RURAL ECONOMY

Canadian Wheat Export Prospects in the Asian Noodle Market: Analyzing Japanese and Korean Milling Industries

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Project Report 02-02
AARI Project #99M444

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Department of Rural Economy
Faculty of Agriculture & Forestry,
and Home Economics
University of Alberta
Edmonton, Canada

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The authors are, respectively, Professor and Associate Professor, Department of Rural Economy, University of Alberta, Edmonton, Alberta, and Assistant Professor, Department of Agricultural Economics, University of Manitoba, Manitoba.

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Abstract

The motivation for this study is the lack of knowledge of millers' preferences for noodle wheat in Asia, where noodle wheat is an expanding market segment. Data for the study are from interviews and questionnaires completed by millers in South Korea and Japan. Two different methodologies were applied--stated preference methods and semantic differential scales. Consistent results are seen from each method. Millers' choices of wheat with varying characteristics were analysed with multinomial logit models. These estimates are used to identify millers' preferred product profiles for various types of wheat and flour. Estimates are reported in the paper for millers' preferences for intrinsic quality features and trade contract terms for major types of wheat. Marginal analysis also yielded comparisons of millers' preferences in the two nations. In contrast to Australia and the United States, Canada does not produce or market a wheat variety that corresponds well to millers' preferred noodle wheat product profiles in terms of the wheat characteristics of falling number, protein level or dockage. Nor is Canada identified by millers in either of these nations as a preferred supplier of noodle wheat. Canada has a minor share of wheat exports to Korea but holds an appreciable share of Japanese wheat imports. However, Canada's market share of Japanese wheat imports may be more reflective of Japan's current regulated import process, rather than millers' preferences. Investment in product development and marketing will be necessary if Canada's share of the noodle wheat market in both Japan and Korea is to be increased.

Key words: market research; Korean and Japanese wheat and flour markets; stated preference methods; semantic differential scales.

Executive Summary

Japan and South Korea are two of the largest wheat-importing nations in Asia. Their wheat-processing sector in each case depends heavily on supplies of imported wheat, since there is virtually no domestic production of wheat in South Korea and only about 15 percent, approximately, of wheat consumption in Japan is supplied domestically. With subsequent recovery from the earlier decline in market prospects associated with Asian market financial pressures in the late 1990s, both of these nations can be expected to continue to be appreciable and consistent buyers of wheat in international wheat markets.

A significant and increasing proportion of wheat is consumed in the form of noodles in both countries. For instance, noodle consumption made up 50 percent of total wheat flour usage during the time period from 1994 to 1999 in South Korea (USDA KS8028, 1998). In Japan, 27 percent of wheat flour usage was consumed as noodles during the period from 1996 to 1999 (USDA JA 0028, 2000). Thus, noodle markets are of importance to the derived demand for wheat and flour in both South Korea and Japan. Demand for wheat used in noodle-processing plays a significant role in determining the demand for wheat in both nations.

The demand for wheat flour is extensively differentiated by its end-uses in the Korean and Japanese markets. The different end-uses for wheat flour are associated with demand for various quality characteristics in wheat. The desired characteristics of wheat and flour for use in noodles appreciably differs from wheat and flour used for bread. The characteristics of wheat are important in Asian buyers' decisions. In general, there are financial rewards for achieving satisfactory quality levels since this enables exporters to market their wheat in higher priced markets (Stanmore and Esfahani, 1994a). The results of this study provide detailed information

on millers' preferences for intrinsic features of wheat quality and related terms of purchase contracts for wheats suited for the noodle industry.

There are fundamental differences in the wheat marketing systems of Japan and South Korea. The importation of wheat was privatized in South Korea in 1990 (KOFMIA, 2000). However, wheat importation in Japan is operated by a central buying agency, the Japan Food Agency (JFA). Even so, Japan has implemented several changes in its wheat and barley marketing policies for the domestic wheat production and milling sectors, due in part to internal problems relating to excess capacity of the domestic milling sector, the high costs of subsidizing domestic wheat farmers, and fiscal constraints (JFA, 1999). This process is expected to continue in future years. The shift toward privatization of wheat marketing systems in both Japan and South Korea can be expected to heighten competition among millers in each market and to focus attention of millers on quality attributes of wheat and flour. The Japanese wheat importing and milling industry is more highly regulated than in South Korea. Consequently future changes in the expression of millers' preferences for wheat can be expected to be reflected in imports in a deregulated Japanese importing process.

This study applied alternative methods of collecting data to assess millers' preferences for alternate product choices for wheat and wheat flour for noodle use in South Korea. These choice alternatives varied in price, country of origin and other significant quality factors. Millers' preferences for wheat and flour for use in noodle processing were also assessed for Japan. For both nations the research approach of stated preference methods (SPM) was applied. For South Korea a traditional marketing analysis method of semantic differential scales (SDS) was also applied.

The qualitative pre-survey interviews and the differences in the results of the estimated models of this study suggest the need for marketing efforts to be differentiated for the Japanese and South Korean markets. The comparison of the marginal effects of changing the level of each factor on the probability of millers' wheat and flour choices for Japan, versus South Korea, shows some differences in millers' preferences in the two nations. Differences are seen, for example, for falling number, protein content, and dockage levels. Overall, the marginal effects of the quality factors of wheat on the millers' probability of choice were greater in South Korea than in Japan. One possible explanation for the differences in millers' preferences is the difference in the organization of the wheat marketing systems in these two nations.

Both Korean and Japanese millers showed somewhat different preferences for product origin. Both groups identified Australia as the most preferred supplier of medium-class wheat. However, Japanese millers ranked domestic producers as the second most preferred supplier of medium-class wheat, while Korean millers ranked the U.S. as the second most preferred supplier. Medium-class wheat of Canadian origin appears to be viewed adversely by Japanese millers, but has a positive effect on Korean millers' choice behavior.

For semi-hard wheat purchases, both Korean and Japanese millers had strong preferences for wheat of Australian origin. Korean millers' likelihood of purchase decreased for semi-hard wheat of Canadian origin. However estimated coefficients on the characteristics of U.S. and Canadian origin in the model of Japanese millers' wheat choices are statistically insignificant, implying that Japanese millers' choice behavior for wheat is not significantly affected by it being of U.S. or Canadian origin.

The estimated coefficients from the models of this study were also used to generate preferred product profiles for both Korean and Japanese flour millers for three wheat classes.

The three preferred wheat profiles are compared with the wheat currently imported by both nations. For South Korea, the U.S. is found to be competitive in the semi-hard and the soft wheat market segment, while Australia is competitive in the medium wheat segment. This component of the analysis is supported also by the results of another (SDS approach) research method used in the study. The SDS ratings showed that wheat of Australian origin was rated highest in terms of consistency of supply, reliability and service/assistance. Canada has been a stable supplier of Canadian winter red spring (CWRS) that has protein level at 13.5 percent to Japan from 1972. This has been mainly used in milling bread flour. Canada's CWRS 13.5 percent has been recently used in processing some Chinese fresh-style noodles (Interview, 2000). Most Canadian wheats currently are not well-suited to the noodle market in either South Korea or Japan. Product development efforts are necessary for Canada to achieve a larger market share in South Korea and Japan.

Canadian Wheat Export Prospects in the Asian Noodle Market: Analyzing Japanese and Korean Milling Industries

Background: The Focus of the Study

This study addresses a lack of information about the preferences of buyers and users for the various quality characteristics of wheat and flour for use in noodle processing in Japan and Korea. Such knowledge can provide critical directions for production and marketing decisions in the Canadian wheat economy. Identification of the levels of wheat and flour characteristics preferred by Japanese and Korean millers provides useful information that may contribute to the efficiency of plant breeding programs, wheat licensing and grading systems, and marketing practices for Canadian wheat exports.

Objectives of the Study

The objective overall for this study is to evaluate the demand for wheat for noodles in Japan and South Korea and to assess the market potential for Canadian wheat exporters to these two countries. The study provides a detailed assessment of quality preferences demanded by the Japanese and Korean millers. The study also compares the different market structures of wheat milling industries in Japan and South Korea and assesses implications of these for Canadian exports. The specific objectives are to:

1. Evaluate demand for wheat quality characteristics in the milling industry in both Japan and Korea.
2. Evaluate and compare implications of the market power of the flour milling industry in Japan and Korea.
3. Assess the likely impacts of the Asian financial crisis on future wheat importation by both countries.

4. Apply economic analysis to assess the future demand for wheat for use in the noodle industry by South Korea and Japan in order to provide some assessment of the potential for Canadian exports to these markets.

Background: Relevant Market Trends

World trade in wheat has averaged 100 MMT per annum, 20 percent of total world production in recent years. During the 1980s, wheat importation by East Asian countries grew rapidly and accounted for 34 percent of world wheat trade by the early 1990s (CWB, 1996). Despite some decline in Asian market prospects associated with Asian market financial pressures in the late 1990s, select Asian markets such as South Korea and Japan are still considered to be key markets for growth in future Canadian wheat exports.

Japan ranks as the second largest importer of wheat in East Asia, following China. Japan imports some 6 MMT per annum on average, and 85 percent of its consumption is dependent on imports. South Korea, the third largest wheat importer in East Asia, has averaged 4.7 MMT of wheat imports per annum in recent years (CWB). The South Korean market for wheat is met entirely by imports. Japan and South Korean both have highly concentrated market structures in the flour milling and noodle processing industries. Yet, they have contrasting wheat importing systems; South Korea has a decentralized wheat import system, while Japan has a centralized system with imports regulated by the Japan Food Agency.

Wheat demand in Japan's flour milling industry is considered to be highly differentiated by end-uses and to have high quality standards. Access to the Japanese wheat import market is limited; consequently price premiums apply to its imports, relative to other world markets. As in Japan, demand for wheat by Korean millers' emphasizes quality and service and is driven by end-uses. These two markets have a wide variety of end-uses for imported wheat and these often

have very specific requirements for various quality characteristics of wheat (CIGI, 1997). Noodles are the major wheat end-product in both Japan and South Korea. Soft white wheat usage in noodle processing was reported to be 45 percent and 50 percent of these two nations' total wheat usage, respectively, in 1995. The Japan Food Agency has identified the Japanese instant noodle industry as a high growth market, while the bakery and bread industry in Japan are viewed as more of a "zero-sum" market (JFA, 1997). The Japanese instant noodle industry grew at 1.8 percent and 3.3 percent in 1995 and 1996, respectively, while the total growth rate of Japanese bread production over the preceding four years had been near zero percent (JFA, 1997). It appears that the demand for wheat classes that are used in noodle processing will increase substantially in future years, while the demand for wheat classes used in bread making will remain relatively stable.

Trends in demand for wheat in South Korea also show a significant increase in preference for higher quality instant noodles. Under pressure from the U.S., South Korea liberalized its milling wheat imports in 1990. Reduction of government intervention in wheat importation has led to more flexible market access for wheat exporters, and more imports. The increasing demand for noodles in Japan and South Korea increases the derived demand for soft and medium white wheats and potentially for white 3 M-type wheats for noodle processing.

Canada has been a relatively small supplier of white wheat to Japan and South Korea and faces significant competition in the noodle market segment from the United States and Australia. Canadian wheat production and exports have long been dominated by hard red spring wheats, which have been agronomically suited to the Prairie region and attracted market premiums reflecting high protein levels. However, world demand for higher yielding, lower protein wheats, used in noodle processing, has grown at a rapid rate since the 1970s, while the demand for higher

priced, high protein red wheats grew more slowly; consequently (Veeman, 1987). Progress in baking and milling technology that enabled increasing substitutability among wheat with different levels of quality characteristics has also affected the import demand for high protein wheat. Critics argued that the Canadian share of the total export market suffered due to concentration on high protein wheat markets (Henning and Martin, 1989). In more recent years, markets which use lower protein, higher yielding wheat have also been targeted as export outlets for Canadian wheat and Canada has somewhat broadened its wheat breeding and licensing procedures.

