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Determinants of Wheat Import Demand

Agriculture
and Trade
Analysis
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Terri Raney
Nancy Morgan

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South Korea: Determinants of Wheat Import Demand. Terri Raney and Nancy Morgan.
Agriculture and Trade Analysis Division and Commodity Economics Division, Economic Research
Service, U.S. Department of Agriculture. Staff Report AGES 9330.

Abstract

The Korean wheat import market includes a stable, quality-conscious milling segment of about 2 million tons and a volatile, price-sensitive feed wheat segment. The U.S. share of the milling wheat market was virtually 100 percent until 1983, but has dropped to 80 percent following the termination of a government-mandated import monopoly. The primary reason for the decline is that Australian wheats provide specific and more consistent intrinsic characteristics, such as protein quantity and gluten strength, required for the various noodles, breads, and snacks consumed in Korea. Dockage is not an important determinant of Korean wheat import demand.

Keywords: South Korea, wheat, grain quality, protein, dockage, import demand

The authors appreciate the assistance of the late Robert McConnell, former U.S. Agriculture Minister-Counselor in South Korea, and his staff, particularly Mr. Robert Macke and Mr. Choi. Lois Caplan, John Dyck, and Alan Webb provided thoughtful comments and suggestions. Wilma Davis prepared the tables and figures.

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Preface

This report is 1 of 17 reports covering 18 wheat-importing countries prepared by the Economic Research Service (ERS) in support of a comprehensive study of cleaning U.S. wheat destined for export. Similar reports are forthcoming for corn and soybeans.

The Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA) required the Federal Grain Inspection Service (FGIS) to establish or amend grain grades and standards to include, "...economically and commercially practical levels of cleanliness." The legislation required FGIS to determine if the benefits of cleaning exceeded the costs. FGIS subsequently asked ERS to conduct the study. The comprehensive study on wheat included two major components: 1) economic-engineering studies of the cost of wheat cleaning in the United States and estimates of domestic benefits from cleaning and 2) a series of in-country interviews of buyers in major wheat-importing countries to determine the effects of cleaner U.S. wheat on sales in these markets.

The results of this work have been prepared in a three-volume set:

"Economic Implications of Cleaning Wheat in the United States" (AER-669), by B.T. Hyberg, M. Ash, W. Lin, C. Lin, L. Aldrich, and D. Pace;

"The Role of Quality in Wheat Import Decisionmaking" (AER-670), by Stephanie Mercier; and

"The Costs and Benefits of U.S. Cleaning Wheat: Overview and Implications" (AER-675), by William Lin and Mack Leath.

The 18-country case studies form the foundation for the results of the international component of the wheat-cleaning study. The 18 countries studied accounted for 58 percent of world wheat imports and 63 percent of U.S. wheat sales in 1991. Each report has two components: background on the wheat-marketing policies, institutions, and distribution system in the wheat-importing country and results of interviews of wheat traders, processors, and government officials. All the interviews were completed during April-September 1992, and all followed a similar format. Each interview team consisted of both a commodity specialist and a country specialist. They attended a series of seminars on grain quality issues, data collection, and interview procedures before doing their interviews.

All the interviews followed a specific set of guidelines. An advisory panel of government officials, private traders and trade association members helped develop the questions, which consisted of five topic areas:

- The most important factors in the choice of a supplier country;
- Quality factors most important to the importer's purchase decisions and the importer's perception of wheat purchased from their suppliers;
- Contract specifications the importer uses to communicate preferences;
- The level of dockage in the shipments the importer receives and the costs of removing it; and
- If U.S. wheat were cleaner, would the importer purchase more and/or be willing to pay more?

The background information on the wheat-importing country and the responses from the interviews provide a unique insight into the role of quality factors in the wheat purchase decisions of the major importers of U.S. wheat.

Alan J. Webb
Coordinator, Country Case Studies

Reports in the Series, "Determinants of Wheat Import Demand"

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Summary

Korea produces almost no wheat, relying on imports for virtually its entire supply. Liberalization of the wheat import system began in 1983 and was completed in January 1990. There are no direct import barriers against wheat. The Korean wheat market includes a stable, quality-conscious milling wheat segment of about 2.0 million metric tons and a volatile, price-sensitive feed wheat sector of up to 2.5 million metric tons per year. The U.S. share of the Korean milling wheat import market was virtually 100 percent until 1983, but dropped to 80 percent by 1991 and is projected to decline further.

The Korea Flour Millers Industry Association (KOFMIA) and the three largest flour millers in Korea were surveyed during the study. The three flour millers purchase approximately 70 percent of Korea's annual milling-wheat imports, and KOFMIA purchases approximately 15 percent of the total on behalf of smaller millers. The millers surveyed in the study report that wheats with specific intrinsic characteristics are required for the various wheat products consumed in Korea. The biggest problems facing U.S. milling wheat concern protein levels and variability. Korean millers report that protein levels in U.S. western white (WW) wheat have drifted upward over the years from 9.5-10 percent to an unacceptably high 10.5-11 percent. Protein levels in U.S. dark northern spring (DNS) wheat, on the other hand, have drifted downward. Millers report undesirable variability in protein quantity and quality over years, within marketing years, and within shiploads. They express strong dissatisfaction with the Federal Grain Inspection Service's Cu-sum method, which allows individual sublots of a grain shipment to deviate slightly from grade specifications as long as the cumulative sum of deviations does not exceed a certain level. Australian and Canadian wheats reportedly provide the desired intrinsic characteristics with less variability.

Dockage is not a major quality issue in the Korean market. Millers complained that nonmillable materials in U.S. wheat exceed the amount found in Australian wheats and that the U.S. system for dealing with wheat quality complaints is inadequate. The millers noted, however, that their contracts specify "all dockage deductible," and that the cleaning of all wheat is an integral part of the milling process. Dockage is an irritant, but not a determining factor in Korean sourcing decisions.

The availability of GSM credit guarantees is important for Korean wheat buyers, because domestic sources of credit are inadequate. Flour millers provide financing to their customers for up to 6 months, while the normal letters of credit available to them for importing wheat are valid for only 60 days. The Korean Ministry of Finance has reduced the term for GSM credit guarantees from 12 to 6 months for FY 1993, and is expected to eliminate GSM entirely for FY 1994. Millers stated that they would likely reduce their imports of U.S. wheat if GSM credits were eliminated.

Testing for pesticide residues is a regulatory problem in Korea. The Korean Ministry of Health recently adopted stringent tolerance levels for agricultural chemical residues and began testing wheat imports for 24 chemicals. The tolerance levels are not consistent with internationally accepted standards, and the required tests have caused delays in the customs clearance process for wheat from the United States and other sources.

South Korea:

Determinants of Wheat Import Demand

Terri Raney and Nancy Morgan

Introduction

South Korea is one of Asia's highest income countries, with a population of 43.4 million and per capita gross domestic product (GDP) of about \$6,500. Korea has one of the world's fastest growing economies, averaging 9.8-percent real annual GDP growth since 1985 (table 1). Since 1971, real GDP has increased almost fivefold, and per capita incomes have almost quadrupled. Industrial development and urbanization have transformed the Korean economy and society in the span of one generation. The agricultural sector, in contrast, remains relatively undeveloped, and its contributions to GDP and total employment are shrinking rapidly. In 1971, agriculture accounted for 27 percent of GDP and 47 percent of total employment. By 1991, agriculture contributed 9 percent of GDP and 18 percent of total employment.

