Chapter 5

The Changing Role of **Quality in Grain Markets**

Contents

Tables

Chapter 5

The Changing Role of Quality in Grain Markets

The quality concerns of each industry using wheat, corn, and soybeans are identified in chapter 4. Wheat, by its very nature, is the most complex of the three grains in terms of defining quality because of the vast array of products and processing technologies involved. Quality requirements differ not only by type and individual product, but between mills using the same type wheat to produce flour for the same type of product. Corn is somewhat less complex in that fewer products are produced and quality concerns can be traced to the individual industries, Nevertheless, the quality required by one corn industry is not necessarily important to others, so decisions regarding corn quality must be assessed in terms of major usage. Quality concerns of different industries using wheat are somewhat offset by the fact that different types of wheat exhibit different properties. Soybean quality is the least complex, because the vast majority of soybeans are used to produce oil and meal,

The varying quality requirements exhibited by these industries, especially for wheat, highlight the need for the United States to become more aware of individual industry requirements if the goal is to produce and deliver high-quality grain, The Nation has developed the reputation as a consistent supplier for any type and quality of grain desired; to become a supplier of high-quality grains, it must become more quality-conscious and develop a reputation as a supplier of high quality. The U.S. grain industry must understand the specific requirements of its customers in order to deliver the quality requested and must become more aware of the dynamic issues surrounding the qualities required by the marketplace. Areas such as technological advancements in processing technologies, Government policies, customer preference, development of new finished products, and consumption patterns all affect customers' purchasing decisions and their definition of quality at any one point in time.

QUALITY IN THE MARKETPLACE

High quality, as defined by the specific attributes required by each industry, is constantly changing. But the ability to produce and deliver high-quality grain can mean more than just providing grain that meets specific test results. What constitutes high quality from the customer's point of view can range from special handling (low-temperature drying of corn) to the uniformity of specific attributes within and between shipments. The importance of the latter was evident in the OTA survey results and in the statements by overseas wheat millers (ch. 4).

The OTA survey specifically asked respondents to rank the importance of uniform quality between shipments. Domestic and overseas respondents considered uniformity as being important even though they differed on which attributes were more critical. Overseas millers also indicated the importance of uniformity: Canada and Australia stress uniformity between shipments and this often accounts for wheats from these countries being considered first choice.

Even identifying the important quality attributes for specific industries is not simple. Some traditional measuring technologies are not accepted by all industries producing the same product. In the OTA survey, tests for rheological properties (extensograph, alveograph, and mixograph) were considered more important by overseas wheat millers than by domestic

88-378 - 89 - 4

ones. Though overseas millers considered these tests key, their importance varies by region of the world. Paul Clark, for example, has indicated that in trying to identify and establish soft wheat flour quality characteristics, Archway Cookies, Inc., found not only that companies had different quality requirements but that different companies keyed on different analytical tests for performance parameters (3).

As processing technologies become more sophisticated through automation or as more demanding qualities are required for finished products, the need for specific attributes within well-defined ranges becomes more critical. Technologies for baking bread, rolls, and similar products in large bakeries have advanced significantly. While bread can be made by hand using low-protein wheat, large dough mixers and other equipment found in large automated bakeries place too much stress on the low-protein flour, which results in unacceptable finished products and the need for different attributes. The way the flour will be baked plays a very important role in determining the specific values for the various attributes required.

In addition to advances in processing technologies, technological advances in other areas can have an impact on the quality required by different industries. For many years, high-protein wheats have been blended with low-protein wheats to strengthen flour. More recently, vital wheat gluten, a product containing 75 to 80 percent protein, has been used as a flour fortifier. The recent expansion of vital wheat gluten production is the result of technological improvements in breadmaking, population growth, and increasing urbanization in some countries. Vital wheat gluten in these nations has become more attractive than higher priced, imported wheat.

Many countries striving to become self-sufficient in wheat production are producing vital wheat gluten to fortify their locally produced low-protein wheat. Some European processors are also producing isoglucose, a sweetener and sugar substitute, from wheat starch (that portion of the wheat kernel remaining after the gluten is extracted), similar to corn sweetener's use in the United States.

