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Grades/Classes of Hard Wheat Exported from the United States: Analysis of Demand and Trends 1986-2003

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Abstract

Questions have emerged in the United States and Canada regarding the role and function of quality in international markets. One has been the definition and composition of different market segments, with a particular focus on higher quality customers. In this study, trends in U.S. wheat exports are analyzed by class, grade, protein, and market segment. Analysis shows trends toward increases in exports of higher grades of Hard Amber Durum (HAD) and Hard Red Spring (HRS); whereas, exports of higher quality grades for Hard Red Winter (HRW) appear to be moderate. Exports of HRS, HRW, and HAD show increases in proportion of exports shipped at higher protein levels and increases in the proportion of exports where protein is specified. Cluster analysis for each class indicated there have been changes through time including: dockage levels for the highest quality segments declined, the percent of shipments specifying protein increased, and there is a shift toward more market segments. Shares of export volumes for the highest quality segments for both HAD and HRS more than doubled their share of export volume from 7% to 21% for HAD and 18% to 42% for HRS, while shares for the high quality segment for HRW were similar in size to earlier periods, although two moderate quality segments did emerge that were not present in earlier periods.

Key Words: Trends, wheat quality, grades, classes, protein, Hard Red Spring, Hard Red Winter, Hard Amber Durum, market segments

Grades/Classes of Hard Wheat Exported from the United States: Analysis of Demand and Trends 1986-2003

Bruce L. Dahl and William W. Wilson *

Introduction

Previous analysis and debate on competition in the wheat market has focused on class and country of origin as sources of differentiation. Questions have been raised about the ability to penetrate higher quality hard wheat markets and the effect of the organization of the marketing system on competition. Both the United States and Canada are the dominant producers of hard wheats [Hard Red Spring (HRS), Hard Red Winter (HRW), and Hard Amber Durum (HAD) in the United States and Canadian Western Red Spring (CWRS) and Canadian Western Amber Durum (CWAD) in Canada]. These wheats are the dominant source of hard wheats in the world market and have averaged 38% of world wheat trade from 1980/81 to 2002/03; the majority of the remainder being varying types of soft wheat.

Due to the indigenous similarities among hard wheats in Canada and the United States, the competitive environment is particularly acute. Differences exist between the U.S. and Canadian grading systems, which in turn impacts trade. Other studies (see below) have noted the effects of the differences, mostly in terms of the results of surveys of importers and hedonic values. The principal difference is that the U.S. system relies upon specifications of characteristic limits in contracts between buyers and sellers, with reference to grade (e.g., test weight, foreign material, etc.) and non-grade determining factors (e.g., dockage, protein, etc.). It is incumbent upon buyers, through their negotiations with sellers and subject to competition from other buyers, to determine optimal levels of particular characteristics. In contrast, the Canadian system relies more upon a regulatory approach toward grading and standards, with less use of individual specifications. However, pressure is emerging for less homogeneity to meet customer demands (due in part to privatization of importing functions) and competition.¹

Besides the differences in the grading systems, there are two important phenomena that affect competition in the offshore market. One is that the United States has a relatively large domestic market and, in recent years, has consumed over 60% of the domestic wheat crop. Traditionally, the U.S. domestic milling industry purchased primarily No. 1's and No. 2's. Given that typically about 65% and 89%² of the HRS and HRW wheat crop grades as No. 2 or better, a large percentage of the higher quality wheat is consumed domestically, leaving lesser amounts for the offshore market.

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¹ In reference to changes in Canadian grain marketing, Ewins recently indicated that “. . . the number of segregations is seen as a major factor limiting the efficient movement of grain from farm to port and increasing the costs incurred by grain handling companies.”

² Average of 1980-2003 for North Dakota, Minnesota, Montana, and South Dakota Regional Crop Quality Survey for HRS and Kansas Crop Quality Survey for HRW grading No. 2 or better (NDSU Department of Cereal Chemistry; Tierney).

The second factor affecting the changes in grades of wheat purchased is the shift toward privatization of wheat imports (Wilson 1996a and 1996b). One of the important implications of privatization is a tendency for more specificity in purchase contracts. Generally, private buyers have a greater incentive to evaluate the value of higher quality and are more willing to pay premiums (and discounts) if that greater (lower) quality enhances (reduces) their profits. Importer procurement strategies, i.e., the combination of price and quality specifications, are critical factors in the HRS market with some importers using more stringent contract specifications than U.S. domestic millers.³ The latter are accustomed to mixing and blending and can target specific producing regions for their wheat procurement. Contract specifications have considerable strategic importance, particularly in view of competition among buyers (Johnson, Wilson, and Diersen).

Important questions have emerged in each of these countries regarding the role and function of quality in international markets. One has been the definition and composition of different market segments, with a particular focus on higher quality customers. The definition of segments in the international wheat market is important, as well as the specific characteristics of importers deemed as higher quality customers. The objective of this study is to analyze trends in U.S. wheat exports by classes, grades, and protein, and to estimate market segments. Changes over time for class and grade are estimated. Cluster analysis was used to identify segments of buyers according to the grade factor and other specifications, and comparisons are made through time.

Background

Wheat has numerous end uses and indigenous characteristics. Wilson (1989) demonstrated that over time, differentiation (using the Hufbauer index) has increased. Hedonic studies generally have similar conclusions.⁴ Wilson and Gallagher (1990) and Wilson (1989) indicated that through time, there has been a growing diversity of demands for end-use characteristics. Class differences have been recognized and have become a focus of analysis (Agriculture Canada; Wang; Chai; Chang; Benirschka and Koo; Wilson, 1994).

Other major wheat exporting countries are going through related debates and policy analysis. The Grains Council of Australia conducted a series of studies on the international market (Grains Council of Australia). Conclusions indicated a large portion of the variability in prices received by the Australian Wheat Board were due to variability in quality characteristics. Further, it suggested that Canada and Australia were thought to be “quality suppliers” and the United States, along with the EU, Saudi Arabia, and Argentina, were price suppliers. More

³ See Johnson, Wilson, and Diersen for a summary of export specifications of major hard wheat importing countries.

⁴ There have been numerous studies using hedonic analysis in the international wheat market. These include Wilson (1989); Veeman; and Wilson and Preszler (1992, 1993).

recently, it appears Australia is evolving toward increased emphasis on niche marketing whereby varieties and production regions are being matched to customer needs.⁵

While it has always been claimed that Canadian wheat has certain characteristics preferred by importers, mostly related to cleanliness and uniformity,⁶ the value of that preference in terms of higher sales prices has always been a mystery. Kraft, Furtan, and Tyrchniewicz analyzed prices and differentials for sales of Canadian wheat from 1980 to 1994. Results indicated that the average premium received for Canadian wheat relative to its benchmark was \$C13/mt. However, as Carter and Loyns indicate, the additional costs imposed on the Canadian system necessary to achieve these premiums were about \$C21-28/mt. Interviews with some buyers also indicated a preference for Canadian wheat on several characteristics (Exchange Group).

Two studies addressed these issues in the United States. The first was undertaken by the Office of Technology Assessment (OTA) (U.S. Congress – Office of Technology Assessment), followed by a U.S. Department of Agriculture (USDA) study as summarized in Mercier.⁷ The OTA suggested that a highly interdependent “system” impacts the quality of grain offered for export. This is comprised of variety development and release mechanisms, agronomic conditions, trading practices, grading and standards, and farm policies.

The U.S. grading system measures physical (not chemical) characteristics, and these are the mechanisms upon which the establishment of quality measures for premiums and discounts rely. Trading practices cover a range of issues, but are crucial in making cross-country comparisons. These include mechanisms by which premiums and discounts develop, whether by marketing boards or through a market system; local competitive environment; trading practices with respect to indigenous (e.g., protein, varieties, etc.) and extraneous (e.g., damage, dockage, foreign material) quality characteristics; regulations regarding cleanliness and hygiene (e.g., infestation); and the extent that variety is used in the marketing system.

The U.S. system with respect to wheat cleaning, which was the primary motive of these analyses, operates differently from other countries. Both Canada and Australia include wheat cleaning either in terms of restrictive factor limits or as a regulation to induce cleaning on a large portion of wheat entering the market system. In contrast, this is a non-grade determining factor in the United States (Johnson and Wilson, 1993,1995). As such, it is a contractual term, the level of which is determined through negotiation and buyer-seller competition. The upshot is that wheat is cleaned extensively in the United States, but only for those market and competitive conditions in which buyers and sellers specify the limit contractually.

In an earlier study, Dahl and Wilson examined growth and trends for grades and classes of hard wheat exports from North America from 1986 to 1994. They found shifts toward

⁵ See Drynan for a recent summary of export strategies with respect to quality in each of Australia and Canada.

⁶ See Wilson and Dahl for a discussion on issues related to uniformity and consistency.

⁷ See Mercier for a summary analysis and Hyberg, et al. for an overview of the implications.

increases in exports of higher grades for HAD, HRS, and HRW, and an increase in heterogeneity of purchases by hard wheat importing countries.

Young evaluated trends in wheat grades and classes for U.S. wheat from 1982 to 1997. She observed changes in the classes of wheat exported with HRS increasing in importance and HRW decreasing. She found increases in exports of No. 1 HRS, HRW, and, to a lesser extent, White Wheat. The increases in exports of hard red wheats were primarily attributed to South Korea and Mexico. She compared quality parameters for wheat in eight countries that had procured through state agencies and private traders and found no noticeable patterns in quality data that would indicate private buyers purchase higher quality than state agencies.

Lavoie also examined the impact of reform of State Trading Enterprises (STEs) on imports of higher quality wheat. She presented a methodology to analyze the effects of reform of STEs on imports of a quality differentiated product. She assumed higher quality wheats where differentiated by source (those from Australia and Canada sources were considered high quality). Her results for the conceptual model indicate that after reform of an STE, imports of both higher and lower quality wheats should increase, while domestic production should decline. Trends for selected importing countries that had reformed STEs tend to indicate increases in imports of both high and low quality wheat using the definition of high quality as those imported from Australia and Canada. Similar results were found for South Korea for U.S. exports where higher grades increased after reform of their STEs.