Economic growth has slowed somewhat from the double-digit rates of the 1980s, but is expected to remain above 5 percent through 1993. Rising labor costs and stiff competition from Southeast Asia and China are forcing the Korean economy to restructure away from traditional industries, such as low-value shoe manufacturing and textiles, toward higher value manufactured products and services. Inflation approached 10 percent a year in 1990 and 1991, and is estimated at about 5 percent for 1992. Strong demand for imported goods by Korean consumers and slack exports due to economic weakness in world markets produced a large current account deficit in 1991. The current account deficit is estimated at \$5.6 billion for 1992, down from \$8.7 billion the previous year.

The South Korean Government subsidizes the agricultural sector through producer price supports, government purchases, import barriers, and land-use restrictions. Rice and vegetables are the dominant commodities produced in Korea, with rice the staple grain in the Korean diet. Livestock production is increasing, especially dairy and poultry.

Wheat Supply and Demand Trends

Korea relies on imports for virtually its entire wheat supply. The Korean wheat market includes a rather stable, quality-oriented milling wheat segment of about 2 million tons per year, and a volatile, price-sensitive feed wheat segment which ranges from 0 to 2.8 million tons per year (table 2). Korea exports a small but growing quantity of flour and bakery mixes, primarily to Japan.

Table 1--South Korea: Economic indicators

Item	Unit	1985-89 average	1990	1991	1992
Gross domestic product:					
In current prices	Bil. won	110,733	172,724	208,201	231,727
In current prices	Bil. \$	139	244	284	297
Per capita	\$	3,348	5,693	6,561	6,808
In 1985 prices	Bil. won	101,498	131,503	142,633	149,463
Change	Percent	9.8	9.2	8.5	4.8
Domestic prices:					
Wholesale price index (1985=100)		100.5	107.5	113.3	115.7
Change	Percent	0.8	4.2	5.4	2.1
Consumer price index (1985=100)		108.4	130.2	142.8	151.7
Change	Percent	4.5	8.6	9.7	6.2
Balance of payments:					
Imports	Mil. \$	43,111	66,141	77,202	77,438
Change	Percent	12.6	19.8	16.7	0.3
Exports	Mil. \$	45,794	65,016	71,870	76,632
Change	Percent	12.2	9.9	10.5	6.6
Foreign debt	Mil. \$	8,568	7,853	7,773	N/A
Debt/total receipts	Percent	-1.2	8.8	8.8	N/A
Exchange rate	Won/\$	795.4	707.8	733.4	780.7
Population	Mil.	41.6	42.9	43.3	43.6
Change	Percent	1.0	1.0	0.9	0.8

N/A = Not available.

Source: International Financial Statistics, International Monetary Fund.

Table 2--South Korea: Supply and use of wheat

Year	Production	Opening stocks	Imports	Consumption	Feed use	Food use	Per capita cons.	Imports from U.S.	U.S. share of imports	U.S. share of food use
----- 1,000 tons -----							Kgs	1,000 tons	Percent	Percent
1960	159	0	361	520	18	502	20.3	336	93	67
1961	172	0	413	585	22	563	22.0	362	88	64
1962	164	0	913	1,077	33	1,044	39.5	667	73	64
1963	139	0	834	973	34	939	34.5	679	81	72
1964	190	0	528	718	28	690	24.7	351	66	51
1965	184	0	600	784	30	754	26.3	527	88	70
1966	193	0	654	847	32	815	27.7	544	83	67
1967	211	0	1,126	1,242	40	1,202	39.9	1,026	91	85
1968	224	95	1,369	1,402	40	1,362	44.2	1,369	100	101
1969	219	286	1,254	1,421	40	1,381	43.8	1,254	100	91
1970	196	338	1,659	1,656	40	1,616	50.1	1,659	100	103
1971	149	262	1,778	2,033	40	1,993	60.6	1,742	98	87
1972	100	156	1,772	1,896	40	1,856	55.4	1,587	90	86
1973	74	132	1,584	1,497	40	1,457	42.8	1,584	100	109
1974	97	136	1,711	1,704	27	1,677	48.3	1,711	100	102
1975	82	113	1,857	1,816	20	1,796	50.9	1,476	79	82
1976	45	236	1,989	1,981	22	1,959	54.6	1,989	100	102
1977	36	279	1,730	1,691	20	1,671	45.9	1,730	100	104
1978	42	211	1,674	1,741	20	1,721	46.5	1,674	100	97
1979	42	164	1,845	1,874	7	1,867	49.7	1,845	100	99
1980	92	142	2,095	2,069	7	2,062	54.1	1,997	95	97
1981	57	260	1,868	1,983	7	1,976	51.0	1,848	99	94
1982	66	202	1,880	1,980	5	1,975	50.2	1,846	98	93
1983	112	168	2,351	2,356	366	1,990	49.8	1,979	84	99
1984	17	275	3,111	2,988	973	2,015	49.7	2,107	68	105
1985	11	415	3,032	3,145	1,104	2,041	49.7	1,761	58	86
1986	5	313	3,895	3,848	1,788	2,060	49.6	1,983	51	96
1987	4	365	4,459	4,287	2,087	2,200	52.4	2,056	46	93
1988	2	541	2,822	3,288	1,225	2,063	48.7	1,849	66	90
1989	1	77	2,009	2,000	42	1,958	45.9	1,530	76	78
1990	1	87	4,206	3,550	1,527	2,023	47.0	1,749	42	86
1991	0	744	4,396	4,830	2,821	2,009	46.4	1,523	35	76
1992	1	268	3,895	3,420	1,432	1,988	45.5	1,461	38	73
1993	1	744	4,500	4,500	2,500	2,000	N/A	N/A	N/A	N/A

N/A=Not available

Source: USDA.

The Korea Flour Millers Industry Association (KOFMIA) is an industry association representing Korea's flour mills. Until September 1983, KOFMIA exercised a government-mandated import monopoly for wheat. KOFMIA, in consultation with the Ministry of Agriculture, Forestry, and Fisheries (MAFF), determined the total quantity and grades of wheat to be imported. KOFMIA imported the wheat and distributed it among the flour mills. The Korean Government terminated KOFMIA's import monopoly in September 1983, but MAFF continued to set total import quotas and KOFMIA retained the power to allocate the import quotas among member mills. The mills gained the right to make direct purchases of wheat on the world market, within their allocated quotas, and to specify wheat grades and quality standards according to their needs. The wheat import system was completely liberalized in January 1990, and there are currently no direct government barriers to wheat consumption or trade.

Production

South Korea has historically produced between 150,000 and 200,000 tons of wheat per year to supply a small domestic market for traditional noodles. Domestic production dwindled sharply in the 1970s and 1980s, and fell below 1,000 tons by 1991. Korean agricultural policy has traditionally focused on subsidizing rice production and consumption, with the result that production of other commodities, including wheat, has been discouraged relative to rice. Korean wheat production peaked at 224,000 tons in 1968 but has dropped to negligible levels in recent years.