Overview of Market Structure Trends

Prior to the 1970s, Japan's flour milling industry was very stable. However, fundamental restructuring occurred in this industry over the past several decades, with the number of milling companies dropping from 434 in 1965 to 137 in 1997. Concurrently, the number of flour mills fell from 480 in 1965 to 174 at the end of the 1996-97 fiscal year (Sosland, 1998). The mills of the "Big Four" companies tend to operate at full capacity, running 24 hours per day for 300 days each year. The market share of small millers is low and some 20 milling companies went out of business in the past decade. The largest four milling firms exhibited a stable market share over the past decade, reflecting guaranteed quota allocations of imported wheat from the JFA.

The wheat-flour milling sector in South Korea was tightly regulated by government for three decades following World War II. Policy reform towards a less regulated milling sector was initiated in 1983 when the right to recommend wheat imports was transferred from government authority to a quasi-government agency called the Korea Flour Millers Association (KOFMIA). In 1990 the right to import wheat was extended to individual millers. In 1995, with liberalization of the wheat import system, import licensing for flour mills was dropped. An

import reporting system continues. Subsequently, there has been consolidation in the South Korean milling sector and this is now viewed to be a more competitive and efficient industry than formerly. Currently there are nine South Korean flour-milling companies. By the latter 1990's the largest four firms accounted for 74% of market sales (KOFMIA, 1999).

The total volume of wheat flour milled in South Korea has gradually increased over time, for example, from 2.1 MT in 1975 to 3.1 MT in 1995, a 50 percent increase. During this period, the growth rate of milling capacity fluctuated somewhat and the importance of the largest four South Korean milling firms increased significantly; the four largest millers controlled 73 percent of the milling capacity in 1995, relative to 69 percent in 1985, and 55 percent in 1975. Currently, Cheil (23%), Daehan (23%), Dongah (15%)and Shin Han (11%) are the four major Korean milling companies.

Due to the liberalization of wheat importation in 1990 and several mergers and acquisitions during the past two decades, the structure of the South Korean milling industry has shown more change than is the case in Japan. Main marketing strategies of South Korean millers to increase their market shares have been cited as diversification of the wheat classes they use; competitive pricing; and securing demand of secondary users (CIGI, 1997). A diversification strategy suggests some potential for market expansion of Canadian wheat exports.

Assessment of South Korean and Japanese Millers' Preferences for Noodle Market Wheat

Two alternate methodologies were used in this study to assess millers' preferences in South Korea. Both approaches involved collection of survey data from individual firms. One approach applies stated preference methods (SPM) in which respondents chose preferred products from an array of alternate choices that embodied different combinations of product characteristics, including product price. The resulting analysis of respondents' product choices

focuses very directly on the trade-offs between the various characteristics that are embodied in these choices. Preferred product profiles are developed from the SPM and compared to the wheat and flour quality attributes of the products currently used by millers. For South Korea, in particular, SPM is shown to provide very similar information to that revealed by the products actually purchased by millers. Another market assessment approach that was applied in the South Korean market only, for reasons outlined later in this report, involves a simpler, traditional marketing analysis technique using a semantic differential scale (SDS) approach in which respondents are asked to rate characteristics individually, using a seven-point rating system, relative to bipolar descriptors.

Flour mill representatives in South Korea and Japan were interviewed in 1999 and 2000. The first round of interviews was used to gather information on the industry, and its regulatory environment, the market structure of the flour milling industry and the noodle market. The information gathered in these interviews was also used to develop the written survey instruments applied to millers in a second round of interviews to elicit information on their preferences for wheat and flour used in noodle markets. Thus the initial interviews were directed toward identification of the various characteristics of wheat and flour that are of importance to millers and processors of noodles and the various levels of these characteristics that are relevant to their product choices. Respondents also responded to general questions about their satisfaction with different aspects of imported wheat.

Selected Literature Review

Analyses of competition in the world wheat market have focused often on the effects of the organization of the marketing system on competition. Abbott and Young (1999) demonstrated that the operation of the Japan Food Agency (JFA), a state trading enterprise

(STE), isolates Japanese domestic markets from world wheat market conditions. They hypothesized that in countries for which STE are the designated sole importers, the market may be less responsive to price differences between exporters and imports may be more likely to rigidly reflect historical shares of import sources than in countries in which private firms seek the most economic source of supply.

Wilson and Gallagher (1990) found that Japanese millers are less responsive to price changes and have less flexible preferences for imported wheat than millers in other markets such as Asia, Latin America and the U.S. They conclude that this is due to the JFA's wheat import operations. Millers and end users in Japan are insulated from international prices, but can request specific quality specifications through the JFA.

One facet of change in the competitive environment in international wheat markets has been that differentiation of wheat by quality characteristics has become increasingly important (Wilson, 1989). The degree of product differentiation in wheat marketing and trading has increased significantly in the last two decades, becoming a competitive factor in international trade. As the importance of product differentiation in wheat characteristics has become evident, numbers of studies have focused specifically on valuation of wheat quality characteristics (Esfahani and Stanmore 1994a, Esfahani and Stanmore 1994b, Larue 1991, Wilson 1989 and Veeman 1987).

Two methods for commodity quality evaluation in economic research are hedonic and discrete choice analyses. The latter may be applied both to revealed preferences (actual market data) and stated preferences (hypothetical market data). Hedonic price analysis and revealed preference discrete choice analysis both use observed market data to determine the quality characteristics of a commodity that may be important to a consumer or buyer. This limits the

analysis to historical relationships and precludes the exploration of new or emerging marketing issues that may apply if there are substantial changes in market structure or in consumer preferences.

Numbers of previous studies have estimated implicit values or premiums of various wheat attributes as by (Veeman (1987), Wilson (1989) and Larue (1991). However no previous studies have combined extensive interviews of representatives of the milling industry in these countries with a survey instrument that includes stated preference questions. The stated preference discrete choice framework of experimental choice analysis uses hypothetical market data generated through stated preference surveys to analyze buyers' contingent behavior. This empirical approach can be used to explore new or emerging market issues for which historical data do not explicitly exist, as in this study.

Comparison of the Japanese and Korean Noodle Markets

The three major types of noodles in the South Korean noodle market are dry noodles, Udon (fresh) noodles and instant noodles. Instant (fried) noodles are called "Ramen" in South Korea, while in Japan, Ramen represent instant (fried) Chinese noodles. In Japan, there are two sub-categories for Chinese noodles: fresh noodles and instant noodles (Bingrae, 1999). Udon, dry noodles and Ramen are the major noodle categories in South Korea, while Udon, dry noodles, fresh Chinese noodles and Ramen are the major noodle categories in Japan. Among these four types of noodles in Japan, Udon noodles accounts for 35 percent of total noodle consumption, followed by instant noodles with 20 percent market share (JFA, 1999).

Consumption of wheat flour in the form of noodles in South Korea increased from 23.6 percent of all wheat flour utilization in 1981, to 50 percent in 1998 (KOFMIA 1999;USDA, FAS, 1998). The Korean Ramen market segment has the largest noodle market share at

approximately 80 percent of the noodle market, while the other two noodle categories each represent 10 percent of the remaining market share (KOFMIA, 1999). A Bingrae report (1999) has projected that demand for the high quality bag Ramen and the cup noodles will further increase, while common-quality bag Ramen noodle consumption will decrease.

According to the report of Samyang (1999), manufacturers in the Korean Ramen market compete through product differentiation and new product development. Millers and Ramen manufacturers conduct joint research on wheat flour milling and Ramen processing to develop new Ramen products. Quality specifications for wheat flour are becoming much more specific and stringent among the Ramen manufacturers, and this significantly influences millers' purchases of wheat (Interview, 1999). The market for cup Ramen products (i.e. small servings of Ramen) is expected to grow since the main consumer of Ramen are young people who have preferences for convenience noodle products (Samyang, 1999). Samyang also reports a trend of increasing health consciousness by consumers in South Korea. This increases the demand for fresh noodles since these are perceived to be healthier than Ramen noodles. In the past, the Korean noodle market could not readily supply fresh noodles due to a lack of marketing infrastructure (Interview, 2000). Recently, there have been improvements in the cold-chain storage system that coordinates efficient transportation of fresh noodle products (Interview, 2000). Although the fresh noodle market and the dry noodle market represent an equivalent proportion (about 10% each) of Korean noodle demand, the fresh noodle market has been projected to grow more rapidly, as consumers prefer the convenience, health benefits and functionality of fresh noodles (Samyang, 1999).

Industry observers suggested that the Korean Ramen market has peaked in volume and that market strategies to achieve firm growth in this market are changing from a focus on

expansion of sales volumes to ward quality improvement. Quality competition among Ramen manufacturers is projected to translate into marketing of higher priced premium Ramen products, extensive product differentiation and improvements in the aesthetic and functional aspects of packaging. This can be expected to impact on the future demand for wheat and the preferences for wheat quality attributes.

The Japan Food Agency (JFA) has identified the Japanese instant noodle industry as a growth market, while the bakery and bread industries in Japan are expected to be static (JFA, 1997). The Japanese instant noodle industry grew at 1.8 percent and 3.3 percent in 1995 and 1996, respectively. A Tradescope report (1994) presented a comprehensive overview of Japan's noodle market at that time, noting that the demand for dried noodles stagnated in the 1980s, due to their lack of convenience and old-fashioned image. In contrast, the demand for fresh noodles was reported to have increased due to their convenience in preparation.

Industry participants noted that changes in the composition of wheat flour consumption in Japan can be explained by several factors. Japan's economy grew rapidly to 1985 when per capita GDP was US$ 11,282. By 1995, per capita GDP in Japan was US$41,075 (ESCAP, 2000). Concurrently, the dietary pattern of Japanese consumers has westernized during the early 1980s. However, during the economic recession in Japan in the late 1990s, consumption of western dishes at upscale restaurants decreased, while consumption of noodles in low priced noodle shops became increasingly popular among Japanese consumers. This contributed to the increase in the consumption of wheat flour in the form of noodles (Interview, 2000).

Changes in demographics have also contributed to changes in the composition of wheat flour consumption in Japan. While the growth rate of the total population continually decreased during the period of 1980-1997, changes in the age structure of the population and other

components of social structure occurred during this period. The Bingrae report (1999) indicated that approximately 85.8 percent of the Japanese population eats instant noodles; the main consumer group for these products includes younger Japanese, aged from 12 to 25 years. Increases in that age group may raise the consumption of instant noodles. Increased female labor force participation is also expected to increase the consumption of instant noodles in Japan due to a demand for convenience.

As market competition intensifies and the JFA reduces subsidies to millers, individual millers are expected to continue to develop and improve blending formulae for the production of wheat flour (Interview, 1999). Product differentiation in wheat flour products is expected to continue to increase in Japan. This may potentially change the demand for wheat and for wheat flour quality characteristics.

The demand for noodles in Japan is more diverse than in South Korea. While the instant noodle (Ramen) market segment has only 20 percent market share in Japan, demand for fresh-type Chinese noodles has been growing rapidly. For instance, in 1996 the annual volume of wheat flour used for fresh-type Chinese noodles was 724,800 MT, while the wheat flour usage for dried noodles and instant noodles was 259,300 MT and 324,300 MT, respectively. The freshness of fresh-type Chinese noodles relative to instant (fried) noodles, and the increasing interest in health which is associated with freshness, are claimed to be the main factors contributing to the considerable growth in the demand for fresh-type Chinese noodles in Japan (Interview, 1999).