World Perspectives Inc. examined North American wheat trends. They indicate global demand for milling quality wheat has begun to decline, offset by growth in lower quality, lower priced feed wheat demand. Production of higher quality wheat in Canada and the United States has been declining, while production has increased in non-traditional exporters such as Ukraine, Kazakhstan, Russia, India, etc. However, they define higher quality wheat demand as total wheat food consumption (total consumption less feed consumption). Thus, their analysis is more comparable to trends in wheat classes.

Production Quality for Wheat Protein and No. 1

Ultimately the quality of exports is subject to the supply of quality from production and the extent that higher quality is captured by domestic markets and not available for export. Therefore, changes in export quality may reflect variability in production quality as well as changes in buyer specifications. The quality of hard wheat production available for both domestic use and exports has varied throughout the 1990s and early 2000s. This variability is especially important if domestic markets are able to capture most of the higher quality production within a year.

Production quality of HAD, HRS, and HRW was characterized by lower average protein levels for many of the years in the middle 1990s but protein levels increased for much of the 2000s (Figure 1). In addition, the percent of production that would grade No.1 trended downward for HRS and HAD for many years in the 1990s, reflecting growing conditions and effects of vomitoxin outbreaks in several of those years (Figure 2). In the 2000s, however, with the adoption of less susceptible varieties, the percent of production that would grade No. 1 HRS or HAD has been increasing to levels near those experienced prior to 1993.

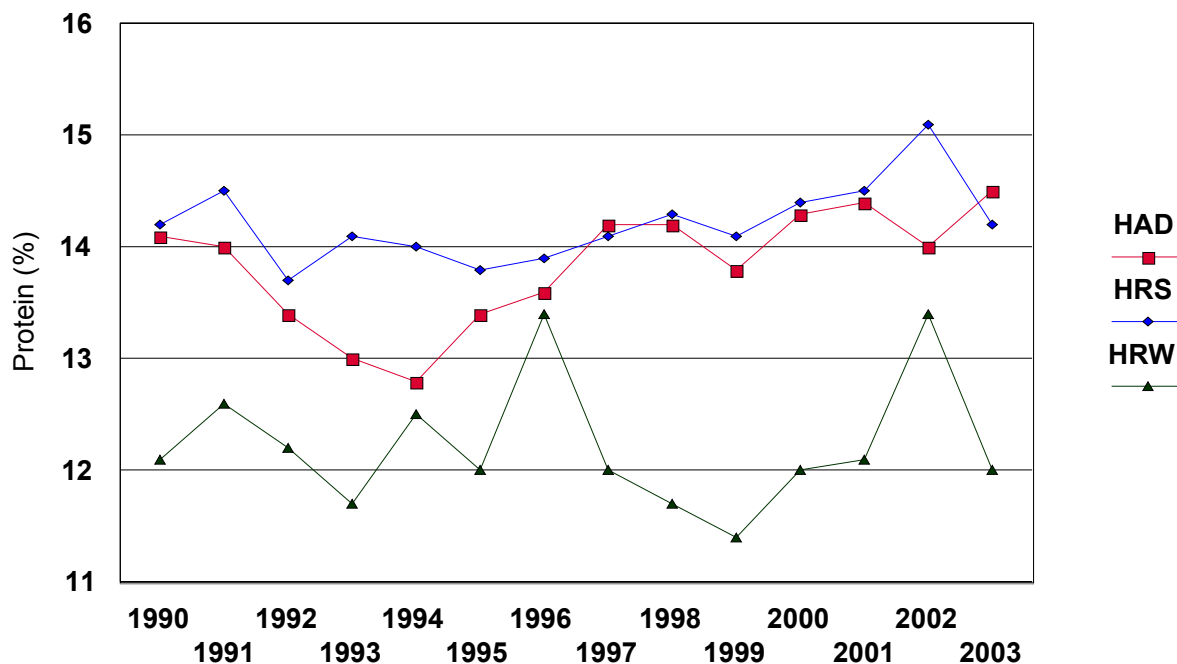


Figure 1. Average Protein Level for U.S. Wheat Production, by Class, 1990-2003.

Data

For this analysis, data were gathered on U.S. wheat export shipments. Data were obtained from USDA-GIPSA from 1986-2003. Data were for individual export shipment inspections and included information on wheat class, grade, grade characteristics (test weight, moisture, foreign material, damaged kernels, total damage, wheat of other classes and wheat of contrasting classes), protein, dockage, volumes, and destinations.

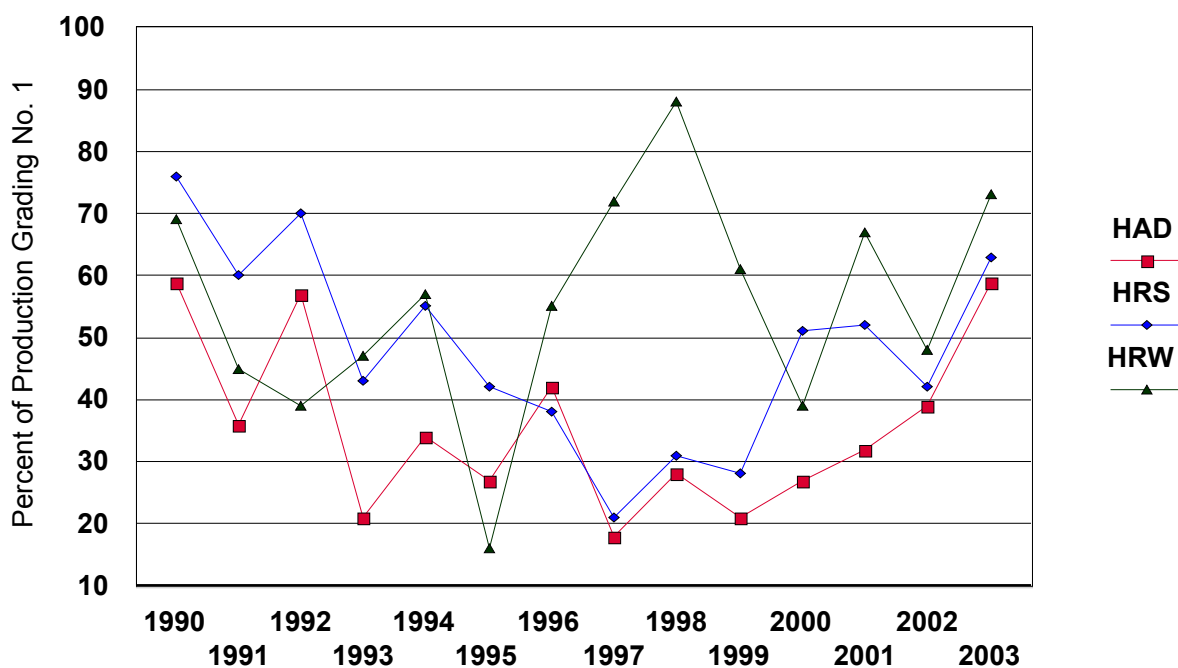


Figure 2. Percent of U.S. Wheat Production Grading No. 1, by Class, 1990-2003.

Trends in Wheat Exports by Class

U.S. wheat exports peaked in 1987/88 at over 1.5 billion bushels and have declined to less than 1.0 billion bushels in 2002/03. Volumes of exports for HRW and HRS also show this trend, with HRW peaking in 1987/88 and declining since and HRS peaking in 1992/93 (Figures 3 and 4). Shares of exports for the wheat classes show shifts by year that are largely amongst HRS, HRW, and Soft Red Winter (SRW) (Figure 5).

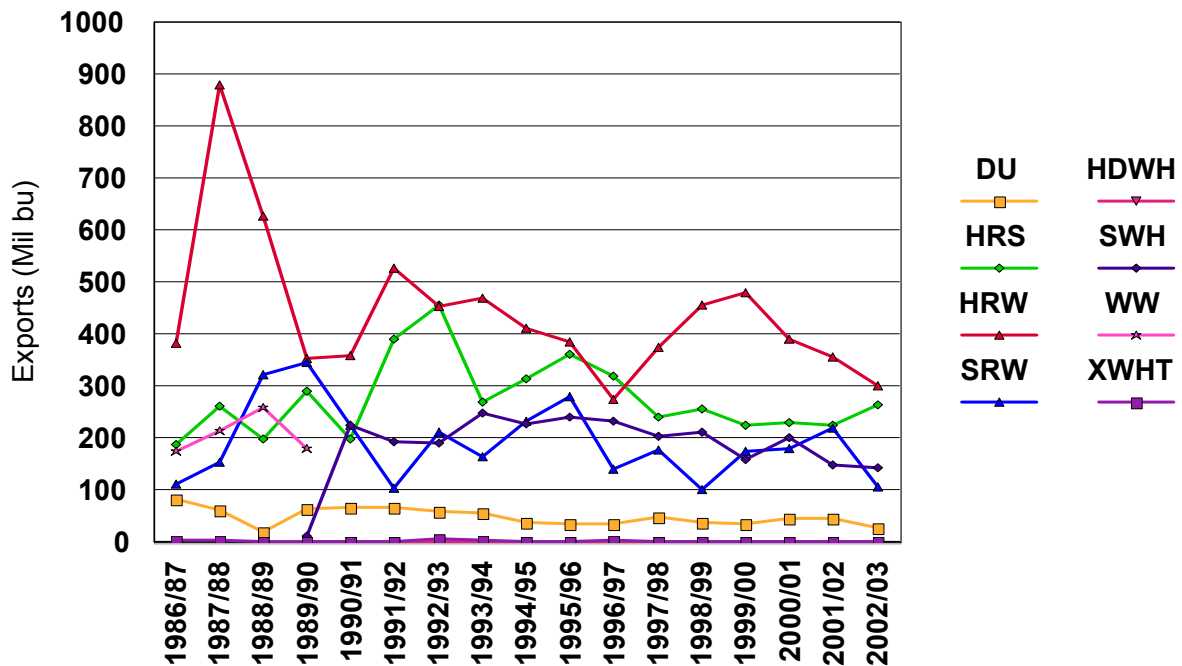


Figure 3. U.S. Wheat Exports, by Class, 1986/87 to 2002/03.