Consumption

Korean consumption of milling wheat has been fairly stable at about 2 million tons per year since the early 1970s (fig. 1). Feed wheat imports were negligible until 1984, and have ranged from 0 to 2.8 million tons per year since then. The Korean Government does not directly restrict wheat consumption or imports. Korean rice policies may indirectly constrain the growth of wheat demand, but their net impact is difficult to assess. The government actively encourages rice consumption through promotional campaigns and regulatory requirements, but consumer prices for rice are significantly higher than world prices because of trade barriers and domestic supports to rice producers. Economic Research Service (ERS) calculations of consumer subsidy equivalents (CSE) show that quantifiable Korean rice policies have the effect of an ad valorem tax of about 83 percent (1990) on consumer prices. The comparable tax on consumer wheat prices was only about 6 percent. Per capita rice consumption, at almost 125 kilograms per year, is much higher than in Japan and Taiwan, where annual per capita consumption has fallen to about 70 kilograms.

Feed Use

Feed use of wheat was negligible--between 5,000 and 40,000 tons per year--until the early 1980s when policy and market forces combined to make feeding wheat economically feasible. In September 1983, KOFMIA's import monopoly ended, allowing feed compounders to import wheat directly for the first time. Feed use increased steadily through the mid-1980s and, although the amount of wheat used in feed is highly variable from year to year, it accounts for more than half of total wheat disappearance in some years. Korean feed millers use state-of-the-art technology to produce least-cost feed rations and are capable of changing inputs quite rapidly in response to changing relative prices. Feed millers claim that Korean livestock farmers prefer lower prices even at lower feed-value. According to Korean feed millers, feed use of wheat depends almost exclusively on the relative prices of wheat and corn. Figure 2 shows monthly relative prices for feed wheat and corn in Korea from October 1986 through April 1991, charted against feed wheat and corn imports. When the wheat/corn price ratio drops below 0.9, feed wheat imports strengthen. To paraphrase one feed miller, "When the price of any feed drops below \$100 per ton, we buy it."

Figure 1
South Korea: Wheat consumption

Million metric tons

6.0

5.0

4.0

3.0

2.0

1.0

0

1960

65

70

75

80

85

90

Total consumption

Feed use

5

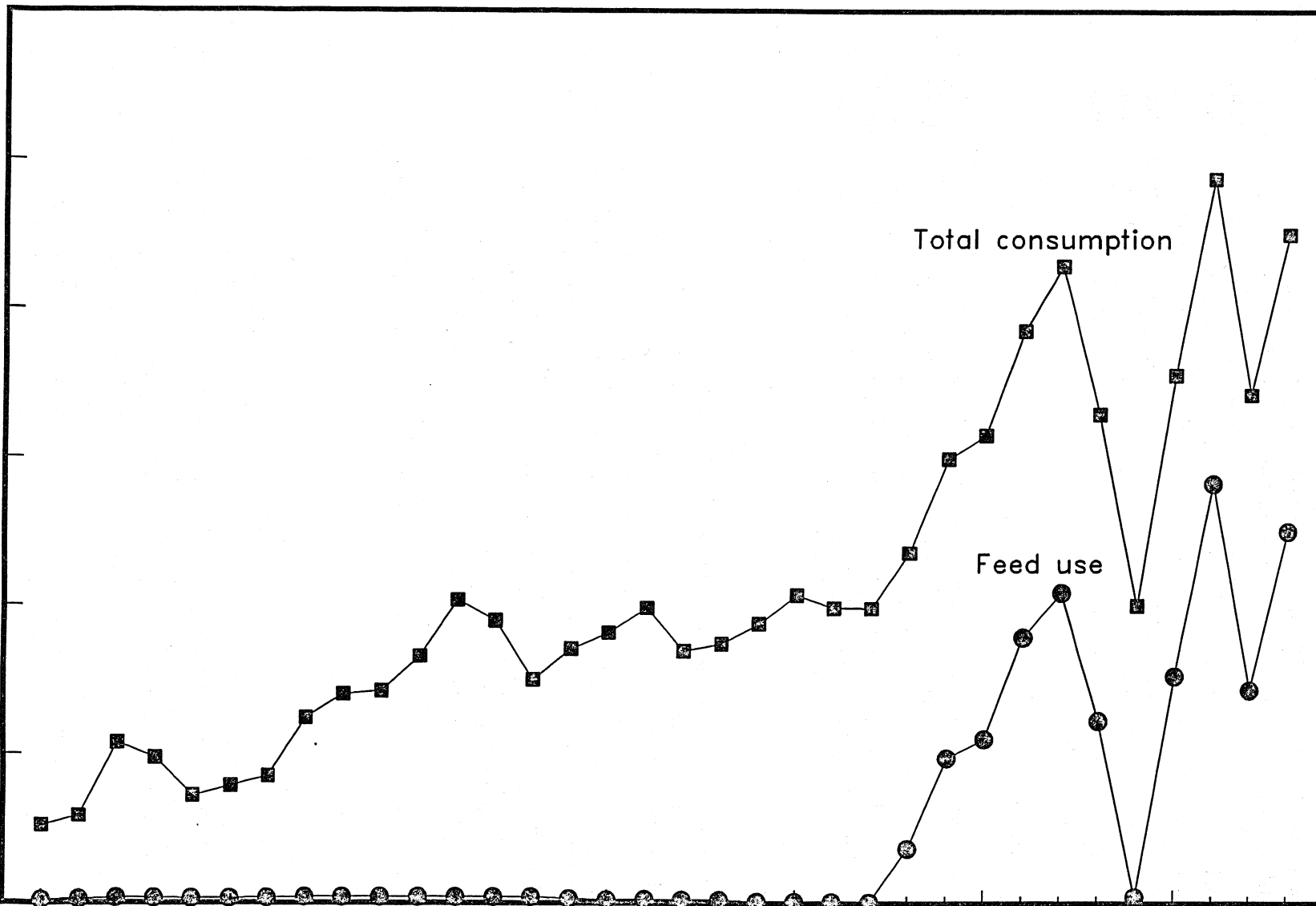
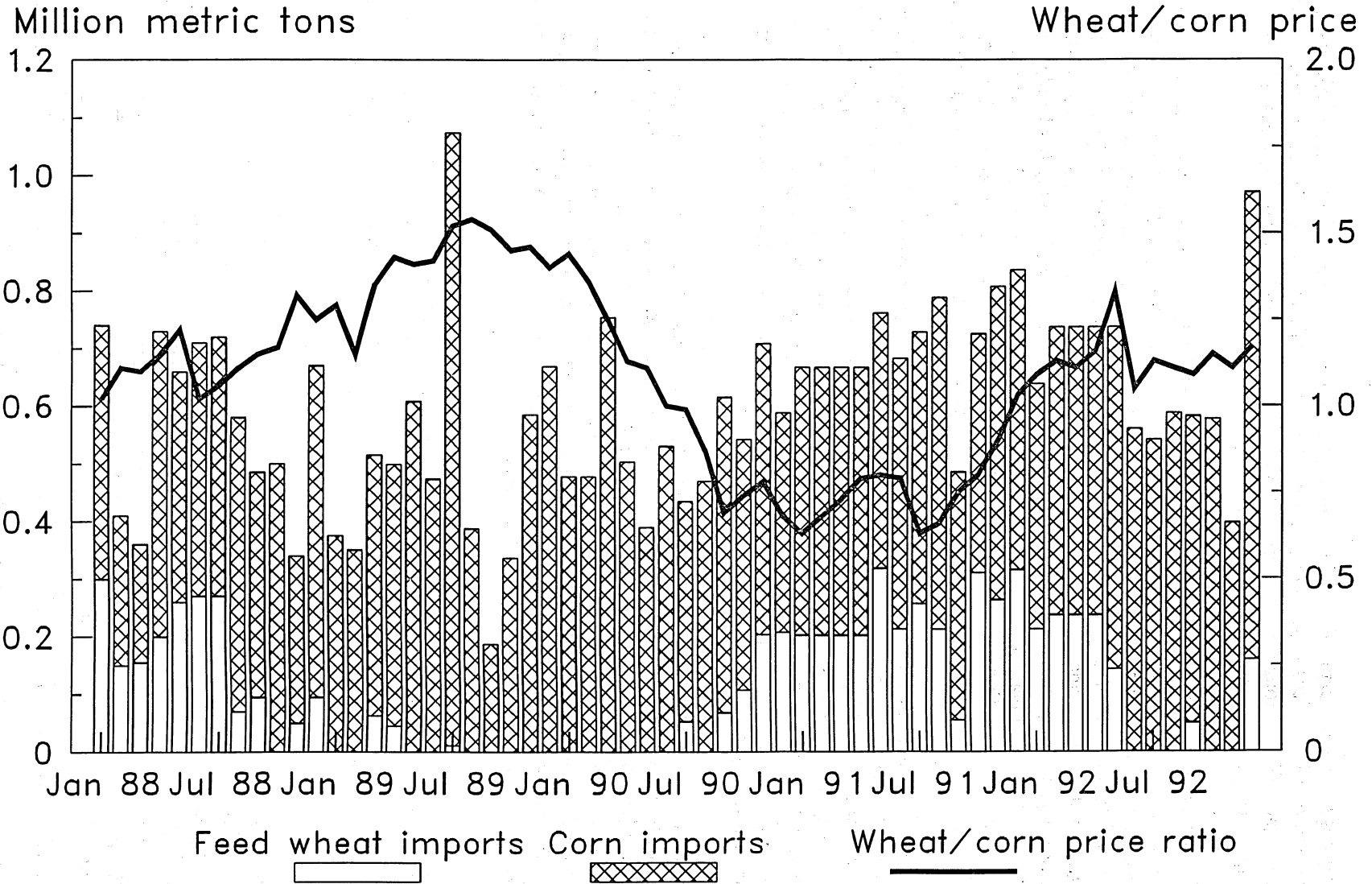