Comparison of the Japanese and Korean Flour Milling Industries

Although Japan and South Korea are both heavily dependent on importation for supplies of wheat and each imports from the same exporting nations, there are fundamental differences in

the wheat trading systems of these two nations. The importation of wheat is regulated by the JFA in Japan, while the wheat marketing system has been privatized in South Korea since 1990.

In the 1970s there were 19 flour-milling companies in South Korea. Extensive consolidation occurred in the 1980s and the 1990s and the number of the milling companies had fallen to eight by 1999 (Table 2.11). The largest four millers controlled 55 percent, 69 percent and 73 percent of the market in 1975, 1985 and 1995, respectively (KOFMIA, 1996). The four major Korean milling companies, held in aggregate 74 percent of market share in 1999. Thus, the milling sector in South Korea can be characterized as having a fairly high degree of market concentration. By the end of the year 2000, there were expected to be seven companies in the Korean milling sector (Interview, 2000).

The four largest flour milling companies in Japan account for 67.9 percent market share in total (Nitto, 2000). Their market share increased from 64.1 percent in 1988 to 67.9 percent in 1997, while the market share of the largest sixteen millers increased from 82.7 percent in 1988 to 85.5 percent in 1997 (JFA, 1997). As the industry consolidated, the number of milling companies decreased, from 434 in 1965 to 134 in 1999 (Sosland, 1998). However, South Korea has far fewer milling firms than Japan.

Comparison of the Japanese and Korean Wheat Import Systems

Japan's Wheat Import System

In 1995, the Government of Japan (GoJ) introduced a new Food Law in line with the implementation of the Uruguay Round multilateral trade agreement. However, rice and wheat have continued to be state traded items and the JFA has continued to control importation and pricing of imported wheat. Dual marketing of domestic and imported wheat through "Wheat and Barley Management Improvement Measures" [under the Staple Food Control Law] has applied

since the latter half of the 1960s (USDA, 1995). Within this system, border protection measures and domestic subsidies have applied for the domestic sector. The quantity of wheat imported is set to "clear" the domestic market at administered resale and producer prices (Murniningtyas and Love, 1992). The JFA annually sets specific import quota volumes for three major wheat exporters--the U.S., Australia and Canada. The annual import quotas of the JFA are allocated to licensed trading companies. Some 30 trading companies have licenses to import wheat but the top five wheat importing companies, which handle 65 percent of imports, dominate this business (Interview, 1999). Exporters do not sell directly to the JFA, but negotiate with the designated trading companies. These companies, in turn, sell wheat to the JFA. The JFA then resells the imported wheat to domestic millers at administered resale prices. An explanation of this process is:

> “The two tier pricing policy has an alternative function as a risk management tool used to avoid short-term negative effects caused by fluctuations in international market prices and foreign exchange rates. There are three factors that are considered by the JFA in setting resale price levels. Firstly, the JFA considers factors such as changes in the exchange rate, changes in imports of processed wheat and any changes in preferences by consumers and millers. Secondly, the JFA also considers trends in international wheat prices since this affects the JFA’s profit margin from reselling imported wheat, used to cross-subsidize domestic wheat market. Thirdly, the relationship between the prices of wheat and rice is another important factor. One of the JFA’s mandates is to balance the supply among food staples and to support domestic rice producers. The method of calculation of resale prices is reported to be excessively complex and subject to significant official discretion. The purpose of the two-tier pricing system is to cover all of

the JFA's losses in the purchase and sales of domestic wheat by the profits from the resale of imported wheat, and to cross-subsidize the rice sector (Iwaasa, 1999)."

Economic constraints and the changing environment of international trade have forced the Japanese government to reconsider its wheat and barley marketing policies. The JFA continues to import wheat as a state-trader to meet demand that is not filled by domestic wheat supply. However, introduction of a "Simultaneous Buy and Sell" (SBS) system is being considered to contribute some flexibility and diversification to wheat imports. The JFA traditionally allocated imported wheat to the millers based on past sales records. This system did not reflect the lowest import prices and competition among grain traders was limited. It is believed that the JFA will move from allocating import quotas based on past sales records to allocate these based on the performance of the grain traders (Interview, 2000). This may contribute to the Japanese grain trading industry becoming more profit driven and competitive and may create new opportunities for some wheat exporting nations that can supply wheat that matches preferences of traders and ultimately, flour millers.

Another change in Japanese domestic policy is contributing to a degree of competition in the flour milling industry. The Government of Japan (GoJ) liberalized the beef import system in 1991, resulting in rapid growth of beef imports and a significant decrease in the market share of domestic beef. For the previous two decades, in order to aid the domestic beef industry, the GOJ had lowered the price of feed grain by subsidizing local milling flour companies that were specialized in bran milling for livestock use. These milling companies are typically small-scale operations, specialized in producing feed wheat flour that has a high content of bran which can be formulated into feed mix. Economic constraints in the Japanese economy and availability of cheaper types of feed grains has led the JFA to phase out the subsidy for the bran flour milling

companies from 1999 (Interview, 2000). Consequently, many small size flour-milling companies are expected to be consolidated, heightening competition among millers based on quality. Since the quality of wheat flour primarily depends on the quality of wheat, the quality of wheat is expected to be a major competitive factor for wheat exporters in the Japanese wheat market.

Korea's Wheat Import System

Total annual wheat production in Korea is less than 5,000 MT so that wheat supply is almost entirely dependent on imports. This is mainly due to an unsuitable climate for growing wheat and reflects the lack of import protection affecting domestic production of this crop. The Korean government purchases about 15 to 20 percent of the domestic rice crop at highly subsidized prices, giving an incentive to South Korean farmers to concentrate on rice production. Wheat production is not defined as an essential staple and is not subsidized in South Korea.

During the 1980s Korea had continuing current account surpluses with the U.S. (ESCAP, 2000). The U.S. Government exerted strong pressure on the South Korean Government to allow greater market access in order to improve their balance of trade. To avoid trade sanctions by the U.S., the Korean Government introduced trade import liberalization measures on selected products, and wheat was one of the targeted items (Agricultural Cooperative Yearbook, 1996).

The trade liberalization program for milling wheat imports began in 1983 and was completed in 1990. For instance, the annual milling wheat import quota was set at 2.28 MT for 1989 but this was eliminated in 1990 (KOFMIA, 2000). Subsequently, South Korean millers have imported wheat through two routes. First, millers can directly negotiate with exporters; second, wheat can be purchased by tender from the Korean Flour Mills Industrial Association (KOFMIA), formerly a central buying agency of the Korean Government.

The privatization of the Korean wheat marketing system and recent changes in the Japanese marketing system contribute to competition in the milling sector. Consequently, millers in both countries increasingly appear to be more concerned with the quality of the wheat that they purchase from the international market. This feature is currently most apparent in South Korea.

Theoretical Framework for Analyzing Millers' Stated Preference Choice Data

Probabilistic discrete choice models were developed to explain millers' preferences for wheat quality factors. Discrete choices among product alternatives are modeled in a random utility framework using a multinomial logit (MNL) model. An individual's indirect utility function is expressed as:

$$U_{in} = V(X_{in}) + e(X_{in}) \quad (1)$$

where: U_{in} is person n's utility of choosing alternative i; V is the systematic component of utility; e is a random element; X_{in}, is a vector of attribute values for alternative i as viewed by respondent n. Total utility, U_{in} is a sum of observable and unobservable components, which can be expressed as V and e, respectively. The systematic component, V, is a function of observable attributes of products, while the random component relates to variations in choice due to within- and between-individual variance, omitted variables, measurement errors and imperfect information (Ben-Akiva and Lerman, 1985). The systematic component can be estimated in a Multinomial Logit Model (MNL) by assuming that the error terms are independently, identically and Gumbel distributed. The probability of choosing an alternative i is defined as the multinomial logit (MNL) model:

$$\pi_n(i) = \frac{\exp(\mu V_{in})}{\sum_j \exp(\mu V_{jn})} \quad (2)$$

Typically the μ is assume to equal 1 and the systematic component V_{in} is modeled as linear in parameters such that

$$V_{in} = \beta_1 + \beta_2 x_{in2} + ... + \beta_k x_{ink} \quad (3)$$

where V_{in} is respondent n's conditional indirect utility function; x_{ink} is k'th attribute values for alternative i as viewed by respondent n and β_1 to β_k are coefficients to be estimated.

The functional form expressed in equation (4) is additive, reflecting the assumption that the factors are independent in their respective effects on consumer utility. Thus, interaction effects are assumed to be negligible; consequently only main effects are assessed (Adamowicz et al, 1997; Unterschultz et al, 1998). The non-nested MNL model outlined above was applied to analyze the data collected from the SPM survey questionnaires. An example of one of the SPM questions is given in Figure 1.

Research Methodology of the Semantic Differential Scale Analysis

In semantic differential scale (SDS) analysis, respondents' attitudes toward individual product quality characteristics are assessed by asking them to rate the importance of the selected individual characteristics on a five-point or seven-point rating scale bounded at each end by polar adjectives or phrases. The SDS approach has been commonly used as a marketing tool to describe the set of beliefs that constitute a respondent's view of a product or brand (Aaker, Kumar and Day, 1998). This is a relatively traditional method of marketing research that is simple to design, respond to and analyse. After discussion with South Korean millers, three different sets of SDS questions were developed. These ask respondents to indicate their assessment of the importance of the different individual quality attributes of wheat and flour. A series of SDS questions is also directed at the issue of the quality of services provided by different exporters for wheat sourced from different origins. The SDS scaling questions probe the

direction and intensity of millers' attitudes towards the specified quality attributes. An example of a SDS question used in this study is given in Figure 2. Questions that ask respondents to choose the desired level of individual product attributes are depicted in Figure 3.

Data Collection

Information gathered from the first set of interviews with the milling industry in South Korea and Japan was used to develop the SPM survey instrument. This was designed to enable the estimation of coefficients of the multinomial logit (MNL) model. The SPM was applied to elicit Japanese and South Korean millers' stated quality preferences for characteristics of wheat destined for use in noodle flour. A similar set of data was developed for noodle flour characteristics.

In the stated preference survey experiments, each respondent chose a desired product from two product alternatives based on descriptions of the product in terms of specific levels of attributes, alternative A and alternative B. Alternatively C, a non-choice option, provides a "base" alternative that sets the origin of the utility scale. The base alternative acts as a constant subtracted from the utilities of the other alternatives (Louviere, 1992).

Each major factor was specified to have four different possible levels in the survey. A fractional factorial experiment was designed for each wheat product description, resulting in 32 questions for each product. To reduce respondent burden, these questions were blocked into four sets, providing eight questions on each product per questionnaire. The product categories and series of experiments identified for the SPM questions on wheat and flour preferences are given in Figure 4. Detailed descriptions of the various attributes are given in Figure 5. Each respondent answered eight questions on each wheat subset related to specific wheat characteristic and

country of origin. The questionnaires were pre-tested in initial discussions and interviews with millers who also advised on the appropriate attributes and their levels.

Analysis of the first section of the questionnaire assesses the effects of intrinsic wheat quality characteristics on the probability of miller's wheat choices among different wheat classes (Model I). These quality attributes [also referred as factors] are ash content, falling number and test weight. Price is also included as one of the variables in this model. These attributes have a direct impact on flour quality in the noodle market.