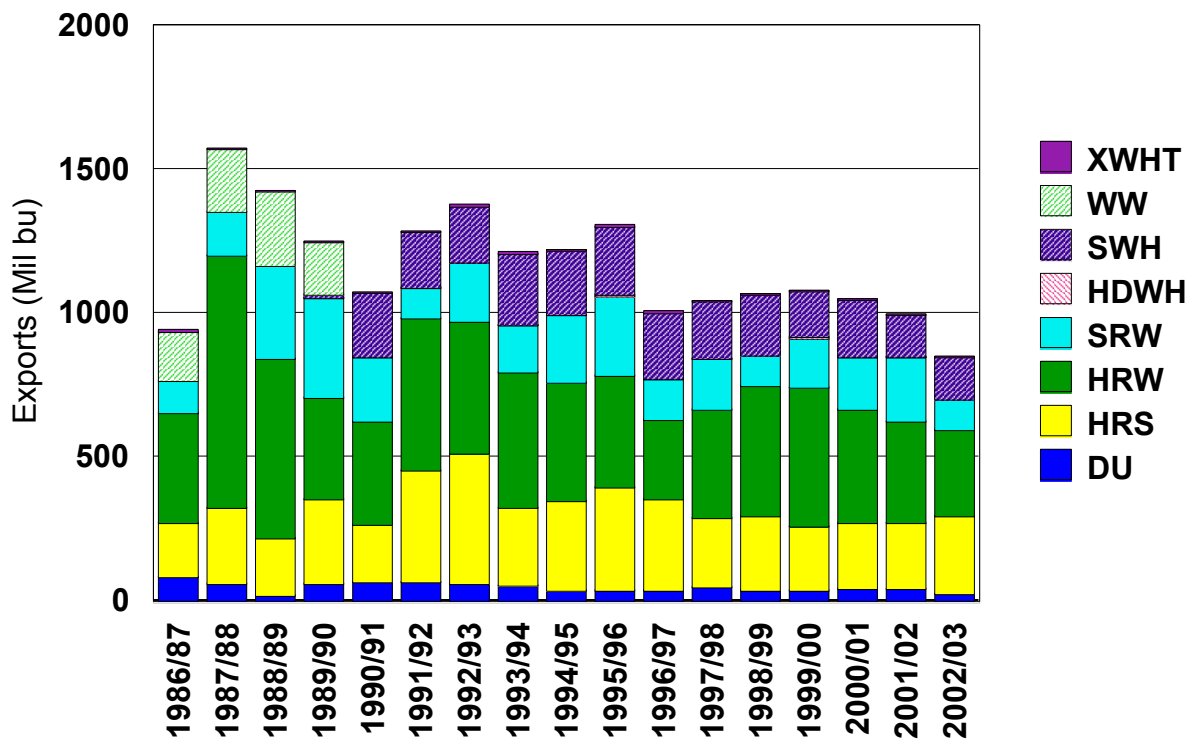


Figure 4. U.S. Wheat Exports, by Class, 1986/87-2002/03.

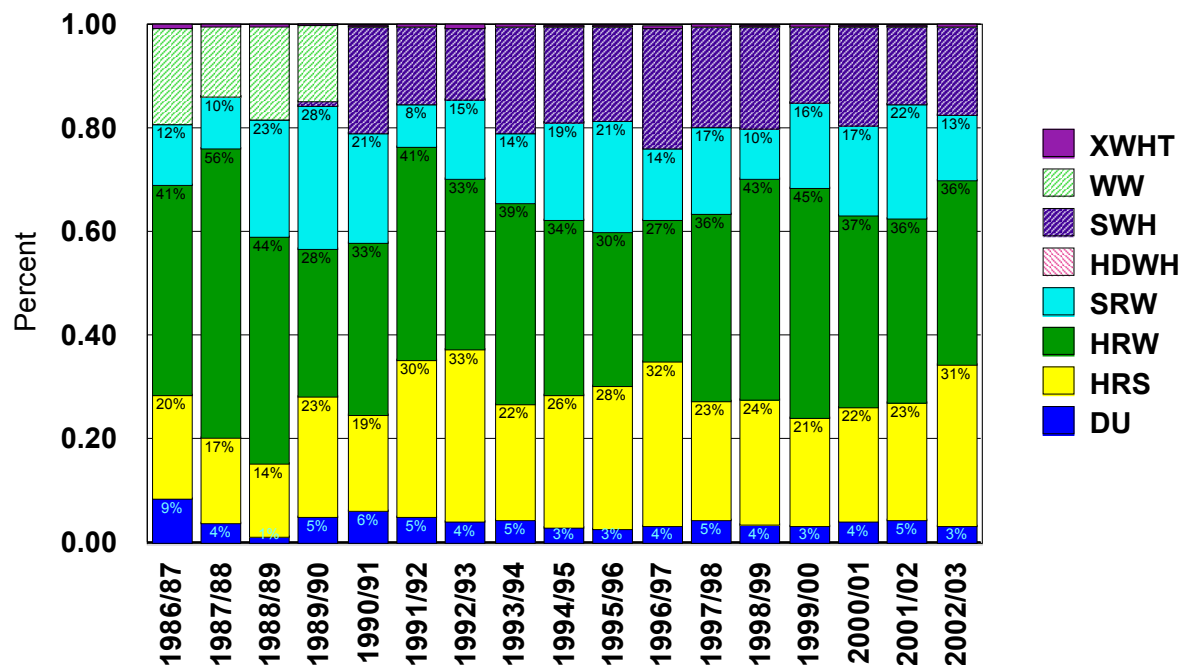


Figure 5. Shares of Wheat Exports, by Class, 1986/87-2002/03.

Trends in Wheat Exports by Class and Grade

Exports of HRS increased from 1986/87 to 1992/93 and have since declined (Figure 6). Exports are largely U.S. No. 2 or Better (OB), although exports of No. 1 have increased in importance from 4%-6% in the late 1980s to 20%-22% of exports in the early 2000s (Figure 7). The increase in No. 1 exports has largely come from reductions in exports of No. 2 OB.

Durum export volumes have declined, mostly from reductions in exports of lower quality grades (\leq No. 3 OB) (Figure 8). Volumes for No. 1 peaked in 1999/00 at over 18 million bushels and have moderated in the early 2000s at about 8-9 million bushels per year. Exports in the late 1980s were largely No. 3 OB which composed up to 70% of HAD exports (Figure 9). Since the early 1990s, exports of No. 3 OB have declined and exports of No. 1 and No. 2 OB have increased. In the early 2000s, exports of No. 1 ranged from 18% to 32% of HAD exports and No. 2 OB were 26% to 47%.

Exports of HRW have declined and remain largely No. 2 OB (Figures 10 and 11). Exports of No. 1 increased in the mid 1990s to 5%-8% of HRW exports and have maintained that through the early 2000s. This differs from both exports of HRS and HAD which show marked increases in exports of higher quality grades.

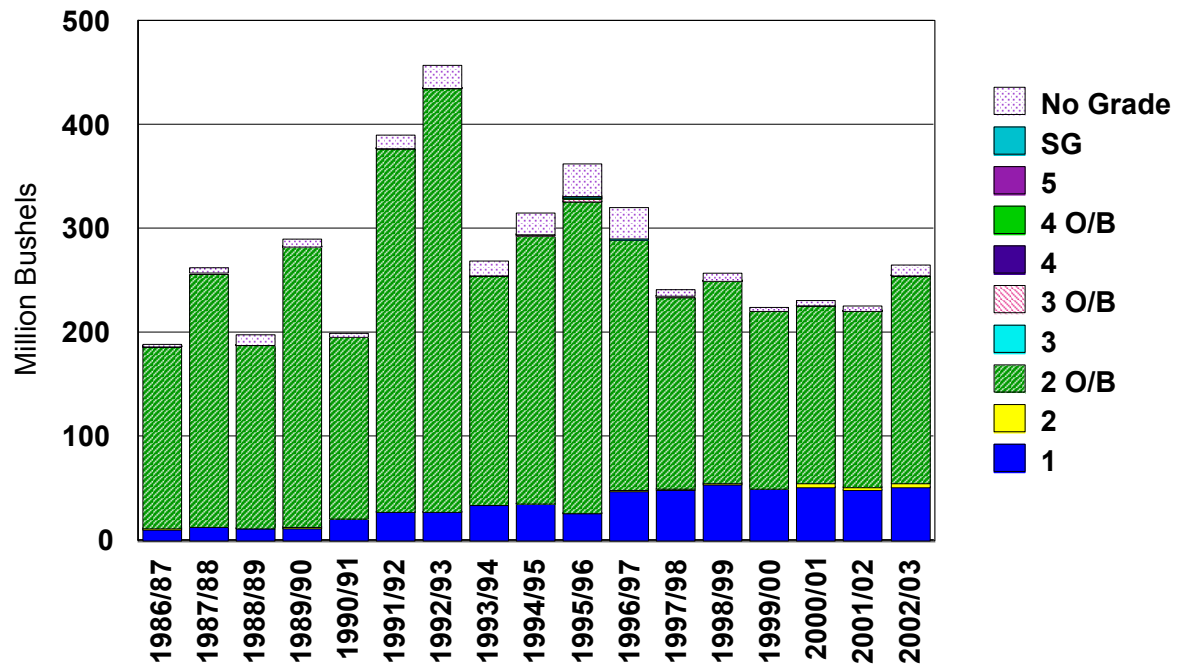


Figure 6. Volume of HRS Exports by Grade, 1986/87 to 2002/03.