Figure 2
 South Korea: Feed Wheat and Corn Imports
 and Relative Prices



Food Use

Aggregate and per capita food use of wheat increased very rapidly during the 1950s and 1960s in response to low prices and rising incomes. Food use stabilized in the 1970s at about 2 million tons per year. Wheat flour consumption in Korea, at 32 kilograms per person, is slightly higher than in Japan and Taiwan, and about half the U.S. level.

Korean consumers eat a wide variety of wheat-based foods, including raised breads, pastries, noodles, beverages, and puffed snacks. The flour milling industry is very sophisticated, with the largest mill producing more than 50 types of flour, each with specific end-use characteristics. About 49 percent of milling wheat is used for noodles, including instant "ramen" noodles, flat buckwheat noodles, other traditional noodles, and Italian pasta (table 3). About 22 percent is used for bread and confectionery. Korean consumers increasingly prefer European-style raised breads, often hard rolls made from whole wheat, rye, and other mixed grains, rather than American-style pan breads. Confectionery items include a range of French pastries and traditional Korean cookies and snacks. The remainder of Korean milling wheat consumption goes into home use and a variety of processed products.

A mildly fermented traditional beverage called makkoli accounted for almost 20 percent of milling wheat consumption in 1985. Makkoli is still a popular beverage, but its share of total wheat consumption is falling as processors respond to Korean Government incentives to increase rice consumption. A recent regulatory change in Korea has permitted the use of rice in makkoli production, and price subsidies on old-crop rice are making it cheaper than wheat as a base for makkoli. In 1991, rice largely displaced wheat in makkoli production, and continued rice subsidies are likely to keep wheat uncompetitive.

Korean flour production is changing rapidly as consumers' incomes and quality standards rise. Flour is being milled increasingly to meet specific end-use requirements. Table 4 shows flour production in Korea by category since 1981. Data are available for only 5 broad categories of flour, although as many as 50 different types of wheat flour are being produced. Since 1981, all-purpose flour has declined as a share of total production from almost 90 percent to 65 percent. Bread and cake flours have each increased to about 15 percent of production, with special composite blends and whole grain flour accounting for the remaining 5 percent.

Table 3--South Korea: Milling wheat consumption by end-use

Item	1986	1987	1988	1989	1990	1991
	Percent					
Noodles	40.5	42.3	41.5	38.2	42.9	48.6
Bread and confectionery	29.4	29.3	24.8	23.6	24.7	22.3
Makkoli	18.1	12.6	14.5	12.2	7.3	4.8
Soy sauce	2.7	2.4	3.8	2.7	3.7	3.7
Home use	1.4	5.8	1.3	7.5	4.8	2.9
Industrial use	3.9	4.6	4.6	4.8	4.2	2.8
Other	4.0	3.0	9.5	11.0	12.4	14.9

Source: Korea Flour Millers Industry Association (KOFMIA)

Table 4--South Korea: Flour production and share of total, by type

Year	All Purpose Flour		Bread Flour		Cake Flour		Composite Flour*		Total
	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share	
	Metric tons	Percent	Metric tons	Percent	Metric tons	Percent	Metric tons	Percent	
1981	1,273,000	88.6	96,000	6.7	66,000	4.6	--	--	1,437,000
1982	1,221,000	85.5	113,000	7.9	94,000	6.5	--	--	1,429,000
1983	1,221,000	82.5	147,000	10.0	112,000	7.5	--	--	1,480,000
1984	1,255,000	81.6	165,000	10.8	117,000	7.6	--	--	1,537,000
1985	1,299,000	80.5	178,000	11.0	137,000	8.5	--	--	1,614,000
1986	1,186,000	74.4	184,000	11.5	165,000	10.3	60,000	3.8	1,595,000
1987	1,159,000	70.9	189,000	11.6	178,000	10.9	108,000	6.6	1,634,000
1988	1,162,000	69.7	221,000	13.3	174,000	10.4	110,000	6.6	1,667,000
1989	1,018,000	67.6	209,000	13.9	184,000	12.2	95,000	6.3	1,506,000
1990	996,000	65.9	235,000	15.5	214,000	14.2	67,000	4.4	1,512,000
1991	951,000	65.3	223,000	15.3	213,000	14.6	71,000	4.8	1,458,000

-- = less than 1,000 tons or 0.1 percent.

* Includes special blends and whole grain flours.

Source: KOFMIA

Exports

Korea exports a small but growing quantity of flour and bakery mixes, primarily to Japan (69,000 tons, wheat equivalent, in 1991). The scope for continued exports depends on trade policy developments in Japan and other potential markets.

Imports

Import Market Shares

The U.S. share of the Korean milling wheat import market was virtually 100 percent until 1983, when private importers were permitted to enter the market. The U.S. market share dropped to 80 percent by 1991, and is projected to decline further in the near future. U.S. milling wheat has been displaced in the Korean market primarily by Australian wheat, including Australian standard white (ASW), Australian hard (AH), and Australian soft (AS). Canadian western red spring (CWRS) 13.5-percent protein wheat has begun to make inroads and will probably capture a larger share of the market as the Korean baking industry becomes increasingly sophisticated (table 5). Wheat used in animal feed rations enters Korea from a variety of sources and is usually poor quality wheat, damaged by drought, frost, storage, or other factors that make it unsuitable for milling. Canada, the European Community, Australia, and Turkey are the primary suppliers of feed wheat to Korea. Of those exporters, only Canada and Australia supply any milling wheat to the Korean market.

