3.17	19.29
1964-65	16.62	3.77	12.85
1965-66	34.68	14.50	20.18
1966-67	32.61	19.52	13.09
1967-68	40.31	17.79	22.52
1968-69	43.46	13.73	29.73
1969-70	43.84	11.46	32.38
1970-71	43.67	27.60	16.07
1971-72	36.90	25.27	11.63
1972-73	75.40	42.76	32.64

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(1) These figures would also include any durum exports from Montana. Estimates of durum exports from Montana for 1967-1973 were made by subtracting North Dakota West Coast durum shipments from total Pacific durum exports. Figures before 1967 were unavailable. Montana durum export estimates in million bushels are: 1967-68 = 0.02; 1968-69 = 0.13; 1969-70 = 0.78; 1970-71 = 1.33; 1971-72 = 1.55; 1972-73 = 1.33.

Pacific states were obtained from milling industry sources. These estimates could be subject to error; however, they were used since they were the only figures available. All other figures used were from published sources or from readily available and reliable unpublished sources.<sup>5</sup>

## II. MONTANA WHEAT EXPORTS

Montana exports of wheat have increased rapidly from the early 1960's to 1973. In 1960 Montana exported about 15 million bushels compared to 75 million in 1972. While 1972 was an abnormal marketing year because of the "Russian Wheat Deal" exports are still important to the State of Montana.

A good indication of the increasing importance of the export market for Montana wheat can be seen when exports as a percentage of total production are examined. Three distinct periods seem to emerge when examining these percentages over the last thirteen years. From 1960-1964 exports as a percentage of production amounted to an average of 20 percent; from 1965-1970 (the period immediately following the advent of the inverse freight rates) this percentage grew to about 35 percent, and during the three years of the 70's has averaged 50 percent. In

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<sup>5</sup>The raw data used to construct estimates of Montana wheat exports and their sources are presented in Appendix A, Table 1.

1972 exports of Montana wheat rose to 76 percent of that year's total Montana wheat production. Though the export figures are not entirely made up out of current production, these percentages provide a good comparison of exports relative to production.

The greatest increase in exports has occurred in hard red spring wheat. Before 1965 hard red spring exports were consistently less than 5 million bushels but since have grown to more than 25 million bushels in each of the last three years. In 1972 they were estimated at nearly 43 million bushels.

Hard red winter exports have shown a slower rate of growth. Since 1962 they have averaged 20-25 million bushels, with 32.38 and 32.64 million bushels in 1969 and 1972 as the highest levels. These recent high levels indicate that the export market is of vital importance to the future well-being of the Montana wheat producers.

There is some variation in these estimates of Montana wheat exports. One of the causal factors of this variation was a dock strike in 1971-72 which completely immobilized the West Coast ports. The strike began July 1, 1971, and continued until a court injunction forced a return to work on October 6, 1971. However, work again ceased on January 17, 1972, and was not resumed until a final settlement ended the strike action on February 21, 1972. The total number of days covered by the two strike periods was 135.

Total Pacific Coast exports dropped from the 1970-71 figure of

214.5 million bushels to 175.6 million bushels in 1971-1972, a decline of 38.9 million bushels or 18.15 percent. Hard red spring and hard red winter wheat exports, those of most importance to Montana, dropped considerably with declines of 18.8 million bushels and 14.5 million bushels respectively, compared to a drop of only 5.1 million bushels for the largest class of Pacific exports, white wheat.

A similar drop in total Pacific Coast exports (not reflected in Montana export figures) was experienced in 1968-1969 when a drop from 237.1 million bushels in 1967-1968 to 189.4 million bushels occurred. This drop, however, was absorbed entirely by a loss of white wheat exports with slight gains in hard red spring and hard red winter exports during the same period. The cause in this case concerned only white wheat as the Japanese complained of sprout damage and discontinued white wheat purchases temporarily. Total Pacific Coast white wheat exports dropped 52.9 million bushels during this period.

Another fluctuation which can easily be explained is the sudden jump in Montana hard red spring exports in 1965-1966. On June 11, 1965, a major freight rate change became effective, allowing hard red spring wheat to reach the North Pacific Coast ports with a substantially lower price than previously possible. In order to attract hard red spring wheat into the Pacific export market, an inverse rate structure was established. Such a rate structure meant "that prices received in the Dakotas for wheat destined for export through Pacific Coast ports

would compare favorably with prices received for wheat shipped to Minneapolis." The inverse rate structure "provided for reductions in rates up to 25 cents per hundredweight from the eastern Dakotas and Minnesota; most Montana rates, except from the easternmost points, remained the same."<sup>6</sup> Pacific Coast exports of hard red spring immediately showed a marked gain, climbing from 3.8 million bushels in 1964-1965 to 19.9 million bushels in 1965-1966 and 25.1 million bushels in 1966-1967. A steady increase since then (with the exception of the strike reduced 1971-1972 figures) to a high of 66.2 million bushels of hard red spring exports from Pacific ports has occurred. The advent of the inverse freight rate also brought about a large gain in the Pacific ports' share of total United States hard red spring exports. This is shown in Table VII.

For the 1965-1966 and the 1966-1967 years the estimates of Montana hard red spring West Coast exports are probably higher than actual, and correspondingly the estimates of Montana hard red winter West Coast exports are probably lower than actual. This is because of incomplete figures for North Dakota hard red spring movements to the West Coast. The total Montana West Coast export figures for these years would not

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<sup>6</sup>Maxine Johnson, "Growth of an Export Market: The Inverse Rate Structure and Hard Spring Wheat," Montana Business Quarterly, Vol. 6, No. 2, Spring, 1968, p. 28.

TABLE VII

UNITED STATES HARD RED SPRING WHEAT EXPORTS  
FROM THE PACIFIC COAST PORTS  
(thousand bushels)

<u>Year</u>	<u>Pacific Hard Red Spring Exports</u>	<u>Pacific Hard Red Spring Exports as a % of Total United States Hard Red Spring Exports</u>
1963-64	3,171	6.2%
1964-65	3,768	18.6%
1965-66	19,929	23.9%
1966-67	25,060	21.3%
1967-68	36,782	52.2%
1968-69	38,893	50.7%
1969-70	41,235	46.3%
1970-71	54,444	48.1%
1971-72	35,554	34.7%
1972-73	66,156	34.0%

Source: United States Department of Agriculture, Grain Division -  
Agricultural Marketing Service. Grain Market News. Various  
weekly summaries.

be affected by the use of more complete data, although the disparity between spring and winter estimates, especially in the 1966 crop year, would be reduced.

### III. COMPARISON WITH OTHER ESTIMATES

The Montana Department of Agriculture cooperating with the Statistical Reporting Service of the United States Department of Agriculture has estimated total Montana wheat exports from the Pacific Northwest since the 1968 crop year. Since they obtain only a total figure and not class designations, they use a somewhat simpler procedure than that used in this study. Table VIII shows a sample of the Montana Department of Agriculture's and the Statistical Reporting Service, USDA's procedure for estimating Montana wheat exports.

A comparison of results for comparable years obtained by using the two procedures illustrated in Table IX shows fairly similar results.<sup>7</sup>

This approach at estimating exports arrives at two different figures for the 1970 and 1971 crop year. The column in Table IX titled "Pacific Northwest" was arrived at by using data from the "Pacific Northwest Wheat Summary" for determining total Montana wheat shipped to the Pacific Northwest, which is substantially the same data as was used

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<sup>7</sup>The 1971 and 1972 estimates are the same since the thesis procedure incorporated the milling and shipment figures used by the Montana Department of Agricultural and Statistical Reporting Service.

TABLE VIII

MONTANA DEPARTMENT OF AGRICULTURE AND THE  
 STATISTICAL REPORTING SERVICE, USDA'S PROCEDURE  
 TO ESTIMATE MONTANA WHEAT EXPORTS  
 (million bushels)

Total wheat milled in Pacific Northwest		29.8
(-) white wheat milled in Pacific Northwest		(-)10.4
<hr/>		
Total red wheat milled in Pacific Northwest		19.4
(-) red wheat from Pacific Northwest milled in Pacific Northwest		(-) 1.5
<hr/>		
Estimate of Montana wheat milled in Pacific Northwest		17.9
Total Montana shipment to Pacific Northwest		
Pacific Northwest Wheat Summary	46.2	
Montana Project		54.8
(-) Estimate of Montana wheat milled in Pacific Northwest	(-)17.9	(-)17.9
<hr/>		
Estimate of total Montana wheat exports	28.3	36.9
	<hr/> <hr/>	<hr/> <hr/>

Source: Montana Crop and Livestock Reporting Service. Montana Wheat Disposition - 1972 Marketing Year. Helena, Montana: March 7, 1974.

TABLE IX

TOTAL MONTANA WEST COAST WHEAT EXPORTS—  
 A COMPARISON OF ESTIMATING PROCEDURES  
 (million bushels)

<u>Crop Year</u>	<u>Thesis Procedure</u>	Montana Department of Agriculture and Statistical Reporting Service Procedure	
		<u>Pacific Northwest</u>	<u>Montana</u>
1968	42.89	40.4	
1969	43.33	47.7	
1970	42.19	37.1	42.7
1971	36.90	28.3	36.9
1972	75.40		75.4

in the thesis estimation method. The figures in the column labeled Montana were derived by using data for total Montana wheat shipments to the Pacific Northwest that was obtained by the Statistical Reporting Service and the Montana Department of Agriculture. The 1971 figures from the two sources (as shown in the sample procedure in Table VIII) varied by more than 6 million bushels.

This comparison of estimation techniques provided a good check of the reliability of the total Montana West Coast wheat export figures obtained by using the thesis procedure. A check of estimates obtained for exports by class is unavailable.

#### IV. FLOUR EXPORTS

All figures so far have dealt only with the exports of wheat. Flour exports from the major Pacific Coast ports have amounted to 4.7 to 8.5 million bushels over the last five years, and undoubtedly include some which was originally Montana wheat.

Table X shows the 1968-1972 flour exports from the major Pacific ports. Seattle and Portland shipped the most flour during this period, and San Francisco and Los Angeles were rather small exporters in comparison. From 4.5 to 7.5 million bushels equivalent of flour were sent from the Portland and Seattle ports during this time.

The only way to obtain some estimate of the amount of Montana wheat being exported as flour is to use percentage estimates. By applying the

TABLE X

FLOUR EXPORTS FROM LOS ANGELES, SAN FRANCISCO,  
SEATTLE, AND PORTLAND<sup>1</sup>  
(thousand bushels)

<u>Ports</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Los Angeles	76.6	231.6	51.0	4.0	0.1
San Francisco	648.4	989.4	666.6	166.6	209.2
Seattle	3060.4	3043.7	2523.8	1918.0	3335.2
Portland	2788.1	4244.7	3253.4	2576.4	3124.3
<hr/>					
TOTAL	6573.4	8509.4	6494.8	4665.1	6668.8

<sup>1</sup> Includes wheat flour, durum flour, and semolina. Expressed in terms of wheat equivalents - (cwt. flour x 2.283 = bu. wheat)

Source: United States Department of Commerce, U.S. Exports, Series EA 622. Annual 1968-1972.

percentage of total wheat exported from the coastal areas to the amount of this wheat that was of Montana origin, a rough approximation of the flour exports attributable to Montana was obtained. These estimates for the last five years range from 2.99 to 4.79 million bushels. The total procedure is shown in Appendix A, Table 2.

Destination of flour exports from the West Coast ports is primarily to Asian countries. During the last five years at least 70 percent of the flour shipped from West Coast ports had an Asian destination. Total figures are given in Appendix A, Table 3.

The major single country destinations and their five year total purchases included: South Vietnam, 10.2 million bushels; Korea, 8.7 million bushels; Sri Lanka, 5.4 million bushels; Indonesia, 3.5 million bushels. No other single country purchased over 1 million bushels for the five years. Though flour exports are relatively small in comparison to wheat exports, it is important that their existence be acknowledged.

#### V. FINAL DESTINATION OF MONTANA WHEAT EXPORTS

Identification of Montana wheat once it leaves the state is virtually impossible. Wheat from all sources is blended at the terminal facilities, and though class designation and protein content are used to label exported wheat, all other traces of origin are lost.

The only way to attain even rough estimates of the final destination of Montana wheat would be to determine Montana's percentage share

of West Coast wheat exports and then apportion them to the final destinations of the West Coast exports. This procedure provides us with crude estimates of the final destination of Montana wheat.

Table XI shows the West Coast exports of both hard red spring and hard red winter wheats for the five year period of 1967-1971. Also listed are the estimates of Montana hard red spring and hard red winter wheat exports for the same period, and the percentage of the total West Coast exports that Montana provides. As can be seen, Montana has provided from 28 percent to 71 percent of the West Coast hard red spring wheat exports and from 30 percent to 57 percent of the West Coast hard red winter wheat exports. Montana's share of the hard red spring export market has shown some increase while their share of the hard red winter export market has shown a slight decline.

Yearly summaries published in the Grain Market News provide figures for all West Coast wheat exports categorized by country of destination, class of wheat, and type of sale. Table XII shows the major purchasers of West Coast hard red winter exports since 1967. These figures include wheat moved under the following Grain Market News sale program classifications: Dollar Sales, CCC Credit, Barter, Public Law 480. Japan purchased all of its wheat through "Dollar Sales" while most of the other countries have participated in a variety of programs.

Japan has consistently been the largest buyer of hard red

TABLE XI

MONTANA SPRING AND WINTER WHEAT EXPORTS AS A PERCENTAGE  
OF WEST COAST SPRING AND WINTER WHEAT EXPORTS

(million bushels)

<u>Crop Year</u>	Montana Hard Red <u>Spring Export</u>	West Coast Hard <u>Red Spring Export</u>	Montana Spring Wheat Exports as a Percent of West Coast Spring <u>Exports</u>
1967	17.79	36.78	48.37
1968	13.73	38.89	35.30
1969	11.46	41.24	27.79
1970	27.60	54.44	50.70
1971	25.27	25.55	71.08
1972	42.76	66.16	64.63

<u>Crop Year</u>	Montana Hard Red <u>Winter Export</u>	West Coast Hard <u>Red Winter Export</u>	Montana Winter Wheat Exports as a Percent of West Coast Winter <u>Exports</u>
1967	22.52	52.67	42.67
1968	29.73	56.78	52.36
1969	32.38	56.63	57.08
1970	16.07	52.30	30.73
1971	11.63	37.83	30.74
1972	32.64	67.01	48.71

Source: United States Department of Agriculture. Grain Division -  
Agricultural Marketing Service. Grain Market News. (Various  
weekly summaries).

TABLE XII

HARD RED WINTER EXPORTS FROM WEST COAST PORTS  
BY COUNTRY OF DESTINATION  
(thousand bushels)

	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Total All Sales	52,617	56,775	56,732	52,303	37,827	67,014
El Salvador	--	--	--	170	143	113
Percent of All Sales	--	--	--	0.3	0.4	0.2
Taiwan	7,159	6,239	6,149	9,509	4,472	7,842
Percent of All Sales	13.6	11.0	10.8	18.2	11.8	11.7
India	1,757	9,472	1,358	--	--	2,520
Percent of All Sales	3.3	16.7	2.4	--	--	3.8
Japan	36,684	29,318	37,898	29,861	26,775	33,700
Percent of All Sales	69.7	51.6	66.8	57.1	70.8	50.3
Korea	4,683	8,071	10,153	8,582	2,970	12,412
Percent of All Sales	8.9	14.2	17.9	16.4	7.8	18.5
Philippines	907	714	672	622	459	898
Percent of All Sales	1.7	1.3	1.2	1.2	1.2	1.3
U.S.S.R.	--	--	--	--	--	1,938
Percent of All Sales	--	--	--	--	--	2.9
Other	1,427	2,961	502	3,558	3,008	7,592
Percent of All Sales	2.7	5.2	0.9	6.8	8.0	11.3

Source: United States Department of Agriculture. Grain Division -Agricultural Marketing Service. Grain Market News, (Various weekly summaries).

winter wheat from the West Coast. In 1972 Japan purchased 33.7 million bushels which accounted for slightly over 50 percent of the hard red winter shipped from West Coast ports. From 1967 through 1971 Japan's purchases accounted for from 52 percent to 71 percent of the West Coast hard red winter. Taiwan and Korea have also consistently been major hard red winter purchasers, with each usually accounting for from 10 percent to 20 percent of the total. The U.S.S.R.'s highly publicized grain purchases had a relatively small effect on West Coast hard red winter sales. Their purchase of 1,938 million bushels accounted for only 2.9 percent of the total, and ranked them behind traditional purchasers such as Japan, Korea, Taiwan, and India.

Table XIII shows that Japan also accounts for the largest purchases of hard red spring wheat of all countries obtaining West Coast shipments. The Philippines are also major purchasers of hard red spring wheat though their share has declined somewhat recently. Taiwan and Korea have also been consistent purchasers, and in 1972 Bangladesh became a large market.

By applying the percentage figures from Table XI to the purchase totals in Tables XII and XIII, the rough approximations of the final destinations of Montana wheat exports can be obtained. These estimates are shown in Table XIV. According to these estimates the four countries which we can assume to be getting most of Montana's wheat are Taiwan, Japan, Korea, and the Philippines. Japan alone has apparently used an average of over 20 million bushels of Montana wheat per year.

TABLE XIII

HARD RED SPRING EXPORTS FROM WEST COAST PORTS  
BY COUNTRY OF DESTINATION

(thousand bushels)

	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Total all Sales	36,782	38,893	41,235	54,554	35,554	66,156
Bangladesh	--	--	--	--	--	5,269
Percent of All Sales	--	--	--	--	--	8.0
El Salvador	1,060	1,521	1,413	2,226	2,206	1,552
Percent of All Sales	2.9	3.9	3.4	4.1	6.2	2.4
Taiwan	1,456	2,011	1,755	3,081	1,878	3,266
Percent of All Sales	4.0	5.2	4.3	5.7	5.3	4.9
India	--	--	--	--	--	3,813
Percent of All Sales	--	--	--	--	--	5.8
Japan	12,634	12,449	17,560	28,880	14,607	27,400
Percent of All Sales	34.4	32.0	42.6	53.0	41.1	41.1
Korea	147	1,442	362	3,501	2,143	3,429
Percent of All Sales	0.4	3.7	0.9	6.4	6.0	5.2
Philippines	17,042	14,257	14,171	9,446	8,011	9,417
Percent of All Sales	46.3	36.7	34.4	17.4	22.5	14.2
Other	4,443	7,213	5,974	7,310	6,709	12,010
Percent of All Sales	12.1	18.6	14.5	13.4	18.9	18.2

Source: United States Department of Agriculture. Grain Division - Agricultural Marketing Service. Grain Market News, (Various weekly summaries).