Corn, which has always been considered from a feed point of view, is beginning to experience pressures in areas similar to those experienced by wheat. As feed manufacturing becomes more sophisticated and automated, along with the need for strictly controlled balanced diets especially in the poultry industry, the demand for quality attributes and consistency in delivery is of increased importance. In other cases, individual dry and wet corn milling companies are placing more stringent demands on the quality of corn they purchase. Companies are contracting with farmers to grow certain varieties and provide special handling, such as low-temperature drying.

Traditional quality attributes, *even* though varied, thus may be influenced by technological advances, economic concerns, and Government policies here and abroad. For the United States to produce and deliver high-quality grain, it must not only become increasingly aware of concerns over quality expressed by domestic and overseas industries and match quality to their wishes, but it must understand why importers purchase grain in the first place.

The findings in chapter 4 could lead to the conclusion that the United States should stress developing high-protein wheats. Yet the expanded use of vital wheat gluten in some countries to obtain self-sufficiency provides a completely different picture. Knowledge of customer preference, consumption patterns, and the role of Government policies is critical when considering what direction the United States should take. The rest of this chapter examines these areas using wheat as an example.

CHANGING NATURE OF MARKETS-A CASE STUDY IN WHEAT

As the intensity of competition in grain markets increases, so does the differentiation of important quality characteristics. Because of the dynamic nature of wheat markets, OTA analyzed the demand for wheat quality characteristics in international markets. The analysis had two specific objectives—to identify the extent to which market shares are determined by factors such as relative prices, income, preferences, and other factors, and to analyze preferences for wheat by quality factors and estimate changes in these preferences. *

Background

Various types of wheat are produced around the world based on conduciveness of the local climate. For example, the semiarid climate found around the Mediterranean Sea is particularly suitable for production of Durum wheat. Environmental factors including rainfall, temperatures, soils, available nutrients, and topography influence and cause wide variety in such wheat characteristics as protein content, test weight, and kernel size. Genetics is also a major factor in wheat characteristics. Plant breeding programs differ greatly from one producing area to the next, resulting in wide variations in inherited attributes. Differences in environment and genetics among wheat-producing areas of the world or within a country result in wide variations in the characteristics of wheats produced, even among those of the same general type.

Numerous classes of wheat are available from the major wheat-exporting countries of Argentina, Australia, Canada, France, and the United States (see table 5-1). Although each exports one or more wheat class, the United States is alone in exporting five classes in significant amounts. Hard Red Winter (HRW) has always been the dominant class in U.S. wheat exports, followed by Hard Red Spring (HRS); White and Soft Red Winter (SRW), in varying arrangements—the second through fourth positions. Durum is consistently the class with the lowest export volume. Each of the remaining exporter countries is known for one dominant class or, in the case of France, type. Argentina predominantly exports Trigo Pan whereas Canada has established a reputation with high bread-making quality Canadian Western Red Spring (CWRS). France, a member of the European Community (EC), exports soft wheats. Australian Standard White is by far the dominant class in Australian wheat exports.

The quantity and quality of protein is the most important attribute of wheat in determining end-use suitability. Table 5-2 shows the required protein levels of typical American wheat products and protein ranges for U.S. wheat classes. The overlapping of class protein ranges portrays the possibilities of class substitutions. Differences between protein ranges and realization of protein quality differences between classes reveal the inability of wheat classes to be perfectly substitutable or homogeneous from a technical perspective.

Product Consumption and Wheat importation

Consumers generally prefer end products that make good use of the characteristics of wheat grown in their local or regional area. Tastes and preferences thus tend to be regionalized by climate and culture (l). In the Mediterranean area, for instance, where Durum wheat is grown, products typically consumed include bread, couscous, bulgur, and fereek, all of which are made from Durum alone or in a blend with common wheat. The Far East provides another example of this behavior. Vast amounts of soft wheat are grown in this region so that noodles, chappatis, and steamed breads join rice as common consumer products.