Wheat Class and Quality Preferences

The wide range of wheat products consumed in Korea implies a demand for a variety of wheats to satisfy many end-use requirements. Levels and consistency of protein content and gluten strength are the most important wheat quality characteristics in the Korean milling industry. Each type of bread, noodle, and snack requires specific protein and gluten characteristics. Whole-grain raised rolls require very high protein wheat flour made from wheats with minimum protein of 13.5 to 14.5 percent. High-protein wheat with strong gluten is necessary to give the doughs enough strength to rise and to maintain their shape during baking. Instant noodles, in contrast, require wheat with

Table 5--South Korea: Milling wheat imports by supplier and class, 1990 and 1991

Origin	Class	Specified protein	1990		1991		
			Quantity	Share of total	Quantity	Share of total	
		Percent	Metric tons	Percent	Metric tons	Percent	
United States	Western white		815,738	39.0	737,219	35.3	
	Western white	9.5 max	8,621	0.4	57,882	2.7	
	Western white	10.0 max	79,552	3.8	5,500	0.3	
	Hard red winter	11.5 min	467,120	22.3	489,439	23.4	
	Hard red winter	13.0 min	--	--	1,100	0.1	
	Hard white		--	--	937	--	
	Soft red winter		500	--	550	--	
	Dard northern spring	14.0 min	--	--	--	--	
	Dark northern spring	14.3 min		96,198	4.6	102,375	4.9
	Dark northern spring	14.5 min		301,579	14.4	267,266	12.8
	Subtotal		1,769,308	84.5	1,662,268	79.5	
Australia	Standard white		139,456	6.7	216,528	10.3	
	Soft		161,508	7.7	120,898	5.8	
	Hard		13,591	0.6	39,552	1.9	
	Subtotal		314,555	15.0	376,948	18.0	
Canada	Western red spring	13.5 min	1,172	0.1	42,000	2.0	
	Western red spring	14.5 min	5,000	0.3	--	--	
	Western red spring		--	--	2,990	0.1	
	Western red winter		2,820	0.1	7,700	0.4	
	Prairie spring		--	--	86	--	
	Subtotal		8,992	0.5	52,776	2.5	
All sources	Total		2,092,885	100.0	2,091,992	100.0	

-- = less than 1 ton or 0.1 percent.

Source: KOFMIA

maximum protein of about 10 percent. A new product in the Korean snack market, puffed pretzels, require very low protein wheat, below 9 percent. Each final product requires different and quite specific flour characteristics. Variations in wheat protein quantity and gluten strength are troublesome to an industry that must guarantee specific flour characteristics to its customers. U.S. wheats of all classes were criticized as being too variable in terms of protein content and gluten quality.

In addition to protein requirements, noodle makers have other specific quality demands. Viscosity, measured in Korea by "amylograph" numbers, relates to the texture of instant noodles. Low amylograph numbers (below about 800) imply low viscosity and a tendency for the noodles to dissolve during cooking. Flour color is important in the noodle industry, with a bright white or slightly yellow tint preferred by consumers. Millers expressed a preference for Australian standard white wheat, which imparts the desired color without bleaching or tinting. U.S. western white wheat reportedly does not have the desired slightly yellow color found in ASW. Flour color is not an issue when producing bread flours for the Korean market.

U.S. and Competitor Programs

The U.S. Government provided extensive concessional wheat sales to Korea under the PL-480 program and other food aid programs from the mid-1950s through 1981. From 1956 to 1963, almost all of Korea's wheat imports were under the PL-480 program, ranging from a low of 32,000 metric tons to a high of 756,000 metric tons in 1963. PL-480 was gradually phased out so that by 1974 all Korean wheat imports were on a commercial basis. From 1976 through 1981, some additional PL-480 wheat was made available to Korea, but most of its imports remained on a commercial basis. The last PL-480 shipments to Korea were made in 1981, but the United States continued to dominate the market as long as the Korean Government, through KOFMIA, controlled wheat imports. A combination of political influence and customer familiarity kept the KOFMIA buying U.S. wheat long after millers, noodle makers, and bakers had discovered wheats better suited to their needs. When KOFMIA's import monopoly was lifted, Korean millers were ready to buy from other than U.S. sources.

Since 1981, all Korean imports from the United States have been on a commercial basis; however, extensive GSM-102 credit guarantees have been made available to Korean importers. In 1992, Korea received \$155 million in GSM-102 credit guarantees for wheat imports, second only to the amount available to the former Soviet Union. The availability of GSM-102 credits was widely cited by those we interviewed in Korea as an important factor influencing purchasing decisions. Korea is not eligible for the Export Enhancement Program (EEP) and Australia and Canada do not provide direct price or credit subsidies to Korean importers.

Marketing and Distribution

Wheat marketing in Korea is conducted by private firms engaged in milling, baking, noodle-making, and other food processing activities. The largest mills establish minimum and maximum wholesale prices for wheat flour. The government price control system was abolished in 1983, but price-setting by the large mills continues. Individual mills have some price-setting flexibility, but competition is based more on quality and service than on price.

Organization of the Import System

As mentioned above, KOFMIA was the sole importing agent for wheat in Korea until September 1983. KOFMIA imported wheat almost exclusively from the United States and distributed it to member flour mills. Individual mills had little influence on purchase decisions regarding wheat class

and quality. Since KOFMIA's import monopoly ended, Korea's three largest mills began directly importing wheat on world markets. KOFMIA still serves as the purchasing agent for some smaller mills, while other small mills purchase collectively, either with each other or with larger mills. The three largest mills account for about 75 percent of the milling wheat imported into Korea. KOFMIA handles about 15 percent on behalf of smaller mills, and the remaining 10 percent is imported collectively by small and mid-sized milling companies.

Wheat imports from the United States are tendered on an open-bid basis, while Australian and Canadian wheats are contracted for through private negotiations with the Wheat Boards. Open tenders are required for U.S. wheat to comply with GSM-102 regulations. Negotiations with the Australian and Canadian Wheat Boards allow the importers to assess specific price and quality tradeoffs with more flexibility than is possible under GSM-102. The Korean Government requires that all wheat import contracts specify all dockage deductible.

Technical milling experts at each milling company decide what quantity and quality of wheat to purchase based on the flour end-use requirements being demanded by the baking and noodle-making industries. Price decisions are made in the purchasing departments of each firm, either through the open-bid process or through negotiations. Quality factors, rather than price, dominate the purchase decisions of the private mills. KOFMIA still imports exclusively from the United States.

All Korean wheat imports from the United States are purchased on an f.o.b. basis, and are carried on Korean flagships, almost all by Pan Ocean Freight. Australian wheats are purchased c.i.f., and no single carrier dominates the trade. The practice of buying U.S. wheat on an f.o.b. basis and shipping via Pan Ocean Freight developed when KOFMIA's import monopoly was operating.

Domestic Milling, Baking, and Noodle-Making Industries

There are 11 flour milling companies in Korea, all privately owned, operating 13 milling plants, with annual milling capacity of more than 3 million tons. The three largest mills control about 70 percent of the domestic flour market (their import share is larger because they regularly purchase wheat on behalf of smaller mills). The large flour mills are all owned by large corporate conglomerates engaged in a wide variety of businesses, including sugar processing, feed milling, pharmaceuticals, and other industries. Flour mills are prohibited by law from owning or operating bakeries and noodle-making facilities.