Analysis of the second section of the SPM questionnaire evaluates those wheat quality attributes which apply as the terms of purchase contracts (Model II). These are specified as protein content, country of origin, dockage level and price. For each of its two different sections, the questionnaire was structured into three sub-sets based on three different wheat classes which were specified as: hard, semi-hard and medium wheat for Japan, and semi-hard, medium and soft wheat for South Korea. The different product attributes and levels have to be identified for each product category in each section, reflecting the feature that six sets of choice experiments were developed and applied since appropriate choice variables and associated choice sets were sufficiently different for different classes of wheat types.

Japan and Korea have slightly different schemes for categorization of wheat class and wheat flour grading (KOFMIA 1998). In Japan, four categories are commonly used to distinguish wheat classes. These are hard wheat, semi-hard wheat, medium wheat and soft wheat. In South Korea, three categories are used to distinguish wheat classes. These are hard wheat, medium wheat and soft wheat (Figure 4). In terms of protein content and variety, Japan's semi-hard wheat and Korea's hard wheat are similar, while medium and soft wheat in both markets are defined with identical wheat quality characteristics (Interview, 1999). Therefore, hard wheat in

Korea is described as "semi-hard wheat" throughout the discussion of the results in order to avoid confusion that may be created due to the discrepancy in the terminology of wheat classes in the two markets.

Dummy variables (-1,+1) were used to effects-code the attribute levels so that the base alternative is exactly equal to the origin. The fourth level of each attribute was omitted during estimation, to avoid singularity, and estimates for this level are subsequently calculated, using the effect-coding constraint that all four attributes must sum to zero. The maximum likelihood method is used to estimate the MNL model.

In South Korea the interviewer met and interviewed 35 mill representatives in the two sets of interviews and pre-testing. Some 23 respondents answered the full survey questionnaire that contained both SPM and SDS questions. The completed responses gave an industry-level representation that covered 95 percent of the entire Korean flour milling industry. The interviews were conducted in the Korean language.

In Japan, the interviewer met and surveyed 57 mill representatives, 41 of whom responded to the full SPM survey. These interviews were conducted from January to July, 1999. Most respondents were senior-level sales and quality managers, with 10 or more years of experience in milling technology. Those surveyed were representatives of the largest and mid-sized mills, representing 85 companies within Japan's flour milling sales.

Results of the Comparative Surveys for the South Korea and Japanese Wheat Markets

One major difference is revealed in the two markets from the different price attribute levels employed in the questions. Different attribute levels on price changes were required in the two markets, reflecting the experience of millers in the two nations. The SPM methodology requires that the choices be within the range of the knowledge base of the respondents. Based on

the process of industry consultation with Japanese millers that was used to design the questionnaire, the Japanese questionnaire specified relatively limited changes in prices from the previous price. During pre-testing in Japan, the respondents strongly indicated that any wider range in price changes would be beyond the ability of the respondents to evaluate. It is of interest to note that the original research plan was to include semantic differential scaling questions on wheat attributes such as protein and ash content in Japan, as well as in South Korea. Despite considerable effort on the part of the researchers, it was not possible to design a set of scaling questions to scale the importance of individual wheat attributes that Japanese mill representatives were comfortable with. Members of this group preferred only to evaluate the wheat product as a whole, such as in the format of SPM questions. Similar problems were not encountered in designing the South Korean surveys.

Model Diagnostics

The calculated chi-squared statistics for Korean Models I and II were 456.36 and 263.22, respectively, which were greater than the corresponding critical value at the 95% confidence level. This indicates that the specified four attributes in both model were jointly important in affecting millers' stated preferences in purchasing products. The pseudo R^2 values were at 0.41 and 0.23, for Model I and II, respectively indicating a reasonable measure of goodness-of-fit for each model (Tables 1 and 2).

For Japanese Models I and II, the calculated chi squared statistics from each of the log likelihood tests also indicated that in each model the specified attributes were jointly important in affecting buyers' preferences in purchasing wheat. The pseudo R squared values were 0.29 and 0.23 for Model I and II, respectively, indicating a reasonable fit for each model (Tables 3 and 4).

Importance of Quality Attributes

Empirical results of the estimated models based on the SPM data for Korean and Japanese millers' wheat choices are given in Tables 1 to 4. In the interests of brevity, and to focus on that component of the study that is most relevant for Canadian agriculture, analogous results from analysis of millers' flour choices are not presented here. However the full results for flour are presented in detail in the PhD thesis of Renee Kim (Kim, 2001). The estimated coefficients of the SPM models indicate the direction and effect of the particular level of the independent factor on the probability of millers' purchasing that product. A positive coefficient indicates that this factor level increases the probability that the particular product will be chosen. Coefficient estimates are statistically significant and have expected signs in all models.

Marginal Analysis of Wheat Quality Factors

The specification of the multinomial (MNL) models is different for the Japanese and South Korean markets since different attributes and attribute-levels are used in each case. Therefore, direct comparison of the parameter estimates of the MNL models in these two markets is not feasible. An alternative approach to interpret the results of the MNL models is to examine the marginal effect of the estimated coefficients, which can allow direct comparison of the Japanese and the Korean models. Even though the signs of parameter estimates [i.e. the signs of the coefficients of the MNL model] give indications of the likelihood of the response event or response with respect to a particular level of an attribute, this does not indicate 'how much' the specific level of an attribute increases or decreases the likelihood of the response (Liao, 1994). Evaluation of marginal effect of attribute levels can be particularly useful in comparing the differences in choice responses between Japanese and Korean millers regarding wheat quality

attributes. This information may aid inference of how to differentiate marketing efforts in these two different markets.

The values in the set of explanatory variable determine the level of event probabilities, and the marginal effect of an explanatory variable on probability will vary with the level of the event probability. Hence, to interpret the marginal effects of explanatory variables, two predicted probabilities that use different values for a particular variable and that use the same set of values for the rest of the explanatory variables (*ceteris paribus*) can be compared. The difference between these two predicted probabilities is interpreted as the marginal effect of the specific variable on the probability of miller's choice.

The predicted probabilities of product choices are calculated using a set of values (levels) for the attribute variables. To calculate predicted probabilities, a specified level of each of the explanatory variable needs to be determined for choice A and choice B. The variable with the highest estimated value for each set of explanatory variables is presumed to have the largest impact on the probability of millers' purchasing a product. Therefore, the set of values of explanatory variables for the marginal analysis [i.e. the base case] is chosen based on the variables with the highest level of estimated coefficients in the MNL models. One exception to this procedure is made in computing the marginal probabilities. To facilitate a better understanding of the marginal probabilities, it is assumed that the factor level for the price variable is fixed at the level of "no change" for all calculations of the marginal probabilities.

Marginal Effects of Ash Content and Falling Number

Table 5 and 6 report the calculated marginal effects of changes in specified quality factors on the probability of millers' wheat choices in both South Korea and Japan. For falling number, the probability of Korean millers making a purchase of medium wheat increases by 0.26

when the falling number increases from 300 to 337. The probability of purchase of medium wheat by Japanese millers increases by 0.18 for a rise in the falling number from 250 to 300. This suggests that an improvement in the condition of the falling number of wheat would have a substantial impact on millers' purchase behavior in both countries. However, Japanese millers' probability of purchase of semi- hard wheat decreases by 0.03 when the falling number increases from 337 to 380. If exporters attempt to improve the condition of the falling number in semi-hard wheat, they need to be careful not to exceed the preferred range of falling number, which is between 250 and 337.

Marginal Effects of Protein Content

Korean and Japanese millers exhibit different reactions to changes in the level of protein content. Japanese millers place a greater value, within the given price ranges, on a protein content increase from 11. 0 to 12.0 percent, while Korean millers place greater value on a change in the protein level from 10.8 to 11.5 percent. Japanese millers appear to prefer a higher level of protein for semi-hard wheat than is the case for Korean millers.

Millers in both Japan and South Korea have negative reactions to a rise in wheat protein content from 10.7 to 11.5 percent for medium wheat. Korean millers' probability of wheat purchase decreases by 0.19 for such an increase in the protein level. For the same protein change, the probability of purchase of medium wheat by Japanese millers decreases by 0.05. Thus a higher level of protein content does not necessarily result in an increased probability of purchase by millers in Japan and South Korea. It is important to increase the protein level to add value to the medium wheat class, but this must be done within the range that is revealed through the marginal probabilities. Korean millers are more responsive than Japanese millers to changes in protein levels. This suggests that the potential benefit to an exporter from an increase in the

protein content of a medium wheat could be greater in the Korean market than the Japanese market.

Preferred Dockage Level

Differences in the preferences for dockage levels by Japanese and Korean millers suggest that Korean millers are more stringent in their preferences for this aspect of wheat. Although dockage level at 0.2 percent was specified as the lowest level for each wheat class for millers in both Japan and South Korea, the levels of acceptance of dockage were different for Japanese and Korean millers. A 0.4 percent level of dockage had a positive effect on the probability of purchase of wheat by Japanese millers, while this dockage level had a negative effect on the probability of wheat choices by Korean millers. Wheat dockage is a contract term subject to negotiation between buyers and sellers. Dockage differs from other quality attributes in that it can be controlled at several points in the marketing system. This factor is used by some exporting nations as a grade-determining factor, with stringent limits that make grain cleanliness a component of export strategy (Johnson and Wilson, 1995). The lower level of acceptance for dockage by Korean millers than Japanese millers suggests that Korean millers may be more stringent in negotiating contract terms with exporters. Given this feature of Korean millers' behavior, there appear to be rewards for exporting extra-clean wheat to the South Korean market.

Marketing Implications for Exporters from the Marginal Analysis

The qualitative pre-survey interviews and the results of the estimated models suggest the need for marketing efforts to be differentiated for the Japanese and South Korean markets. The comparison of the marginal effects of changing the level of each factor on the probability of millers' wheat and flour choices for Japan versus South Korea shows some differences in

millers' preferences in the two nations. Overall, the marginal effects of the quality factors of wheat on the millers' probability of choice were greater in South Korea than in Japan.

As noted earlier in this report, one possible explanation for differences in millers' choice responses is the difference in the organization of the wheat marketing systems in these two nations. The wheat marketing system in South Korea was privatized in 1990. Prior to 1990, KOFMIA regulated the importation of wheat. As South Korea privatized its wheat marketing system, millers were allowed to import wheat directly and they have tended to use more stringent and specific contract specifications than formerly (Interview, 1999). Private buyers (millers) may tend to develop more specificity in purchase contracts, as suggested by Wilson, since they have a greater incentive to evaluate the value of wheat quality and can be more willing to pay a premium if that greater quality enhances their profits (Dahl and Wilson, 2000). This may suggest that quality improvements in wheat classes that are tailored for the South Korean noodle market could result in a greater response by millers than would be expected in the Japanese market under the current marketing regime.

In Japan, the central buying agency, the Japan Food Agency (JFA) regulates the importation of wheat and does this through quota allocations and two-tier pricing. Japanese millers are tertiary buyers who take the resale prices of imported wheat that are set by the JFA. The primary buyers of imported wheat in Japan are the grain traders who sell the imported wheat to the JFA, which is the secondary buyer. Japanese millers purchase imported wheat from the JFA at fixed resale prices on which a substantial mark-up is added. Since Japanese millers are insulated from international wheat prices and may only request quality specifications from the JFA, millers in Japan may be less willing to pay premiums for improvements in wheat quality. They also appear to be less responsive to changes in quality characteristics of wheat and flour. It

seems that the scope of product differentiation of wheat marketed to Japan may be constrained by the current system of wheat marketing in that country since Japanese millers have limited influence on the quality specifications for imported wheat. However, as the wheat marketing system gradually deregulates, it is anticipated that the competition among Japanese millers may intensify, with a consequent increase in competition among wheat exporting nations relative to this market. One implication of gradual market deregulation in Japan is that Japanese millers' preferences for quality characteristics of imported wheat could effectively translate into changes in actual market demand. It is expected that Japanese imported wheat market may present a marketing opportunity for wheat exporting nations as the wheat marketing system in Japan becomes more open.