TABLE XIV

ESTIMATES OF THE FINAL DESTINATION  
OF MONTANA WHEAT EXPORTS  
(thousand bushels)

	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Bangladesh HRS	--	--	--	--	--	3,405
HRW	--	--	--	--	--	--
TOTAL	--	--	--	--	--	3,405
El Salvador HRS	512	537	393	1,129	1,568	1,003
HRW	--	--	--	52	43	54
TOTAL	512	537	393	1,181	1,611	1,057
Taiwan HRS	704	710	488	1,562	1,335	2,111
HRW	3,055	3,267	3,509	2,922	1,374	3,810
TOTAL	3,759	3,977	3,997	4,489	2,709	5,930
India HRS	--	--	--	--	--	2,464
HRW	750	4,960	775	--	--	1,227
TOTAL	750	4,960	775	--	--	3,691
Japan HRS	6,111	4,394	4,880	14,642	10,382	17,709
HRW	15,653	15,351	21,632	9,176	8,230	16,415
TOTAL	21,764	19,745	26,512	23,818	18,612	34,124
Korea HRS	71	509	101	1,775	1,523	2,216
HRW	1,998	4,226	5,795	2,367	912	6,045
TOTAL	2,069	4,735	5,896	4,412	2,435	8,261
Philippines HRS	8,243	5,033	3,938	4,789	5,694	6,086
HRW	387	374	383	191	141	437
TOTAL	8,630	5,407	4,321	4,980	5,835	6,523
U.S.S.R. HRS	--	--	--	--	--	--
HRW	--	--	--	--	--	943
TOTAL	--	--	--	--	--	943
Other HRS	2,149	2,546	1,660	3,706	4,769	7,762
HRW	609	1,550	286	1,903	924	3,698
TOTAL	2,758	4,096	1,946	4,799	5,693	11,460

Source: Calculated from Tables XI, XII, and XIII.

It should be kept in mind that although the countries listed in Table XIV are the major users of West Coast and hence Montana wheat, during the period 1967-1973 a total of 35 countries purchased hard red spring and hard red winter wheat from West Coast ports. Montana wheat could have easily ended up in any or all of these countries.

Exports of Montana wheat and flour have shown tremendous growth and provide an important source of income to the state. Combined exports were at their highest level in 1972, possibly exceeding the 80 million bushel level for the first time. The primary destination of Montana wheat and flour exports is probably Japan; but since 1967 a total of 35 countries may have obtained Montana wheat, and 39 countries may have bought flour of Montana origin.

Asian countries demand the bulk of both Montana wheat and flour exports. With the many less developed countries in Asia, this market has the potential for greatly expanded import demands for wheat in the near future.

#### VI. MARKET SHARE ANALYSIS

In order to analyze the United States export market for wheat it is important to look at more than just absolute changes in total exports from year to year or percentages of markets controlled by the major exporters. Factors responsible for these changes and the relative importance of each of these factors should also be determined.

By using this approach the changes in export shares can be assessed, and with due caution inferences can be made about the reasons behind these changes.

L. R. Rigaux<sup>8</sup> initially developed this model of market share analysis, applying it to Canadian wheat exports, and later D. C. Sprott<sup>9</sup> used the same method to study Australian wheat exports. The basic idea behind this approach is to determine a country's change in export share over a specified time period and to analyze this change. The change, either a loss or a gain, can be separated into portions caused by three distinct effects which have been referred to as the size of market effect, the distribution effect, and the competitive effect.

#### Description of Effects

Of the three effects, the size of market effect is the most straightforward and easily understood. It simply refers to changes in exports which are due to a change in the size of the total world market for wheat and flour exports. This effect is evidenced when a country's exports

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<sup>8</sup>L. R. Rigaux, "Market Share Analysis Applied to Canadian Wheat Exports," Canadian Journal of Agricultural Economics, Vol. 19, No. 1, July, 1971, pp. 22-34.

<sup>9</sup>D. C. Sprott, "Market Share Analysis of Australian Wheat Exports Between 1950-51 and 1969-70," The Wheat Situation, Bureau of Agricultural Economics, No. 35, July, 1972, pp. 11-16.

grow even though their market shares in individual countries and their total world market share remains constant. This effect is illustrated in Table XV.

This example and the others in Table XV assume that only the exports of Country X are being considered. The external market for Country X is composed of only two sectors, or countries, A and B, who together comprise the "overall" market. It is also assumed that Country X has only one competitor in this export market.

To isolate the size of market effect the underlined values (X's market share of the individual sectors, and its share in the overall market) are held constant. The relative sizes of markets A and B are also held constant, so that both before and after the size of market effect has been introduced A purchases one-fourth and B three-fourths of the overall total. That which changes is the size of the market, as total overall imports grow from 1600 to 2000. Because of this growth, Country X's exports grow from 400 to 500. This 100 unit growth is entirely due to the size of market effect. Country X has not improved its position relative to that of its competitor (X still provides 25 percent and the competitor 75 percent of the overall market) yet its exports have grown by 100 because the size of the overall market has increased. This illustrates a positive size of market effect though a negative effect may just as likely have occurred.

The competitive effect may be defined as the export loss or gain for the exporting country because its competitiveness changes in given

TABLE XV

HYPOTHETICAL EXAMPLES OF THE SIZE OF MARKET,  
COMPETITIVE, AND DISTRIBUTION EFFECTS

	Year 1	Total Imports	Imports from X	Share of X
Isolated Size of Market Effect	Market A	400	160	.40%
	Market B	1200	240	.20%
	Overall	1600	400	.25%
<u>Year 1a</u>				
1	Market A	500	200	.40%
	Market B	1500	300	.20%
	Overall	2000	500	.25%
<u>Year 1a</u>				
Isolated Competitive Effect	Market A	500	200	40%
	Market B	1500	300	20%
	Overall	2000	500	25%
<u>Year 1b</u>				
2	Market A	500	250	50%
	Market B	1500	450	30%
	Overall	2000	700	35%
<u>Year 1b</u>				
Isolated Distribution Effect	Market A	500	250	.50%
	Market B	1500	450	.30%
	Overall	2000	700	35%
<u>Year 2</u>				
3	Market A	200	100	.50%
	Market B	1800	540	.30%
	Overall	2000	640	32%

markets as reflected in its market shares. This effect becomes zero if shares remain constant or if rises in shares of some markets exactly offset declines in shares of others. In the example in Table XV the size of the markets remain constant, the only change being the share of these markets controlled by Country X. The market share of Country X rises from 40 to 50 percent in Market A, and from 20 to 30 percent in Market B. This results in an increase from 25 to 35 percent for Country X in the overall market. These increases come at the expense of the competition, whose share of the overall market falls from 75 to 65 percent. Country X's total exports have grown from 500 to 700, resulting from an increase of 50 units in Market A and 150 units in Market B. This 200 unit increase is due entirely to the competitive effect. Had X's market shares fallen, the competitive effect would have been negative.

The name "competitive" may prove to be misleading, since it really has little to do with actual competitive practices within these markets. Embodied within the competitive effect are internal policies of the importers. These policies may well include discriminatory barriers against particular importers. Also, many countries establish bilateral or multilateral agreements which often cover periods of more than one year. This makes it prudent to analyze further specific market information before final conclusions about a "competitive" position are reached.

The distribution effect is caused by a change in relative importance in individual importing markets. As a result of this effect an exporting

country can maintain its market shares in individual importing countries yet still lose part of its share of the overall market due to changes in absolute quantities demanded by the importers. This effect can probably best be explained by use of the example in Table XV.

In this example the underlined values that remain constant include X's share in the individual markets and the size of the overall market. The changes occur in the relative sizes of the individual markets (Market A's share of the overall purchases falls from 25 to 10 percent, as Market B's grows from 75 to 90 percent) and hence in the absolute amount of imports from X. This in turn causes the market share of X of the overall market to fall.

The overall market share for X has dropped from 35 to 32 percent, although X has maintained the same share as previously in each of the separate markets. By contrast, the relative position of the competitor has improved from 65 to 68 percent because the relative importance of each market is different than for X and because the rate of growth differs in the individual markets. Thus the decline in X's total exports from 700 to 640 is due to a negative distribution effect. This distribution effect has also been referred to as a "country" or "direction" effect.

Of the three effects mentioned, the distribution effect has probably received the least attention. While the other two effects can generally be noticed, the distribution effect is much harder to recognize without an analysis such as this. Unawareness of the existence and results of

the distribution effect often causes its burdens to be wrongly attributed to a lack of competitiveness.

The three effects can combine with unpredictable results. They can and do move independently and consequently have a differential impact on a country's exports. Any movement by one effect can override movements in the opposite direction by the other two effects.

Had the three effects illustrated in Table XV occurred together, the total changes given in Table XVI would have resulted. Table XVI also illustrates the form which henceforth will be used to show the results of the various market share analyses. The summary at the bottom of Table XVI shows that Country X's total exports grew by 240 units over the period. The size of market effect was the cause of 100 units gain, the competitive effect contributed a gain of 200 units, while the distribution effect was somewhat offsetting as it resulted in a 60 unit loss.

By separating an exporter's losses or gains into components specifically attributable to one of the three effects, a better understanding of the reasons behind the losses or gains can be had. This can ideally lead to either policy recommendations in an attempt to exert a positive influence on a negative effect, or to realizations that the losses (or gains) are beyond the range of an exporter's policy decisions.

#### Selection of Time Periods

This analysis can be used to compare exports for any two years or

TABLE XVI

## SAMPLE PROCEDURE FOR MARKET SHARE ANALYSIS

Year 1	Total Imports	Imports from X	Share of X
Market A	400	160	40%
Market B	1200	240	20%
Overall	1600	400	25%

Year 2

Market A	200	100	50%
Market B	1800	540	30%
Overall	2000	640	32%

<u>Actual Exports</u>	<u>Year 1</u>	<u>Year 2</u>
Overall	1600	2000
X	400 (A <sub>1</sub> )	640 (A <sub>2</sub> )
X's Market Share	25%	32%

X's Potential Exports in Year 2

Year 1 market share (25% x 2000) = 500 (B)  
at Year 2 export level

Year 1 individual market shares (40% x 200)  
at Year 2 import levels +(20% x 1800) = 80 + 360 = 440 (C)

<u>Gain for X</u>	<u>Units</u>	<u>Percent</u>
Total Gain (A <sub>2</sub> -A <sub>1</sub> )	240	+100
Size of Market Effect (B-A <sub>1</sub> )	+100	+42%
Competitive Effect (A <sub>2</sub> -C)	+200	+83%
Distribution Effect (C-B)	-60	-25%

any two groups of years. A problem of choice of appropriate years or periods of comparison then becomes apparent. It is impossible to choose a base year or base period without arbitrarily creating the impression that this base is typical, or in some cases, an indication of what should be. This becomes an important consideration since there are some years where uncontrollable external effects can alter the market considerably.

Time periods chosen to examine total United States wheat exports through the use of this market share analysis were the periods of 1950 to 1952, 1959 to 1961, and 1970 to 1972.<sup>10</sup> Use of three year averages helps to minimize any chance of single year abnormalities. The choice of the 1970-1972 period posed a problem in that to report relevant information recent years' data had to be included yet these years were rather abnormal and hardly "perfect" choices for comparison. The 1970 market year followed fairly normal trading patterns, but 1971 wheat shipments were disrupted by the United States dock strikes, and in 1972 the United States shipments skyrocket due to the Russian wheat sales and to an overall increased world demand situation. However, by using the three year average, the major fluctuations should be tempered enough to

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<sup>10</sup> These periods are on a crop year basis, so would include July 1, 1950 to June 30, 1953 and July 1, 1959 to June 30, 1961 and July 1, 1970 to June 30, 1973.

give a realistic comparison.

Use of these three time periods also fits well into the developmental scheme of the International Wheat Agreements. The 1950-1952 period includes the last three years of the 1949 International Wheat Agreement, while the 1959 to 1961 time period encompasses all three years of the 1959 International Wheat Agreement. Though the influencing effects of the various International Wheat Agreements were admittedly small, it is nonetheless helpful that these years' figures used were under the influence of only one specific agreement. This adds a degree of stabilization to the three year average figure, since the same price provisions were in effect for all three years used in each case. (Actually though the price minimum fell 10 cents per year under the 1949 International Wheat Agreement, the market price stayed at or above the constant maximum price for the duration of the agreement.) The final period, 1970-1972, includes the beginning of the 1971 International Wheat Agreement and the last of the ill-fated 1968 International Grains Arrangement. The International Wheat Agreement had no price provisions, and by 1971 all provisions of the International Grains Arrangement had been scrapped.

For the analysis of the Asian market only the final two time periods (1959-1961 and 1970-1972) were used. The 1950-1952 period was not used because of incomplete data. More pronounced changes in the Asian market

occurred during the 1959-1961 to 1970-1972 period than during the earlier period.

For the Japanese market analysis the 1967 export figures were compared with the 1972 export figures. Exports by class of the three major suppliers (United States, Canada, Australia) were available only for the period 1967 through 1972. To maintain consistency it would have been helpful to use comparisons of the previously mentioned three year average figures, but the necessary data just was not available.

#### Analysis of Results.

World market 1950's vs. 1960's.<sup>11</sup> United States exports of wheat and wheat flour in the 1950's were 388.4 million bushels, and had grown to 629.1 million bushels in the 1960's. This growth of 240.7 million bushels at first glance seems to indicate that the United States position has been greatly improved. However, at closer examination it can be seen that the world market increased by 595.8 bushels and had the United States just maintained their 1950's market share level of 40.51 percent, their exports would have grown by 241.3 million bushels, or 0.6 million bushels larger than their actual growth. The size of market effect is then responsible for over 100 percent (100.3) of the United States export

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<sup>11</sup>For ease of exposition from now on the 1951-53 period will be called the 1950's, the 1959-61 period will be called the 1960's and the 1971-73 period will be called the 1970's. Unless otherwise mentioned any figures given in association with these periods refer to the average of the three years' totals.

gain. This leaves the distribution and the competitive effects to explain the remaining 0.3 percent loss.

By splitting out the competitive and the distribution effects it can be seen that they are nearly offsetting, with the competitive effect accounting for a gain in trade of 48.6 million bushels while the distribution effect accounts for a loss in trade of 49.3 million bushels. A disaggregated approach for estimating the competitive effect in given markets is reported in Table XVII.

This figure lists countries or groups of countries in a localized area and allows one to see the specific results of the competitive effect in each separate area. The classification structure includes:

1. single countries which are themselves important markets, or which cannot be easily grouped with others;
2. groups of countries which for reasons of economic integration can be treated as a singular unit (EEC, Eastern Europe);
3. collections of countries whose markets are too small to treat individually.

An important exception of this classification structure is the lumping together of all Asian countries except Japan. This was done because a separate similar analysis was done solely on the Asian Market. The EEC classification includes the six original members - France, West Germany, Italy, Belgium, the Netherlands, and Luxembourg. Though the EEC did not come into existence until 1958, the 1950's values include the sum of the imports to the individual countries. The 1972 value which

TABLE XVII

 UNITED STATES WHEAT EXPORTS AND MARKET SHARES, 1950-52 AND 1959-61  
 (Figures except percentages are thousand bushels)

Market	1950-52			1959-61			(3)x(4)	(5)-(7)
	Total	U.S.	%	Total	U.S.	%		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EEC	215285	110425	51.3	221089	60260	27.2	113396	-53136
United Kingdom	169260	25689	15.2	165238	19291	11.7	25083	- 5792
U.S.S.R.	---	---	---	2498	---	---	---	---
Other W. Europe	117755	52109	44.2	118132	61032	51.7	52273	+ 8759
Other E. Europe	---	---	---	179641	28366	15.8	---	+28366
Japan	54849	37618	68.6	100936	35237	34.9	69222	-33985
Other Far East	152106	67547	44.4	332790	187211	56.2	147792	+39419
Near East	22445	10382	46.3	93771	60260	64.3	43778	+16882
UAR	34300	10300	30.0	52287	47216	90.3	15702	+31514
Other Africa	32433	7322	22.6	78926	30351	38.4	17821	+12530
Other N. & Cent. Am.	67367	26070	38.7	41925	15212	36.3	16225	- 1013
Brazil	51454	19959	38.8	75288	42145	56.0	29204	+12941
Other S. Amer.	33280	15582	46.8	52617	32702	62.2	24735	+ 8067
Oceania & Unspecified	8300	5413	65.2	39500	9847	24.9	25762	-15915
<b>World Total</b>	<b>958833</b>	<b>388425</b>	<b>40.5</b>	<b>1554602</b>	<b>629131</b>	<b>40.5</b>	<b>580493</b>	<b>+48637</b>

Source: International Wheat Council, "World Wheat Statistics," (various issues).

was used in computing the 1970's average includes the total EEC values minus individual values for the three new member countries of Denmark, Ireland, and the United Kingdom.

Table XVII shows the sales to each designated area by the United States in each time period and the total amounts imported in each area from all sources. The percentage share of each market's imports captured by the United States is given in column 3 and 6. Column 7 shows what the level average sales in each area would have been if the 1950's market shares had been maintained in the 1960's period. The sum of the figures in column 7 is the total level of exports the United States could have expected if it had held all market shares constant, or if the sum of the increases equaled the sum of the declines. The difference between the actual United States exports in the 1960's and the sum of column 7 gives the amount of the competitive effect as previously defined. Column 8 (the difference between columns 5 and 7) gives the losses or gains in each area due to rising or falling market share values over the time period.

A summation of the results is given in Table XVIII, and the relative importance of the three effects is shown. In this comparison 100.3 percent of the change in export levels could be attributed to the size of market effect, while the competitive effect contributed to 20.2 percent of the increase, but was more than offset by an adverse distribution effect of 20.5 percent.