Flour millers and other wheat product providers in importing countries are well aware of the tastes and preferences in their markets. Millers are interested in buying wheats that em-

*The analysis is based on William W. Wilson, Paul Gallagher, and Jean Riepe, "Analysis of Demand for Wheat Quality Characteristics, " prepared for the Office of Technology Assessment, U.S. Congress, Washington, DC, 1988.

Table 5-1 .—Export Classes of Wheat Categorized by Characteristics and Country of Origin

	Characteristics						
	Kernel hardness			Bran color		Habit	
Country/wheat class	Hard	Medium-hard	soft	Red	White	Winter	Spring
Argentina:							
Trigo Pan	X			x		X	
Fideos and Candaal Taganrock (Durum)[a]							
Australia:							
Prime hard	X				X	X	
Hard	X				X	X	
Australian Standard White		X			X	X	
Australian Standard White—soft varieties			X		X	X	
Australian Soft Durum[a]			X		X	X	
Canada:							
Canadian Western Red Spring	X			x			X
Canadian Prairie Spring		X		x			X
Canadian Utility	X			x			X
Canadian Western Red Winter	X			x		X	
Eastern Western Amber Durum[a]			x		X		X
France:							
By lot specifications			x	x	X	X	X
United States:							
Hard Red Spring	X			x		X	
Hard Red Winter	X			x	X		
White wheat					X	X	
Western White			x		X	X	
Western Club			x		X	X	
Soft Red Winter			x	x		X	
Durum[a]							

[a]Durum is a highly specialized wheat type generally not classified with others.

SOURCE: Canada Grains Council, *Wheats of the World* (Winnipeg, MB: 1979)

Table 5-2.—Required Protein Levels for Wheat-Based End Products and Protein Content of U.S. Wheat Classes

Uses		Sources	
Product	Protein content (percent)	Wheat class	Protein content (percent)
Pasta	13 and above	Hard Red Spring	12-18
Hearth bread	13-14	Durum	10-16
Hard rolls	13-14	Hard Red Winter	9-14
Pan bread	11.5-13	Soft Red Winter	8-11
Crackers	10-11	White wheat	7-11
Biscuits	9.0-11.0		
Cake	9-9.5		
Pie crust	8-10		
Cookies	8-9		

SOURCES: S. Evans, "Wheat: Background for 1985 Farm Legislation," Agriculture Information Bulletin No 467, Economic Research Service, US Department of Agriculture, Washington, DC, 1984, and J. Halverson and L. Zeleny, "Criteria of Wheat Quality," *Wheat Chemistry and Technology*, Y Pomeranz(ed) (St Paul, MN American Association of Cereal Chemists, 1988)

body the characteristics suitable for the desired end products. Table 5-3 provides a guide to regional tastes and preferences for end products as well as the required flour protein levels and wheat types to produce them. Western White wheat has been the preferred U.S. wheat class imported by Far East Asian countries under Public Law 480, and the region still imports substantial amounts of White wheats from the United States and Australia {41 Besides hav-

Table 5-3.—Regional Tastes, Preferences, and the Requirements for Wheat-Based End Products

Region	Major products consumed	Average required protein level	Types of wheat used
Far East Asia	Pan bread	12-14	Hard Red
	Steamed products	10-11	Medium-hard
	Noodles	9-11.5	Soft to Medium-hard White
	Chappatis	9-1o	Soft to Medium-hard White
Middle East and North Africa	Bread		Durum, medium-hard White and Red
	Couscous, Pasta, Bulgur, Fereek	9-11	Durum
Europe	White pan bread	10-12	Hard Red, domestic soft
	Rolls	9.5	
	Pasta		Durum
Latin America	Breads	10-14	Hard Red, domestic soft
	Pasta		Durum

SOURCE Canada Grains Council, *Wheats of the World* (Winnipeg, MB 1979)

ing appropriate protein content, White wheats are preferred because they produce products with acceptable color,

Wheat importers in regions of high bread consumption have more than one option for achieving protein levels required based on relative prices and qualities, Government policies, and other factors (4). If there is sufficient domestic production of soft wheat, high-quality wheats can be imported for blending to upgrade the flour. This is customary in the United Kingdom, which imports CWRS and HRS for this purpose. In regions of insufficient or no local production, flour millers can import either moderately high-quality wheat, all of which is the desired protein content, or a combination of hard and soft wheats to blend together to achieve the required protein level. In the Mediterranean region, medium-hard White wheats from the United States and Australia are imported to fill the gap between domestic production and total wheat needs.