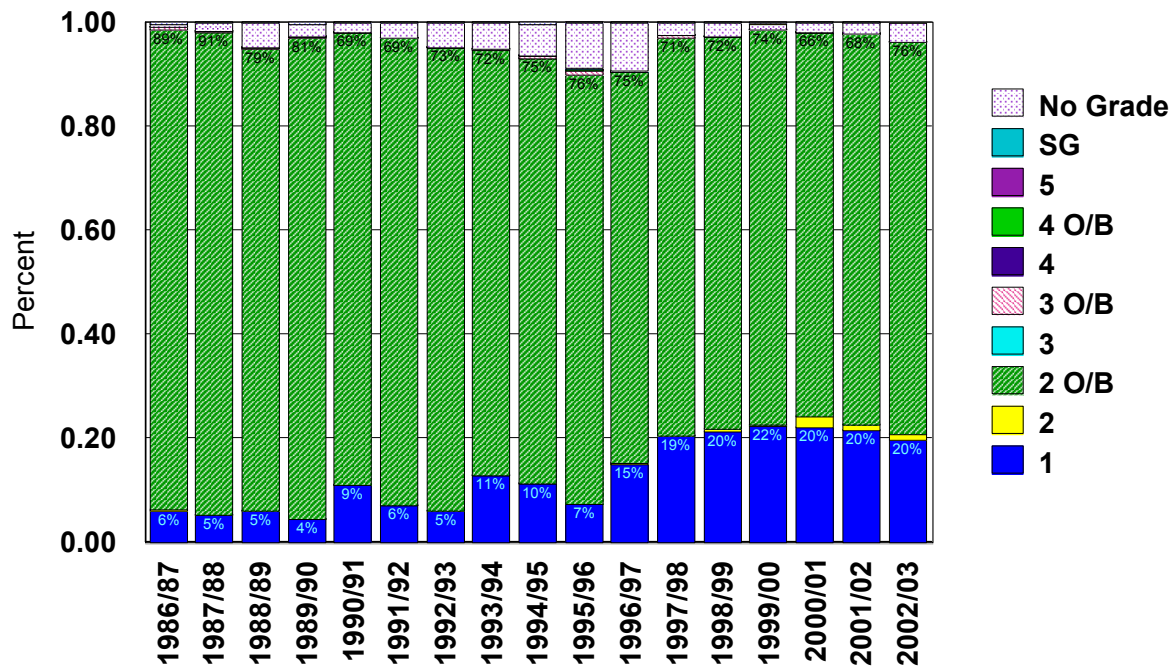


Figure 7. Percent of HRS Exports by Grade, 1986/87 to 2002/03.

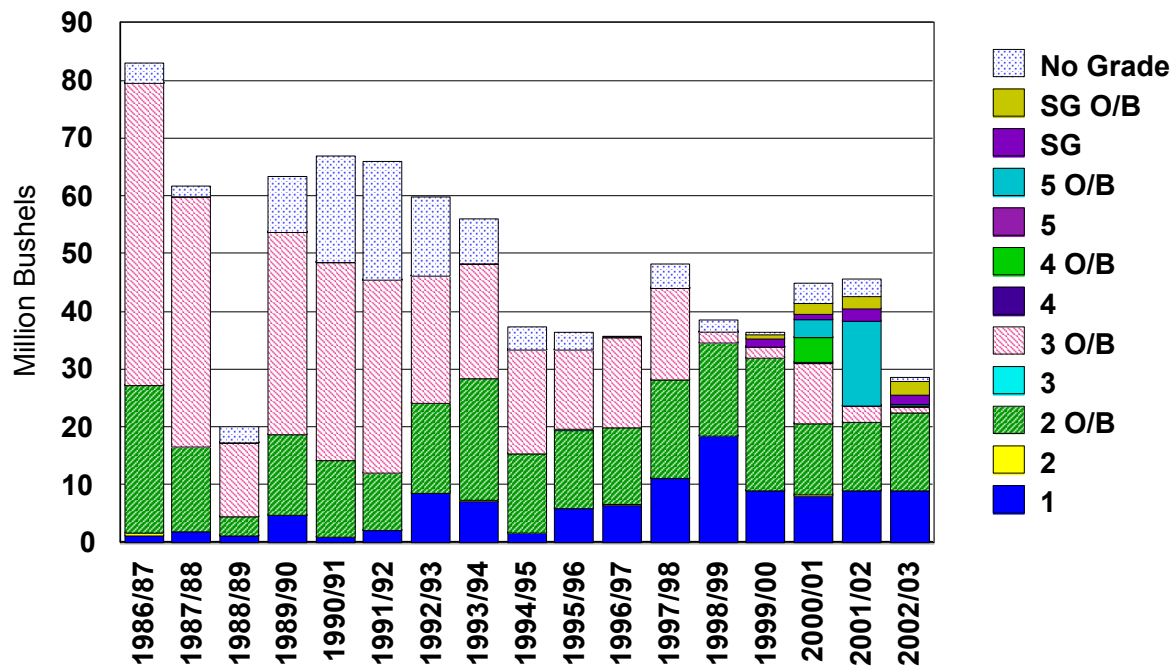


Figure 8. Volume of HAD Exports by Grade, 1986/87 to 2002/03.

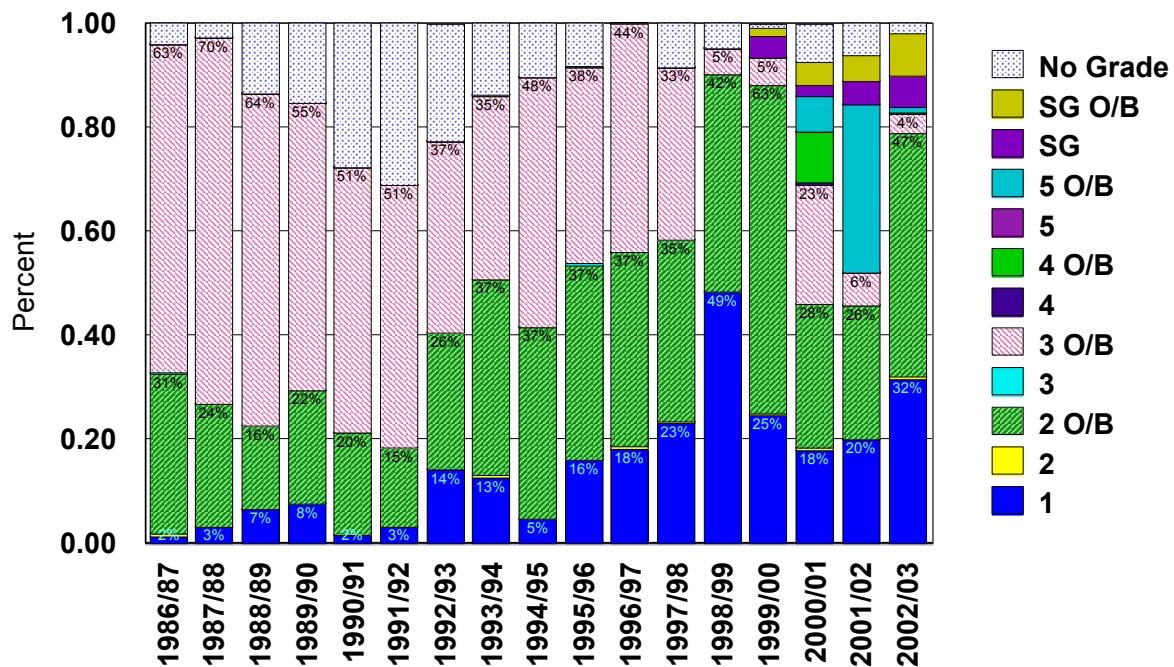


Figure 9. Percent of HAD Exports by Grade, 1986/87 to 2002/03.

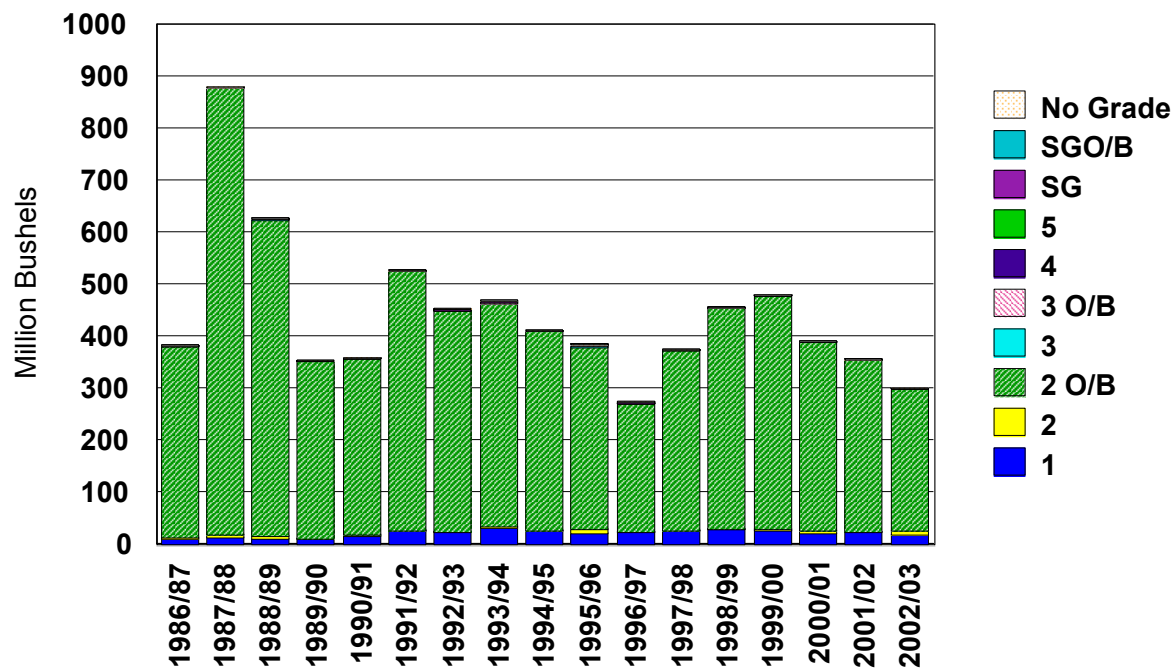


Figure 10. Volume of HRW Exports by Grade, 1986/87 to 2002/03.