TABLE XVIII

COMPONENTS OF UNITED STATES WHEAT EXPORT GAIN  
IN THE WORLD MARKET

1950-52 to 1959-61

<u>Actual Exports</u>	<u>1950-52</u>	<u>1959-61</u>
World: mil. bus.	958.8	1554.6
U.S.: mil. bus.	388.4 (A <sub>1</sub> )	629.1 (A <sub>2</sub> )
Market Share %	40.51	40.47
Potential Exports - 1950-52 market share at 1959-61 export level	629.8(B)	
1950-52 Market shares in individual markets	580.5(C)	
<u>Gain for U.S.</u>	<u>mil. bus.</u>	<u>percent</u>
Total Gain (A <sub>2</sub> - A <sub>1</sub> )	+240.7	+100
"Size of market" effect (B-A <sub>1</sub> )	+241.3	+100.3
"Distribution" effect (C-B)	- 49.3	- 30.5
"Competitive" effect (A <sub>2</sub> -C)	+ 48.6	+ 20.2

A closer look at Table XVII shows that sizeable losses in market share in the EEC and Japan were more than offset by many smaller gains, the most significant of which were in the Other Far East, the UAR, and Eastern Europe. These losses and gains in market share are attributed to the competitive effect.

So in summation, the major influence on the United States export market growth was the increase in the size of the world wheat market. Gains were also attributable to a better "competitive" position, though these were only one-fifth as large as the gains due to the size of market increase, and were wholly offset by an unfavorable distribution effect.

World market 1960's vs. 1970's. Total United States wheat and wheat flour exports in the 1970's showed a gain of 212.6 million bushels over the sales in the 1960's. This was a slightly smaller gain than the 240.7 million bushels between the 1950's and the 1960's period, but still amounted to an increase of 33.8 percent. The total world market increased by 3.65 percent to 2,122 million bushels, and consequently the total United States market share fell slightly from 40.5 percent to 39.7 percent.

Analyses similar to the two previously presented give the results for the 1960's vs. 1970's comparisons. (Tables XIV and XX)

Once again it is apparent that the size of market effect is the primary force behind the increase in United States wheat exports. This time the size of market effect accounted for a gain of 229.7 million

TABLE XIX

 UNITED STATES WHEAT EXPORTS AND MARKET SHARES, 1959-61 AND 1970-72  
 (Figures except percentages are thousand bushels)

Market	1959-61			1970-72			(3)x(4)	(5)-(7)
	Total	U.S.	%	Total	U.S.	%		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EEC	221089	60260	27.3	135181	65037	48.1	36850	+28187
United Kingdom	165238	19921	12.1	148593	30093	20.2	17920	+12173
U.S.S.R.	2498	---	---	240342	115964	48.2	---	+115964
Other W. Europe	118132	61032	51.7	61987	29946	48.3	32047	- 2067
Other E. Europe	179641	28366	15.8	159028	16057	10.1	25111	- 9054
Japan	100936	35237	34.9	187725	103508	55.1	65535	+37973
Other Far East	332790	187211	56.2	510742	215356	42.2	287292	-71936
Near East	93771	60260	64.3	138672	62171	44.8	89111	-26940
UAR	52287	47216	90.3	107917	3711	3.4	97449	-93738
Other Africa	78926	30351	38.5	150834	60444	40.1	58011	+ 2433
Other N. & Cent. Am.	41925	15212	36.3	75766	35568	46.9	27488	+ 8080
Brazil	75288	42145	56.0	77934	30534	39.2	43627	-13093
Other S. Amer. Oceania & Unspecified	52617	32702	62.2	108358	63273	58.4	67344	- 4071
	39500	9847	24.9	19107	9994	52.3	4763	+ 5231
World Total	1554602	629131	40.5	2122150	841695	39.7	852523	-10867

Source: International Wheat Council, "World Wheat Statistics," (various issues).

TABLE XX

COMPONENTS OF UNITED STATES WHEAT EXPORT GAIN  
IN THE WORLD MARKET

1959-61 to 1970-72

<u>Actual Exports</u>	<u>1959-61</u>	<u>1970-72</u>
World: mil. bus.	1554.6	2122.2
U.S.: mil. bus.	629.1 <sup>(A<sub>1</sub>)</sup>	841.7 <sup>(A<sub>2</sub>)</sup>
Market Share %	40.47	39.66
Potential Exports - 1959-61 market share at 1970-72 export level	353.8 <sup>(B)</sup>	
1959-61 market shares in individual markets	852.5 <sup>(C)</sup>	
<u>Gain for U.S.</u>	<u>mil. bus.</u>	<u>percent</u>
Total Gain (A <sub>2</sub> - A <sub>1</sub> )	+212.6	+100
"Size of market" effect (B-A <sub>1</sub> )	+229.7	+108.1
"Distribution" effect (C-B)	- 6.3	- 3.0
"Competitive" effect (A <sub>2</sub> -C)	- 10.8	- 5.1

bushels, or 108.1 percent of the total increase. Therefore it can be seen that if the United States had just maintained its 1960's market share into the 1970's period, exports would have increased 17.1 million bushels more than they actually did. In this comparison both the distribution and competitive effects were negative but relatively small. The adverse distribution effect was responsible for a loss of 6.3 million bushels while the competitive effect accounted for a loss of 10.8 million bushels.

Column 8 of Table XIX gives an indication of the changes in the individual designated markets. The changes of the 1950's were nearly reversed during the 1960's. The largest gainers were the U.S.S.R., Japan, and the EEC, while offsetting losses occurred in the UAR and the Other Far East. In absolute figures the changes in market shares led to hypothetical increases of 116.0 million bushels in the U.S.S.R., 38.0 million bushels in Japan and 28.2 million bushels in the EEC, and losses of 93.7 million bushels in the UAR and 71.9 million bushels in the Other Far East. These changes are based entirely on market share figures and do not represent actual changes in purchases by the importing areas. Actual purchases in Japan increased by 68.3 million bushels; but gains due to the increased United States market share (from 34.9 to 55.1%) accounted for "competitive effect" gains of 38.0 million bushels.

Had the Russian wheat sales not occurred the United States would have suffered a much larger negative competitive effect. Russia's

entrance into the world market accounted for over 40 percent of the gain in the size of the market and the United States share of this market grew from 0 to 48.2 percent. Whether the increased market share in Russia can be ascribed to beneficial competitive behavior by the United States<sup>3</sup> seems debatable. The Russians made an unexpected policy change, opting not to simply tighten their belts in the face of poor crops, but to continue previous levels of feeding and direct consumption. This policy decision coinciding as it did with an easing of political differences between the two countries led to the large grain sale.

Asian Analysis. Results of a market share analysis specifically for the Asian market covering the 1970's export figures in relation to the 1960's exports are summarized in Table XXI. This analysis also includes the United States' two major competitors in the Asian market, Australia and Canada.

All three countries showed increased sales, though the absolute amounts varied tremendously from Australia's 15.0 million bushels to Canada's 107.5 million bushels. Only Canada showed a positive movement from each of the three effects, as the United States had an adverse distribution effect and Australia did rather poorly in terms of the competitive effect.

Other competitors showed some movement into the Asian market during this period. The market share controlled by Canada, Australia and the United States fell from 95.5 percent to 90.6 percent, with Argentina

TABLE XXI

MARKET SHARE ANALYSIS OF THE ASIAN WHEAT MARKET  
 FOR AUSTRALIA, CANADA, AND THE UNITED STATES  
 (million bushels)

	<u>1959-61</u>	<u>1970-72</u>		
Total Asian Trade	<u>433.7</u>	<u>698.5</u>		
United States	222.4	318.9		
Australia	91.3	106.3		
Canada	100.7	208.2		
Market Shares				
United States	51.3%	45.6%		
Australia	21.0%	15.2%		
Canada	23.2%	29.8%		
Summary of Effects	<u>Total Gain</u>	<u>Size of Market</u>	<u>Distribution</u>	<u>Competitive</u>
United States	+96.4	+135.9	-67.6	+28.2
Australia	+15.0	+ 55.4	+18.2	-58.5
Canada	+107.5	+ 61.3	+16.5	+20.7

(2.0 percent), the EEC (3.9 percent), and the U.S.S.R. (2.7 percent) accounting for most of the rest of the market.

It could be argued that these results are biased against the United States since the dock strikes in 1971 cut heavily into wheat export figures, particularly in the Asian market. In fact, 1971 exports to Asia were 278.2 million bushels, 40.6 million bushels less than the three year average. United States market share declined in India, Pakistan, Taiwan, South Korea, Malaysia and Singapore, and showed increases elsewhere, particularly in Japan. Canada's major market share gains came in the People's Republic of China (PRC) and India, and the major loss was in Japan. Australia lost major shares of the PRC, Indonesia and Other Asian countries' markets, and made small gains in Japan, Taiwan, and Korea. The individual results for each country are given in Appendix B.

Japanese Market. A further refinement of the market share analysis approach was made, incorporating a commodity effect, which refers to the distribution among the types of wheat (hard, semi-hard, soft or durum) which are used in a particular country. Data necessary for this analysis was only available for the country of Japan.

With this analysis the entire scale becomes smaller. The size of market effect now is in reference to the size of the Japanese market rather than the world or Asian markets; the distribution effect deals

with types of wheat within the total Japanese market rather than countries within the world market; the competitive effect is now concerned with changes in market shares of the various types of wheat rather than changes in market shares of individual country or regional markets. Under these circumstances the distribution effect is now called the commodity effect. This commodity effect reflects a change in tastes and preferences as are made manifest by a relative change in importance of the types of wheat within the overall market.

Results of the analysis in the Japanese market comparing 1972 to 1967 are given in Table XXII.

The United States is the only country of the three to offer all four types of wheat for sale. Australia produces no durum and only small amounts of hard wheats. Canada has produced soft wheats only on an experimental basis and exports small amounts of semi-hards.

Though each of the countries showed a gain in sales to Japan, only the United States had a total gain larger than its size of market effect. Both Australia and Canada suffered adverse competitive effects which more than offset slightly positive commodity (distribution) effects. In all cases the size of market effect was dominant. The complete figures of the analysis are given in Appendix B.

Of special importance to Montanans are the sales of hard wheats to Japan. Total hard wheat purchases by the Japanese climbed from 73.2 million bushels in 1967 to 92.3 million bushels in 1972. The United

TABLE XXII

MARKET SHARE ANALYSIS OF THE JAPANESE WHEAT MARKET  
FOR AUSTRALIA, CANADA AND THE UNITED STATES  
(thousand bushels)

<u>1967</u>		<u>U.S.%</u>	<u>Canada %</u>	<u>Australia %</u>	<u>Others %</u>
Durum	1,049	71.1	28.9	-	-
Hard	73,197	38.4	56.6	5.0	-
Semi-hard	25,904	87.5	-	12.5	-
Softs	43,370	61.6	-	38.4	-
Totals	143,520	54.5	29.1	16.4	0
<u>1972</u>					
Durum	1,694	100.0	-	-	-
Hard	92,251	47.2	48.4	4.4	-
Semi-hard	24,393	79.4	-	4.7	11.9
Softs	62,009	64.2	-	35.2	0.6
Totals	108,347	57.9	24.8	15.5	1.8
<u>Summary of Effects</u> (million bushels)	<u>Total Gain</u>	<u>Size of Market</u>	<u>Commodity</u>	<u>Competitive</u>	
United States	+26.2	+20.0	-2.1	+8.2	
Australia	+ 4.4	+ 6.0	+1.9	-3.5	
Canada	+ 2.9	+10.8	+0.2	-8.0	

Source: Calculated from figures released by Japanese Food Agency.

States share of these amounts grew from 35.9 percent (28 million bushels) to 41.7 percent (44 million bushels) in 1972.

#### Implications

The recorded results must be interpreted with a certain amount of caution. The analysis is very sensitive to the choice of years included, though the use of three year averages should lessen the sensitivity. Also, this approach is completely demand oriented. Since the analysis covers periods of adequate and overabundant levels of stocks, the problem of a market share decreasing because of unavailable supplies should not constitute a major factor.

The results of the analyses were similar in respect to the United States in each case. The size of market effect was always positive and dominant, (at least twice as big as the next most influential effect) and the distribution effect was always negative. Three out of four times the competitive effect was positive.

Policy implications concerning correction of the adverse distribution effects are hard to pinpoint. Factors which lead to changes in distribution of the total wheat market, including institutional and policy factors governing the level of production in importing countries, and changes in demand factors in non-producing countries, are factors over which the United States can exert little control. However, a poor distribution effect could indicate a problem of trading with "wrong" countries, or misallocating the sales effort. Any corrective measures

would involve efforts to increase or reallocate sales. It is not at all clear that the benefits of any such measures would outweigh the possible costs involved.

In any case, the studies done for Canadian and Australian exports were better suited to promoting policy changes which could possibly apply to their export program since in each country a state agency (The Australian Wheat Board and the Canadian Wheat Board) controls wheat exports. Market conditions in the United States make overall policy suggestions rather impractical.

In many instances the implications of competitiveness (in terms of increased market share due to market development, pricing policies, and quality differentials) loses its meaning when a large part of the wheat exports consist of P.L. 480 transactions. Thus when market shares increase it may be due to an increased level of concessional transfers, rather than improved performance in a competitive market.

In these analyses only in the case of the Japanese market were the influences of concessional transfers nonexistent. Japan last received concessional wheat from the United States in 1962. However, the United States is not alone in regards to concessional wheat transfers. All of the major exporters were participants under the 1968 and 1971 Food Aid Conventions. In 1971-72, Canada recorded 44.1 million bushels of wheat sent through aid programs including contributions to the Food Aid Convention of the International Wheat Agreement, the F.A.O. World Food

Program, and the United Nations Relief and Works Agency, while United States P.L. 480 shipments amounted to 179.3 million bushels.

Though several limitations of this type of analysis exist, its use helps to form a descriptive picture of the export markets covered. By breaking out the various effects and their magnitudes a better understanding of the changes in United States exports can be attained.

## Chapter 3

### THE INTERNATIONAL MARKET FOR WHEAT

Wheat has long been an important commodity on the world market. The importance of wheat in international trade rises from three factors. It is a staple food in many countries, and in most advanced countries is the preferred bread grain. Wheat can be stored easily and relatively cheaply and therefore can be transported by slower but cheaper means of transportation. Finally due to differences in the geographic production and consumption patterns, large surpluses arise in a few countries, and deficits are prevalent in many other countries.<sup>1</sup>

A higher proportion of wheat enters into international trade than any other grain crop. Wheat has the distinction of being the most extensively traded cereal in the non-Communist world.<sup>2</sup>

#### I. PATTERNS OF INTERNATIONAL WHEAT TRADING

World wheat production patterns have remained remarkably stable over the past forty years. The largest producing country is the U.S.S.R. with production twice as large as the next largest producer's. Table XXIII

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<sup>1</sup>John M. Slater, "The World Wheat Economy; Implications for the Consumption and Trade of United States Wheat," Unpublished Ph.D. Thesis, University of Illinois, 1966, p. 62.

<sup>2</sup>C. I. M. Reekie, "Some Aspects of Foreign Demand for United States Wheat," Unpublished Ph.D. Thesis, North Carolina State University, 1967, p. 1.

TABLE XXIII

WHEAT PRODUCTION IN THE SIX MAJOR PRODUCING COUNTRIES  
(million bushels)

<u>Country</u>	<u>1934-38</u>	<u>1954-59</u>	<u>1968-72</u>
U.S.S.R.	1400	2144	3363
United States	716	1117	1507
PRC	799	909	847
France	299	348	666
India	272	316	973
Canada	263	544	533
<hr/>			
TOTAL	3749	5378	7739
WORLD	6150	8357	12227
%	61	64	63

Source: International Wheat Council, "World Wheat Statistics," (various issues).

shows the six largest wheat producers and their production levels. Though total world production has approximately doubled from the 1934-1938 averages the same six countries are the largest producers, and their combined production accounts for approximately the same percentage of the total.

The largest producers are not necessarily the major exporters. Of the top six producing countries in 1972 only three, United States, France, and Canada were net exporters. The major exporters normally would include the U.S.S.R., United States, Canada, France, Australia, and Argentina. Exports by these countries for the last three years are shown in Table XXIV. Together these countries accounted for over 95 percent of the world export market in wheat and wheat flour.

In terms of the major competitors in the free world wheat export market, only the United States, Canada, Australia, and France (or the EEC) would be included. The U.S.S.R. would be excluded because its exports are confined to the Communist Bloc countries, and Argentina must be discounted because of its relatively small size of production and its lack of stability in the export market.

When speaking of the total world production it must be remembered that harvesting takes place at different times of the year in the various producing countries. Table XXV shows the harvest dates for the major producers and exporters. As can be seen, harvests are occurring in at least one of these areas each month of the year, though the most

TABLE XXIV

AMOUNTS OF WHEAT EXPORTED BY  
 MAJOR WORLD WHEAT EXPORTERS  
 (million bushels)

<u>Country</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Argentina	63	49	129
Australia	349	321	204
Canada	425	504	575
EEC	114	171	231
United States	728	621	1175
U.S.S.R.	<u>260</u>	<u>201</u>	<u>48</u>
TOTAL	1939	1867	2362
World	1973	1927	2472

Source: International Wheat Council. "World Wheat Statistics", (various issues).

TABLE XXV

## WHEAT HARVESTING CALENDAR

Countries	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov
U.S. Middle States						*****					
Northern States								*****			
Southern States					*****						
Canada								*****			
Australia	****										*****
Argentina	****										*****
India		*****									
U.S.S.R. Central							*****				
North								*****			
South						*****					
EEC North							*****				
South						*****					
People's Republic of China					*****						

Source: International Wheat Council, "World Wheat Statistics", (various issues).

common harvest months are June, July, and August. This harvest balance together with relatively large holdings of stocks helps prevent severe seasonality problems in the world price level, though the summer months definitely account for the most production.

## II. UNITED STATES WHEAT TYPES

Wheat is commonly referred to and treated in economic studies as a homogeneous commodity. While there is some justification for this action it should always be kept in mind that all wheat is not alike.

In the United States, there are five basic classifications for wheat. These divisions are primarily based upon time of planting, degrees of hardness of the wheat, and color of the kernels. The five divisions consist of: hard red winter, hard red spring (also called dark northern spring), durum (also called hard amber durum), soft red winter and eastern white, and western white.

Hard red winter wheat is produced in three general regions in the United States. These include:

- 1) Central and Southern Great Plains States
- 2) Intermountain and Western States
- 3) Northern and Midwestern States

The major hard red winter producing states include Kansas, Oklahoma, Nebraska, Montana, Texas, and Colorado. Hard red winter, as the name implies, is planted in the fall, thereby somewhat limiting its production to areas of relatively mild winters. The primary domestic use of this

wheat is in the milling of bread flour, and its use accounts for over 40 percent of total domestic food use of wheat. It is one of the major export classes of wheat, and domestic feed use is rather small.