The Dynamics of the Wheat Market

International wheat trade has been characterized by change. As a result, there has been no consistent indication by the market of ideal wheat quality. Major importers purchase a variety of classes and grades. Many new importers that have entered the market require different characteristics from the quality bread wheats in high demand during the last two decades. Changes in milling and baking technology have resulted in lower protein requirements, while increased sophistication in milling and baking technology has made knowledge of the specifications of wheat shipments more important. Generally, the required average flour protein differs by country and end product, as indicated in chapter 4.

Developing countries are rapidly becoming the areas of growth in world market demand from a total wheat import perspective. Traditional importers such as Japan and Western Europe have declined in relative importance. This trend is expected to continue as imports by developing countries account for a greater proportion of world trade. Africa and the Middle East have historic wheat consumption growth rates of 8 percent, compared with 3 percent for Japan and 4 percent for the world.

Related to this is the observation by several researchers that wheat product consumption patterns in developing countries differ from the leavened bread orientation of industrial countries. The demand growth in non-bread-consuming countries has switched the emphasis in world trade away from high bread-making quality wheats toward lower priced, lower protein wheats. Technological changes and declining consumption in industrial countries have also aided this shift.

Analysis Results

Many factors influence demand for quality characteristics, as indicated. Relative prices,

income, domestic production, and preferences all have an effect.

Relative Prices

One important factor influencing demand for wheats of different qualities is the variability in relative prices. Price differences in international markets were relatively small prior to 1973, probably reflecting the supply/demand situation and the lack of need to distinguish between wheat classes, Since then, differentials have increased dramatically in nearly all markets, indicating the increased differentiation in the international market (2). Notable gaps occurred between the prices of stronger wheat (HRS and CWRS) and all other classes, and the relative increase in CWRS has exceeded that of HRS. Embedded in these prices are implicit values for quality characteristics. Analysis of these values indicates that significant premiums exist for Canadian wheats (or discounts for U.S. wheats), that significant implicit values exist for spring v. winter planted, and that the implicit value of protein has been increasing throughout the 1980s.

Income and Domestic Production

With the importance of developing countries in the growth of the world grain trade, it is essential to examine the role of income in the quality of wheat purchased. In addition, the importance of the level of per capita domestic wheat production is considered. Countries with higher wheat production may have different requirements regarding imported wheat quality than those with little or no domestic production.

Countries representative of wheat producers and importers with different income levels were selected for analysis (table 5-4). Bread prices range from $().4()/kilogram in Pakistan to $1.88/kilogram in Sweden. Per capita consumption for food ranges from 47 kilograms in Brazil to 164 kilograms in Greece, compared with 86 kilograms in the United States.

Previous studies indicate a tendency for high-income countries to use relatively more wheat for feed (5). The logic is that in times of wheat surpluses the price differential between wheat and coarse grains may be reduced to the point

Table 5-4.–Wheat Consumption in Selected Countries, 1984/85

Country	Bread price (cents per kilogram)	Real income (thousand dollars per person)	Wheat consumption; (kilogram per person)	
			Total	Food
Importers:				
Austria	61	***6.9305***	112.848	71.788
Brazil	85	**0.0540**	47,518	47.518
Denmark	133	**7.6354**	342.857	92.368
Germany	96	**8.7645**	157,437	77.738
Greece	52	**1.5632**	185.930	163.819
Ireland	77	**3.1068**	210.734	112.994
Japan	151	**9.6621**	52.216	51.033
Jordan	56	**0.9351**	117.262	117.262
Netherlands	78	**7.2426**	132.455	83.911
Norway	173	**9.2084**	91.787	79.710
Pakistan	***40***	**0.2305**	133.247	133.247
South Africa	***136***	**1.4330**	69.065	64.025
Spain	***49***	**2.6039**	149.702	103.815
Sweden	***188***	**8.0802**	102,638	66.307
Switzerland	***98***	**11.5979**	121.118	91.149
United Kingdom	***53***	**5.7339**	184.422	97.681
Exporters:				
Argentina	41	0.0130	152.824	150.332
Australia	106	7.9079	187.967	146.396
Canada	129	9.7567	207.043	107.561
France	129	6.0351	233.236	113.706
United States	177	12.3430	132.512	85.998