Conclusions from the Marginal Analysis

Regional and global trade agreements are changing the landscape of world agricultural trade. This can create new or emerging markets and changes in the composition of import demand for agricultural products. These can be seen in the international wheat market. A prominent feature of these changes is a rapid growth of wheat importation in the Asian market for noodle uses, coupled with a shift toward privatization in their wheat import systems. A related feature is the increased emphasis on quality characteristics for wheat exported to Japan and South Korea.

The use of stated preference methods (SPM) to obtain survey data on millers' attitudes to selected quality attributes of wheat in Japan and South Korea enabled comparisons of choice behavior of Japanese and Korean millers through the marginal analysis of quality factors. There are several conclusions from this. First, Korean millers are more responsive than Japanese millers to changes in the levels of quality factors of wheat and flour. This implies that product

development that closely matches the quality specifications of South Korean millers could result in greater response by Korean millers. Second, Korean millers are found to be more stringent in the quality specifications that they apply in purchasing wheat. Most notable is the difference in the preferences for dockage level by Japanese and Korean millers. A level of dockage at 0.4 percent had a positive effect of probability on the probability of wheat purchase by Japanese millers, while this dockage level had a negative effect on the probability of wheat choices by Korean millers. These differences in millers' responses to quality changes support the general hypothesis that differences in institutional features of the two markets may be associated with differences in attitudes towards the quality of imports.

Conclusions from the Alternate Methodologies of SPM and SDS

The results from the traditional approach to marketing analysis of Semantic Differential Scale (SDS) questions are summarized in Tables 7, 8, and 9. Overall, these are consistent with and support the results of the SPM analysis.

Analysis of the South Korean wheat and flour market allowed application of two alternative methods of collecting choice data and assessing millers' attitude to price, country of origin and other significant quality factors for wheat and wheat flour for noodle use in South Korea. Overall, the results from both approaches demonstrate similar results in identifying the nature of preferences for wheat and flour quality. The results of the SPM indicate that millers prefer semi-hard and medium wheat of Australian origin; for the soft wheat class Korean millers expressed a preference for wheat of U.S. origin. Canadian origin does not significantly affect millers' utility. These findings were confirmed by the results of the SDS analysis.

The SPM is well grounded in a body of economic and statistical theory. However the SDS approach may be simpler to apply and analyse. Both approaches require good information

about the relevant products, quality attributes and the levels of these that are relevant to respondents' actual choice sets. Thus each approach must be based on information from industry experts or focus groups that reflects accurate knowledge of the industry. The experience from this component of the study suggests that both approaches can be complementary, as in deriving South Korean millers' quality preferences for wheat and wheat flour. These techniques may be valuable in future research on desired product profiles in new or emerging market segments.

Analyzing Preferred Product Profiles

The various product profiles preferred by millers are derived by selecting the levels of attributes that are indicated from the model results in Tables 1 through 4 to be most preferred by millers. For example, the coefficients on the Korean SPM models for wheat in Table 1 indicated that for the semi-hard wheat class, protein level at 12.2 percent and a dockage level at 0.2 percent is preferred. Korean millers also prefer semi-hard wheat with ash content at 1.45 percent, falling number at 380 and test weight at 80. For the medium wheat class, a preference is displayed for wheat with protein at 10.7 percent, dockage level at 0.2 percent, ash content at 1.55 percent, falling number at 380 and test weight at 82. For the soft wheat class, Korean millers expressed a preference for protein at 9.5 percent, dockage level at 0.2 percent, ash content at 1.45 percent, falling number at 380 and test weight at 80. Similarly, preferred levels of the quality attribute for the various flour products are developed. For millers in Japan and Korea, the preferred product profiles are summarised in Table 10.

The preferred product profiles can be readily compared to the features of the various wheat classes that are currently marketed into each of these markets from three of the world's major wheat exporters: the U.S., Australia and Canada. For exports from Australia, these features are outlined in Tables 11. For wheat exports from the U.S. and Canada, similar information is in

Table 12. Comparison of preferred products with actual exports sheds light on the issue of whether or not each major exporting nation is developing and marketing wheat according to the quality preferences stated by South Korean millers. For example, Table 11 indicates that Australia marketed five different wheat types classes to South Korea in 1998/99. One of these, described as "100% Australian noodle wheat" is targeted specifically at Korea's market for Ramen noodles. The quality profile for this wheat type is very similar to the preferred profile for the class of medium wheat class that is shown in Table 10. The Australian "100% noodle wheat" product matches these preferences very well, with test weight of 81.5, ash content of 1.33%, protein content of 10.2%, dockage of 0.3% and falling number of 395. Evidently Australia has developed a wheat category that is particularly well suited to millers' preferences in the medium wheat market segment in South Korea. In contrast, the medium wheat class that is marketed by the U.S. is hard red winter wheat (11.5% protein). However, this wheat class has protein content and falling number at levels much higher than the preferred level for Korean millers. Canada currently does not market medium class wheat to South Korea.

All three exporting nations do compete in the semi-hard wheat market segment in South Korea. In terms of this class of wheat, the U.S. markets hard red winter wheat (HRW) at 13.0% protein, while Canada promotes Canada western red spring wheat (CWRS) at 13.5% protein. Australia exports Australian hard (AH) wheat in this wheat category. The analysis reported here shows Korean millers' preferred profile for the semi-hard wheat class with ash content of 1.45%, falling number of 380, test weight of 80, protein content of 12.2% and dockage level of 0.2%. Australian hard wheat has protein content which is lower (11.6%) than the preferred level and ash content of a higher level (1.63%) than preferred (1.45%). Canadian western red spring wheat has protein content at a higher level (13.3%) than preferred. Canadian western red spring wheat

also has a higher level of ash content (1.57%) than the level preferred (1.45%) by Korean millers. However, the U.S. appears to be competitive in terms of the product characteristics preferred by Korean millers for semi-hard wheat. Its HRW (13.0%) has protein content (12.9%) that is close to the preferred level (12.2%), although ash content (at 1.57%) is also higher than the preferred level (1.45%).

The U.S. is also competitive in the soft wheat market segment in Korea. Australia promotes the Australian soft (AS) wheat class, which has ash content at 1.32%, protein content at 8.7%, dockage at 0.3%, and falling number at 353, while the U.S. exports western white wheat (WW) that has test weight at 80, ash content at 1.43%, protein content at 9.5%, dockage at 0.5% and falling number at 379. Since the preferred profile by Korean millers for soft wheat includes ash content at 1.55%, falling number at 380, test weight at 80, protein content at 9.5% and dockage level at 0.2%, WW from the U.S. is closest to the soft wheat profile preferred by Korean millers. Canada does not export soft wheat to South Korea market.

We conclude from comparing the SPM preferred product profiles of Korean and Japanese millers (Table 10) to the actual market-level attributes (Tables 11 and 12) that Australia is competitive in the medium-class wheat market segment of the South Korean market. The U.S. is competitive both in the semi-hard and the soft wheat market segments. Although Canada supplies wheat with the lowest level of dockage, meeting millers' preferences with respect to this particular attribute, the classes of wheat that it exports to South Korea are not a good match to the preferences of wheat millers catering to the noodle market.

In South Korea, the 100% Australian noodle wheat category is found to be closely matched with the preferred quality specifications of medium wheat, while HRW (11.5%) of the U.S. has protein content and falling number at much higher levels than the preferred levels.

Canada began to market CWRS with lower levels of protein content in 1998 (KOFMIA, 2000). Specifically Canada exported CWRS at 11.5% and 12.5% protein content to South Korea in 1998 and 1999 to target the medium wheat market segment. For semi-hard wheat, there is no wheat class that matches precisely the quality profile preferred by Korean millers. AH from Australia and CWRS 13.5% from Canada both are targeted to the semi-hard wheat segment, but do not match the protein and the ash content preferred by Korean millers. DNS from the U.S. also has protein content (13.5%) that is higher than the preferred level (12.2%) and ash content (1.55%) that is higher than the preferred level (1.45%).

WW from the U.S. meets the soft wheat profile preferred by Korean millers. AS from Australia has a protein content (8.7%) that is lower that preferred for soft wheat (9.5%) in South Korea. Canada does not export soft wheat to the South Korean market. Australia exports the largest number of wheat categories, which may have helped to increase its market share in South Korea. Overall, Australia appears to be successful in positioning itself in the market segment for medium wheat, while the U.S. sells wheat with characteristics that are preferred in the smaller market segments for soft wheat in South Korea.

In Japan, the U.S. is competitive in both the hard wheat and semi-hard wheat market segments. Ash content and protein content of DNS (14.0% protein) from the U.S. is reported to match the protein content and ash content preference for hard wheat expressed by Japanese millers. CWRS (13.5% protein) from Canada is too low in protein content and too high in ash content (1.57%) to match the preferences for this wheat class stated by Japanese millers. APH (14.7% protein) from Australia has a higher level of protein than the preferred level, as well as a higher level of falling number (713) than the preferred level (380). Canada and Australia

currently do not have hard wheat or semi-hard wheats that closely meets millers' stated preferences for protein content and ash content in Japan.

In the medium wheat category, ASW from Australia has quality characteristics that are close to the preferred profile stated by Japanese millers. In summary, the U.S. appears to have a competitive position, in this context, in the hard wheat and the semi-hard wheat market segments, while Australia is competitive in the characteristics of its wheat for the large market segment of medium wheat in Japan. Australia is reported to have been rapidly evolving toward increased emphasis on niche marketing, whereby varieties and production regions are being matched to customers' specific needs (Drynan 1998). Our study suggests that this policy has been successful in catering to Asian millers' preferences.

Implications of the Study Relative to Canada and Alberta's Agriculture

Major findings from this study are summarized in Table 13. Overall, this study shows that Australia appears to have a stronger "brand image" in both the medium and the semi-hard wheat categories in Japan and South Korea, compared to the U.S. and Canada. Currently, Australia does not provide semi-hard wheat that closely meets the preferred quality profiles for this wheat type that are stated by Japanese and Korean millers. However, Australia was perceived to have the strongest brand image in the semi-hard wheat market segment. It may be that the effective niche marketing emphasized by Australia in developing a medium class noodle wheat that meets these customers' quality specifications may have contributed to a positive brand image of Australia as a quality supplier in general.

Alston et al (1989) and Esfahani (1995) have argued that the Japanese government has managed wheat imports with quotas that favor the U.S. over other exporters due to the political and economic importance of the U.S. to Japan and that political bias has distorted market shares.

Our observations are consistent with this hypothesis. We find that both Japanese and Korean millers prefer wheat of Australian origin to wheat from either the U.S. and Canada for both the semi-hard and medium wheat classes that are suitable for production of noodle flour. However, Australia's market share has been approximately 20 percent in Japan during the period from 1976 to 1996, while the U.S. market share in Japan has been 57 percent during the same period. The preferences for wheat of Australian origin expressed by Japanese millers do not translate into the actual market share of Australia in Japan. With future privatization in the wheat marketing system in Japan, it could be expected that Australia could benefit through an increasing market share from market liberalization and Canada could lose market share, particularly in the noodle wheat market segment.

In South Korea, the preferences for wheat of Australian origin by millers are currently reflected in the actual market shares of three exporting nations. These are summarized in Table 13. The market share of the U.S. decreased from 100 percent to 68 percent from 1970 to 1996, while the market share of Australia increased rapidly, from zero percent to 29 percent and then to almost 40 percent in 1970, 1996 and 1999, respectively. It appears that the privatization of the wheat marketing system in South Korea resulted in appreciable changes in import market shares for wheat.