The largest milling firms and KOFMIA control the handling and distribution of wheat from port to mill to food processor. Government inspectors check wheat shipments for compliance with pesticide residue standards, and the individual mills inspect each shipment for compliance with contract specifications. Each mill has its own storage facilities. Most mills are located near the ports of Pusan and Inchon.

The flour mills, in cooperation with KOFMIA, control wholesale flour prices. Despite being dominated by three very large firms, the Korean milling industry is somewhat competitive. Milling capacity exceeds 3 million tons per year, but domestic consumption has stabilized at about 2 million tons. The number of mills has declined from 24 in 1971 to 13 today, and these compete for market share in a stagnant market. Competition among mills takes place on the basis of flour quality, service, and credit, with limited price competition among the smaller mills.

The level of milling technology in Korea is fairly sophisticated, but it does impose some quality constraints on wheat demand. All Korean flour mills except one blend wheats of various classes before milling in order to produce flour for a given end-use. Only the largest mill has sufficient storage capacity and milling lines to mill separately wheats of different classes and intrinsic

characteristics and to blend the resulting flours for the desired end-use characteristics. Blending before milling imposes two technical constraints pertaining to wheat quality. First, inconsistent moisture content and kernel hardness reduce the flour yield from a given quantity of wheat. Second, variations in protein and gluten characteristics produce flours with unpredictable end-use characteristics.

Quality preferences are communicated from end-users to millers through price signals and market shares. The largest mill produces the highest quality and widest variety of flours. It is reportedly the only mill which does not discount the price of its flour. The other mills, because they blend before milling, cannot produce the consistency demanded by the baking and noodle-making industries, and are forced to discount prices to maintain market share. It was difficult to assess the extent to which price discounting occurs.

The Korean baking industry, in contrast with the milling industry, is very unconcentrated. More than 8,000 so-called "window bakeries" serve the market for breads. Window bakeries range in size from 220 kilograms of flour per day to more than 10,000 kilograms per day. Dry and wet noodle production are dominated by small- and medium-sized plants. Instant noodles, which use about 400,000 tons of wheat each year, are produced by five large companies, of which two dominate the market. Cookies and crackers, which account for about 100,000 tons of wheat each year, are produced by six large companies.

Review of Survey Results

In May 1992, ERS analysts traveled to South Korea to interview wheat importers regarding the factors influencing wheat demand and sourcing decisions. Representatives of the three largest flour mills and KOFMIA were interviewed. The three flour mills and KOFMIA purchase approximately 90 percent of the wheat imported to Korea. The remaining 10 percent is purchased collectively by small and mid-sized mills.

Factors affecting choice of supplier are very similar among all the flour millers in Korea. The large private millers are sophisticated in the use of contract specifications, premia, and discounts to achieve the desired wheat quality characteristics. The only Korean Government restrictions that may affect wheat sourcing are phytosanitary and chemical residue certification requirements and domestic credit policies. KOFMIA still imports exclusively from the United States.

The chief factor affecting choice of wheat supplier is the ability to provide desired intrinsic quality characteristics, particularly protein content and gluten quality. Price is important, but certain quality attributes are essential. Once their minimum quality specifications are met, Korean millers consider net price, which takes into account credit terms, shipping costs, transit time, and flour yields, as well as the f.o.b. wheat price. Pesticide residue tolerance levels and testing requirements recently adopted by the Korean Government may affect wheat importers' sourcing decisions. Trade servicing and the long-term relationship between importers and exporters are also important factors influencing Korean purchasing decisions.

Quality

On the leading issue of meeting intrinsic quality demands, Australian wheats are clearly preferred. U.S. wheats rank a distant second among most of the millers surveyed; however, some millers rank Canadian wheats above comparable U.S. classes. The biggest problems reported with U.S. wheat are that protein quantity and quality are not within the desired ranges and that the levels are too variable. Korean millers report that U.S. soft western white wheat protein levels have drifted upward over the

years from 9.5-10 percent to an undesirably high 10.5-11 percent. Protein levels in U.S. DNS, on the other hand, have drifted downward. Millers report unacceptable variability in protein quantity and quality over years, within marketing years, and even within shiploads. Even when millers specify minimum or maximum protein levels in their contracts and pay premia for that assurance, they report having trouble getting what they want. They expressed strong dissatisfaction with the Cu-sum method used by the Federal Grain Inspection Service. The Cu-sum method permits individual sublots of grain shipments to deviate within a narrow range from the grade and contract specifications as long as the cumulative total of deviations does not exceed a certain level. One miller said that when he requests a minimum of 14.5-percent protein in DNS, he wants a minimum of 14.5 percent, not an average. The millers expressed similar demands for minimum, rather than average, falling number and amylograph guarantees.

Credit

On the issue of credit, the United States is the preferred supplier because Australia and Canada do not provide credit guarantees or subsidies. The availability of GSM credit guarantees is an important consideration for all Korean wheat importers because domestic sources of credit are inadequate. Domestic letters of credit available to Korean wheat importers are usually valid for up to 60 days, but flour millers typically provide financing for their customers for up to 6 months (180 days), as part of the nonprice competition typical within the industry. GSM credit guarantees, valid for much longer than Korean letters of credit, in effect provide financing to the entire Korean milling, baking, and noodle-making sector. The millers expressed concern that the Korean Ministry of Finance has already reduced the term for GSM credit guarantees from 12 to 6 months, and is threatening to eliminate GSM entirely by FY1994. The Ministry of Finance argues that the proposed reduction in GSM credit guarantees is necessary to help control the expansion of the domestic money supply and to bring down inflation, which is near 7 percent. Flour millers stated that the GSM program has been a very important tool in stemming the slide of U.S. market share and that they would likely reduce their imports of U.S. wheat if GSM credit guarantees were eliminated. KOFMIA and the individual mills report that they hope to persuade the Ministry of Finance to maintain the GSM program.

Price

Price is an important factor in Korean wheat-purchasing decisions, but only after minimum quality requirements are met. Korean millers indicated that U.S. and Australian wheats rank almost the same in terms of price, depending on the class and grade specified. Some millers have switched from standard U.S. No. 2 grade wheats to higher quality grade No. 1 wheats, which have lower levels of defects and higher test weights, despite the higher cost. Australia has a marketing advantage over the United States in terms of freight cost and delivery time because the distances are shorter than from U.S. ports. Low-bid c & f prices received by Korean importers during representative periods in 1991, 1992, and 1993 are reported in table 6. Australian wheats were priced about \$6 to \$10 per ton less than comparable U.S. classes, and Canadian CWRS No. 2 was priced \$20 per ton less than U.S. DNS. Contract specifications were not available, however, so the prices quoted may not be exactly comparable.

Dockage

Dockage is not an important issue in the Korean milling wheat market. Korean wheat contracts specify "all dockage deductible," and millers clean all the wheat they receive before milling. Korean millers claim that the level of nonmillable materials in U.S. wheat is almost three times the level found in Australian wheat, and they complain that the U.S. system for dealing with wheat quality disputes is inadequate. Their preferred level of dockage is less than 0.5 percent, but they said they

Table 6--South Korea: Representative wheat prices, c & f Korea 1/

Type of wheat	Mar 12-14 1991	Jan 10-Feb 20 1992	Jan 26-Mar 11 1993
	U.S. dollars per ton		
U.S. western white	143	202	167
U.S. hard red winter	147	196	174
U.S. dark northern spring	159	203	196
Australian soft	149	197	180
Australian standard white	150	190	179
Australian hard	n.a.	195	185
Canadian western red spring #2	136	183	189
Canadian western red winter #2	149	n.a.	n.a.