SOURCE: Office of Technology Assessment, 1989

where feeding wheat becomes economical, and generally only high-income countries can afford to feed large livestock populations. OTA analysis indicates that a significant inverse relationship exists between the proportion of wheat used for food and income. A smaller proportion of wheat is used for food in higher income countries or they use relatively more wheat for feed. Lower income countries, on the other hand, consume a greater proportion of wheat as food.

Table 5-5 shows market shares by class of wheat imported. CWRS, HRS, and EC wheat do relatively well in Western Europe. Correlations between market shares, income, and domestic production were computed (table 5-6). A number of points are clear. First, market shares for stronger, high-protein wheats are positively related with income. Second, market shares of HRW and SRW are inversely related to per capita income. Third, domestic wheat production is inversely related to HRW and Argentine shares, but positively related to the CWRS market share. These results suggest that income level and domestic production influence wheat import patterns. Countries with relatively large domestic per capita production have a tendency to import a greater proportion of Canadian wheat and less Argentine and HRW. Lower income countries tend to purchase the less expensive wheats, possibly due to reduced ability to pay or because they do not require the characteristics of stronger wheats. The level of domestic wheat production affects wheat class market shares, likely reflecting blending v. filler wheat requirements. Thus, the tendency is a shift to CWRS by countries with higher levels of domestic production and a shift away from HRW.

Preferences

Considerable variation exists among markets in the wheat classes imported, their relative importance, and historic growth rates. Useful information can, therefore, be gained by analyzing class or quality import demand on a market-by-market basis. Such an analysis, as previously noted, shows that relative prices and income are significant determinants of market shares. In addition, however, it indicates that a different preference structure exists for individual wheat classes.

The most prominent shifts are away from the dominant HRW and toward weaker wheats (EC and SRW) or stronger wheats (HRS, CWRS, and Durum) (table 5-7). In the overall world trade market, preferences shifted from HRW and toward all other classes. Results from most regional markets are similar. Growing nonprice preferences for SRW, HRS, and CWRS exist in Asia. SRW and Durums are gaining preference in Africa relative to HRW. In Japan, HRW is losing preference to White and HRS. In addi-

Table 5-5.–Market Shares of Imported Wheat Classes, 1984/85

Country	Argentina (ARG)	Australia (ASW)	Canada (CWRS)	European Community (EC)	Us. HRS	Us. HRW	Us. SRW	Us. White	Us. Durum
Brazil	0.15	0.00	***0.27***	0.01	0.00	**0.54**	**0.01**	**0.00**	0,00
Denmark	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**0.00**	**0.00**	0.00
France	0.00	0.00	**0.73**	0.00	**0.02**	**0.00**	**0.00**	**0.00**	0.23
Germany	0.00	0.00	**0.66**	0,00	**0.33**	**0.00**	**0.00**	**0.00**	0.00
Greece	0.00	0.00	**0.00**	0.00	**0.00**	**0.00**	**0.00**	**0.00**	0.00
Japan	0.00	0.17	**0.23**	0.00	**0.17**	**0.22**	**0.00**	**0.18**	0.00
Jordan	0.13	0.15	**0.00**	0.01	**0.00**	**0.69**	**0.00**	**0.00**	0.00
Netherlands	0.04	0.00	**0.10**	0.00	**0.69**	**0.00**	**0.01**	**0.00**	0.14
Norway	0.27	0.00	**0.53**	**0.19**	**0.00**	**0,00**	**0.00**	**0.00**	0.00
Pakistan	0.02	0.60	**0.00**	**0.14**	**0.00**	**0.00**	**0.04**	**0.17**	0.00
South Africa.	0.03	0.93	0.00	0.00	0.00	0,02	0.00	0.00	0.00
Spain	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	***0.60***	0.40	0.00	0.00	0.00	0.00	0.00
Switzerland	0.00	0.00	***0.36***	0.63	0.00	0.00	0.00	0.00	0.00
United Kingdom	0.00	0.00	***0.93***	0.00	0.06	0.00	0.00	0.00	0.00