The U.S. has exported wheat to South Korea since 1959, while Canada and Australia began their exportation of wheat to this nation in 1983. Canada has a relatively weaker position than the U.S. and Australia in the South Korean market with respect to semi-hard and soft wheat categories. Improvement would require much product development and marketing effort to better match buyer preferences. Nonetheless, the South Korean market could be viewed to be

promising from a Canadian perspective since Korean millers are more responsive than Japanese millers to quality improvements in wheat classes that are used in producing noodle flour.

Coefficient estimates of the MNL models for the Japanese market indicate Japanese millers' preferences for U.S. origin over Canadian origin for both semi-hard and medium wheat classes. Canada has been a stable supplier to Japan from 1972 of Canadian western red spring (CWRS) that has protein level at 13.5 percent. This has been mainly used in milling bread flour. Canada's CWRS 13.5 percent has been recently used in processing some Chinese fresh noodles (Interview, 2000). Canada's wheat market share in Japan has been maintained at 25 percent during this period. However, Canadian exporters may need to extend their product development and marketing efforts to Japan as Japan's wheat market deregulates. As the Japanese wheat market gradually deregulates, millers' preferences for imported noodle wheat will be more effectively revealed and competition among exporting nations can be expected to intensify.

In general, Canadian wheat does have certain characteristics [cleanliness and uniformity] preferred by importers (Dahl and Wilson 1999). However the effectiveness and efficiency of Canada's current wheat quality control system is increasingly under scrutiny as import demand becomes more segmented, leading to requirements of specificity and heterogeneity in order to serve different niche markets. The Japan Food Agency, the sole marketing agency for wheat imported to Japan, has, in effect, guaranteed the importation of a stable quantity of wheat from Canada for the past three decades. This agency has purchased consistent quantities and types of wheat classes from year to year. However, it is expected that Japan's wheat import system will gradually deregulate with international pressures for import markets to become more open. As the market control of the JFA is dismantled, the market position of Canada in Japan will

ultimately be determined by the effectiveness of Canada's marketing strategies in supplying wheat varieties that meet importers' preferences.

Increasing demand for new 'niche' quality types of wheat to serve particular markets such as Japan and South Korea are adding pressure on the wheat licensing and grading system in Canada, particularly relative to its long-maintained system of kernel visual distinguishability (KVD) in the licensing of approved wheat varieties. To respond to buyers' specific quality needs, Canada recently developed a hard white wheat variety that has been registered within the Canadian Prairie Spring White (CPSW) class, yet has fundamentally different hardness and protein quality to other wheats in that class (CGC 2000). This hard white wheat variety has end-use qualities similar to CWRS or DNS, but has a white seed coat, which it is hoped may be popular in Asian noodle wheat markets (CWB/CGC 2000). This variety is segregated to preserve its identity within the Canadian grain handling system through a contract and identity preservation program administered by the CWB. To accommodate development of more white wheat varieties that are suitable to marketing to Asian noodle wheat markets, it may be necessary to modify further the current wheat quality control system.

Summary and Conclusions

The motivation for this study is the lack of knowledge of millers' preferences for noodle wheat in Asia, where noodle wheat is an expanding market segment. Data for the study are from interviews and questionnaires completed by millers in South Korea and Japan. Millers' choices of wheat with varying characteristics were analysed with multinomial logit models. These estimates are used to identify millers' preferred product profiles for various types of wheat and flour. Estimates are reported in the paper for millers' preferences for intrinsic quality features and trade contract terms for major types of wheat. Marginal analysis also yielded comparisons of

millers' preferences in the two nations. Overall, the results of the study indicate that millers in both Japan and South Korea exhibit strong preferences for wheat of Australian origin for noodle uses. In contrast to Australia and the United States, Canada does not produce or market a wheat variety that corresponds well to millers' preferred noodle wheat product profiles in terms of the wheat characteristics of falling number, protein level or dockage. Nor is Canada identified by millers in either of these nations as a preferred supplier of noodle wheat. Canada has a minor share of wheat exports to Korea but holds an appreciable share of Japanese wheat imports. However, Canada's market share of Japanese wheat imports may be more reflective of Japan's current regulated import process, rather than millers' preferences. Investment in product development and marketing will be necessary if Canada's market share of the noodle wheat market in both Japan and Korea is to be increased.

In South Korea where market liberalization has occurred, intense competition among exporters is driven by quality differentiation. The case of Australia's marketing success in South Korea suggests that those exporters that effectively respond and cater to importers' preferences will be able to position themselves for the long term. This implies that Canada needs to develop wheat marketing and quality control systems which can accommodate efficient development and commercialization of new wheat varieties if it is to cater effectively to the Asian noodle market segment.

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Figure 1. Example of Stated Preference Method (SPM) Question

Segment 3: Trade, Medium wheat

Assume that the following alternatives are the only ones on your next order for medium wheat. Would you choose A or B or would you choose neither?

Product Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Price	5% less than previous price paid	Same price as previous price paid	Neither alternative A nor B
Protein level	10.8%	11.5%	
Country of origin	Canada	Australia	
Dockage	0.4	0.6	
I would choose			

Figure 2. Example of Semantic Differential Scale (SDS) Question: Evaluation of Quality of Service and Promotional Activities

Attribute										
Reliability		Excellent	1	2	3	4	5	6	7	Poor
	The U.S.	Excellent	____:	____:	____:	____:	____:	____:	____	Poor
	Canada	Excellent	____:	____:	____:	____:	____:	____:	____	Poor
	Australia	Excellent	____:	____:	____:	____:	____:	____:	____	Poor

Figure 3. Example of Question on Preferred Level of an Individual Quality Factor: Evaluation of Wheat Quality

Attribute		
Protein Content (Preferred %)		
	Semi-hard wheat	12.0 12.4 12.8 13.2 13.6 14.0 14.2 ____:____:____:____:____:____:____ 10.5 11.0 11.5 12.0 12.5 13.0 13.5
	Medium wheat	____:____:____:____:____:____:____ 9.0 9.5 10.0 10.5 11.0 11.5 12.0
	Soft wheat	____:____:____:____:____:____:____

Figure 4. Factors/ Product Categories specified for the SPM Choice Experiment for Japanese and Korean Markets

Section	No. of Choice Experiment	Product Categories For Korean Survey	Product Categories For Japanese Survey	Factors
Section 1	1st	Semi-hard wheat	Hard Wheat	Price, Ash content, Falling number, Test weight
Section 1	2nd	Medium wheat	Semi-Hard wheat	Price, Ash content, Falling number, Test weight
Section 1	3rd	Soft wheat	Medium wheat	Price, Ash content, Falling number, Test weight
Section 2	4th	Semi-hard wheat	Hard wheat	Price, Protein content, Country of origin, Dockage
Section 2	5th	Medium wheat	Semi-Hard wheat	Price, Protein content, Country of origin, Dockage
Section 2	6th	Soft wheat	Medium wheat	Price, Protein content, Country of origin, Dockage

[c] The first choice experiment includes 32 questions on semi-hard wheat class for the Korean market. The second choice experiment includes 32 questions on medium wheat class, while the third choice experiment includes 32 questions on soft wheat class. For the Japanese market, the first choice experiment has 32 questions on hard wheat class and the second choice experiment has 32 questions on semi-hard wheat class. The last choice experiment in the Japanese questionnaire includes 32 questions on medium wheat class.

Figure 5. Wheat and Flour Quality Attribute Description

Attribute	Description
Amylograph	Amylograph is a test for amylase activity of flour. A higher value of amylograph indicates low level of amylase activity, which is a desirable property of flour quality.
Ash Content	Ash is composed of inorganic material present predominantly in the outer layers of the grain. The ash is expressed on an 11% moisture basis for wheat and 13.5% moisture basis for flour. The ash content of flour is a good indication of milling quality, since a high ash content indicates significant contamination with aleurone cells and bran during the milling operation. Ash has a positive relationship with flour yield since extraction of higher yields of flour will give higher ash content of flour.
Color Grade	The color grade of a flour is a valuable measure of quality since it reflects two important aspects of milling quality: (a) the freedom of the resulting flour from finely divided bran specks, i.e. the ease with which the aleurone and outer layers can be removed from the endosperm, and (b) the actual color of the endosperm. The reflection of light from flour at a wavelength where there is minimum interference from yellow xanthophyll measures the color grade. There are several different instruments that measure the color grade. In this study, the value of the color grade (L value) is based on the measurement from Minolta colorimeter.
Dockage Level	Dockage level measures the cleanliness of the grain. The dockage level indicates the amount of unmillable material and foreign matter that exist among the grains. The dockage level is a deductible in transactions and the removal of dockage depends on the incentives in the market.
Falling Number	It measures the amount of amylase released and the susceptibility of the starch in the sample to enzymic attack. The falling number test measures the rate at which a weight falls through a starch gel or flour paste prepared under standardized conditions. A high falling number value represents low amylase activity. Falling numbers of 250 seconds or above are indicative of sound wheat, the exact value depends on the variety under test and the growing conditions. These features relate to the texture of dough and the noodle products.
Protein	Protein is a key quality factor that buyers of wheat grain normally expect a minimum guaranteed protein content to suit their particular end use. Protein is an important guide to wheat quality since it affects the gluten strength of dough and the quality of the finished product. The quantity of protein is used as a proxy for trading since the quality of protein is not easily measured.
Test Weight	Test weight is a measure of volume of grain and is expressed in kilograms per hectolitre or in pounds per bushel. The test weight indicates growing and harvesting conditions of wheat. Very low test weight is associated with sub-optimum growing and harvesting conditions, and such conditions can cause shrinkage, bleaching and subsequent loss of grade.
Water absorption (%)	Evaluation of water absorption capacity of flour indicate rheological properties of flour dough. The Farinograph is used to measure the amount of water absorption. Strong flour has higher water absorption.
Elasticity (B.U.)	The Extensigraph is used to determine elasticity and extensibility of doughs. Useful indicator of noodle processing.
Stability (Min)	Stability of dough is measured with Farinograph. Mixing tolerance is measured by stability, defined as the interval in minutes between the time the curve reaches the 500 Brabender Unit (B.U.) line and the time the curve first drops below the 500 B.U.line.
Moisture Content (%)	The percent of moisture in cleaned grain or flour. The moisture content of each class of grain is a grade determinant of the grading system. High level of moisture content in grains is not desirable since it creates environment for growth of moulds.

Source: Canadian International Grains Institute (CIGI) and Simmonds, 1989 p. 79.