1/ Prices are not directly comparable because contract specifications were not available.

n.a. = not available

Source: Korea Flour Millers Industry Association

do not specify it because "we know we can't get it." The millers did not have detailed information on the costs of cleaning wheat; they said that cleaning is an integral part of the milling process and implied that it is a trivial share of the total costs.

Disposal of wheat screenings is a complex issue in Korea. Wheat stalks may not be imported for animal feed because of government phytosanitary regulations. Wheat screenings, with the exception of stalks, may be used in animal feeds. Screened-out stalks must be burned off before the other screenings are combined with wheat bran for sale to feed mills. Neither data on the disposal costs for stalks nor the millfeed value of screenings were available. Bran is currently selling for about 100 won/kg, or about \$125/MT delivered to the feed mills. Given that Korean millers clean wheat from all sources before milling and blend at least part of the resulting wheat screenings with bran for sale to feed mills, we concluded that dockage is an irritant, but not a determining factor in Korean sourcing decisions.

Pesticide Residues

Korean millers report that they rarely encounter unacceptably high levels of pesticide residues in imported wheat; however, the issue has become a regulatory problem. Tolerance levels and testing requirements for pesticide residues established by the Korean Government may affect wheat importers' sourcing decisions. The Ministry of Health and Social Affairs (MOSHA) began intensive testing for 6 agricultural chemicals in imported wheat in May 1992, and implemented new residue tolerances and testing requirements for 18 more chemicals in January 1993 (table 7). Many of the Korean tolerance levels are considerably more restrictive than internationally accepted norms, such as those established by the Codex Alimentarius Commission of the Food and Agriculture Organization of the United Nations.

When the regulations were initially implemented, MOSHA accepted certifications of compliance issued by the governments of wheat-exporting countries. Wheat certified in the exporting country could enter the Korean market without being tested by MOSHA prior to clearing customs. Wheat that did not carry the required certification from the exporting country was subject to testing at the port before it could be cleared through customs. This practice caused delays of several weeks during

which the importers had to pay for storage at the port. According to Korean importers, it created a marketing disadvantage for U.S. wheat because FGIS was unable to issue the required certification for all 24 chemicals. Some U.S. exporters had wheat tested and certified for the Korean market at State government facilities rather than through FGIS, but the procedure was costly and provided no guarantee that MOSHA would accept the results. Conflicts have arisen between tests conducted by MOSHA and certifications provided by agencies in exporting countries, including the Australian Wheat Board and the Oregon State Department of Agriculture. U.S. Government agencies are addressing the problem.

Trade Servicing

Trade servicing and long-term business relationships are very important in the Korean market. The United States has a long history of exporting wheat to Korea, and KOFMIA continues to purchase wheat exclusively from the United States, partly because of the traditional trading relationship.

Private mills are more willing than KOFMIA to experiment with other suppliers, but they prefer to deal with suppliers and wheats that are familiar to them.

Table 7--Chemical residue tolerances for wheat

Chemical	Tolerance level	Effective date
Dichlorovos	0.1	5/1/92
Methomyl	0.2	5/1/92
Methyl bromide	50.0	5/1/92
Thiophanate-methyl	0.05	5/1/92
Carbofuran	0.2	5/1/92
Ethylene dibromide	0.5	5/1/92
Benomyl	0.1	1/1/93
DDT, DDD, DDE	0.1	1/1/93
BHC	0.1	1/1/93
Aldrin and Dieldrin	0.01	1/1/93
Endrin	0.01	1/1/93
Captan	5.0	1/1/93
EPN	0.1	1/1/93
Diazinon	0.05	1/1/93
Dimethoate	0.2	1/1/93
Malathion	2.0	1/1/93
Parathion	0.3	1/1/93
Fenitrothion	2.0	1/1/93
Fenthion	0.1	1/1/93
Phenthoate	0.2	1/1/93
Cabaryl	1.0	1/1/93
Pirimophos-methyl	5.0	1/1/93
2.4 D	0.5	1/1/93
Endosulfan	0.1	1/1/93

The millers were strongly dissatisfied with several aspects of the trade service provided by the United States. Their sharpest complaints dealt with the system for resolving quality disputes in shipments of U.S. wheat. When a dispute arises, the mill is required to file a complaint through the U.S. Embassy, which in turn, passes the complaint to FGIS. FGIS then tests its file samples from the disputed shipment. If the test confirms the Korean complaint, the mill then has the right to reject the shipment. The millers complained that this system is too slow and indirect, and that their complaints are almost always rejected. Even when their complaints are confirmed, they must pay storage costs on the wheat during the dispute settlement process and acquire other wheat to meet their milling needs. They claimed that the Australian Wheat Board is much more responsive to their complaints, resolving disputes immediately, often by paying compensation on the disputed shipment or by providing a price discount or a quality bonus on a subsequent shipment. The Korean millers described the Australian system as more flexible and more customer oriented than the U.S. system. As mentioned above, the millers also were very critical of the Cu-sum system used by FGIS to evaluate grain shipments, and recommended that it be replaced by guaranteed minimum and maximum standards.

Source: Korean Ministry of Health and Social Affairs

Korean millers complained about the quality of trade service provided by U.S. milling equipment manufacturers and drew a connection between Korean imports of Japanese milling equipment and declining imports of U.S. wheats. According to the millers, Japanese milling equipment is calibrated for Australian wheats, especially ASW, which is similar to domestic Japanese wheat in color and texture. The millers claim that ASW is preferable to U.S. wheats for use with Japanese milling equipment. They also reported that they are more likely to buy equipment manufactured in Japan than in the United States because U.S. companies do not provide adequate marketing and service.

Outlook

The Korean milling wheat market is a mature and increasingly sophisticated one. Per capita food use of wheat is stable, and is not likely to expand much in the near future even as incomes rise because the income elasticity of demand is very low. The estimated own-price and rice cross-price elasticities of demand are also very low, indicating that lower wheat prices, either in absolute terms or relative to rice, would not induce much expansion in food use. ERS is projecting about a 1-percent annual increase in wheat consumption for food through the end of the 1990s, driven primarily by population growth.

Flour millers indicated that Korean consumers are becoming more sophisticated in their choice of wheat-based foods. Raised breads, bakery goods, and high-quality noodles are replacing pan breads, lower quality noodles, and traditional wheat-based beverages (makkoli) as the primary wheat products in the Korean diet. Flour millers indicated that their wheat-sourcing decisions will be driven increasingly by their customers' demands for specific flour end-use characteristics.

The United States will continue to face intense competition in the Korean milling wheat market. U.S. market share and total exports to Korea will erode further unless importers' demands for specific intrinsic wheat quality characteristics are satisfied. Australia has captured 20 percent of the market since 1984 with a variety of wheats, and Canada is poised to enter the high-protein sub-market.

The Korean feed wheat market is much more difficult to predict, because it is influenced almost entirely by the relative prices of corn and wheat. The relative prices of feed wheat and corn in Korea depend on the availability of low-quality wheat on world markets and the supply of corn. China is the primary supplier of corn to the Korean market. The demand for feedstuffs is growing steadily in Korea as the livestock sector expands, but the demand for feed wheat will continue to be volatile and very price-sensitive.