SOURCE: Office of Technology Assessment, 1989,

Table 5-6.—Correlation of Imported Wheat Class Market Shares, Income, and Domestic Wheat Production, 1984/85

Market shares	Australia (ASW)	Canada (CWRS)	European countries (EC)	Argentina (ARG)	United States					Income	Domestic wheat production
					HRS	HRW	SRW	White	Durum		
Australia	−1.0	—	—	—	—	—	—	—	—	—	—
Canada	−0.52[a]	−1.0	—	—	—	—	—	—	—	—	—
European Community	−0.18	−0.29	−1.0	—	—	—	—	—	—	—	—
Argentina	−0.04	−0.22	−0.14	−1.0	—	—	—	—	—	—	—
U.S. HRS	−0.18	−0.13	−0.26	−0.12	1.0	—	—	—	—	—	—
HRW	−0.02	−0.38	−0.24	−0.44[a]	−0.15	1.0	—	—	—	—	—
SRW	0.39	−0.38	−0.09	0.08	0.01	0.05	1.0	—	—	—	—
White	0.38	−0.33	−0.11	−0.15		0.03[a]	0.58[a]	1.0	—	—	—
Durum	−0.18	0.07	−0.21	−0.14	0.38	−0.17	−0.04	−0.14	1.0	—	—
Income	−0.44[a]	0.34	0.13	−0.13	0.31	−0.42	−0.46[a]	−0.03	0.11	1.0	—
Domestic Wheat Production	0.27	0.69[a]	− 2	−0.4[a]	−0.1	−0.45[a]	−0.19	−0.25	0.22[a]	0.11	1

[a]Indicates significance at the 10-percent level.

Office of Assessment. 1989.

Table 5-7.—Average Growth Rates[a] of Wheat Class Imports by Country, Region, and World, 1961/62-84/85 (percent)

Country/region	United States							Canada			Total imports	Consumption
	HRS	HRW	SRW	WHI	DLR	ARG	ASW	CWRS	CAD	EC		
Africa	—	5.2	13.0	—	19.1	—	—	2.9	33.1	9.8	8.9	—
Asia	9.2	−3.3	34.8	3.0	—	5.9	1.1	2.8	—	3.6	2.4	—
Japan	24.6[b]	3.6	—	2.8	—	—	4.3	0.20	—	—	3.3	—
Latin American	7.5	6.0	5.7	−0.3	17.2	−1.1	—	7.6	—	3.2	5.1	—
Middle East	—	3.2	9.2	18.1	—	—	2.9	15.2	—	0.6	9.5	
United States	1.4	2.4	1.9	2.1	2.6	—	—					2.1
World	8.5	3.0	8.6	3.6	—	4.3	3.3	2.7	—	6.0	4.0	—

[a]Derived from a simple regression of $\log Q_i = y + B \cdot T$ using autoregression techniques. Q_i is annual imports of Class i, T is time trend, and B is the growth rate and the reported coefficient.
[b]This figure is relatively high because in early years HRS imports were nil.

SOURCE: Office of Technology Assessment, 1989.

tion, CWRS, though preferred, is losing relative to White and HRS. But the Latin American market has a strong preference for HRW. Similarly, there are strong and relatively stable preferences for HRW in U.S. domestic markets,

Simulations of changes in wheat class market shares that extrapolate historical preference changes identify important changes (table 5-8). The important underlying assumption is that of constant relative prices. The SRW share of the Asia market is expected to grow by 14 percent by 1995 with losses between 2 and 5 percentage points for most other competitors. In Japan, the HRS share increases by 5 percent. HRW consistently loses between 2 and 4 percent in all regional import markets except Latin America.