Table 1. Estimated Coefficients of the Multinomial Logit Model I: Korean Market

	Semi-hard Wheat		Medium Wheat		Soft Wheat	
Factor	Factor level	Estimated Coefficient (S.E.)	Factor level	Estimated Coefficient (S.E.)	Factor level	Estimated Coefficient (S.E.)
Price						
	10% down	1.40* (0.31)	10% down	1.21* (0.31)	10% down	1.02* (0.29)
	5% down	0.12 (0.28)	5% down	0.61* (0.29)	5% down	0.63* (0.28)
	No change	-0.65* (0.27)	No change	-1.14* (0.31)	No change	-0.43* (0.27)
	5% up	-0.88* (0.28)	5% up	-0.68* (0.28)	5% up	-1.22* (0.29)
Ash content						
	1.90%	-1.20* (0.28)	1.85%	-1.76* (0.34)	1.85%	-1.23* (0.28)
	1.75%	0.27 (0.27)	1.70%	0.16 (0.27)	1.75%	-0.42* (0.28)
	1.60%	0.31* (0.26)	1.55%	1.02* (0.27)	1.55%	1.07* (0.27)
	1.45%	0.63* (0.23)	1.45%	0.59* (0.25)	1.45%	0.58* (0.25)
Falling number						
	250	-3.72* (0.59)	250	-3.31* (0.54)	250	-3.14* (0.51)
	300	0.79* (0.31)	300	0.18 (0.32)	300	0.41* (0.29)
	337	1.37* (0.29)	337	1.46* (0.30)	337	1.31* (0.28)
	380	1.56* (0.30)	380	1.68* (0.31)	380	1.42* (0.29)
Test weight						
	73	-0.91* (0.31)	75	-0.77* (0.32)	75	-0.47* (0.29)
	77	0.64 (0.25)	79	-0.07* (0.26)	77	-0.18* (0.26)
	80	0.60* (0.32)	82	0.78* (0.34)	80	0.58* (0.30)
	84	0.31* (0.27)	86	0.58 (0.30)	84	0.07 (0.27)
Log likelihood function			-332.11			
Log likelihood ratio test (χ^2 Statistic)			456.36*			
Pseudo R^2			0.41			

* indicates statistical significance at 95% confidence level
N (number of respondent) =23

Table 2. Estimated Coefficients of the Multinomial Model II: Korean Market

	Semi-Hard Wheat		Medium Wheat		Soft Wheat	
Factor	Factor Level	Estimated Coefficient (S.E.)	Factor Level	Estimated Coefficient (S.E.)	Factor Level	Estimated Coefficient (S.E.)
Price						
	10% down	0.99* (0.23)	10% down	0.93* (0.22)	10% down	0.93* (0.21)
	5% down	0.66* (0.27)	5% down	0.55* (0.26)	5% down	0.50* (0.23)
	No change	-0.60* (0.25)	No change	-0.22* (0.23)	No change	-0.34* (0.23)
	5% up	-1.04* (0.27)	5% up	-1.26* (0.27)	5% up	-1.09* (0.26)
Protein						
	10.8%	-1.04* (0.29)	9.5%	-0.90* (0.27)	8.5%	-0.01 (0.23)
	11.5%	0.15 (0.25)	10.2%	0.18 (0.23)	9.0%	-0.46* (0.24)
	12.2%	0.48* (0.24)	10.7%	0.84* (0.24)	9.5%	0.73* (0.22)
	12.8%	0.41* (0.23)	11.5%	0.04 (0.22)	10.0%	-0.26* (0.23)
Country of Origin						
	The U.S.	0.57* (0.25)	The U.S.	0.20* (0.23)	The U.S.	0.41* (0.24)
	Canada	-0.13* (0.24)	Canada	0.32 (0.23)	Canada	0.02 (0.22)
	Australia	1.19* (0.26)	Australia	0.54* (0.23)	Australia	0.25* (0.22)
	Domestic	-1.62* (0.33)	Domestic	-1.06* (0.28)	Domestic	-0.69* (0.25)
Dockage						
	0.8	-0.88* (0.29)	0.8	-0.64* (0.26)	0.8	0.25* (0.24)
	0.6	-0.20 (0.23)	0.6	-0.03 (0.23)	0.6	-0.68* (0.24)
	0.4	-0.18 (0.26)	0.4	-0.12 (0.25)	0.4	-0.04* (0.24)
	0.2	1.25* (0.25)	0.2	0.79* (0.23)	0.2	0.47* (0.22)
Log likelihood function			-426.68			
Log likelihood ratio test (χ^2 statistic)			263.22*			
Pseudo R^2			0.23			

* indicates statistical significance at 95% confidence level
N (number of respondent) =23

Table 3. Estimated Coefficients of the Multinomial Logit Model I: Japanese Market

	Hard Wheat		Semi-hard Wheat		Medium Wheat	
Factor	Factor Level	Estimated Coefficient (S.E)	Factor Level	Estimated Coefficient (S.E)	Factor Level	Estimated Coefficient (S.E)
Price						
	2% down	0.65* (0.19)	2% down	0.83* (0.18)	2% down	0.70* (0.19)
	1% down	0.16 (0.18)	1% down	0.06 (0.18)	1% down	0.20* (0.19)
	No change	-0.07 (0.19)	No change	-0.31* (0.19)	No change	-0.17 (0.19)
	1% up	-0.74* (0.21)	1% up	-0.57* (0.21)	1% up	-0.72* (0.20)
Ash content						
	1.90%	-1.02* (0.21)	1.85%	-1.16* (0.20)	1.85%	-1.40* (0.22)
	1.75%	-0.39* (0.18)	1.70%	-0.52* (0.19)	1.70%	-0.78* (0.19)
	1.60%	0.84* (0.18)	1.55%	0.54* (0.17)	1.55%	1.12* (0.17)
	1.45%	0.75* (0.18)	1.45%	1.13* (0.18)	1.45%	1.07* (0.17)
Falling number						
	250	-0.95* (0.19)	250	-1.46* (0.23)	250	-0.96* (0.20)
	300	0.57 (0.19)	300	0.23* (0.19)	300	0.07 (0.20)
	337	0.42* (0.18)	337	0.67* (0.18)	337	0.26* (0.18)
	380	0.48* (0.17)	380	0.56* (0.18)	380	0.63* (0.18)
Test weight						
	73	-1.63* (0.24)	75	-0.95* (0.22)	75	-0.60* (0.21)
	77	-0.39 (0.18)	77	-0.04 (0.18)	77	-0.20* (0.18)
	80	0.68* (0.17)	80	0.53* (0.19)	80	0.42* (0.18)
	84	1.00* (0.18)	84	0.46* (0.18)	84	0.38* (0.18)
Log likelihood function			-726.89			
Log likelihood ratio test (χ^2 statistic)			589.66*			
Pseudo R^2			0.29			
* indicates statistical significance at 95% confidence level						
N (number of respondent)=41						

Table 4. Estimated Coefficients of the Multinomial Logit Model III: Japanese Market

	Hard Wheat		Semi-hard Wheat		Medium Wheat	
Factor	Factor Level	Estimated Coefficient (S.E.)	Factor Level	Estimated Coefficient (S.E.)	Factor Level	Estimated Coefficient (S.E.)
Price						
	2% down	0.76*	2% down	0.98*	2% down	1.14*
		(0.17)		(0.17)		(0.17)
	1% down	0.61*	1% down	0.57*	1% down	0.67*
		(0.17)		(0.17)		(0.16)
	No change	-0.21	No change	-0.18*	No change	-0.36*
		(0.17)		(0.17)		(0.18)
	1% up	-1.17*	1% up	-1.37*	1% up	-1.46*
		(0.21)		(0.21)		(0.22)
Protein						
	12.0%	-0.90*	10.2%	-0.78*	9.5%	-0.30*
		(0.20)		(0.20)		(0.18)
	12.7%	-0.37*	11.0%	-0.46*	10.2%	-0.06
		(0.18)		(0.18)		(0.18)
	13.5%	0.59*	12.0%	0.73*	10.7%	0.24*
		(0.17)		(0.17)		(0.17)
	14.0%	0.69*	12.8%	0.51*	11.5%	0.13
		(0.16)		(0.16)		(0.16)
Country of Origin						
	The U.S.	0.36*	The U.S.	0.12	The U.S.	-0.12
		(0.16)		(0.17)		(0.17)
	Canada	0.21*	Canada	0.04	Canada	-0.47*
		(0.17)		(0.18)		(0.17)
	Australia	-0.12	Australia	0.17*	Australia	0.37*
		(0.17)		(0.17)		(0.17)
	Domestic	-0.46*	Domestic	-0.32*	Domestic	0.22*
		(0.18)		(0.18)		(0.18)
Dockage						
	0.8	-0.80*	0.8	-0.83*	0.8	-1.14*
		(0.20)		(0.20)		(0.22)
	0.6	-0.27*	0.6	-0.41*	0.6	-0.32*
		(0.17)		(0.17)		(0.17)
	0.4	0.28*	0.4	0.30*	0.4	0.41*
		(0.17)		(0.17)		(0.17)
	0.2	0.81*	0.2	0.94*	0.2	1.06*
		(0.16)		(0.17)		(0.18)
Log likelihood function			-803.55			
Log likelihood ratio test (χ^2 statistic)			475.86*			
Pseudo R^2			0.23			

* indicates statistical significance at 95% confidence level
N (number of respondent)=41

Table 5. Marginal Analysis on the Quality Attributes of Wheat in the Korean Market

Marginal Analysis of Factors in the Korean Market						
	Semi-hard Wheat		**Medium Wheat**		**Soft Wheat**	
Factor[a,b]	**Change in level**	**Marginal Probability**	**Change in level**	**Marginal Probability**	**Change in level**	**Marginal Probability**
Ash content						
	1.90% to 1.75%	0.27	1.85% to 1.70%	0.23	1.85% to 1.75%	0.09
	1.75% to 1.60%	0.01	1.70%to 1.55%	0.20	1.75%to 1.55%	0.31
	1.60%to 1.45%	0.08	1.55%to 1.45%	-0.11	1.55% to 1.45%	-0.12
Falling No.						
	250 to 300	0.30	250 to 300	0.17	250 to 300	0.25
	300 to 337	0.13	300 to 337	0.26	300 to 337	0.20
	337 to 380	0.05	337 to 380	0.05	337 to 380	0.03
Test weight						
	73 to 77	0.32	75 to 79	0.12	75 to 77	0.06
	77 to 80	-0.01	79 to 82	0.20	77 to 80	0.18
	80 to 84	-0.07	82 to 86	-0.05	80 to 84	-0.12
Marginal Analysis of Factors in the Japanese Market						
	Hard Wheat		**Semi-Hard Wheat**		**Medium Wheat**	
Factor[a,b]	**Change in level**	**Marginal Probability**	**Factor level**	**Marginal Probability**	**Factor level**	**Marginal Probability**
Ash content						
	1.90% to 1.75%	0.09	1.85% to 1.70%	0.06	1.85% to 1.75%	0.05
	1.75% to 1.60%	0.27	1.70%to 1.55%	0.19	1.75%to 1.55%	0.35
	1.60%to 1.45%	-0.02	1.55%to 1.45%	0.14	1.55% to 1.45%	-0.01
Falling No.						
	250 to 300	0.32	250 to 300	0.27	250 to 300	0.18
	300 to 337	-0.04	300 to 337	0.11	300 to 337	0.04
	337 to 380	0.01	337 to 380	-0.03	337 to 380	0.09
Test weight						
	73 to 77	0.12	75 to 79	0.17	75 to 77	0.08
	77 to 80	0.21	79 to 82	0.14	77 to 80	0.15
	80 to 84	0.08	82 to 86	-0.02	80 to 84	-0.01

[a] Two predicted probabilities that use different values for a particular variable and that use the same set of values for the rest of the explanatory variables (*ceteris paribus*) are compared to derive the marginal probability of change in the level of a factor. The difference between these two predicted probabilities is interpreted as the marginal effect of the specific variable on the probability of miller's choice. To calculate predicted probabilities, a specified level of each of the explanatory variable needs to be determined for choice A and choice B. The factor levels that are identified from preferred product profiles are used as the base case (choice B).

[b] Note that the factor level for the price variable is fixed at the level of "no change" for all calculations of the marginal probabilities.