Conclusions

The U.S. share of the Korean milling wheat market has dropped from virtually 100 percent to less than 80 percent since the market was opened to competing exporters in 1983. The primary reason for a declining U.S. market share is that Australian and Canadian wheats do a better job of consistently meeting the specific intrinsic wheat characteristics demanded by the Korean milling industry. The Korean milling wheat market is a collection of niche markets. Wheats with specific intrinsic characteristics are required for the many different wheat products consumed in Korea. Intrinsic quality characteristics are the paramount determinants to winning market share in Korea, and the most important characteristic is protein. U.S. wheats were criticized for having protein levels that are inappropriate for the intended end-use and excessively variable both within shiploads and over time. Millers repeatedly stated that they cannot get the wheat they need from the United States even when they specify protein levels, falling number, and amylograph numbers in their contracts and pay

premia for these assurances. Dockage is an irritant in the Korean market, but it is not an important determinant of market share. Korean millers expressed intense dissatisfaction with the Cu-sum method used by FGIS to evaluate wheat shipments. Credit guarantees under the GSM program have slowed the decline of U.S. market share in Korea, but the millers indicated that the erosion of U.S. market share will continue unless their quality concerns are met. One miller said, "If the United States cannot give us what we need, the Australians will."

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Glossary

Blending: The systematic combining of two or more lots or kinds of grains to obtain a uniform mixture to meet a desired specification.

C & f: Cost and freight to the designated delivery point, paid by the seller.

C.i.f.: Cost, insurance, and freight to the designated delivery point, paid by the seller.

Commodity Credit Corporation (CCC): An agency of the U.S. Department of Agriculture created in 1933 to carry out loan and storage operations as a means of supporting prices above the level that would have prevailed in a free market.

Cu-Sum: A set of rules established by FGIS, that exporters must follow when loading grain on ocean vessels. The rules control variability among sublots blended to meet contract grade limits.

Damaged grain: In U.S. grading standards, the term damage refers primarily to biological deterioration associated with discoloration. Physical damage (such as cut or broken kernels) is not included in U.S. grades but is included in the standards of some other countries.

Defects: Computed total amount of damaged kernels, foreign material, and shrunken and broken kernels.

Dockage: Nongrain material that can be readily removed by accepted screening devices.

Durum wheat: Very hard, high-protein wheat used in the production of semolina flour for pasta products.

Export Credit Guarantee Program (GSM-102): U.S. agricultural export promotion program that guarantees repayment of private, short-term credit for up to 3 years.

Export Enhancement Program (EEP): Program to help U.S. exporters meet competitors' prices in subsidized markets: Exporters are awarded generic certificates that are redeemable for CCC-owned commodities, enabling them to sell certain commodities to specified countries at prices below the U.S. market price.

Extraction rate: The fraction of the wheat kernel that is converted into flour during the milling process.

Falling number test: A test used to measure sprout damage in wheat.

F.a.s.: Free alongside ship specifies that the seller delivers goods to the port elevator or dock at a specified location and the buyer pays for loading the ship and ocean freight.

Federal Grain Inspection Service (FGIS): An agency of the U.S. Department of Agriculture that establishes grain standards and develops the technology to measure the factors contained in such standards. This agency also develops and publishes sampling and inspection procedures, evaluates and approves equipment, monitors inspection accuracy, and oversees mandatory export inspection of grain by agency or FGIS-licensed inspectors.

F.o.b.: Free on board specifies that the seller loads the ship or other conveyance at the specified

delivery point with the buyer paying freight charges.

Foreign material: Nonwheat material of similar size and weight to wheat kernels.

Gluten: A tenacious, elastic protein substance found especially in wheat flour that gives cohesiveness to dough.

Grade: A number or letter designation assigned to grain based on an established set of criteria.

Grade factor or grade determining factor: Those characteristics of grain used to determine the numerical grade. The grade factor is based on quantitative limits (either maximums or minimums) placed on each factor for each grade.

Grain grades and standards: Specific standards of grain quality established to maintain uniformity of grains from different lots and permit the purchase of grain without the need for visual inspection and testing by the buyer.

Hard Red Spring wheat: Spring seeded; includes the following three subclasses: dark northern, northern, or red: This wheat is high in protein and has a vitreous endosperm, is used primarily to produce bread flour and is produced in the upper Great Plains.

Hard Red Winter wheat: Fall seeded; This wheat may be either dark hard, hard, or yellow hard, medium to high in protein, a vitreous endosperm, and used primarily to produce bread flour. It is produced in the lower Great Plains.

Hard wheat: A generic term applied to wheat with a vitreous endosperm suitable for making bread flour or semolina; yields coarse, gritty flour that is free-flowing and easily sifted; and flour consists primarily of regularly shaped particles of whole endosperm.

Impurities: Any nongrain material contained within a shipment that could hinder the processing of a grain or detract from its end value.

Intrinsic value or end-use value: Characteristics critical to the end-use of grain. These are nonvisual and can only be determined by analytical tests. For example, the intrinsic quality of wheat is determined by characteristics such as protein, ash, and gluten content.

Moisture content: The amount of water in grain; measured by the weight of water as a percentage of the total weight of the grain including water (wet basis) or total weight of the dry matter excluding water (dry basis).

Nongrade determining factor: Factors that influence the quality of grain but are not taken into account in the grading of grain. These factors must be reported as information whenever an official inspection is made.

Nonmillable material: All material that is not wheat, includes shrunken and broken kernels.

Physical quality: Grain characteristics associated with the outward appearance of the grain kernel, including kernel size, shape, color, moisture, damage, and density.

Premiums: Prices that exceed the base price offered for grains with higher quality characteristics than specified. Generally calculated for factors that increase the value of the grain in market channels.

Public Law 480 (PL-480): Common name for the Agricultural Trade Development Assistance Act of 1954, which seeks to expand foreign markets for U.S. agricultural products, combat hunger, and encourage economic development in developing countries.

Sanitary quality: Grain characteristics associated with cleanliness. They include the presence of foreign material that detracts from the overall value and appearance of the grain, including the presence of dust, broken grain, rodent excreta, insects, residues, fungal infection, and nonmillable matter.

Screenings: The material removed from grain by means of mechanical sizing devices; generally include broken grain as well as nongrain material removed on the basis of density or particle size with mechanical cleaners.

Semolina: A coarse separation of endosperm extracted from Durum wheat to make pasta.

Shrunken and broken kernels: All matter that passes through a 0.064 inch by 3/8 inch oblong-hole sieve.

Soft wheat: A general term describing wheat with a chalky endosperm suitable for making pastry flour; yields a very fine flour consisting of irregularly shaped fragments of endosperm cells that adhere and sift with difficulty.

Spring wheat: A general term for wheat that is grown in the spring and harvested in the summer or fall; It has a relatively high protein content and is used in bread flours.

Test weight: Weight per unit volume as measured in pounds per bushel as defined in the United States. Determined by weighing the quantity of grain required to fill a 1-quart container. The international equivalent measure is kilograms per hectoliter (conversion factor 0.77).

Uniformity: Conformity within and between shipments for quality attributes; such as physical, milling, and baking performances.

Wheat middlings: Fine particles of the bran and the wheat kernel. Normally used for livestock feed.

White wheat: Fall or spring seeded; it includes four subclasses: hard, soft, club, western: It is soft or hard and low in protein and is used mainly for pastry flours and oriental noodles.

Winter wheat: A general category describing wheats that are sown in the fall, lie dormant in the winter, and are harvested the following spring or summer.

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