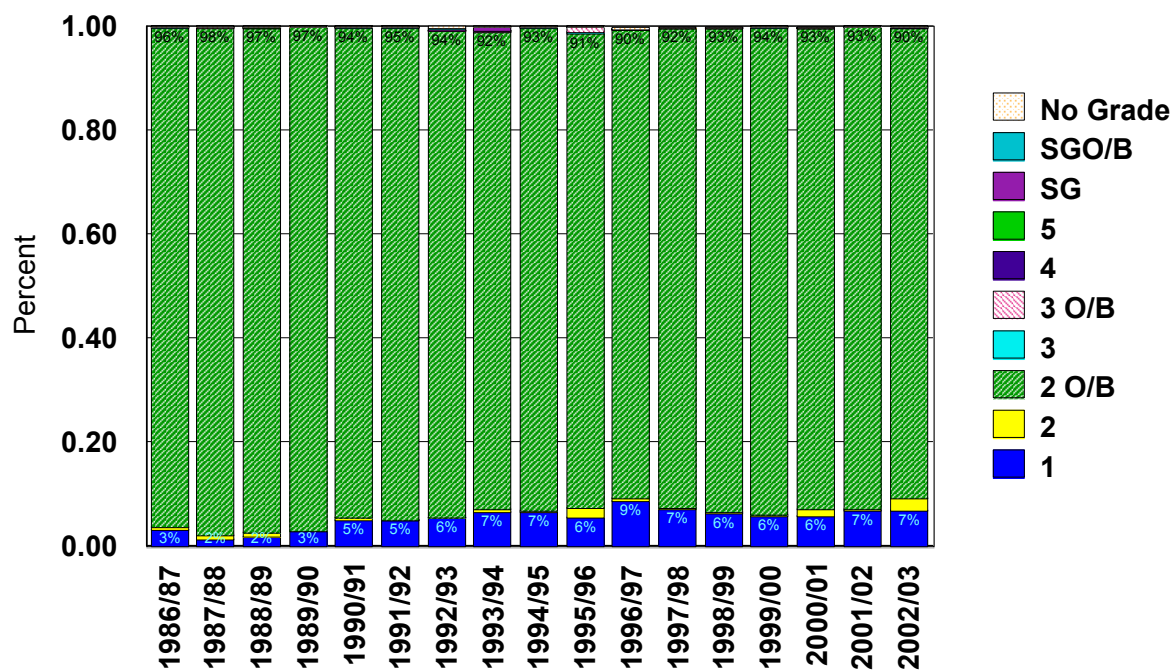


Figure 11. Percent of HRW Exports by Grade, 1986/87 to 2002/03.

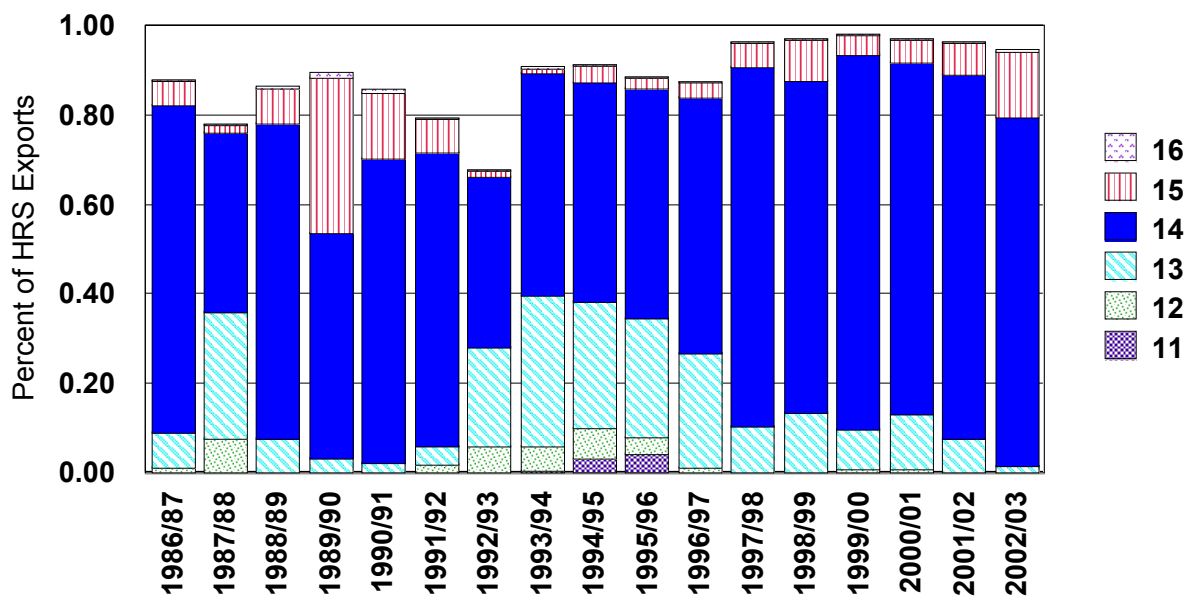
Individual country imports were also examined to determine which have changed the proportion of U.S. exports they import by grade. For HAD, a few countries have changed the proportion of imports from lower grades to higher grades over time. This generally resulted from shifting imports from No. 3 OB to No. 2 OB and included countries like Algeria, Belgium, Costa Rica, and, to a lesser extent, Morocco which also increased exports of No. 1 (Appendix Figure 1). For HRS, shifts toward higher grades were shifts from No. 2 OB to No. 1 by Belgium, Italy, Japan (to a limited extent), Korea, Malaysia, Mexico, Netherlands, Norway, Nicaragua, and the UK, among others, that imported lesser amounts of No. 1 in selected years (Appendix Figure 2). For HRW, the shift in grades is largely a Korean phenomena, although Mexico has tended to increase imports of U.S. No. 1. Korea started to shift from imports of U.S. No. 2 OB HRW to No. 1 in the early 1990s and by the 2000s was importing near 100% of No. 1 (Appendix Figure 3).

Exports by Protein Level

HRS exports by protein level have changed from periods where exports less than 14% protein accounted for up to 40% of exports to periods where lower protein HRS accounted for minimal exports (Figure 12). Periods of high levels of lower protein exports occurred both in 1987/88 and the period comprising the early to middle 1990s. Shares of exports for HRS with less than 14% protein have since declined to less than 13% of exports in most of the 2000s and a low of 1.5% of exports for 2002/03. Reductions in HRS exports for lower protein wheats were generally replaced by exports with 14.0%-14.9% protein. It is notable that since 1996/97, over 94% of export volumes had protein specified and the average level of protein exported was 14.2%. Prior to then, protein was specified on over 80% of export volumes and the average level was 14.1%. The exceptions are for 1987/88 and 1992/93 when only 78% and 67% of export volumes specified protein.

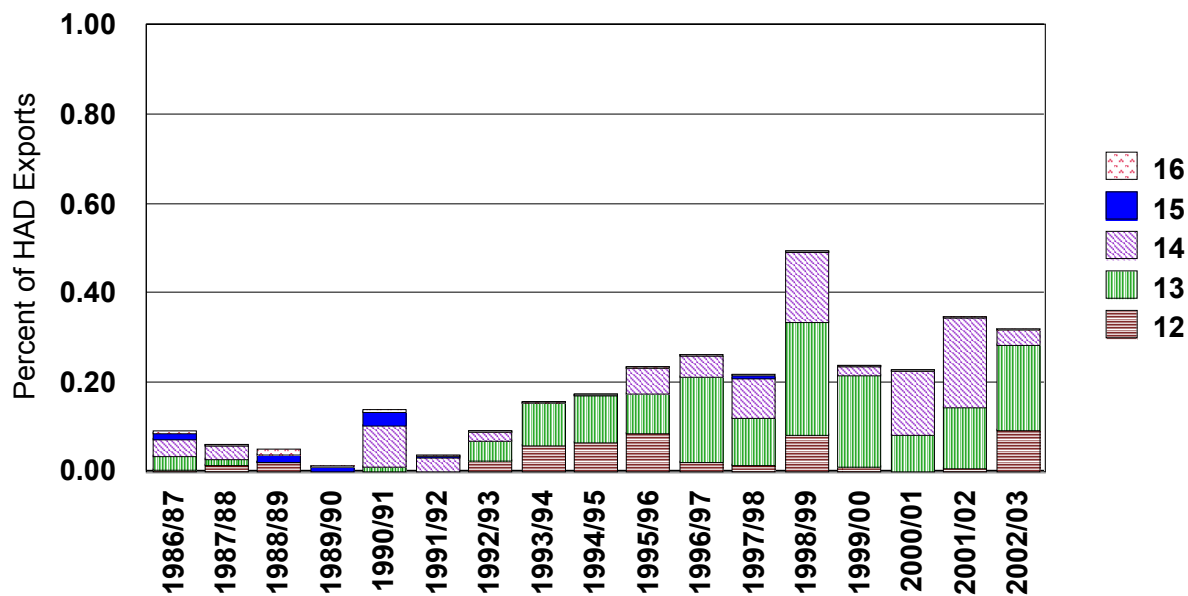
For HAD, protein levels are generally not specified (Figure 13). In the late 1980s less than 10% of HAD exports specified protein. This has trended upward and peaked at 50% of HAD exports in 1998/99 and has averaged from 22% to 34% in the early 2000s. Average protein levels for HAD exports peaked at 15.3% in 1989/90, and declined to a low of 12.7% in 1994/95 (Figure 15).