Hard red spring wheat is grown in the northern sections of the United States. Its principle producing states include: North Dakota, South Dakota, Montana, and Minnesota. Planted in the spring, this wheat is similar to hard red winter except yields are generally lower and protein content is normally higher. Hard red spring is a quality bread wheat containing a large quantity of strong elastic gluten. Because of its strength its use has grown with the increase of commercial baking. It is sometimes substituted for hard red winter wheat and is not often used for feed.

Durum is also a spring wheat, produced in substantially the same areas as hard red spring wheat. North Dakota produces up to four-fifths of the durum crop with lesser crops produced in surrounding states of Montana, Minnesota and South Dakota. Of all wheats durum has the most specialized usage. Its nearly exclusive use is in manufacturing semolina which is used to produce spaghetti, macaroni, and related products.

Soft red winter and eastern white wheat are grouped together because of their similar uses and because the eastern white wheat is grown in isolation from the western white wheat area. Major producing states for these wheat types include: Indiana, Illinois, Ohio, Missouri, Arkansas, and Pennsylvania. Flour milled from these eastern soft wheats

is used in the manufacture of pastries, cookies, crackers, and cakes. At times large quantities of soft red winter move into feed use.

Western white wheat is grown in several of the western states, but major production comes from the Pacific Northwest states of Washington, Oregon, Idaho, and California. Domestic uses parallel those of the eastern soft wheats, primarily used as cracker and pastry flour. Most western white is also blended with higher protein hard wheats for multi-purpose or family flour. There has also been substantial feed and export usage of western white wheats.

Competition and substitutability in the world market is based mainly on the protein contents of the major wheat classes. Table XXVI shows the Japanese Feed Agency's listing of comparable world wheat classes according to use and kernel hardness.

### III. SURVEY OF COMPETING EXPORTERS

The United States normally produces approximately 12 percent of the world's wheat. Production over the last fifteen years has ranged from 1094 to 1711 million bushels. Production, export, and stock figures for United States wheat are given in Table XXVII for the past fifteen years.

The United States has held stocks equal to more than a single year's production; however, recently stock holdings have dwindled in the face of increased exports. The 1973-74 crop year shows stocks at their lowest (for the past fifteen years) and production and exports at their highest levels.

TABLE XXVI

## COMPARABLE WORLD WHEAT CLASSES

Use	Division	Class
Food	Durum	U.S. Hard Amber Durum, No. 2 or better Canadian Western Amber Durum, No. 2 or better
	Hard	U.S. Hard Red Spring, No. 2 or better U.S. Hard Red Winter, (13%) No. 1 Canadian Western Red Spring, No. 2 or better Australian, Queensland Prime Hard (13.0%)
	Semi-Hard	U.S. Hard Red Winter (11.5%), No. 3 or better U.S. Hard Red Winter (Ord.), No. 2 or better Australian, South Australia (11.5%) Argentina, Duro (11.5%) No. 1 Bulgarian (11.5%), No. 2 or better
	Soft	U.S. Western White, No. 2 or better U.S. Soft Red Winter Australian, Western Australia FAQ Australian, Victoria FAQ Australian, Victoria Soft Australian, New South Wales FAQ
Feed	Hard	U.S. Hard Red Winter (13.0%), No. 1 Australian, Queensland Prime Hard (13.0%)
	Semi-Hard	U.S. Hard Red Winter (Ord.), No. 2, or better Australian, New South Wales
	Soft	U.S. Soft Red Winter U.S. Western White, No. 2 or better Australian, Western Australia FAQ Australia, Victoria FAQ Australia, New South Wales, FAQ Australia, Offgrade French, No. 2 or better South African

Source: Western Wheat Associates, U.S.A., Incorporated. Wheat Importation and Marketing in Japan. Toyko, Japan: National Food Life Improvement Association, 1971.

TABLE XXVII

UNITED STATES PRODUCTION, STOCKS AND EXPORTS  
(million bushels)

<u>Years</u>	<u>Production</u>	<u>Stocks</u> <sup>1</sup>	<u>Exports</u>
1958	1462	881	443
1959	1121	1295	510
1960	1357	1314	661
1961	1235	1411	718
1962	1094	1322	638
1963	1147	1195	849
1964	1283	901	720
1965	1316	817	860
1966	1312	535	742
1967	1522	424	742
1968	1576	539	540
1969	1443	817	605
1970	1352	885	728
1971	1618	731	621
1972	1545	863	1175
1973	1711 <sup>2</sup>	420 <sup>3</sup>	1300 <sup>4</sup>

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<sup>1</sup>Refers to stocks on hand at beginning of crop year.

<sup>2</sup>Small Grains Summary 1973, Montana Crop and Livestock Reporting Service.

<sup>3</sup>Stocks of Grain Quarterly, Montana Crop and Livestock Reporting Service, October 1, 1973.

<sup>4</sup>Forecast figures from United States Department of Agriculture. "World Agricultural Production and Trade." Statistical Report, Foreign Agricultural Service, September, 1973, World Summaries.

Source: International Wheat Council, World Wheat Statistics, (various issues).

More United States wheat exports go to the Asian areas than to any other, though United States market share in this area has dropped. Exports in 1959-61 accounted for 54 percent of the total Asian market, but in 1970-72 accounted for only 46 percent. Japan is the major Asian purchaser of United States wheat, and their purchases have nearly quadrupled since 1959. Exports to Japan of 124 million bushels in 1972 amounted to 30 percent of the total Asian purchases of United States wheat.

European markets also absorb much of the United States wheat exports. Sales to Europe have declined over the four periods, but market share has remained fairly stable. Table XXVIII shows the United States export patterns in detail. South American demand has increased slightly, and United States market share has stayed at fifty percent or above. United States sales to Africa were nearly equal to their sales to North and Central America (36 million bushels) during 1970-72, but few other market similarities exist. The African use of United States wheat has halved over the four periods while the North and Central American usage has more than doubled. The importance of the European and African markets has been declining while Asian and Russian markets have absorbed a greater percentage of the United States exports.

Canada is the United States' major competitor in the hard, bread wheat markets. Canadian exports are smaller than the United States level, though Canada exports a larger percentage of its production. Canadian

TABLE XXVIII

A COMPARISON OF THE DESTINATIONS OF UNITED STATES  
WHEAT AND FLOUR EXPORTS DURING FOUR TIME PERIODS  
(million bushels)

	<u>Europe</u>	<u>N. and C.</u> <u>America</u>	<u>S.</u> <u>Amer.</u>	<u>Asia</u>	<u>Africa</u>	<u>U.S.S.R.</u>
1959-61	169	15	75	283	78	--
Market Share Provided by the U.S.	25%	36%	59%	54%	59%	--
1963-65	158	15	79	435	100	21
Market Share Provided by the U.S.	25%	24%	53%	53%	76%	8%
1967-69	84	20	91	394	40	--
Market Share Provided by the U.S.	16%	34%	50%	50%	21%	--
1970-72	141	36	93	381	36	116
Market Share Provided by the U.S.	28%	47%	50%	46%	14%	48%

Source: International Wheat Council. World Wheat Statistics, (various issues).

production accounts for about 5 percent of the world's total while their exports amount to 20 to 25 percent of the total world exports. Table XXIX shows Canadian stocks, exports, and production. Canada, like the United States, has held large amounts of wheat in stock positions. In 1970 their stocks grew to over 1009 million bushels but have decreased rapidly since then. Production has stayed fairly constantly within the 500-700 million bushel range with the exception of 1970 when it fell to only 332 million bushels. Their highest production position was in 1966 when they produced 827 million bushels.

Canadian exports have shown slightly shifting patterns over the four periods as shown in Table XXX. Their market share in Europe has fallen off slightly, and total exports to this area are 70 to 80 million bushels less than in the first two periods. Exports to North and Central America have not changed too much, though the 1970-72 figure exceeds that of 1959-61 by 10 million bushels. The South American and African markets are fairly similar with small but growing export amounts. The Asian market is by far the most important for the Canadians as 1970-72 exports averaged 224 million bushels, nearly double the levels in the previous three periods. Of all Canadian exports in 1970-72, forty-four percent of them went to Asian destinations. The U.S.S.R. has also been an important market for the Canadians. During 1963-65 144 million bushels, amounting to 30 percent of Canadian total exports, were Russian bound. Lately these exports have dropped somewhat as the United States has

TABLE XXIX

CANADIAN PRODUCTION, STOCKS, AND EXPORTS  
(million bushels)

<u>Years</u>	<u>Production</u>	<u>Stocks</u> <sup>1</sup>	<u>Exports</u>
1958	372	648	300
1959	414	588	278
1960	518	600	342
1961	283	608	365
1962	566	391	331
1963	723	487	554
1964	600	459	438
1965	649	513	545
1966	827	420	545
1967	593	577	327
1968	650	666	320
1969	684	852	331
1970	332	1009	425
1971	530	734	504
1972	533	589	575
1973	625 <sup>2</sup>		

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<sup>1</sup>Refers to stocks on hand at beginning of crop year.

<sup>2</sup>Forecast figures from United States Department of Agriculture (World Agricultural Production and Trade, "Statistical Report, Foreign Agricultural Service, September 1973, world summaries).

Source: International Wheat Council, World Wheat Statistics, (various issues).

TABLE XXX

A COMPARISON OF THE DESTINATIONS OF CANADIAN WHEAT  
AND FLOUR EXPORTS DURING FOUR TIME PERIODS  
(million bushels)

	<u>Europe</u>	<u>N. and C. America</u>	<u>S. Amer.</u>	<u>Asia</u>	<u>Africa</u>	<u>U.S.S.R.</u>
1959-61	189	16	7	104	9	2
Market Share Provided by Canada	28%	38%	6%	20%	7%	100%
1963-65	195	27	10	129	5	144
Market Share Provided by Canada	31%	53%	7%	16%	4%	57%
1967-69	122	22	5	135	9	32
Market Share Provided by Canada	23%	38%	3%	17%	5%	94%
1970-72	113	26	21	224	28	89
Market Share Provided by Canada	22%	34%	11%	27%	11%	37%

Source: International Wheat Council, World Wheat Statistics, (various issues).

entered heavily into this market. Canadian supply of total Russian imports dropped to 37 percent in 1970-72, which is substantially lower than before. In summary, the three areas of Europe, Asia and the U.S.S.R. are of greatest importance in terms of Canadian wheat imports; the Asian market is growing while the European and Russian markets are declining. The other three areas (North and Central America, South America, and Africa) each accounted for approximately 5 percent of Canada's wheat exports in 1970-72 and are relatively unimportant.

Australia is another of the major wheat exporting countries. Australia's production consists primarily of soft wheats, though it is also made up of some hard and semi-hard types. Production peaked at 544 million bushels in 1968 but has normally stayed between 200 and 400 million bushels. (Table XXXI) Australian stock levels have never been too great, with the 1969 total of 267 million bushels being the highest for the period considered.

Total exports from Australia have grown considerably from 75 million bushels in 1958 to a high of 349 million bushels in 1970. The last two years have shown a decline in total exports, as the Australians became concerned with their high stocks and relatively unstable export market and cut back in 1972 to 204 million bushels which is the second lowest level of the last ten years.

Australian wheat exports have typically been destined for either Europe or Asia, but lately other markets have become more important.

TABLE XXXI

AUSTRALIAN PRODUCTION, STOCKS, AND EXPORTS  
(million bushels)

<u>Year</u>	<u>Production</u>	<u>Stocks</u> <sup>1</sup>	<u>Exports</u>
1958	215	16	75
1959	199	65	116
1960	274	61	184
1961	247	25	231
1962	307	18	176
1963	328	23	287
1964	369	20	238
1965	260	24	209
1966	467	17	257
1967	277	81	258
1968	544	52	197
1969	388	267	266
1970	290	265	349
1971	318	127	321
1972	229	51	204
1973	432 <sup>2</sup>		

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<sup>1</sup>Refers to stocks on hand at beginning of crop year.

<sup>2</sup>Forecast figures from United States Department of Agriculture, "World Agricultural Production and Trade," Statistical Report, Foreign Agricultural Service, September, 1973, world summaries.

Source: International Wheat Council, World Wheat Statistics, (various issues).

The absolute volume of grain sent to Europe has stayed fairly stable (Table XXXII) but whereas in 1959-61 the 51 million bushels exported amounted to 28 percent of Australia's total exports, in 1970-72 the 49 million bushels accounted for only 16 percent of total exports. Actually during the four periods Australia's market share in Europe has grown as the European market has decreased in size. Exports to the Asian markets have fluctuated in size, but the Australian's market share has been fairly steady at from 15 to 20 percent. The South American and African markets have increased in importance for the Australians lately. Exports of 18 million bushels went to South America during 1970-72, while exports to Africa of 63 million bushels in the same period actually exceeded exports to Europe during the same time.

Argentina and the EEC are the other two major competitors in the international wheat market. Argentina is relatively small in wheat exports, and due to a scarcity of storage and widely fluctuating production, has been rather unpredictable.

Since 1958 production has varied from 146 to 414 million bushels, while exports have ranged from 49 to 292 million bushels. Other South American countries provide the major market for Argentine exports, with Europe and Asia taking most of the remainder. Average exports from 1970-1972 included 47 million bushels to South America, 15 million bushels to Asia, and 16 million bushels to Europe. Most Argentine exports are

TABLE XXXII

A COMPARISON OF THE DESTINATION OF AUSTRALIAN WHEAT  
AND FLOUR EXPORTS DURING FOUR TIME PERIODS  
(million bushels)

	<u>Europe</u>	<u>N. and C. America</u>	<u>S. Amer.</u>	<u>Asia</u>	<u>Africa</u>	<u>U.S.S.R.</u>
1959-61	51	--	--	107	10	--
Market Share Provided by Aus.	7%	--	--	20%	8%	--
1963-65	34	1	--	156	8	37
Market Share Provided by Aus.	5%	1%	--	19%	6%	14%
1967-69	41	--	12	174	9	--
Market Share Provided by Aus.	8%	--	6%	22%	5%	--
1970-72	49	1	18	138	63	17
Market Share Provided by Aus.	10%	1%	10%	16%	24%	7%

Source: International Wheat Council. World Wheat Statistics, (various issues).

of a semi-hard wheat.

The EEC produces and exports mainly soft wheats. The major producing country of the EEC is France, with Germany and Italy contributed greatly. EEC exports in 1970-72 totaled 172 million bushels. Africa (80 million bushels), Asia (41 million bushels), and Europe (36 million bushels) provided the major markets for these exports.

Worldwide there has been a general shift of wheat exports away from the European markets. This can be seen in Table XXXIII.

European wheat demands now amount to 24 percent of the total world trade as compared to 44 percent in 1959-61. All other regional markets have shown slight trade percentage increases, with the largest impacts being made by the occasional large scale imports by the U.S.S.R. In 1963-65 and 1971-72 they absorbed respectively 12 and 11 percent of the total world trade and flour movement.

TABLE XXXIII

WORLD WHEAT AND FLOUR TRADE DISTRIBUTION  
 (Figures are percentages of world movement totals)

	<u>Europe</u>	<u>N. and C. America</u>	<u>S. Amer.</u>	<u>Asia</u>	<u>Africa</u>	<u>U.S.S.R.</u>
1959-61	44%	3%	8%	34%	8%	--
1963-65	31%	2%	7%	39%	8%	12%
1967-69	29%	3%	10%	44%	11%	2%
1970-72	24%	4%	9%	39%	12%	11%

Source: International Wheat Council, World Wheat Statistics, (various issues).

## Chapter 4

### REVIEW OF DEMAND STUDIES IN THE ASIAN MARKET

Numerous studies have been made to project future wheat usage. This section will include a review of some of these studies and discuss their procedures and results. In order to keep this review relevant it will be limited in scope to projections for selected Asian countries which are probably large users of Montana wheat exports. Japan will receive the main emphasis, while one projection each for Taiwan and the Philippines will also be discussed.

The following are the projection studies which will be discussed:

- 1) Agricultural Commodity Projections, 1970-1980, Food and Agricultural Organizations of the U.N.
- 2) "Japan's Food Demand and 1985 Grain Import Prospects," Joseph R. Barse.
- 3) "The Japanese Grain - Livestock Economy - An Econometric Projection to 1980 with Emphasis on Grain Imports," A. Nicholas Filipello.
- 4) World Demand Prospects for Wheat in 1980 with Emphasis on Trade by the LDC's, Hutchison, Naive and Tsu.
- 5) World Demand Prospects for Grain in 1980 with Emphasis on Trade by the LDC's, Rojko, Urban, and Naive.
- 6) Long-Term Projections of Supply, Demand and Trade for Selected Agricultural Products in Taiwan, Research Institute of Agricultural Economics, National Taiwan University.
- 7) The Philippines, Long-Term Projections of Supply of and Demand for Selected Agricultural Products, Mercantile Incorporated.

## I. JAPANESE DEMAND STUDIES

The projection figures that were estimated in each of the studies of the Japanese market are listed in Table XXXIV.

In light of the recent growth in the Japanese import demand for wheat some of these projections seem rather small. In fact, purchases in 1972 and 1973 have already exceeded one study's 1980 projection. Total Japanese wheat imports in Japanese Fiscal Year 1972<sup>1</sup>, including free wheat purchases, amounted to 182.68 million bushels of which the United States share was 106.33 million bushels or 58 percent. USDA-FAS preliminary 1972-1973 Japanese wheat imports are listed at 202 million bushels. The column of actual Japanese wheat imports included in Table XXXIV gives a good indication of the growth that has risen 1973 imports to 160 percent of the 1965 level.

Study 1 was written by the FAO and printed in 1971. Detailed projections involving fifty agricultural commodities and approximately 130 countries were made. Basic assumptions to the projections were that national policies and agricultural trends in effect in 1970 would continue unchanged until 1980; prices for all commodities except fibers would retain 1970 levels until 1980; no relative price changes would occur. Time series data on production and consumption on a commodity

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<sup>1</sup>The Japanese Fiscal Year is from April 1 to March 31.

TABLE XXXIV

SUMMARY OF ACTUAL AND PROJECTED IMPORT DEMAND  
FOR WHEAT IN JAPAN  
(million bushels)

<u>Year</u>	<u>Study #</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>Actual</u>
1965							128.6
1970							176.4
1971							183.7
1972							202.1
1973							205.8
1980		259.6		194.74	214.58-	234.84-	
					252.72	268.23	
1985			113.02- <sup>1</sup>				
			245.43				

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<sup>1</sup>Wheat for food usage only.

and country basis was assembled and combined with per capita income figures to obtain coefficients of income elasticity of demand. With projected growth in population and income combined with the income elasticity coefficients, annual rates of increase in total consumption for each commodity were determined.