Table 6. Marginal Analysis on the Quality Attributes of Wheat in Model II

Marginal Analysis of Factors in the Korean Market						
	Semi-hard wheat		Medium wheat		Soft wheat	
Factor[a,b]	**Change in level**	**Marginal Probability**	**Change in level**	**Marginal Probability**	**Change in level**	**Marginal Probability**
Protein						
	10.8% to 11.5%	0.23	9.5% to 10.2%	0.18	8.5% to 9.0%	-0.08
	11.5% to 12.2%	0.08	10.2% to 10.7%	0.16	9.0% to 9.5%	0.25
	12.2% to 12.8%	-0.02	10.7% to 11.5%	-0.19	9.5% to 10.0%	-0.22
Origin						
	The U.S to Canada	-0.14	The U.S to Canada	0.03	The U.S to Canada	-0.09
	Canada to Australia	0.28	Canada to Australia	0.05	Canada to Australia	0.05
	Australia to the U.S.	-0.43	Australia to the U.S.	-0.32	Australia to the U.S.	-0.20
Dockage						
	0.8 to 0.6	0.08	0.8 to 0.6	0.11	0.8 to 0.6	-0.19
	0.6 to 0.4	0.003	0.6 to 0.4	-0.04	0.6 to 0.4	0.12
	0.4 to 0.2	0.30	0.4 to 0.2	0.20	0.4 to 0.2	0.12
Marginal Analysis of Factors in the Japanese Market						
	Hard wheat		**Semi-Hard wheat**		**Medium wheat**	
Factor[a,b,c]	**Change in level**	**Marginal Probability**	**Change in level**	**Marginal Probability**	**Change in level**	**Marginal Probability**
Protein						
	12.0% to 12.7%	0.08	10.2% to 11.0%	0.05	9.5% to 10.2%	0.05
	12.7% to 13.5%	0.21	11.0% to 12.0%	0.26	10.2% to 10.7%	0.07
	13.5% to 14.0%	0.02	12.0% to 12.8%	-0.05	10.7% to 11.5%	-0.03
Origin						
	U.S to Canada	-0.037	U.S to Canada	-0.02	U.S to Canada	-0.07
	Canada to Australia	-0.078	Canada to Australia	0.03	Canada to Australia	0.19
	Australia to the U.S.	-0.072	Australia to the U.S.	-0.12	Australia to the U.S.	-0.04
Dockage						
	0.8 to 0.6	0.08	0.8 to 0.6	0.05	0.8 to 0.6	0.09
	0.6 to 0.4	0.11	0.6 to 0.4	0.13	0.6 to 0.4	0.13
	0.4 to 0.2	0.13	0.4 to 0.2	0.15	0.4 to 0.2	0.15

Table 7. Value of Means And Standard Deviation (S.D.) From The SDS Survey Results For Wheat Quality Evaluation

Attributes	Hard wheat		Medium wheat		Soft wheat	
	Attribute level	Mean value of scale (S.D.)	Attribute level	Mean value of scale (S.D.)	Attribute level	Mean value of scale (S.D.)
Protein content	12.0-12.5%	4.63 (1.36)	10.5-11.0%	4.56 (1.09)	9.5-10.0%	4.5 (1.10)
Ash content	1.4-1.5%	3.55 (1.44)	1.4-1.45%	3.09 (1.04)	1.35-1.40%	2.73 (1.01)
Moisture content	9.5-9.7%	4.40 (2.01)	9.3-9.5%	3.90 (1.79)	9.0-9.4%	3.70 (1.77)
Falling no.	365	6.45 (1.29)	361	6.09 (1.58)	353	5.36 (2.01)
Test weight	81-82	5.90 (1.76)	81-82	5.27 (1.68)	81-82	5.18 (1.66)
Dockage	0.40-045%	2.17 (1.99)	0.40-0.45%	2.17 (1.70)	0.35-0.40%	1.92 (1.37)

Table 8. Values of Means and Standard Deviations (S.D.) from the SDS Survey Results for Wheat Flour Quality Evaluation by South Korean Millers

Attributes	Instant ramen flour		Udon flour		Dry-noodle flour	
	Attribute level	Mean value of scale (S.D.)	Attribute level	Mean value of scale (S.D.)	Attribute level	Mean value of scale (S.D.)
Color (L value)	91-91.5	3.18 (1.99)	92.5-93	4.82 (2.18)	91.5-92	3.73 (2.00)
Amylograph (AU)	800-850	4.09 (1.51)	900-950	5.45 (1.13)	850-900	4.55 (1.21)
Ash content (%)	0.40-0.41%	5.29 (1.49)	0.36-0.37%	3.36 (1.22)	0.40-041%	5.07 (1.27)
Protein content (%)	9.30-9.50%	5.79 (0.80)	8.75%	4.50 (1.22)	9.30-9.50%	5.79 (0.89)
Moisture content (%)	12.25-12.50%	5.85 (1.86)	12.50-12.75%	6.38 (1.19)	12.20-12.40%	5.69 (2.17)
Stability (Min)	9.75-10.00 min	3.91 (2.02)	9.75-10.00 min	3.91 (2.11)	10.45-10.55 min	4.55 (2.02)
Elasticity (BU)	135-137.5	2.4 (1.95)	140-142	3.2 (3.03)	135-135.5	2.0 (1.73)
Water absorption (%)	60	4.82 (0.60)	60	5.18 (1.40)	60	5.0 (1.09)

Table 9. Values of Means and Standard Deviation (S.D.) from the SDS Survey Results for Service Quality Evaluation by South Korean Millers

Attributes	The U.S.		Canada		Australia	
	Range of the attribute	Mean value of scale (S.D.)	Range of the attribute	Mean value of scale (S.D.)	Range of the attribute	Mean value of scale (S.D.)
Consistency of supply	1: poor 7: good	4.60 (1.35)	1: poor 7: good	4.93 (0.96)	1: poor 7: good	5.47 (0.99)
Reliability	1: poor 7: good	4.71 (1.14)	1: poor 7: good	5.00 (1.11)	1: poor 7: good	5.43 (1.16)
Service & assistance	1: poor 7: good	4.67 (1.59)	1: poor 7: good	5.00 (1.25)	1: poor 7: good	5.47 (1.19)
Variety of products	1: high 7: low	2.60 (1.18)	1: high 7: low	4.33 (1.40)	1: high 7: low	3.33 (0.90)
Quality of technical information	1: high 7: low	2.81 (1.28)	1: high 7: low	4.00 (1.41)	1: high 7: low	2.56 (1.36)

Table 10. Preferred Product Profiles of Wheat by South Korean and Japanese Millers

Preferred Product Profiles of Wheat by South Korean Millers

A. Preferred Product Profiles for Three **Wheat** Classes relating to intrinsic wheat quality

Factor	**Semi-hard Wheat**	**Medium Wheat**	**Soft Wheat**
Ash content	1.45%	1.55%	1.55%
Falling Number	380	380	380
Test Weight	80	82	80

B. Preferred Product Profiles for Three **Wheat** Classes relating to Trade Contract Terms

Factor	**Semi-hard Wheat**	**Medium Wheat**	**Soft Wheat**
Protein content	12.2%	10.7%	9.5%
Country of Origin	Australia	Australia	The U.S.
Dockage Level	0.2%	0.2%	0.2%

Preferred Product Profiles of Wheat by Japanese Millers

C. Preferred Product Profile for Three **Wheat** Classes relating to intrinsic wheat quality

Factor	**Hard Wheat**	**Semi-Hard Wheat**	**Medium Wheat**
Ash content	1.60%	1.45%	1.55%
Falling Number	380	337	380
Test Weight	84	80	80

D. Preferred Product Profile for Three **Wheat** Classes relating to Trade Contract Terms

Factor	**Hard Wheat**	**Semi-Hard Wheat**	**Medium Wheat**
Protein content	14.0%	12.0%	10.7%
Country of Origin	The U.S.	Australia	Australia
Dockage Level	0.2%	0.2%	0.2%

Table 11. Quality Report on Australian Wheat for Korean and Japanese Markets

Quality Report of Australian Wheat for Korean Market (1998/99) /a

Attribute	**ASW** Blend /b (Western Australia)	**100% Australian Noodle Wheat**	**AS /c**	**AH /d**	**APH /e**
Test weight	82.5	81.5	79.5	82.0	80.5
Ash content	1.35 %	1.33 %	1.32 %	1.41%	1.63%
Protein content	10.4 %	10.2%	8.7 %	11.7 %	13.2%
Dockage	0.2 %	0.32 %	0.3 %	0.36 %	0.36 %
Falling number	452	395	353	356	490

Quality Report of Australian Wheat for Japanese Market (1997) /f

Attribute	**ASW** Blend (Western Australia)	**G.P. /g**	**APH (13.0%)**	**APH (14.0%)**
Test weight	81	78	82.5	83
Ash content	1.35 %	1.63%	1.33 %	1.32 %
Protein content	10.4 %	10.4 %	13.7%	14.7%
Dockage	0.3 %	0.5 %	0.2 %	0.3 %
Falling number	425	N/A	512	713

/a Source: Australian Wheat Board (AWB) Crop Report to South Korea, 1998/99
/b Australian Standard White (ASW) Blend
/c Australian Soft (AS)
/d Australian Hard (AH)
/e Australian Prime Hard (APH)
/f Wheat classes that are particularly marketed to Japan; Source: JFA, The Quality Survey, 1997
/g General Purpose (GP).

Table 12. Quality Reports for U.S. and Canadian Wheat Exports to the Korean and Japanese Markets

Quality Report of US and Canadian Wheat for Korean Market (1998/99) /a

Attribute	**DNS (14.0%) /b**	**HRW (11.5%) /c**	**WW /d**	**CWRS (13.5%) /e**
Test weight	96	87	57	92
Ash content	1.55 %	1.52 %	1.45%	1.60 %
Protein content	13.5 %	11.3 %	9.3 %	13.4 %
Dockage	0.8 %	0.6 %	0.7 %	0.4 %
Falling number	361	335	322	327

Quality Report of US and Canadian Wheat for Japanese Market (1997) /f

Attribute	**DNS (14.0%)**	**HRW (13.0%)**	**HRW (11.5%)**	**WW**	**CWRS (13.5)**
Test weight	80	80	80.5	80	80.
Ash content	1.60 %	1.57 %	1.54 %	1.43%	1.57%
Protein content	14.0 %	12.9 %	11.6 %	9.5-10%	13.3 %
Dockage	0.5 %	0.5 %	0.3 %	0.5 %	0.2 %
Falling number	406	460	431	379	406

/a Source: The Quality Report: six year average (1993-98), by Cheil Chedang Inc. Co. 1999
/b Dark Northern Spring (DNS)
/c Hard Red Winter (HRW)
/d Western White (WW)
/e Canadian Western Red Spring (CWRS)
/f Source: Japan Food Agency (JFA), Annual Quality Survey, 1997

Table 13. Summary of Study Results

Competitiveness of Three Export Nations

	South Korea	**Japan**
Hard Wheat	N/A	Dark Northern Spring (DNS)
Semi-hard Wheat	No Market Leader	Hard Red Winter (HRW)
Medium Wheat	Australian 100% Noodle Wheat	Australian Standard White (ASW)
Soft Wheat	Western White (WW)	N/A

Origin Preferences by Japanese and Korean Millers

	South Korea	**Japan**
Hard Wheat	N/A	the US
Semi-hard Wheat	Australia	Australia
Medium Wheat	Australia	Australia
Soft Wheat	the US	N/A

Actual Market Share of Three Exporting Nations (1996)

	South Korea	**Japan**
Australia	29%	21%
the US	68%	54%
Canada	3%	25%

Publications Emanating from the Study

Kim, Renee Boyoung. (2001). "Quality Preferences for Wheat and Wheat Flour: Noodle Wheat Markets in Japan and South Korea." PhD thesis, Department of Rural Economy, University of Alberta. 126 pp.

Three journal articles based on the research of this thesis are currently under development or review.