Specification of protein for HRW exports has trended higher, increasing from a low of 41% of HRW exports in 1987/88 to over 90% in the 2000s (Figure 14). For HRW, the increase in exports that had protein less than 12%, which had been less than 40% of export volume prior to 1998/99, peaked at just under 80% of exports in 2000/01 and has since declined. This decline in exports of protein less than 12% was largely replaced with 12%-12.9% protein exports.



Note: 11 is 11-11.9, 12 is 12-12.9, 13 is 13-13.9, 14 is 14-14.9%, 15 is 15-15.9%, and 16 is 16 or more
Does not add to 100% as excludes shipments with unspecified protein levels

Figure 12. Percent of HRS Exports by Protein Level, 1986/87 to 2002/03.



Note: 12 is 12-12.9%, 13 is 13-13.9%, 14 is 14-14.9%, 15 is 15-15.9%, and 16 is 16% or more
Does not add to 100% as excludes shipments with unspecified protein levels

Figure 13. Percent of HAD Exports by Protein Level, 1986/87 to 2002/03.

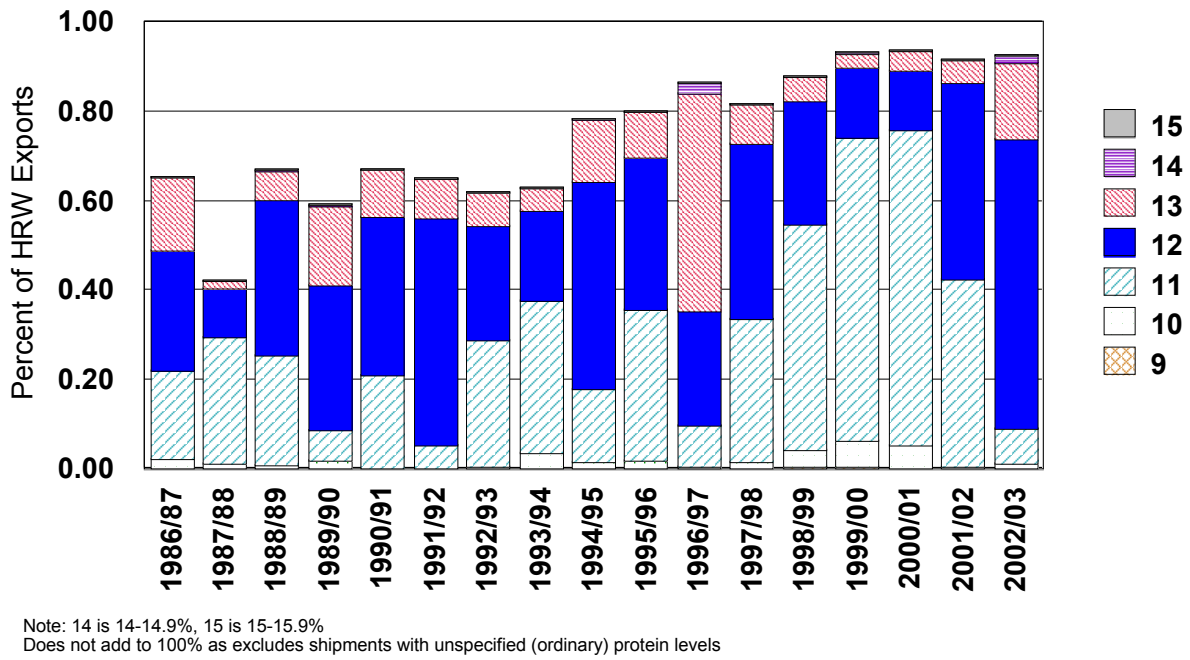


Figure 14. Percent of HRW Exports by Protein Level, 1986/87 to 2002/03.

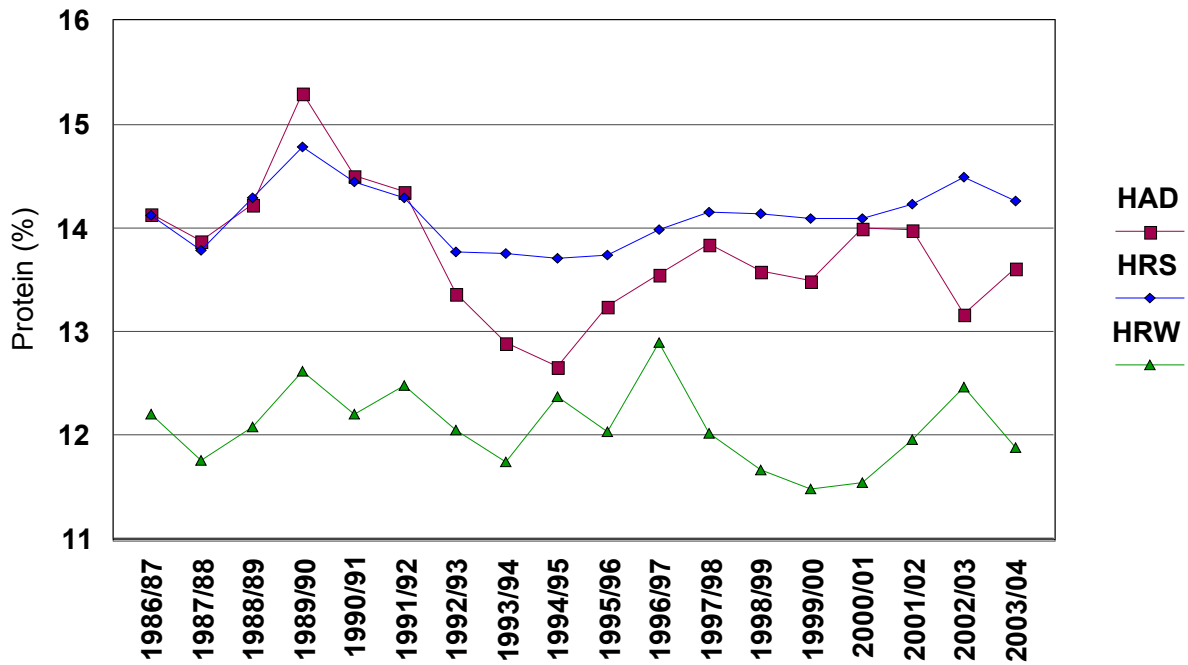


Figure 15. Average Protein Level for Exports by Wheat Class, 1986/87 to 2003/04.

Average protein levels for U.S. HRS exports over the period 1998/99 to 2002/03 were derived for individual countries. Those importing lower protein HRS (<14%) were largely from Africa and Asia, but also included Norway, Indonesia, and the Philippines (Table 1). Countries importing high protein wheat were largely from Western Europe and Southeast Asia, but also included Uzbekistan and Cuba.

Table 1. Average Protein for U.S. HRS Exports, 1998/99-2002/03				
<14%	14%-14.25%	14.25%-14.5%	14.5%-15%	15%-16%
Kuwait Mongolia Tanzania Zimbabwe Rwanda Suriname Sudan Botswana Swaziland Indonesia Cyprus Mozambique South Africa Malta Egypt Norway Togo UAE Philippines	Benin Kenya Mali Cameroon Belize Grenada Colombia Japan South Korea Ecuador Haiti Finland Turkey Ivory Coast St. Vincent Trinidad Netherlands Antilles Jamaica Peru Lebanon Senegal Dominican Rep. Barbados Guyana Venezuela Honduras Vietnam El Salvador Guatemala	Panama Iceland Gabon Ghana Nicaragua Congo Portugal Spain Nigeria UK Italy Costa Rica Taiwan Mexico Netherlands	Switzerland Belgium Malaysia Thailand Uzbekistan China Cuba	Singapore Sri Lanka Namibia Sweden

Trends in protein levels for exports were also examined by country. For HRS, China and Costa Rica showed increasing trends toward higher protein levels from the early 1990s to 2002/03 (Figure 16). Taiwan, Japan, and Korea showed trends that reflect a shift toward less variability from year to year in average protein levels, although Taiwan increased their average level of protein to 14.5% in 1996/97 so that their imports are generally .5% higher than Japan and Korea. Protein levels for Belgium imports fluctuated through time, although they remain one of the highest of any U.S. HRS importing country.

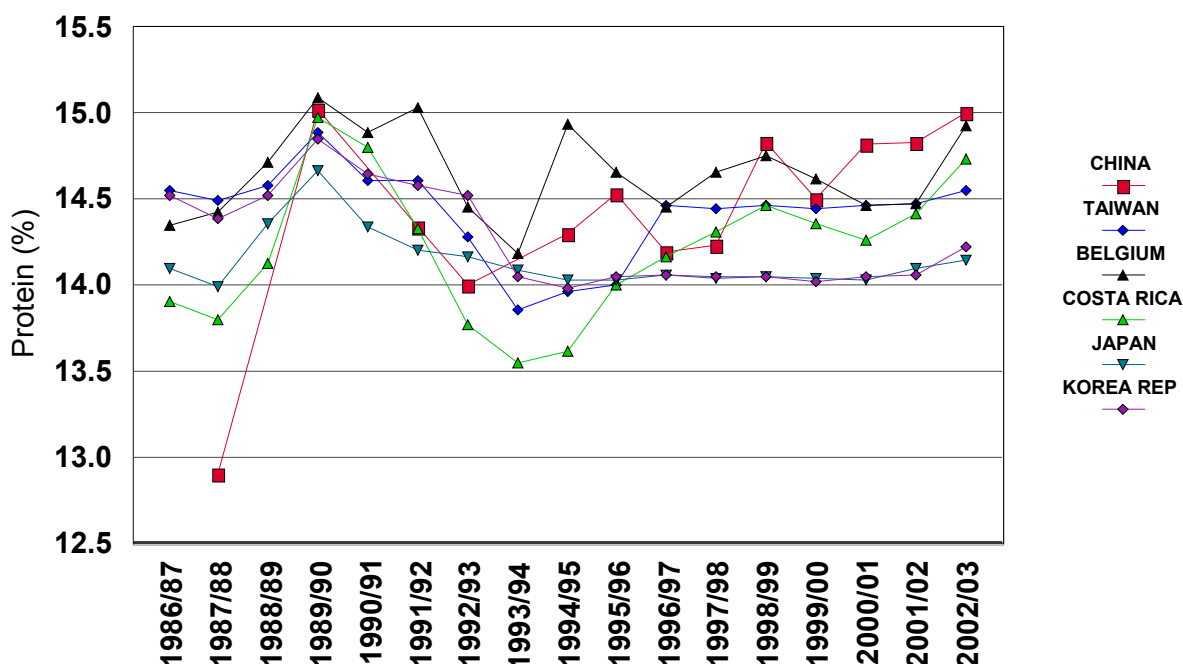


Figure 16. Average Protein Level for U.S. HRS Exports, Selected Importing Countries, 1986/87 to 2002/03.