Production was projected by extrapolating past trends of area, yield and output for each commodity. Adjustments were then made for the influence of past price movements, recent technological improvements and targets of current national plans and programs. Production and demand projections were then balanced, and the 1980 residue balance was used as an indication of export availabilities and import requirements.

In the specific case of Japan, population growth was assumed to grow at 1 percent per year, and Gross Domestic Product was assigned a 5.2 percent per year growth rate. This led to projections of 1980 Japanese wheat production of 18.7 million bushels, total wheat demand of 278.7 million bushels (of which 186.4 million bushels were for food demand and 92.3 million bushels were for feed demand) leaving the import demand for wheat at 260.0 million bushels. The 1980 per capita food usage of wheat was projected to be 33.5 kilograms. For the world a surplus amount of 900.2 million bushels of wheat was projected. The world wheat production growth rate is projected at 2.6 percent per year compounded from 1970 to 1980. In the true sense this study makes no

predictions; it merely shows the various levels of grain which will be needed if the Japanese follow one of three alternative strategies.

This study basically outlines three hypothetical Japanese food strategies and then predicts the various food needs associated with each of these potential strategies. Each of the strategies assumes 1985 Japanese population at 120 million people and projects real Gross National Product to increase at an average annual rate of 7.5 to 8.3 percent. A tabular summation of the major aspects of the three strategies is shown in Table XXXV.

The Western Strategy is aimed at raising Japanese consumption levels to 3000 calories per person per day, corresponding roughly to the consumption patterns in Northern European countries in the 1960's. It envisions easing of present food import restrictions leading to a high level of import dependency, including greatly increased wheat import levels. A large degree of Japanese food processing is also foreseen by this approach.

The Pacific Strategy tends more toward imports of semi-processed foods from countries in the Southern Pacific Basin. Daily per capita consumption would be at a 2900 calorie level, and wheat imports would be kept under control to slow the expansion of wheat product consumption. The Eastern Strategy is the most conservative of the three, and envisions more localized food production and less overall consumption. Per capita daily calorie intake would be at 2800, still higher than the

TABLE XXXV

MAJOR ASPECTS OF POSSIBLE 1985 JAPANESE  
FOOD STRATEGIES

Per Capita Grain Consumption cal./year				Total calories/ person/day	Total Wheat Imports for food mil. bu./year
<u>Strategies</u>	<u>Total</u>	<u>Domestic</u>	<u>Imports</u>		
Western	350,000	180,000	170,000	3000	245.4
Pacific	430,000	280,000	150,000	2900	113.0
Eastern	430,000	310,000	120,000	2800	158.2

Source: Bars e, Joseph R. Japan's Food Demand and 1985 Grain Import Prospects.

than the actual 1965 level of 2424. Included in this strategy are import controls on wheat like in the Pacific Strategy.

As can be seen in Table XXXV the wheat import requirements under the various strategies vary substantially and realistically portray the uncertainty involved in any projections.

Study 3 is an unpublished manuscript written by A. Nicholas Filippelo. Among the assumptions underlying this study are:

- 1) real national income growth at the rate of 8.0 percent per year.
- 2) population growth at the rate of 0.9 percent per year.
- 3) unchanged world average export prices of grains from this 1965 level.
- 4) no significant alteration in Japanese import policies with respect to grains.

This study used a structural projection model, incorporating the methods of ordinary least-squares, two and three-stage least squares and factor analysis regression. From this model the projected Japanese import demand for wheat was estimated to be 196.2 million bushels. When using 1965 imports as a base, this implied a compound increase of 3.0 percent per year. To put this into proper perspective, recent U.S.D.A. forecasts of 1973 Japanese imports are 205.8 million bushels which when extrapolated to 1980 using the compound increase of 3.0 percent per year found by Filippello gives a 1980 wheat import demand level of 253.4 million bushels. The actual rate of increase in Japanese imports

since 1965 has been about 6.0 percent per year compounded. If this rate continues until 1980, Japanese imports would be 308.6 million bushels.

Studies 4 and 5 like Study 3 are parts of an overall research project on the demand prospects for agricultural exports of less developed countries conducted by the Economic Research Service. Study 4 by Hutchison, Naive, and Tsu deals specifically with wheat while the study by Rojko, Urban, and Naive covers all grains. Basic assumptions used in each study include an income growth rate of 8 percent per year, and a 1980 Japanese population of 111,563,000. Both studies provide a range of projections based on differing assumptions concerning various levels of production and pricing. These ranges cover Japanese wheat import demands of from 214.6 to 252.7 million bushels in Study 4 and from 238.8 to 268.2 million bushels in Study 5.

In Study 4 the different levels of imports are established under different world production assumptions (high, medium, and low levels corresponding to the expected effects of the Green Revolution), and for the high and medium production levels alternative production strategies (either controlled or uncontrolled) by the major exporters were considered. There is also an unbalanced world trade model in which no real attempt was made to equate imports and exports.

The unbalanced trade model yielded the lowest projections for Japanese wheat imports, and the highest projections came from the high

production level and the low price situation caused by a policy of maintenance of market shared by the United States, Canada, and Australia.

Study 5 sets up similar alternative projection frameworks; however, the scope of the study is larger in that it covers all grains. There are three projection sets which represent three levels of production by the less developed countries, and under the assumption of high growth in production there are two subsets. One subset assumes major exporters attempt to maintain their share of the world market, and the other assumes that the developed importers adjust their high internal prices. In this case the lowest import projection levels arise from the three original projection cases, while the highest level comes from the subset assuming changes in developed importers' policies.

Most of these studies refer to Japanese imports with no regard for their source, and give little indication as to what share of these the United States may command in 1980.

Study 5 gave two alternative projection sets<sup>2</sup> for world trade in wheat which forecast inter-regional trade patterns. Projection set I forecast United States wheat exports of 144.1 million bushels to Japan, while the second projection set forecast 108.5 million bushels of United

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<sup>2</sup>Set I assumes a continuation of 1970-71 food and fiber policies, allowing for moderate gains in productivity in the LDC's, while set II assumes that agricultural productivity and economic growth in the LDC's would be higher than projected in set I.

States market share of 60 percent in the first and 45 percent in the second projection set.

Filipello stated that the United States share of wheat imports "may likely make up roughly half of the total." Using this as a guideline the 1980 Japanese imports of United States wheat could be expected to fall in the range of from 97.37 to 134.11 million bushels. When one considers that 1972-1973 Japanese imports of United States wheat were 126.52 million bushels, these projections seem rather low. However, it must also be remembered that the United States share of Japanese wheat imports in 1972 was over 60 percent (60.7) and using that percentage as a guide then the projected levels would rise to the range from 118.2 to 162.8 million bushels.

The question then becomes one of how much of the United States share of Japanese wheat imports will originate in Montana. The thesis method for estimating Montana exports showed that for the last five years, excluding 1971, Montana hard red spring has comprised an average of 46.31 percent of the total hard red winter shipped from the West Coast. Further examination shows that the estimates derived from Montana wheat shipments to Japan have averaged 25.5 million bushels for the last five years excluding 1971. This amounts to an average of 27.3 percent of the total Japanese imports of United States wheat for a comparable period. Assuming, just for the sake of arriving at a rough estimate, that all these rates continue then Montana's share of the 1980 Japanese

wheat imports could amount to 27.3 percent of 97.37-162.80 million bushels, which is from 26.6 to 44.4 million bushels.

## II. DEMAND STUDIES FOR TAIWAN AND THE PHILIPPINES

Two other studies which concern projected United States wheat exports deal with the countries of Taiwan and the Philippines. The Taiwan study was done by the National Taiwan University under a contract with the ERS. Printed in 1970 this study included wheat import demand figures for 1970, 1975, and 1980. The projected amounts and some of the recent actual imports can be seen below in Table XXXVI.

TABLE XXXVI

### ACTUAL AND PROJECTED WHEAT IMPORT DEMAND IN TAIWAN (million bushels)

<u>Year</u>	<u>Actual</u>	<u>Predicted</u>
1965	15.9	
1970	26.7	19.94
1971	18.3	
1972	25.4	
1975		25.33
1980		31.33

As can be seen, these predictions have tended to be lower than the

actual values. The United States share of Taiwan wheat imports has constantly been between 70 to 80 percent (with the exception of 1971). So presuming this level is maintained the United States exports of wheat to Taiwan in 1980 would be 21.9-25.1 million bushels.

Montana's share figured in a manner similar to that used in the case of Japan's imports could conceivably be from 5.9 to 6.8 million bushels. This is based on a 1967-1972 (excluding 1971) average of 27.8 percent of the total United States exports having Montana origins.

The Philippine report, "Long - Term Projection of Supply of and Demand for Selected Agricultural Products," was done by Mercantile Incorporated under contract to the ERS. Written in 1963, this report includes projections for 1965 and 1975. Table XXXVII shows these projections and some actual value comparisons.

TABLE XXXVII

ACTUAL AND PROJECTED WHEAT IMPORT DEMAND IN THE PHILIPPINES  
(million bushels)

<u>Year</u>	<u>Actual</u>	<u>Predicted</u>
1965	21.5	11.99
1970	22.0	
1971	24.9	
1972	24.7	
1975		19.67

Once again the predictions seem substantially lower than now appear reasonable. The United States share of Philippine imports has varied considerably over the last ten years, but from 1965 to 1970 they were between 74 and 86 percent and then dropped to 62 and 68 percent in 1971 and 1972 respectively. A 70 percent share seems reasonable to expect in 1975 which would mean 13.77 million bushels of United States wheat exports.

Montana's share of total United State exports to the Philippines has been as low as 24 percent (1969) and as high as 40.1 percent (1972) over the five year period (1967-1970, 1972). The average share during this time was 33.1 percent. This percentage applied to the 13.77 million bushels figure arrived at above would lead to a prediction of 4.6 million bushels of Montana wheat destined to be 1975 Philippine imports. Using the full range of percentages (68 to 86 percent United States share and 24.0 to 48.1 percent Montana's share) we could arrive at a range of from 3.2 to 6.8 million bushels.

### III. SUMMARY

Complementing the previously discussed studies are two other projections for which less complete information was available. In 1968 the Japanese government made public a report which gives the projected demand for wheat for 1977. This figure is a simple projection made by extrapolating past trends. Total demand was projected at 212.8-214.9

million bushels, and domestic production was forecast at 29.2-30.7 million bushels. Projected import demand was 182.1-185.7 million bushels. However, the source from which this information was obtained stated that the import projection "has to be re-examined because of the discrepancy with the actual trends."<sup>3</sup>

Western Wheat Associates in their annual marketing plans<sup>4</sup> also suggested some potential Japanese import levels. The 1971-1972 marketing plan projected total demand at 202.1 million bushels, total import demand at 191.1 million bushels, and the United States share of these imports at 105.1 million bushels. These projections were based on a 2 percent annual increase in wheat usage demand, and an assumption of 18.4 million bushels of domestic production. They also imply a United States market share of 55 percent.<sup>5</sup>

The 1973-74 marketing plan contains forecasts for 1977 based on a 2 percent increase in annual wheat usage and a population growth of 0.9 percent annually. Domestic wheat production is projected to fall to 7.3 to 9.2 million bushels. Total demand is projected to be 209.4-213.1 million bushels while the import demand projection is for 203.0-

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<sup>3</sup>p. 47, Wheat Importation and Marketing in Japan, Wheat Associates, U.S.A., 1971.

<sup>4</sup>Annual Marketing Plan 1971-1972, Western Wheat Associates, May 1971 - Annual Marketing Plan 1973-1974, Western Wheat Associates, May 1973.

<sup>5</sup>p. 27, of 1971-72 Marketing Plan.

207.6 million bushels.<sup>6</sup>

Table XXXVIII gives a summation of the possible export ranges for both the United States and Montana in Japan, Taiwan and the Philippines.

TABLE XXXVIII

UNITED STATES AND MONTANA EXPORTS TO  
JAPAN, TAIWAN AND THE PHILIPPINES  
(million bushels)

<u>Japan</u>	<u>United States</u>	<u>Montana</u>
1977	91.0 - 124.6	24.8 - 34.0
1980	97.4 - 162.8	26.6 - 44.4
<u>Taiwan</u>	<u>United States</u>	<u>Montana</u>
1980	21.9 - 25.1	5.9 - 6.8
<u>Philippines</u>	<u>United States</u>	<u>Montana</u>
1975	13.4 - 16.9	3.2 - 6.8

As shown, the potential for Montana exports to just Japan and Taiwan in 1980 is from 32.5 to 52.0 million bushels of wheat. The upper level of 52.0 million bushels amounts to roughly 50 percent of Montana's total wheat production of 1973. This should indicate the importance to Montana of the cultivation and maintenance of these export markets. When one keeps in mind the import potential of other developing Asian markets the prospects of Montana wheat exports seem very good indeed.

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<sup>6</sup>p. 34 of 1973-74 Marketing Plan.

## Chapter 5

### ELASTICITY OF SUBSTITUTION ESTIMATES FOR JAPANESE WHEAT IMPORTS

Numerous studies estimating demand equations and projecting total demand and import demand have been written. Rather than follow a similar pattern, this section attempts to explain the United States share of exports to the country of Japan. Of more importance to the United States grain trade than the actual or potential size of the market, is the share of the market controlled. Hopefully, from this discussion of what factors affect the United States share of Japanese imports, information will arise that will be relevant to Montana's wheat exports as a share of total United States exports. It is also possible that as other Asian countries develop and begin to demand larger quantities of wheat, factors which determine the United States share in these markets might be relevant to those in the Japanese market.

#### I. THEORETICAL FRAMEWORK

The procedure often followed when looking at the shares of international markets involves computing elasticities of substitution. The elasticity of substitution may be defined as the percentage change in the ratio of the volume of exports divided by a percentage change in the price ratios. In basic terms this elasticity of substitution may be

defined as:

$$\eta_{ab} = \frac{\% \Delta \left( \frac{Q_a}{Q_b} \right)}{\% \Delta \left( \frac{P_a}{P_b} \right)}$$

where

$\eta_{ab}$  = elasticity of substitution of good B with respect to the price of good A in a single market.

$P_a, P_b$  = price of goods A and B, respectively where these goods are related products from competing exporting countries.

$Q_a, Q_b$  = quantity of goods A and B, respectively.

The elasticity of substitution can be estimated based upon the following linear relationship:

$$\left( \frac{Q_a}{Q_b} \right) = f \left( \frac{P_a}{P_b} \right)$$

If estimated under the assumption of linear in logs then:

$$\log \left( \frac{Q_a}{Q_b} \right) = \alpha + \beta \log \left( \frac{P_a}{P_b} \right)$$

and

$\beta$  would be a constant and a measure of the elasticity of substitution.

The use of such price and quantity ratios in computing the elasticity of substitution are subject to some restrictive assumptions

These include:

- (1) The elasticity of substitution is defined precisely and unambiguously with respect to movement along an isoquant, or in the case of demand along an indifference curve, with the assumption that all other quantities are held constant, or
- (2) The changes in other variables, such as income have no differential effect on the demand for wheat exports from the United States and from other exporters.

When considering exports of a single commodity from two exporters to a country or region, the acceptance of the latter assumption does not seem unrealistic. Morrissett gives a thorough discussion of the conditions necessary for estimation of true elasticity of substitution values.<sup>1</sup>

## II. THE MODEL

The basis of the model used to estimate elasticity of substitution values is the expression of the quantity ratios (or market shares) of similar wheats as a function of their corresponding price ratios.

Additional variables were deemed essential in explaining the relative shares of the export market. These included supply ratios, trade balance ratios and dependency rate values. Since pricing patterns by

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<sup>1</sup>I. Morrissett, "Some Recent Uses of Elasticity of Substitution: A Survey," Econometrica, Vol. 21, p. 54, 1953.

exporters do not necessarily reflect relative stock holdings, the ratio of United States stocks to stocks held by the competitors was used. It was also felt that a country's balance of trade in relation to the competitor's balance of trade may influence the relative market shares, so a variable reflecting this was used. The dependency rate variable is in effect another measure of trend. This rate is the ratio of total Japanese wheat imports to total Japanese wheat imports plus total Japanese domestic production. Although this variable is not necessarily an explanatory variable the results obtained from using it showed that as the Japanese turned to imports as their primary wheat source they also turned to the United States as a major supplier. Reasons besides those explained by the price ratios, supply ratios, and balance of trade ratios for the United States market share position that the dependency rate may substitute for, include non-quantifiable political reasons and reasons relating to the fact that the United States offers a more complete range of wheat varieties than is available in any of the competing countries.

A general relation which explains the United States share of exports to the Japanese market would be of the form:

$$MS = a + b_1 PR + b_2 SR + b_3 TB + b_4 DR + u_t$$

where

MS = ratio of the quantity of United States wheat exports to Japan to the quantity of similar wheat exports from the other exporter(s).

PR = ratio of the price of United States wheat exports to Japan to the price of similar exports from the other exporter(s).

SR = ratio of the United States supplies of wheat available for export to similar available wheat supplies of the other exporter(s).

TB = ratio of Japanese exports to United States to Japanese exports to the other exporter(s), in the previous time period.

DR = dependency rate - ratio of Japanese wheat imports to Japanese wheat imports plus Japanese wheat production.

$u_t$  = unknown random error term.

A negative sign of the price ratio variable would indicate that, as the United States export price rises relative to the competing price, the United States share of Japanese exports is falling. Similarly, a positive sign would be expected for the supply ratio variable indicating that, as United States supplies rise relative to the supplies of competitors, the United States share of the export market would also rise. The trade ratio figure would be expected to have a positive sign, thus indicating that as the Japanese exports to the United States grew relative to those of the competitors, the United States share of wheat imports would rise. The dependency rate could also be expected to have a positive sign, since over time both the size of the dependency rate and the United States market share have been increasing.

### III. ESTIMATION

Single equation least squares regression was used as the estimating

procedure. In order to obtain parameter estimates certain assumptions must be made. The necessary conditions for unbiased and efficient estimates require that the error term,  $u_t$ , have the following properties:

- (1)  $u_t$  is a random variable.
- (2) The expected value of  $u_t$  is zero.
- (3) the disturbances are not autocorrelated.
- (4) the variance of  $u$  is finite and constant over time  $t$ .
- (5) the  $u$ 's are independent of the exogenous variables in the equation.