Case Study Summary

The analysis measured and compared underlying nonprice shifts in preferences occurring through time. Several regional shifts of particular interest include:

- increases in SRW, HRS, and CWRS in Asia;
- increases in SRW and Durum in Africa, and decreases in HRW;
- decreases in HRW in the Middle East; and
- decreases in SRW in Latin America and increases in HRW and spring wheats.

In general, the world market is experiencing nonprice shifts in preferences away from HRW and toward soft wheats (SRW and EC) and HRS.

Numerous changes in market shares of wheat classes are expected in specific markets, and in some cases these are relatively large, In general, these changes reflect the shifts in preferences. However, despite the shift in preferences toward HRS, growth in this market will be stalled due to the current high price for this class relative to others.

In general, the results indicate that quality differentials are important in international markets, affecting both relative prices and shares in particular markets. Given the unique demands for different classes of wheat and the key underlying shifts in imports, the ability to differentiate wheats of different classes is an important component of international competition. A particular concern, however, is that in many markets the preferences for U.S. wheats are distinctly different from like wheats of competitors. In some markets, imports tend to shift toward stronger wheats as income increases. This is not generally true, however, and in fact in some cases higher incomes through time result in more imports of softer wheats, Thus, strong wheats are not necessarily a luxury, and softer wheats are not necessarily inferior.

Table 5.8.—Simulated Changes in Wheat Class Market Shares, 1985/95 (percent)

Region Class:	HRW	SRW	WHI	EC	ASW	ARG	HRS	CWRS	OUR	CDUR
Africa:										
1984 share	14.5	19.9	—	46.6	—	—	—	5.0	9.6	4.4
1985-95 change	–3.1	1.6	—	–0.8	–	—	—	–0.8	0.1	3.0
Asia:										
1984 share	7.2	18.3	19.1	—	28.5	—	7.5	19.3	—	—
1985-95 change ... , . .	–4.0	14.3	–3.4	—	–4.3	—	–0.5	–2.3	—	–
Japan:										
1984 share	22.9	–	17.1	—	18.4	—	18.1	23.4	–	–
1985-95 change	–2.0	–	–0.7	–	–0.1	—	5.1	–2.5	–	–
Latin America:										
1984 share	48.0	5.4	1.5	2.4	–	13.0	11.5	15,5	2.7	—
1985-95 change	0.5	–0.2	–0.1	–0.2	–	–2.4	0.6	1.0	0.8	—
Middle East:										
1984 share	12.0	3.4	9.3	21.9	42,8	—	—	10.7	—	–
1985-95 change	–2.5	–0.3	0.8	0.6	0.8	—	—	0.6	–	–
United States:										
1984 share	48.7	25.0	7.5	–	–	—	15.1	—	3.8	–
1985-95 change	– 1.0	0.0	0.6	–	–	—	0.2	—	0.1	–
World:										
1984 share	19.1	7.1	6.0	18.2	15.9	8.4	5.1	20.2	–	–
1985-95 change	– 1.3	1.7	–0.1	0.5	–0.4	–0.1	0.6	–0.9	–	–

SOURCE Office of Technology Assessment, 1989

CHAPTER 5 REFERENCES

1. **Agriculture Canada,** *Analysis of Strategic Mixes for Canadian Wheat Exports,* Guelph, Ontario, 1980.
2. International Wheat Council, *World Wheat Statistics,* Annual Issues, London, 1960-1985.
3. *Milling and Baking News,* "Programs To Improve Flour Quality Showing Promise," 67(5): l&30, 1988.
4. Oleson, B., "Price Determination and Market Share Formation in the International Wheat Market," unpublished Ph.D. dissertation, University of Minnesota, St. Paul, MN, 1979.
5. Woodhams, R., *Wheat to 1991: Adapting to Oversupply,* Special Report No. 1070 (London: The Economist Intelligence Unit, 1986).