Cluster Analysis of Wheat Exports

Many of the issues related to standards and regulations over product quality are affected by the composition and characteristics of segments. Increased heterogeneity of customer purchase characteristics has implications for grade standard strategies that result in more homogenous products. Identification of segments of buyers is a prerequisite to formulation of marketing strategies.

Clustering techniques are a method of identifying customers with similar characteristics, requirements, or purchasing behavior. Several quantitative algorithms can be used for identifying clusters. Hierarchical clustering methods start with each observation in a segment, then combines the two closest segments to create a new segment. This proceeds until the desired number of segments is achieved. Differences in algorithms depend on how the distance (closeness) of segments are calculated. The Ward clustering algorithm was used in this study to identify countries that import wheat with similar characteristics (Ward). This is a hierarchical clustering method that minimizes variance between segments.

Characteristics of individual shipments of U.S. HAD, HRS, and HRW were used to identify countries with similar purchasing patterns. Four grade and non-grade parameters were used to derive market segments and included dockage, test weight, protein, and total defects.

The analysis was conducted over three time periods (1986-89, 1991-94, and 1998-03),⁸ to determine the extent of changes in both the number and composition of segments. For each class the number and characteristics of segments during each period are identified. In addition, for reference we include Appendix Tables 1-2 indicating the segment in which each of the individual countries was grouped for each period.

Clusters for HAD

The number of clusters for HAD increased from three in 1986-1989 to four for 1991-94 and five for 1998-2003 (Table 2). In the period 1986-89, the three clusters included a higher quality segment which tended to specify protein levels, and had the highest average level of protein and test weights and the lowest levels of dockage and total defects. This high quality segment (segment 1) accounted for only 7% of export volume for HAD and included Chile, Egypt, Japan, and Senegal (Appendix Table 1). The other two segments in the early period were two lesser quality segments which had higher dockage and defects and lower protein and test weight, and did not tend to specify protein. Of these, segment 2 was the higher quality of the two and accounted for 51% of export volume, while segment 3 was the lowest quality and accounted for 42% of export volume.

In the period 1991-1994, four segments were identified. These included two higher quality segments each with about 17% of export volumes. One of these higher quality segments tended to specify protein more and had higher protein levels (segment 2) and included Taiwan, Costa Rica, Indonesia, Israel, Japan, Kuwait, Mexico, Peru, Philippines, Tunisia, and Turkmenistan (Appendix Table 1). The other (segment 1) tended not to specify protein and had lower dockage, protein, total defects, and the highest test weights and included Argentina, Dominican Republic, Finland, Italy, Norway, Philippines, South Africa, and Turkey. The remaining two segments included a moderate quality segment which accounted for 18% of export volume (segment 3) and a low quality segment, similar to the low quality segment for the period 1986-89, and accounted for 48% of export volumes (segment 4).

Five segments were identified in the period 1998-2003. These included three lower quality segments and two higher quality segments. The higher quality segments each accounted for 21%-22% of export volumes, where one (segment 1) had lower dockage and total defects and higher test weights, while the other (segment 2) had higher protein levels. Each of these two segments tended to specify protein on 77%-78% of purchases. Segment 1 contained Belgium, Taiwan, Costa Rica, Cyprus, El Salvador, Italy, Kuwait, Netherlands, Nigeria, Switzerland, and Venezuela, while segment 2 contained Algeria, Belgium, Columbia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Italy, Morocco, Netherlands, Nigeria, Panama, Peru, South Africa, Switzerland, and Venezuela (Appendix Table 1). It is notable that Nigeria, Taiwan, Italy, El Salvador, Venezuela, Costa Rica, and the Netherlands were indicated in either of the two high quality segments (segments 1-2) for three or more years from 1998-2002 (Appendix Table 3). The three lower quality segments included segment 3, which was similar to the low quality

⁸ The numerical value for protein in some shipments was not listed. These missing values can be interpreted as protein not-specified or ordinary protein. To capture the effect of this information, an adjusted protein value was estimated. This was equivalent to the average protein value if specified and set at a fixed lower level for missing observations (10% for durum and HRS, 8% for HRW).

segments from the earlier period, and accounted for 37% of exports. The other two low quality segments were two segments which were lower quality but higher protein and more likely to specify protein, although segment 4 only accounted for 18% of exports and the lowest quality (segment 5) represented 1% of export volume.

Table 2. Segment Means for Grade and Non-Grade Parameters for U.S. HAD, 1986-89, 1991-94, and 1998-03					
Segment	1	2	3	4	5
Segment Means 1986-89					
Dockage (%)	0.77 (3)	0.90 (1)	1.11 (2)		
Test Weight (lb/bu)	61.6	60.8	59.4		
Total Defects (%)	1.8	4.0	5.8		
Average Protein (%)	14.4	14.2	13.3		
Specify Protein (%)	98.0	11.0	2.0		
Share of Exports (%)	7.2	50.8	41.9		
Countries (#)	4	22	18		
Segment Means 1991-94					
Dockage (%)	0.55 (4)	0.60 (2)	0.70 (3)	0.82 (1)	
Test Weight (lb/bu)	61.7	60.9	60.6	59.8	
Total Defects (%)	2.1	2.7	3.5	4.5	
Average Protein (%)	13.4	13.8	13.5	13.2	
Specify Protein (%)	3.0	91.0	4.0	2.0	
Share of Exports (%)	17.3	16.6	18.0	48.1	
Countries (#)	8	11	10	15	
Segment Means 1998-03					
Dockage (%)	0.49 (3)	0.67 (2)	0.67 (1)	0.72 (4)	1.25 (5)
Test Weight (lb/bu)	61.8	60.7	60.9	59.3	57.4
Total Defects (%)	2.4	3.9	4.0	10.4	15.0
Average Protein (%)	13.5	13.9	13.1	14.0	14.7
Specify Protein (%)	78.6	77.8	3.8	20.5	66.7
Share of Exports (%)	20.6	21.7	37.3	18.3	1.0
Countries (#)	12	16	20	3	1

Clusters for HRS

Two segments for HRS were identified in the early period (1986-89) (Table 3). This included a higher quality segment (segment 1) which accounted for 18% of export volume and a lower quality segment (segment 2) which represented 82% of export volume. The higher quality segment had lower dockage, total defects, and higher test weights, protein levels, and tended to specify protein more often. The high quality segment included Benin, Taiwan, Hong Kong, Indonesia, Japan, Korea, Malaysia, Netherlands, Nigeria, Philippines, Singapore, Sri Lanka, Thailand, UK, and the USSR (Appendix Table 2).

In the middle period, five HRS clusters were indicated. One was a high quality segment (segment 1) which accounted for 17% of export volume and was similar to the high quality segment from the earlier period. This segment included Barbados, Belgium, Benin, Burkina Faso, Canary Islands, Taiwan, Columbia, Cyprus, Finland, Gabon, Hong Kong, Iceland, Israel, Ivory Coast, Jamaica, Japan, Korea, Malaysia, Mali, Malta, Martinique, Mexico, Netherlands, Norway, Philippines, Senegal, Singapore, Sri Lanka, and Thailand. There was also a moderate quality segment (segment 2) which represented 23% of exports and three lower quality segments that ranged from 15% to 25% of exports and varied by dockage level, test weight, and whether they specified protein or not.

In the period 1998-2003, five segments were identified. The high quality segment (segment 1) now represented 43% of exports, and segments 2, 3, and 4 were moderate quality segments accounting for 21%, 21%, and less than 1% of exports, respectively. Segment 1 included Belgium, China, Finland, Gabon, Indonesia, Ivory Coast, Japan, Korea, Taiwan, Malaysia, Mali, Netherlands, Norway, Philippines, South Africa, Singapore, Sri Lanka, Sweden, Switzerland, Thailand, UK, and Vietnam. It is notable that Japan and Taiwan were classified in segment 1 in all years, while Korea and Malaysia were in segment 1 four out of the five years, Belgium and China three years, and Indonesia, Singapore, Thailand, UK, and Vietnam two years (Appendix Table 4). Segments 3 and 4 differed only in their preference for specifying protein. The last segment (segment 5) is the low quality segment which represented 15% of exports, though this segment included shipments to 45 different countries, more than any other segment in this latest time period.