Other necessary assumptions concerning the relations are that:

- (1) Variables are measured without error, and thus the error term is the result of omission of variables only.
- (2) The relation is linear in the parameters.

#### IV. DATA

Time series data was used, covering the period of 1959 to 1972.

This data was assembled from numerous sources and is included in Appendix C.

Both price and quantity data by class of wheat was obtained through correspondence with Western Wheat Associates' Far East Office, and the United States Agricultural Attache to Japan. Price ratios were figured using weighted averages where more than one price or class of wheat was involved. Classes of wheat were separated according to the Japanese Food Agency's designations of hard, semi-hard, and soft. Yearly average prices were used, based upon the Japanese Fiscal Year.

Quantities of both food and feed wheat were combined, but Free Wheat imports were not included due to a lack of pricing information, and to the re-export nature of their use. Monthly price data was available but its use was prohibited by the absence of monthly quantity data. Prices used were in terms of United States dollars C & F, for each country and class of wheat involved.

Figures for computing supply ratios originated from World Wheat Statistics published by the International Wheat Council and from the Wheat Situation published by the U.S.D.A. Stock figures for individual classes of wheat were not available from the countries of Canada and Australia so total stock figures were used. When finding parameters for individual classes of wheat the United States stocks by class were used in the ratios.

Trade balance ratios were obtained by using figures published in the Japanese Year Books.<sup>2</sup> These were from tables labeled 'Foreign Trade by Country or Territory of Destination and Origin.'

The dependency rate figures were obtained by using import quantity figures and domestic production figures published by the International Wheat Council.

Original intentions included examination of Korea, the Philippines

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<sup>2</sup> Japan, Ministry of Agriculture and Forestry, Statistical Yearbook, (Tokyo: various issues).

and Taiwan in terms of United States market share, but this proved infeasible for two reasons. First, the nature of these markets was such that the United States market share was very high primarily due to major transfers through concessional agreements. The second reason was that necessary data was unavailable.

Data for the year 1971 was not used in the final regression runs. This was because the market shares for 1971 were substantially altered because of the dock strikes in the United States which severely limited the wheat shipments to Japan.

#### V. RESULTS

The empirical results for the regressions used in computing the elasticity of substitution estimates are given below. Results for equation (1) which relates United States and Canadian hard wheat exports are shown first.<sup>3</sup>

$$(1) \quad \text{CAHDQT} = 6.348 - 6.403 \text{ CAHDPR} - 0.218 \text{ USHDCA} \\
\quad \quad \quad (2.833)^* \quad (-3.331)^* \quad \quad \quad (-2.846)^* \\
R^2 = .899 \quad \quad \quad -0.151 \text{ BALUC} \quad + 2.921 \text{ DERATE} \\
\quad \quad \quad \quad \quad \quad (-2.680)^* \quad \quad \quad (4.070)** \\
\text{DW} = 2.636$$

where:

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<sup>3</sup>Numbers in parentheses are t-test values, \* indicates that the coefficient is significantly different from zero at the 5 percent level of probability, \*\* indicates that the coefficient is significantly different from zero at the 1 percent level of probability.

CAHDQT = Ratio of United States quantity of hard wheat to Canadian quantity of hard wheat imported by Japan.

CAHDPR = Ratio of Japanese import price of United States hard wheat to Japanese import price of Canadian hard wheat.

USHDCA = Ratio of United States stocks of hard wheat to total stocks of Canadian wheat.

BALUC = Ratio of Japanese exports to the United States to Japanese exports to Canada.

DERATE = Japanese wheat dependency rate.

In equation (1) all values of the coefficients were significantly different from zero at either the one or five percent probability level. The Durbin-Watson test for autocorrelation gave a value of 2.636 which falls in the uncertain area so the null hypothesis of no autocorrelation can neither be accepted nor rejected. The value of  $R^2$ , which is a measure of the goodness of fit of the regression, is .899. A value of 1 would indicate perfect explanation.

Equation (2) relates total United States wheat exports to Japan to all other country's exports of wheat to Japan.

$$(2) \quad \text{ORACQT} = 5.341 - 6.788 \text{ ORACPR} - 0.215 \text{ BALUC} \\ (2.249) \quad (-2.654)^* \quad (-1.235) \\ +4.118 \text{ DERATE} \\ (6.787)**$$

$$R^2 = .819$$

$$\text{DW} = 2.186$$

where:

ORACQT = Ratio of United States quantity of all wheat

to all other importers' quantities of all wheat imported by Japan.

ORACPR = Ratio of Japanese import prices of all United States wheat to Japanese import price of all other wheat.

BALUO<sub>it</sub> = Ratio of Japanese exports to the United States to Japanese exports to Australia and Canada.

DERATE = Japanese wheat dependency rate.

In equation (2) the dependency rate coefficient was significantly different from zero at the 1 percent probability level; the price ratio coefficient at the 5 percent level; the quantity ratio coefficient at the 10 percent level; and the trade balance ratio coefficient at the 20 percent level. The Durbin-Watson test value fell in the uncertain area so the null hypothesis of no autocorrelation can be accepted. Signs of the coefficients were as expected for the price ratio and the dependency rate variables, but were different from the expected for the trade balance ratio. The  $R^2$  value was .819.

Equation (3) related United States and Canadian hard and semi-hard wheats. It is similar to equation (1) but broader in scope.

$$(3) \quad \begin{array}{r} \text{S-H QT} = 1.549 - 2.770 \text{ S-H PR} - 0.245 \text{ USHDCA} \\ \quad \quad \quad (.822) \quad (-2.001) \quad \quad \quad (-1.798) \end{array}$$

$$\begin{array}{r} + 2.869 \text{ DERATE} \\ \quad \quad \quad (3.354)* \end{array}$$

$$R^2 = .779$$

$$DW = 2.619$$

Where:

S-H QT = Ratio of United State quantity of hard and semi-hard wheat imported by Japan.

S-H PR = Ratio of Japanese import price of United States hard and semi-hard wheat to Japanese import price of Canadian hard and semi-hard wheat.

USHDCA = Ratio of United States stocks of hard wheat to total stocks of Canadian wheat.

DERATE = Japanese wheat dependency rate.

The levels of significance for the coefficients in equation (3) were 5 percent for the dependency rate, 10 percent for the price ratio, and 15 percent for the stock ratio variable. The Durbin-Watson value was again in an uncertain area and the  $R^2$  value was .779. The signs of the coefficients were as expected except for the negative sign on the stock ratio variable.

#### VI. CALCULATION OF ELASTICITIES OF SUBSTITUTION

Elasticities of substitution with respect to the price ratios were calculated for each of the three equations and are shown in Table XXXIX. These elasticities were calculated at the average values of the variables in question.

There has been considerable discussion concerning the precise meaning of the numerical value of the elasticity of substitution. Tinbergen interpreted a -2.0 elasticity of substitution to mean that "a 10% reduction in the export price level only induces a 20%

TABLE XXXIX

## ELASTICITY OF SUBSTITUTION RESULTS FOR EACH EQUATION

<u>Equation Number</u>	<u>Coefficient of Price Ratio</u>	<u>Average Value of Price Ratio</u>	<u>Average Value of Quantity Ratio</u>	<u>Elasticity of Substitution</u>
(1)	-6.403	0.955	0.469	-13.038
(2)	-6.788	0.954	0.883	- 7.333
(3)	-2.770	0.937	0.772	- 3.362

increase in the volume of exports."<sup>4</sup> This interpretation has been criticized by Morrissett who claims that it is only valid when one price remains constant.

Morrissett, though hesitant to accept the assumptions necessary to validate the concept, presented an interpretation of various elasticity of substitution values. He stated that a value of -1 would indicate that market shares (in value terms) will remain constant even though the ratio of prices change. Given that  $X_1/X_2$  is the quantity ratio and  $P_1/P_2$  the price ratio from which the elasticity of substitution is computed, if the value is -10, the market shares will change very rapidly in favor of  $X_2$  if the ratio of  $P_1/P_2$  increases. If the value is -0.5 the market shares will change slowly in favor of  $X_1$  if the ratio  $P_1/P_2$  increases. Positive values of the elasticity of substitution

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<sup>4</sup>J. Tinbergen, "Some Measurements of Elasticities of Substitution," Review of Economics and Statistics, Vol. 28, p. 112, 1946.

would indicate that changes in the ratio of P1 to P2 would result in more than proportionate changes in the market share of X1.<sup>5</sup>

In this light, the elasticity of substitution values shown in Table XXXIX would all indicate that the market shares would change in favor of X2 (which in the three equations would refer to either Canada or all other exporters) if the price ration increases. Thus, the elasticity of substitution value of -13.038 obtained from equation (1) would indicate that Canada's share of the Japanese imports of hard wheat would increase if the value of the ratio between United States and Canadian hard wheat prices increases. The price ratio increase could be due to several factors including:

1. The United States price increases while the Canadian price stays the same or decreases.
2. The United States price increases more than the Canadian price increases.
3. The United States price decreases less than the Canadian price decreases.
4. The United States price stays the same while the Canadian price decreases.

According to the magnitudes of the calculated elasticities it would be expected that the greatest market share changes in response to price ratio changes would occur between United States hard and Canadian hard wheats.

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<sup>5</sup>I. Morrissett, "Some Recent Uses of Elasticity of Substitution: A Survey", Econometrica, Vol. 21, p. 54, 1953.

Reekie found an elasticity of substitution values between Canadian and United States wheat exports to eight countries using time series data from 1951-1963.<sup>6</sup> His elasticity of substitution value was -3.38 where the quantity ratio was the dependent variable, and -56.12 where the price ratio variable was the dependent variable. The elasticity of substitution value is biased toward zero when the price ratio is the dependent variable and away from zero when the quantity ratio is the dependent variable. Reekie disregarded the -56.12 value since it seemed entirely too large from the standpoint of a priori reasoning and results of related studies.

Using the elasticity of substitution value of -3.38 he estimated the change in United States wheat exports that would result from a 1 percent reduction in the price of wheat. He found that assuming aggregate demand elasticity zero, a 1 percent cut in United States price coupled with no change in the Canadian price would lead to increased United States wheat sales of from 2.9 to 4.4 million bushels depending upon whether the price cut occurred during a year of low or high sales. This gain referred to the eight countries of the study: United Kingdom, Japan, West Germany, Holland, Denmark, Norway, Italy and Venezuela. If Canada retaliated with a 1/2 percent price cut the gains to the United States would be from 1.4 to 2.2 million bushels.

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<sup>6</sup>C.I.M. Reekie, "Some Aspects of Foreign Demand for U.S. Wheat," Unpublished Ph.D. Dissertation, N.C. State University, Raleigh, 1967.

Similar estimates were made in this study using the three elasticity of substitution values reported. Additional estimates were obtained by using the upper and lower 95 percent confidence limits of the point estimates of the coefficients in equations (1) and (2) and the upper and lower 90 percent confidence limits of the point estimates of the coefficients in equation (3). In each case the aggregate demand elasticity for the wheat was assumed to be zero. The calculations were made on the basis of: (a) a 1 percent cut in the United States price with no retaliation by the competitor and (b) a 1 percent reduction in the United States price followed by a one-half percent reduction by the competitor. For each equation increased imports were figures using as a base: (a) average exports over the 12 or 13 year period used in the regressions, (b) average exports over the last 5 years used in the regression, and (c) the year of highest exports.

The results of these estimates are shown in the Tables XL, XLI, and XLII. With the negative elasticities of substitution, any decreases in the United States prices which were not overcompensated for by the competitor would result in increased market shares for the United States. This in no way should be accepted as the best alternative for the United States. Though changes in net revenue to the United States wheat industry were not figured in this study, Reekie's results showed losses in every case.

Results show that for the 5 year average a 1 percent United States

TABLE XL  
 ESTIMATED AGGREGATE INCREASE IN UNITED STATES HARD WHEAT  
 EXPORTS TO JAPAN IN RESPONSE TO A 1 PERCENT UNITED STATES PRICE REDUCTION<sup>1</sup>

	Elasticity of Substitution Value	Market Share		Increased Exports: U.S. 1% Price Cut Can. no Price Cut	Increased Exports: U. 1% Price Cut Can. 1/2% Price
		U.S.:	Canada		
<u>High Year (1970) (85,107)</u>		<u>.456:</u>	<u>.544</u>		
Upper Limit (95% C.I.)	-22.292			8651	4326
Computed Value	-13.038			5060	2530
Lower Limit ((5% C.I.)	- 3.781			1467	774
<u>12 Year Average (1959-1970)</u> (56,048)		<u>.319:</u>	<u>.681</u>		
Upper Limit (95% C.I.)	-22.292			3986	1993
Computed Value	-13.038			2331	1166
Lower Limit (95% C.I.)	- 3.781			676	338
<u>5 Year Average (1966-1970)</u> (71,711)		<u>.456:</u>	<u>.544</u>		
Upper Limit (95% C.I.)	-22.292			7290	3645
Computed Value	-13.038			4263	2132
Lower Limit (95% C.I.)	- 3.781			1236	618

<sup>1</sup>Elasticities computed from equation 1).

TABLE XLI  
ESTIMATED AGGREGATE INCREASE IN UNITED STATES TOTAL WHEAT  
EXPORTS TO JAPAN IN RESPONSE TO A 1 PERCENT UNITED STATES PRICE REDUCTION<sup>1</sup>

	<u>Elasticity of Substitution Value</u>	<u>Market Share U.S.: All Others</u>	<u>Increased Exports: U.S. 1% Price Cut Others No Price Cut</u>	<u>Increase Exports: 1% Price Others 1/2% Cut</u>
(Figures in thousand bushels)				
<u>High Year (1970) (174,466)</u>		<u>.526: .474</u>		
Upper Limit (95% C.I.)	-13.698		12,571	6285
Computed Value	- 7.333		6729	3365
Lower Limit (95% C.I.)	- 0.962		883	441
<u>12 Year Average (1959-1970) (126,660)</u>		<u>.469: .531</u>		
Upper Limit (95% C.I.)	-13.698		8137	4069
Computed Value	- 7.333		4357	2178
Lower Limit (95% C.I.)	- 0.962		571	286
<u>5 Year Average (1966-1970) (153,835)</u>		<u>.526: .474</u>		
Upper Limit (95% C.I.)	-13.698		11,084	5542
Computed Value	- 7.333		5934	2967
Lower Limit (95% C.I.)	- 0.962		778	389

<sup>1</sup>Elasticities computed from equation 2).

TABLE XLII  
ESTIMATED AGGREGATE INCREASE IN UNITED STATES HARD AND SEMI-HARD  
EXPORTS TO JAPAN IN RESPONSE TO A 1 PERCENT UNITED STATES PRICE REDUCTION<sup>1</sup>

	Elasticity of Substitution Value	Market Share		Increased Exports: U.S. 1% Price Cut Can. no Price Cut (Figures in thousand bushel)	Increase Exports: U 1% Price Cu Can. 1% Pri
		U.S.:	Canada		
<u>High Year (1972) (114,512)</u>		<u>.544:</u>	<u>.456</u>		
Upper Limit (90% C.I.)	-8.697			5418	2709
Computed Value	-3.362			2094	1047
Lower Limit (90% C.I.)	-0.283			176	88
<u>13 Year Average (1959-1970, 1972)</u> <u>(86,509)</u>		<u>.436:</u>	<u>.564</u>		
Upper Limit (90% C.I.)	-8.697			3280	1640
Computed Value	-3.362			1268	634
Lower Limit (90% C.I.)	-0.283			107	53
<u>5 Year Average (1967-1970, 1972)</u> <u>(104,589)</u>		<u>.544:</u>	<u>.456</u>		
Upper Limit (90% C.I.)	-8.697			4948	2474
Computed Limit	-3.362			1912	956
Lower Limit (90% C.I.)	-0.283			161	81

<sup>1</sup>Elasticities computed from equation 3).

price cut coupled with no Canadian response would result in gains of United States hard wheat exports to Japan of from 1.2 to 7.3 million bushels. A Canadian retaliatory 1/2 percent cut would result in increases 50 percent as large.

Table XL shows increases to the total Japanese wheat import market given United States price decreases. This shows that for the five year period of 1966-1970 an increase in total imports by Japan from the United States of from .8 to 11.1 million bushels would have resulted given a 1 percent United States price cut with no change in the price of other imports.

There is a method devised by Harberger<sup>7</sup> which relates elasticities of substitution to price elasticities of demand. Using the procedure implied elasticities of demand were computed for the three equations. The results obtained were -4.159 for equation (1), -3.439 for equation (2) and -1.466 for equation (3). Reekie estimated directly the price elasticity of export demand for both the United States and Canada obtaining a value of -3.8. In comparison, the results obtained by the indirect method seem plausible.

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<sup>7</sup>A. C. Harberger, "Some Evidence on the International Price Mechanism," *Journal of Political Economy*, Vol. 65, pp. 506-521, 1957.

## VII. CONCLUSIONS

The results presented in this section were from three equations which gave plausible results. These equations show that the price ratio was important in determination of the quantity ratios which were examined.

The equations used all yielded negative signs on the supply ratio variables and on the trade balance ratios. These were not the signs that were expected when these variables were included in the relations. In regards to the trade balance ratios the reason for the unexpected signs could be that trade in wheat as a percentage of total trade is relatively small. For example, in 1972, approximately 25 percent of the value of Japanese imports from the United States was from agricultural trade, and 11.4 percent of this agricultural trade was composed of wheat and wheat flour. Thus, only 3 percent of the total United States exports to Japan were of wheat or wheat flour. This is a small enough percentage to accept the premise that any trade pattern alterations made to improve trade imbalances would probably not greatly effect the wheat import market shares.

The negative stock ratio values can also be rationalized. The major exporters to Japan, (United States, Canada, and Australia) all have consistently held large stocks. Therefore, since stocks have in recent years always been large enough to more than adequately fill export demands, the ratios of these stocks would be of slight importance

in determining relative market shares. Therefore, the rather small negative coefficients would not necessarily be implausible.

Though the legitimacy of any elasticity of substitution figures has been questioned, the values which were reported are as would be expected from a review of other studies. Tinbergen found elasticity of substitution between United States and Canadian exports of between -5.3 and -11.3. Reekie's value for United States and Canadian exports to eight countries was -3.38. Slater obtained elasticity of substitution values for Japanese wheat imports specifically. For the United States and Canada the value was -0.18, and for the United States and Australia the value was -0.75.<sup>8</sup> Slater computed elasticities of substitution for five specific regions and for total world trade between the United States and Canada, Australia, Argentina, France, and all other exporters. His twenty elasticity of substitution values ranged from 8.45 to -11.45 with most values falling between 0 and -3.0. Equation (3) of this study would most closely correspond to Reekie's and the elasticity of substitution values are nearly identical. Equation (2) yielded a value of -7.333, well within the range obtained by Slater, though the -13.038 value in Equation (3) exceeds Slater's range.

The relatively high elasticity of substitution value for Equation

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<sup>8</sup> John M. Slater, "The World Wheat Economy: Implications for the Consumption and Trade of United States Wheat," Unpublished Ph.D. Dissertation, University of Illinois, Urbana, Illinois, 1966.

(1) seems reasonable when one considers the following statement from a publication in cooperation with the Japanese Food Agency: "Specifically, in the case of No. 2 or higher grade Canadian Red Spring versus No. 2 or higher grade U.S. Dark Northern Spring, the difference in selling prices is ¥ 1,130 per metric ton (U.S. 9¢ per bushel). Accordingly, when the difference in the price offered is more than ¥ 1,130, the Agency purchases Canadian Red Spring wheat as it is more favorable, and when the difference in the price offered is less than ¥ 1,130, the Agency purchases U.S. Dark Northern Spring as it is more favorable."<sup>9</sup> Since Equation (1) dealt specifically with the market share of the hard wheats mentioned in the above quote, the degree of market share responsiveness to price changes seems plausible.

The lack of significance in the price ratio variable that was encountered in several equations needs explaining. First the yearly average price data used was not nearly specific enough to get thoroughly reliable estimates. Prices can change daily, and Japanese Food Agency tenders are on a monthly basis. Using yearly average price data obscures the daily or weekly price changes which determine competitiveness. There also seem to be some non-price influences which tend to favor United States wheat. The United States is the only one of the major exporters which offers a complete range of wheats. Canada supplies

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<sup>9</sup>Wheat Associates U.S.A., Wheat Importation and Marketing in Japan, National Food Life Improvement Associates, p. 2 (Addendum), 1974.

hard wheats and Australia supplies predominantly soft wheats. In other words, "one-stop buying" could be in the United States' favor.

The possibility of political influence in Food Agency purchasing decisions still exists. Though information from the Agency states that final decisions are based on the prices that are most favorable to the Agency, there is some doubt that political factors are or can be completely divorced. A statement from a Foreign Agricultural Service publication lends credence to the belief that politics play a part in purchase decisions. In discussion the Agency's purchasing structure they state, "..., this system also makes it possible for Japan to limit or expand imports of state traded items from any one country should it suit the 'national interest'."<sup>10</sup> Since there exist substantial political ties between the governments of the United States and Japan, the probability of some political influence seems likely.

There also seem to be some bilateral agreements which alter the system. The wheat trade stabilization agreement between Japan and Australia is an example of this. Also, previous to 1967 there was some discrimination between exporting countries due to the Japanese government's repricing of imported wheats. The government resale prices did not truly reflect the world market price differentials

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<sup>10</sup>United States Department of Agriculture, Foreign Agricultural Service, "Agricultural Trade Policy, "Nontariff Barriers Affecting Trade in Agricultural Products - Japan", June, 1972, p. 2.

between types of wheat. In most cases, it appeared that the United States was benefiting from these resale pricing methods.

In summation, United States wheat export shares in some cases seem to be responsive to price changes, but it appears that in the Japanese market there exist several non-price stimuli which also cause or at least help explain market share changes.

## Chapter 6

### SUMMARY AND CONCLUSIONS

The objectives originally established for this study included determining Montana's wheat exports by class, reviewing the world market for wheat exports, and finding elasticities of substitution for United States wheat in the Japanese market.

#### I. GENERAL REVIEW

Montana hard red spring wheat exports were estimated by a method which involved subtracting all other states' hard red spring shipments to the West Coast from total West Coast hard red spring exports and attributing the residual to Montana. This method was used because shipment figures by class were not available for Montana, but were available for all other states which shipped hard red spring to the West Coast. Since the shipments by other states were made under an export freight rate it was considered safe to assume that all of this wheat was exported rather than being milled domestically. Montana hard red winter wheat exports were then estimated by subtracting from total Montana westward wheat movement the hard red spring export estimates and estimates of domestic milling of all Montana wheat. These estimates were checked against similar estimates which were made for total exports using a slightly different procedure.

Results shows that Montana wheat exports have increased tremendously

over the last ten years, growing from an estimated 16.6 million bushels in 1964 to an estimated 75.4 million bushels in 1972. Growth has been greatest for the hard red spring exports which were influenced to a large extent by the inverse freight rate's inception in 1965. Presently over 75 percent of Montana's wheat production is leaving the state. Figures from this study show that in the 1972 crop year 96.90 million bushels of wheat left the state for West Coast destinations. This included 21.50 million bushels which were milled domestically and 42.76 million bushels of hard red spring and 32.64 million bushels of hard red winter which moved into the export market. More Montana wheat seems to be milled domestically than was previously thought.

In addition to the amounts exported as wheat, an estimated 2.99 to 4.79 million bushel equivalents of Montana wheat were exported as flour over the last five years.

Rough estimates of the final destinations of Montana wheat exports were made. The results showed the following countries and their approximate per year purchase amounts of Montana wheat during the 1967 to 1972 period: Japan 14 to 26 million bushels, the Philippines 4 to 9 million bushels, Korea 2 to 9 million bushels, and Taiwan 2 to 6 million bushels.

A market share analysis was used to gain some insight into the reasons behind the changes in international wheat markets. Three effects were delineated and changes in market shares were then ascribed

to these effects. Some general conclusions were drawn relative to the results of the several market share analyses. In each case the size of market effect was positive and was the dominant factor in the market share increases. This would indicate that the demand curve for United States wheat exports has been shifting upward and to the right, probably in response to changes in income, tastes, and population. The distributive effect was always negative which indicated that the United States market shares suffered because of changing patterns of purchase by the importing nations. In three out of four of the analyses the competitive effects were positive. This positive effect indicates that the United States is increasing its overall market shares by increasing its shares in individual markets. Though the analysis calls these gains competitive, there are many factors which cause these market share gains.

The review of the international market for wheat showed that whereas Europe formerly constituted the major market for wheat and flour imports, Asia now is the leading purchasing area. From 1970 to 1972, 30 percent of the wheat and wheat flour imports were by Asian countries. The United States was in a favorable position in this market, providing 46 percent of the exports during the 1970 to 1972 period. In 1972 the United States exports of wheat and wheat flour amounted to 47.5 percent of the world's total.

A survey of demand projections lead to the conclusion that the

following export demand may be expected for Montana wheat:

1980 - Japan 26.6 to 44.4 million bushels

1980 - Taiwan 5.9 to 6.8 million bushels

1975 - The Philippines 3.2 to 6.8 million bushels

These are rough estimates, but they serve the purpose of pointing out the potential for Montana wheat exports.

Results of elasticity of substitution computations indicate that relative prices play an important role in determining market shares in the Japanese wheat market. Elasticity of substitution values ranged from -3.362 between the United States and Canadian hard and semi-hard wheats, to -7.333 between United States and all other exporters' total wheat shipments, to a -13.038 value between United States and Canadian exports of hard wheats. These elasticity of substitution values were converted to estimates of elasticities of demand. This resulted in values of from -1.466 to -4.159 for the three equations examined.

These rather high elasticity values lead to two general conclusions. First, these values differ from the mostly inelastic values that have been found for the domestic wheat market and give some degree of justification for the price differentiation between the domestic and export markets for wheat. Second, these values show the Japanese market for hard wheats to be rather price sensitive. Thus it appears that any attempt to differentiate Montana wheat should be preceded by a great deal of further study to determine its feasibility.

## II. SUMMARY OF THE JAPANESE MARKET SITUATION

The total demand for wheat in Japan has grown rapidly and appears capable of further growth. This growth seems to be coming from increased incomes (Japanese national income deflated to 1965 levels more than quintupled from 1958 to 1970) and a general Westernization of diets. Income elasticity of demand is probably decreasing, however, which will tend to slow the total demand increases.<sup>1</sup> Population will continue to have a slight affect as recent growth has been less than 1 percent per year. Changes in population composition may influence wheat usage as the generation first introduced to Western breads now becomes of child bearing age. There is also continued talk of a liberalization of the wheat import marketing system which may increase wheat imports.

Presently the United States provides the greatest share of Japan's wheat imports. One factor which should contribute towards increased Montana exports is Japan's increasing usage of hard wheats. Import demand for hard wheats in Japan has doubled over the last ten years and is still increasing. Another favorable factor is Western Wheat Associates' cooperation with the Japanese Food Agency and individual

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<sup>1</sup>Forecast income elasticities of demand for wheat in the Institute of Agricultural Economic Research's Japanese Import Requirements: Projections of Agricultural Supply and Demand for 1965, 1970 and 1975 are 1965-1970 (0.2) and 1970-1975 (0.1).

milling firms in Japan. Their continued wheat promotion and market development activities in Japan and other Asian countries will undoubtedly aid Montana wheat exports.

The higher range of forecast imports of Montana wheat by Japan and other Asian countries shows the potential of nearly doubled sales by 1980. The major deterrent to increasing United States sales to Japan would appear to be their recent expressed policy of diversification of wheat import sources. Since the United States market share is presently very large, this policy may tend to limit increases in shares if not in total exports.

APPENDIX A

FIGURES USED IN ESTIMATING MONTANA  
WHEAT AND FLOUR EXPORTS AND DESTINATIONS

APPENDIX A, TABLE 1  
(million bushels)

FIGURES USED TO ESTIMATE MONTANA WHEAT EXPORTS

Crop Year	Total West Coast HRS Exports	North Dakota Total Shipments to West Coast	North Dakota Durum Shipments to West Coast
1960	1.71 <sup>a</sup>	-	-
1961	0.80 <sup>a</sup>	-	-
1962	0.83 <sup>a</sup>	-	-
1963	3.17 <sup>a</sup>	-	-
1964	3.77 <sup>a</sup>	-	-
1965	19.93 <sup>a</sup>	5.43 <sup>b</sup>	-
1966	25.06 <sup>a</sup>	5.54 <sup>b</sup>	-
1967	36.78 <sup>a</sup>	19.85 <sup>c</sup>	0.86 <sup>c</sup>
1968	38.89 <sup>a</sup>	23.42 <sup>c</sup>	0.46 <sup>c</sup>
1969	41.24 <sup>a</sup>	23.28 <sup>d</sup>	0.98 <sup>c</sup>
1970	54.44 <sup>a</sup>	17.13 <sup>d</sup>	0.83 <sup>c</sup>
1971	35.55 <sup>a</sup>	6.71 <sup>e</sup>	0.36 <sup>e</sup>
1972	66.16 <sup>a</sup>	16.60 <sup>e</sup>	0.70 <sup>e</sup>

## APPENDIX A, TABLE 1

(continued)

Crop Year	Idaho HRS Shipments to West Coast	South Dakota HRS Shipments to West Coast	Montana Total Shipments to Pacific NW
1960	-	-	40.00 <sup>f</sup>
1961	-	-	30.40 <sup>f</sup>
1962	-	-	42.30 <sup>f</sup>
1963	-	-	49.40 <sup>g</sup>
1964	-	-	34.40 <sup>g</sup>
1965	-	-	56.98 <sup>g</sup>
1966	-	-	50.86 <sup>g</sup>
1967	-	-	57.69 <sup>g</sup>
1968	2.20 <sup>h</sup>	-	62.44 <sup>d</sup>
1969	2.50 <sup>h</sup>	4.98 <sup>d</sup>	65.39 <sup>d</sup>
1970	5.90 <sup>h</sup>	4.64 <sup>d</sup>	58.49 <sup>d</sup>
1971	1.24 <sup>d</sup>	2.69 <sup>d</sup>	54.80 <sup>p</sup>
1972	3.80 <sup>d</sup>	3.70 <sup>d</sup>	96.90 <sup>p</sup>

## APPENDIX A, TABLE 1

(continued)

Crop Year	Montana Shipments to California	Montana HRS Milled in West	Montana HRW Milled in West
1960	1.54 <sup>i</sup>	14.20 <sup>h</sup>	24.00 <sup>h</sup>
1961	1.72 <sup>i</sup>	12.50 <sup>h</sup>	26.50 <sup>h</sup>
1962	2.06 <sup>i</sup>	11.50 <sup>h</sup>	24.60 <sup>h</sup>
1963	0.54 <sup>i</sup>	12.50 <sup>h</sup>	27.30 <sup>h</sup>
1964	0.47 <sup>i</sup>	9.00 <sup>h</sup>	22.40 <sup>h</sup>
1965	1.30 <sup>i</sup>	11.00 <sup>h</sup>	25.20 <sup>h</sup>
1966	2.43 <sup>i</sup>	9.10 <sup>h</sup>	23.20 <sup>h</sup>
1967	2.39 <sup>i</sup>	7.20 <sup>h</sup>	24.40 <sup>h</sup>
1968	3.26 <sup>i</sup>	11.00 <sup>h</sup>	23.00 <sup>h</sup>
1969	2.46 <sup>i</sup>	8.20 <sup>h</sup>	27.60 <sup>h</sup>
1970	3.96 <sup>j</sup>	7.40 <sup>h</sup>	22.40 <sup>h</sup>
1971	2.49 <sup>j</sup>	-	-
			17.90 <sup>k</sup>
1972	3.00 <sup>l</sup>	-	-
			21.50 <sup>k</sup>

## APPENDIX A, TABLE 1

(continued)

Crop Year	Utah Milling of Montana Wheat	Montana In State Milling
1960	6.45 <sup>m</sup>	6.04 <sup>n</sup>
1961	6.54 <sup>m</sup>	6.34 <sup>n</sup>
1962	6.33 <sup>m</sup>	6.23 <sup>n</sup>
1963	6.07 <sup>m</sup>	6.25 <sup>n</sup>
1964	6.57 <sup>m</sup>	6.58 <sup>n</sup>
1965	5.93 <sup>m</sup>	6.67 <sup>n</sup>
1966	5.81 <sup>m</sup>	6.63 <sup>n</sup>
1967	5.75 <sup>o</sup>	6.08 <sup>n</sup>
1968	5.35 <sup>o</sup>	6.41 <sup>n</sup>
1969	4.95 <sup>o</sup>	7.20 <sup>n</sup>
1970	4.55 <sup>o</sup>	6.47 <sup>n</sup>

## SOURCES FOR APPENDIX A, TABLE 1

- a) Grain Market News, United States Department of Agriculture, Consumer and Marketing Service, Grain Division, yearly summary issues.
- b) Marketing Department, Market Development Division, Burlington Northern, St. Paul, Minnesota.
- c) Unpublished figures from United States Department of Agriculture, Statistical Reporting Service, Seattle, Washington.
- d) Pacific Northwest Wheat Summary, United States Department of Agriculture, Statistical Reporting Service, Portland, Oregon.
- e) Unpublished figures from Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota.
- f) Wheat - Supply, Distribution and Value in the Pacific Northwest, Pacific Northwest Wheat Project, Statistical Bulletin Number 2, Nov., 1963.
- g) Unpublished figures from Oregon Crop Reporting Office, Statistical Reporting Service, Portland, Oregon.
- h) Unpublished estimates from milling industry source.
- i) Federal-State Market News Service, United States Department of Agriculture, Consumer and Marketing Service, California Department of Agriculture, Bureau of Market News, Sacramento, California.
- j) Unpublished figures from United States Department of Agriculture, Statistical Reporting Service, Helena, Montana.
- k) Sumoof Montana HRS and Montana HRW milled in Pacific Northwest obtained from p) below.
- l) Preliminary estimates.
- m) Calculated from information contained in n) and o).
- n) Current Industrial Reports, Flour Milling Products, United States Department of Commerce, Series M20A(68)-13.
- o) Unpublished estimates from milling industry source.
- p) Montana Crop and Livestock Reporting Service, Montana Wheat Disposition - 1972 Marketing Year - March 7, 1974.

APPENDIX A, TABLE 2

ESTIMATES OF MONTANA WHEAT EXPORTED AS FLOUR  
(thousand bushels)

Year	Total Wheat Ground for Flour in Wash. and Ore.	Portland & Seattle Flour Exports	Percent	Mt. Flour milled in Wash. & Ore.	M e a
	(1)	(2)	(2) ÷ (1) × 100 = (3)	(4)	(3)
1968	32,097	5,848	18.2	22.9	
1969	30,552	7,288	23.7	18.2	
1970	29,965	5,777	19.3	20.8	
1971	29,936	4,494	16.7	17.9	
1972	28,954	6,459	22.3	21.5	

## APPENDIX A, TABLE 3

FLOUR EXPORTS FROM MAJOR WEST  
 COAST PORTS BY COUNTRY OF DESTINATION  
 (thousand bushels)

<u>S. America</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Bolivia	25.2	-	-	-	-
Brazil	-	-	73.0	-	-
Chile	1.8	50.7	-	-	-
Columbia	-	15.9	-	-	-
Ecuador	17.6	.8	-	-	-
Peru	<u>52.8</u>	<u>22.1</u>	<u>108.1</u>	-	-
TOTAL	<u>97.4</u>	<u>89.5</u>	<u>181.1</u>	-	-
<u>N. &amp; Cent. Am.</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Canada	-	-	-	-	7.0
Costa Rica	-	5.8	-	-	-
Jamaica	5.2	-	-	-	-
Nicaragua	10.2	3.9	1.1	-	-
Panama	1.5	-	-	-	-
Salvador	<u>19.8</u>	<u>25.4</u>	<u>302.9</u>	<u>26.1</u>	<u>10.8</u>
TOTAL	<u>36.7</u>	<u>35.1</u>	<u>304.0</u>	<u>26.1</u>	<u>17.8</u>

APPENDIX A, TABLE 3  
(continued)

<u>Asia</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Bahrain	-	-	9.5	-	-
Israel	-	98.1	-	-	-
Lebanon	-	-	360.7	264.8	27.3
Saudi Arabia	<u>4.5</u>	<u>-</u>	<u>36.5</u>	<u>-</u>	<u>4.5</u>
SUBTOTAL NEAR EAST	(4.5)	(98.1)	(406.7)	(264.8)	(31.8)
Cambodia	-	-	-	322.5	-
Hong Kong	67.9	46.6	78.7	29.9	11.4
India	34.2	-	-	-	-
Indonesia	663.4	1909.6	388.6	464.1	60.4
Japan	48.4	185.7	3.8	2.3	735.1
Korea	708.5	3019.4	1332.5	1270.4	2382.6
Laos	.8	-	11.4	.3	188.9
Malaysia	1.8	15.1	33.0	29.9	1.7
Nepal	6.8	-	26.8	7.9	16.9
Pakistan	.4	.8	.3	-	-
Philippines	282.5	139.3	82.9	10.0	30.3
Singapore	.1	-	-	-	-
S. Vietnam	1908.9	2524.8	2789.2	1266.6	1738.5
Sri Lanka	2517.8	73.0	626.5	793.8	1374.3
Thailand	<u>45.7</u>	<u>34.3</u>	<u>32.3</u>	<u>.6</u>	<u>20.3</u>
SUBTOTAL NEAR EAST	(6287.2)	(7948.6)	(5406.3)	(4198.3)	(6560.4)
TOTAL	<u>6291.7</u>	<u>8046.7</u>	<u>5813.0</u>	<u>4463.1</u>	<u>6592.2</u>

APPENDIX A, TABLE 3  
(continued)

<u>Other Areas</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Australia	.2	-	-	-	-
French Pacific Islands	1.3	.5	1.3	-	-
Nansei Islands	73.7	79.1	123.8	119.2	1.9
New Zealand	.9	-	-	-	-
Mozambique	-	1.3	-	-	-
Pacific Islands	70.6	83.2	70.3	52.4	39.7
Tunisia	-	173.2	-	-	-
Turkey	-	-	-	3.9	-
Unspecified	<u>.9</u>	<u>.8</u>	<u>1.3</u>	<u>.4</u>	<u>17.2</u>
TOTAL	<u>147.6</u>	<u>338.1</u>	<u>196.7</u>	<u>175.9</u>	<u>58.8</u>
GRAND TOTAL	6573.4	8509.4	6494.8	4665.1	6668.8

APPENDIX B

RESULTS OF MARKET SHARE ANALYSIS

APPENDIX B, TABLE 1

UNITED STATES WHEAT EXPORTS AND MARKET SHARES, ASIAN MARKET, 1959-61 TO 1970-72  
(Figures except percentages are thousand bushels)

Market	1959-61			1970-72			(3)x(4)	(5)-(7)
	Total	U.S.	%	Total	U.S.	%		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bangladesh	---	---	---	35164	13558	38.6	---	+13559
China, Republic of	11574	11243	97.1	23429	16975	72.3	22781	- 5805
Hong Kong	5364	918	17.1	6172	1249	27.4	1065	+ 625
India	128163	110819	86.5	58643	33143	56.5	50707	-17564
Indonesia	5842	2608	44.6	21678	13374	61.7	9663	+ 3711
Japan	100935	35237	34.9	187725	103507	55.1	65514	+37993
Korea, North	3674	---	---	17122	---	---	---	---
Korea, Republic of	13558	13558	100.0	66616	61950	93.0	66616	- 4666
Malaysia and Singapore	9590	183	1.9	21164	698	0.3	4005	- 3307
Pakistan	38287	33216	86.8	41888	31011	74.0	36376	- 5365
People's Rep. of China	82122	---	---	145947	7238	5.0	---	+ 7239
Phillipines	13485	8157	60.5	23846	16461	69.0	14440	+ 2021
Thailand	1102	37	3.3	3866	734	25.6	73	+ 661
Other Far East	20098	6503	32.4	60039	18018	30.8	119437	- 935
<b>Asian Total</b>	<b>433726</b>	<b>222448</b>	<b>51.3</b>	<b>698466</b>	<b>318864</b>	<b>45.6</b>	<b>290681</b>	<b>+28182</b>

Source: International Wheat Council, "World Wheat Statistics," (various issues).

## APPENDIX B, TABLE 2

COMPONENTS OF UNITED STATES WHEAT EXPORT GAIN  
IN THE ASIAN MARKET 1959-61 TO 1970-72

<u>Actual Exports</u>	<u>1959-61</u>	<u>1970-72</u>
Asia: Thousand Bus.	433726	698467
U.S.: Thousand Bus.	222448 (A <sub>1</sub> )	318864 (A <sub>2</sub> )
Market Share %	51.3	45.6
Potential Exports - 1959-61 Market Share at 1970-72 export level	358314 (B)	
1959-61 Market Shares in Individual Markets	290682 (C)	
<u>Gain for U.S.</u>	<u>Thousand Bus.</u>	<u>Percent</u>
Total Gain (A <sub>2</sub> -A <sub>1</sub> )	+96416	+100.0
"Size of Market" effect (B-A <sub>1</sub> )	+135866	+140.9
"Distribution" effect (C-B)	-67632	-70.1
"Competitive: effect (A <sub>2</sub> -C)	+28182	+29.2

APPENDIX B, TABLE 3

CANADIAN WHEAT EXPORTS AND MARKET SHARES, ASIAN MARKET, 1959-61 AND 1970-72  
(Figures except percentages are thousand bushels)

Market	1959-61			1970-72			(3)x(4) (7)	(5)-(7) (8)
	Total (1)	Canada (2)	% (3)	Total (4)	Canada (5)	% (6)		
Bangladesh	---	---	---	35164	3784	10.8	---	+ 3785
China, Republic of	11574	110	1.0	23429	1102	4.7	220	+ 882
Hong Kong	5364	1249	23.3	6172	955	15.5	1433	- 478
India	128163	4703	3.7	58643	20503	35.0	2167	+18335
Indonesia	5842	293	5.0	21678	1469	6.8	1102	+ 367
Japan	100935	50155	49.7	187724	46297	24.7	93293	-46996
Korea, North	3674	---	---	17122	1359	7.9	---	+ 1360
Korea, Republic of	13558	---	---	66616	---	---	---	---
Malaysia and Singapore	9590	587	6.1	21164	1028	4.9	1286	- 478
Pakistan	38287	2351	6.1	41888	4372	10.4	2572	+ 1800
People's Rep. of China	82122	33584	40.9	145947	118646	81.3	59672	+58974
Philippines	13485	4813	35.9	23846	6099	25.6	8524	- 2425
Thailand	1102	367	33.3	2866	146	5.1	955	- 808
Other Far East	20098	2425	12.1	60039	2351	3.9	7275	- 4924
Asian Total	433726	100715	23.2	698466	208118	29.8	178502	+29394

Source: International Wheat Council, "World Wheat Statistics," (various issues).

## APPENDIX B, TABLE 4

COMPONENTS OF CANADIAN WHEAT EXPORT GAIN  
IN THE ASIAN MARKET, 1959-61 TO 1970-72

<u>Actual Exports</u>	<u>1959-61</u>	<u>1970-72</u>
Asia: Thousand Bus.	433726	698467
Canada: Thousand Bus.	100715 <sup>(A<sub>1</sub>)</sup>	208228 <sup>(A<sub>2</sub>)</sup>
Market Share %	23.2	29.8
Potential Exports - 1959-61 Market Share at 1970-72 Export Level	162044 <sup>(B)</sup>	
1959-61 Market Shares in Individual Markets	178502 <sup>(C)</sup>	
<u>Gain for Canada</u>	<u>Thousand Bus.</u>	<u>Percent</u>
Total Gain (A <sub>2</sub> -A <sub>1</sub> )	+107513	+100.0
"Size of Market" Effect (B-A <sub>1</sub> )	+ 61329	+ 57.0
"Distribution" Effect (C-B)	+ 16458	+ 15.3
"Competitive" Effect (A <sub>2</sub> -C)	+ 29726	+ 27.6

APPENDIX B, TABLE 5

AUSTRALIAN WHEAT EXPORTS AND MARKET SHARES, ASIAN MARKET, 1959-61 TO 1970-72  
(Figures except percentages are thousand bushels)

Market	1959-61			1970-72			(3)x(4) (7)	(5)-(7) (8)
	Total (1)	Aus. (2)	% (3)	Total (4)	Aus. (5)	% (6)		
Bangladesh	---	---	---	35164	881	2.5	---	+ 4777
China, Republic of	11574	220	1.9	23429	5217	22.2	440	- 735
Hong Kong	5364	2939	54.8	6172	2645	42.8	3380	- 5365
India	128163	12603	9.8	58643	2094	3.6	5732	- 4409
Indonesia	5842	2278	39.0	21678	3196	14.7	8451	+ 1764
Japan	100935	14256	14.1	187725	36633	19.5	26455	+ 184
Korea, North	3674	1359	37.0	17122	955	5.6	6319	+10178
Korea, Republic of	13558	---	---	66616	4409	6.6	---	- 3638
Malaysia and Singapore	9590	7936	83.8	21164	19290	91.1	17526	- 331
Pakistan	38287	2608	6.8	41888	2461	5.9	2866	+ 37
People's Rep. of China	82122	38232	46.7	145947	20025	13.7	68160	- 5354
Philippines	13485	477	3.5	23846	881	3.7	845	-48135
Thailand	1102	661	60.0	2866	1910	66.7	1726	+ 882
Other Far East	20098	7679	38.2	60039	5651	9.4	22928	-17306
Asian Total	433726	91308	21.0	698466	106300	15.2	164833	-58534

Source: International Wheat Council, "World Wheat Statistics," (various issues).

## APPENDIX B, TABLE 6

COMPONENTS OF AUSTRALIAN WHEAT EXPORT GAIN  
IN THE ASIAN MARKET 1959-61 TO 1970-72.

<u>Actual Exports</u>	<u>1959-61</u>	<u>1970-72</u>
Asia: Thousand Bus.	433726	698467
Australia: Thousand Bus.	91309 <sup>(A<sub>1</sub>)</sup>	196300 <sup>(A<sub>2</sub>)</sup>
Market Share %	21.0	15.2
Potential Exports - 1959-61 Market Share at 1970-72 Export Level	146678 <sup>(B)</sup>	
1959-61 Market Shares in Individual Markets	164834 <sup>(C)</sup>	
<u>Gain for Australia</u>		
Total Gain (A <sub>2</sub> -A <sub>1</sub> )	+ 14991	+100.0
"Size of Market" Effect (B-A <sub>1</sub> )	+ 55369	+369.3
"Distribution" Effect (C-B)	+ 18156	+121.1
"Competitive" Effect (A <sub>2</sub> -C)	- 58534	-390.5

APPENDIX B, TABLE 7

UNITED STATES WHEAT EXPORTS AND MARKET SHARES, JAPANESE MARKET 1967 TO 1972  
(Figures except percentages are thousand bushels)

	1967			1972			(3)x(4)	(5)-(7)
	Total	U.S.	%	Total	U.S.	%		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Japan								
Durums	1049	746	71.1	1694	1694	100.0	1204	+ 490
Hards	73197	28120	38.4	92251	43566	47.2	35435	+8141
Semi-Hards	25904	22675	87.5	24393	19359	79.4	21344	-1985
Softs	43370	36705	61.6	62009	39793	64.2	38197	+1596
Total	143520	78246	54.5	180347	104412	57.9	96170	+8242

Source: Japanese Food Agency

APPENDIX B, TABLE 8

## CANADIAN WHEAT EXPORTS AND MARKET SHARES, JAPANESE MARKET, 1967 TO 1972

	1967			1972			(3)x(4)	(5)-(7)
	Total	Can.	%	Total	Can.	%		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Japan								
Durums	1049	303	28.9	1694	----	---	490	- 490
Hards	73197	41413	56.6	92251	44664	48.4	52214	- 755
Semi-Hards	25904	---	---	24393	---	---	---	---
Softs	43370	---	---	72009	---	---	---	---
Total	143520	41716	29.1	180247	44664	24.8	52704	- 804

Source: Japanese Food Agency

APPENDIX B, TABLE 9

AUSTRALIAN WHEAT EXPORTS AND MARKET SHARES, JAPANESE MARKET, 1967 TO 1972  
 (Figures except percentages are thousand bushels)

	1967			1972			(3)x(4) (7)	(5)-(7) (8)
	Total (1)	Aus. (2)	% (3)	Total (4)	Aus. (5)	% (6)		
Japan	1049	---	---	1694	---	---	---	---
Durums	73197	3664	5.0	92251	4021	4.4	4613	- 592
Hards	25904	3229	12.5	24393	2131	8.7	3049	- 918
Semi-Hards	43370	16665	38.4	62009	21841	35.2	23811	- 1970
Total	143520	23558	16.4	180347	27994	15.5	31473	- 3480

Source: Japanese Food Agency

## APPENDIX B, TABLE 10

COMPONENTS OF UNITED STATES WHEAT EXPORT GAIN  
IN THE JAPANESE MARKET, 1967 TO 1972

<u>Actual Exports</u>	<u>1967</u>	<u>1972</u>
Japan: Thousand Bus.	143520	180347
United States: Thousand Bus.	78246 <sup>(A<sub>1</sub>)</sup>	104412 <sup>(A<sub>2</sub>)</sup>
Market Share %	54.5	57.9
Potential Exports - 1967 Market Share at 1972 Export Level	98289 <sup>(B)</sup>	
1967 Market Shares in Individual Markets	96170 <sup>(C)</sup>	
<u>Gain for United States</u>	<u>Thous. Bus.</u>	<u>Percent</u>
Total Gain (A <sub>2</sub> -A <sub>1</sub> )	+26166	+100.0
"Size of Market" Effect (B-A <sub>1</sub> )	+20043	+ 76.6
"Distribution" Effect* (C-B)	- 2119	- 8.1
"Competitive" Effect (A <sub>2</sub> -C)	+ 8242	+ 31.5

\*In this case the "distribution" effect is really a "commodity" effect.

## APPENDIX B, TABLE 11

COMPONENTS OF CANADIAN WHEAT EXPORT GAIN  
IN THE JAPANESE MARKET, 1967 TO 1972

<u>Actual Exports</u>	<u>1967</u>	<u>1972</u>
Japan: Thous. Bus.	143520	180347
Canada: Thous. Bus.	42716 <sup>(A<sub>1</sub>)</sup>	44664 <sup>(A<sub>2</sub>)</sup>
Market Share %	29.1	24.8
Potential Exports - 1967 Market Share at 1972 Export Level	52481 <sup>(B)</sup>	
1967 Market Shares in Individual Markets	52704 <sup>(C)</sup>	
<u>Gain for Canada</u>	<u>Thous. Bus.</u>	<u>Percent</u>
Total Gain (A <sub>2</sub> -A <sub>1</sub> )	+ 2498	+100.0
"Size of Market" Effect (B-A <sub>1</sub> )	+10765	+365.2
"Distribution" Effect* (C-B)	+ 223	+ 7.6
"Competitive" Effect	- 8040	-272.7

\*In this case the "distribution" effect is really a "commodity" effect.

## APPENDIX B, TABLE 12

COMPONENTS OF AUSTRALIAN WHEAT EXPORT GAIN  
IN THE JAPANESE MARKET, 1967 TO 1972

<u>Actual Exports</u>	<u>1967</u>	<u>1972</u>
Japan: Thous. Bus.	143520	180347
Australia: Thous. Bus.	23558 <sup>(A<sub>1</sub>)</sup>	27933 <sup>(A<sub>2</sub>)</sup>
Market Share %	16.4	15.5
Potential Exports - 1967 Market Share at 1972 Export Levels	29577 <sup>(B)</sup>	
1967 Market Shares in Individual Markets	31473 <sup>(C)</sup>	
<u>Gain for Australia</u>	<u>Thous. Bus.</u>	<u>Percent</u>
Total Gain (A <sub>2</sub> -A <sub>1</sub> )	+ 4435	+100.0
"Size of Market" Effect (B-A <sub>1</sub> )	+ 6019	+135.7
"Distribution" Effect* (C-B)	+ 1896	+ 42.8
"Competitive" Effect (A <sub>2</sub> -C)	- 3480	- 78.5

\*In this case the "distribution" effect is really a "commodity" effect.

APPENDIX C

DATA USED IN REGRESSION EQUATIONS

## APPENDIX C, TABLE 1

## PRICE RATIOS USED IN REGRESSIONS

Year	<u>U.S. Hard</u> <u>Can. Hard</u>	<u>U.S. All Classes</u> <u>All Others-All Classes</u>	<u>U.S. Hard &amp; Semi-Hard</u> <u>Can. Hard &amp; Semi-Hard</u>
1959	0.994	0.953	0.986
1960	0.996	0.963	0.970
1961	0.967	0.952	0.974
1962	0.890	0.899	0.756
1963	0.959	0.961	0.950
1964	0.949	0.955	0.946
1965	0.944	0.925	0.917
1966	0.954	0.953	0.945
1967	0.956	0.962	0.950
1968	0.949	0.975	0.970
1969	0.946	0.972	0.947
1970	0.953	0.883	0.940
1972	-----	-----	0.935

## APPENDIX C, TABLE 2

## QUANTITY RATIOS USED IN REGRESSIONS

<u>Year</u>	<u>U.S. Hard Can. Hard</u>	<u>U.S. All Classes All Others-All Classes</u>	<u>U.S. Hard &amp; Semi-Hard Can. Hard &amp; Semi-Hard</u>
1959	0.102	0.494	0.168
1960	0.016	0.463	0.130
1961	0.069	0.460	0.241
1962	0.084	0.593	0.377
1963	0.323	1.005	0.750
1964	0.285	0.837	0.671
1965	0.567	1.183	0.929
1966	0.514	1.039	0.806
1967	0.859	1.199	1.127
1968	0.604	0.730	0.677
1969	0.893	1.077	1.101
1970	1.315	1.511	1.841
1972	-----	-----	1.220

APPENDIX C, TABLE 3

OTHER EXPLANATORY VARIABLES USED IN REGRESSIONS

Year	<u>Japanese Exports to United States</u> Japanese Exports to Canada	<u>Japanese Exports to United States</u> Japanese Exports to Canada and Australia	<u>United States Hard Wheat Stocks</u> Canadian Total Wheat Stocks	Japan Wheat Depen Rate
1959	9.016	5.350	2.019	0.6
1960	9.239	4.183	2.033	0.6
1961	9.147	4.919	2.206	0.6
1962	11.098	5.290	3.253	0.6
1963	12.073	5.327	2.322	0.8
1964	11.081	4.603	1.852	0.7
1965	11.562	4.698	1.427	0.7
1966	11.608	5.365	1.079	0.8
1967	10.986	4.758	0.634	0.8
1968	11.799	5.358	0.686	0.8
1969	10.306	5.182	0.804	0.8
1970	10.585	5.155	0.745	0.9
1972	-----	-----	1.267	0.95

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