Table 3. Segment Means for Grade and Non-Grade Parameters for U.S. HRS, 1986-89, 1991-94, and 1998-03					
Segment	1	2	3	4	5
Segment Means 1986-89					
Dockage (%)	.77 (2)	.88 (1)			
Test Weight (lb/bu)	61.7	59.6			
Total Defects (%)	2.2	3.9			
Average Protein (%)	14.4	14.0			
Specify Protein (%)	99.0	71.0			
Share of Exports (%)	18.3	81.7			
Countries (#)	16	51			
Segment Means 1991-94					
Dockage (%)	0.65 (4)	0.79 (2)	0.84 (1)	0.96 (3)	0.79 (5)
Test Weight (lb/bu)	61.2	60.7	60.2	59.9	59.6
Total Defects (%)	2.4	3.0	3.5	3.4	4.1
Average Protein (%)	14.3	13.9	13.4	14.1	13.7
Specify Protein (%)	89.0	96.0	11.0	85.0	91.0
Share of Exports (%)	16.5	22.5	24.7	15.0	21.3
Countries (#)	30	36	22	31	41
Segment Means 1998-03					
Dockage (%)	0.42 (4)	0.56 (1)	0.63 (2)	0.63 (5)	0.79 (3)
Test Weight (lb/bu)	61.0	61.0	60.1	60.2	60.2
Total Defects (%)	2.4	2.8	3.1	3.1	3.6
Average Protein (%)	14.5	13.9	14.4	14.4	14.0
Specify Protein (%)	98.4	98.1	98.8	13.0	93.0
Share of Exports (%)	42.9	21.3	20.9	0.8	14.6
Countries (#)	23	31	41	2	45

Clusters for HRW

Segments for HRW in the early time period (1986-89) were similar to those for HRS (Table 4). Two clusters were indicated, one higher quality which represented 18% of exports and one lower quality which represented 82% of exports. Differences between the two segments were largely lower dockage content and total defects, higher test weight and more likely to specify protein for the higher quality segment. The higher quality segment (segment 1) included Bangladesh, Benin, Bolivia, Cameroon, Chile, Taiwan, Costa Rica, Egypt, Finland, Hong Kong, Indonesia, Japan, Kenya, Korea, Norway, Philippines, Senegal, Singapore, Sri Lanka, Thailand, and Tunisia (Appendix Table 2).

In the period 1991-1994, four clusters were indicated. These included one high quality segment (segment 1), two lower quality segments (segments 2 and 3), and one very low quality segment (segment 4). The higher quality segment represents 12% of exports, a decline from that held by the higher quality segment in the earlier period and includes Bangladesh, Belgium, Taiwan, Costa Rica, Finland, Hong Kong, Japan, Korea, Kuwait, Malaysia Netherlands, Norway, Philippines, Russia, Singapore, Sri Lanka, Sudan, Thailand, and Yemen. The two low quality segments are similar, although segment 2 has lower dockage, higher defects, protein, and is more likely to specify protein than segment 3. These two lower quality segments account for 44% and 41% of export volume, respectively. The very low quality segment accounts for 3% of export volume and has high total defects and very high dockage levels.

In the later period (1998-2003), the higher quality cluster (segment 1) was 18% of the export volume. Dockage levels for this cluster are markedly lower than in the other periods. Countries in segment 1 included Bangladesh, Brazil, China, Taiwan, Ghana, Indonesia, Japan, Korea, Kyrgyzstan, Mongolia, Mozambique, Panama, Philippines, Thailand, Vietnam, and Zaire. Of these countries, Indonesia, Japan, Korea, and Taiwan were included in the top quality segment in all five years. Thailand was included in segment 1 for four out of the five years, Mongolia, North Korea, and Vietnam were included for two out of the five years (Appendix Table 5). Two moderate quality clusters are indicated (segments 2 and 3) which represent 29% and 11% of exports, respectively. These two segments have high test weights and total defects less than 3%, although protein levels are higher in segment 2 than in segment 3, and segment 2 is more likely to specify protein. The remaining two segments have total defects greater than 3%, where segment 4 represents 34% of export volume and is more likely to specify protein than segment 5 which represents 8% of exports.

Table 4. Segment Means for Grade and Non-Grade Parameters for U.S. HRW, 1986-89, 1991-94, and 1998-03					
Segment	1	2	3	4	5
Segment Means 1986-89					
Dockage (%)	0.58 (2)	0.72 (1)			
Test Weight (lb/bu)	62.1	60.7			
Total Defects (%)	2.6	3.9			
Average Protein (%)	12.3	12.1			
Specify Protein (%)	92.0	43.0			
Share of Exports (%)	17.6	82.4			
Countries (#)	26	67			
Segment Means 1991-94					
Dockage (%)	.55 (3)	.67 (1)	.69 (2)	1.24 (4)	
Test Weight (lb/bu)	61.7	60.3	60.6	59.9	
Total Defects (%)	2.1	3.7	3.6	5.5	
Average Protein (%)	12.3	12.0	11.8	11.6	
Specify Protein (%)	89.0	94.0	20.0	79.0	
Share of Exports (%)	12.3	43.5	41.3	2.9	
Countries (#)	21	44	41	7	
Segment Means 1998-03					
Dockage (%)	0.43 (3)	0.61 (2)	0.57 (4)	0.64 (1)	0.57 (5)
Test Weight (lb/bu)	61.6	61.3	61.7	60.4	60.7
Total Defects (%)	2.0	2.8	2.7	3.4	3.4
Average Protein (%)	12.0	11.7	11.1	11.8	11.3
Specify Protein (%)	99.9	98.1	42.2	98.7	40.0
Share of Exports (%)	17.7	28.8	11.1	34.3	7.9
Countries (#)	20	49	14	25	15

Summary and Conclusions

There are important questions in the United States and Canada regarding the role and function of quality in international markets. One has been the definition and composition of different market segments, with a particular focus on higher quality customers. In this study, trends in U.S. wheat exports are analyzed by class, grade, and protein, and market segments are examined.

Results indicated trends toward increases in exports of higher quality grades of HAD and HRS, whereas the trend for increases in exports of higher quality grades for HRW appears to be moderate. Countries shifting toward higher quality grades varied by wheat class with shifts for HAD being largely No. 3 OB to higher quality grades, and for HRS and HRW, shifts were No. 2 OB to No. 1. For HAD, countries shifting toward higher grades were Algeria, Belgium, Costa Rica, and Morocco. For HRS, countries shifting toward higher grades were South Korea, Malaysia, Thailand, Belgium, Netherlands, Norway, UK, Mexico, Nicaragua, and, to a lesser extent, Venezuela, China, and Japan. For HRW, shifts to higher grades were largely a South Korea phenomena.

Exports of HRS, HRW, and HAD show increases in the proportion of exports shipped at higher protein levels and increases in the proportion of exports where protein is specified. The increase in the proportion of exports where protein is specified was greatest for HRW, followed by HAD and HRS.

Cluster analysis for all classes indicated there have been changes through time including: dockage levels for the highest quality segments declined, the percent of shipments specifying protein increased, and there was a shift toward more market segments. Shares of export volumes for the highest quality segments increased for both HAD and HRS. In both cases, the high quality segments more than doubled their shares of export volume from (7% to 21% for HAD and 18% to 42% for HRS). In contrast, the HRW high quality segment for the later time period had a similar share of exports to that of the earlier periods, although two moderate quality segments did emerge that were not present in the earlier time periods.

These results have several important implications for both the private and public sector. In the public sector, it is clear that the system of grades and standards is facilitating specifications for higher quality wheats, at least for HRS and HAD. These do not necessarily mean that the functional quality is increased, which cannot be discerned from these data. Also, there is an apparent growing demand for higher protein HRS and HAD which has implications for breeders. The fact that there has not been a similar increase in imports of higher quality HRW, but instead moderate quality segments have emerged, suggests that while high quality HRW remains important, increases in quality are due to shifts from lower to moderate qualities.

There are also implications for the private sector. First, it is apparent that there has been a tendency toward the importation of higher quality and protein for HRS and HAD. Thus, buyers can and do demand higher quality shipments from these segments, and, suppliers (from farmers, to handlers to traders) provided it. Second, the fact that a greater portion of higher quality is exported implies a smaller share is available for the domestic market. Third, there are distinct market segments in each class of wheat, and the number of segments has escalated. This

is to be expected in mature markets and is reflective of demanding buyers and seller competition. This has important implications for international marketing strategies in terms of market selection, targeting, and information. These results should provide some insight into the scope of the market segments in these classes of wheat.

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Appendix Table. 1. Allocation of Individual Countries to Market Segments, HAD by Period.

Country	1986-89	1991-94	1998-03
	HQ =1	HQ = 1, 2	HQ = 1, 2
Algeria	2, 3	4	2, 3
Argentina	3	1, 4	
Belgium	3	4	1, 2, 3
Botswana			3
Chile	1, 2		
Taiwan		2	1
Columbia			2
Costa Rica	2, 3	2, 3	1, 2
Cyprus	2	3, 4	1, 3
Dominican Rep	2	1	1, 2, 3
Ecuador	2, 3		2, 3
Egypt	1		
El Salvador	2, 3	3, 4	1, 2
Ethiopia	3		
Finland	2	1, 4	
Germany West	2, 3		
Guatemala	2	3, 4	3
Honduras	2, 3	3, 4	3
Indonesia		2	
Israel		2, 4	3
Italy	2	1	1, 2, 4
Japan	1	2	
Kuwait		2	1
Libya			4
Mexico		2	
Morocco		3, 4	2, 3
Netherlands	2, 3		1, 2, 3, 4
Nigeria			1, 2
Norway		1	
Panama	2, 3	3	2, 3
Peru		2, 2	2
Philippines		1, 2	5

Appendix Table. 1. Allocation of Individual Countries to Market Segments, HAD by Period.

Country	1986-89	1991-94	1998-03
	HQ =1	HQ = 1, 2	HQ = 1, 2
Poland		3, 4	3
Portugal	2, 3		
South Africa	2	1	2, 3
Romania	2		
Senegal	1		
Somalia	2, 3		
Spain			1, 3
Switzerland			2, 3
Tunisia	3	2, 4	3
Turkey	2	1	3
Turkmenistan		2	
Venezuela	2, 3	3, 4	1, 2, 3
Yugoslavia	3		

*Number indicates the segment number defined in Table 2.

** Indicates segment number for high quality segment in Table 2.

Appendix Table 2. Allocation of Individual Countries to Market Segments, HRS and HRW by Period

Country	HRS			HRW		
	1986-89	1991-94	1998-03	1986-89	1991-94	1998-03
	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**
Albania		4			2	2, 4
Algeria	2	3		2	3	3
Angola					2	2, 3, 4
Argentina						
Armenia					2, 3, 4	4
Bangladesh		2		1, 2	1, 3	1, 2, 3, 4
Barbados	2	1, 4, 5	2, 3, 5			4
Belize	2	4, 5	3, 5	2	2	4
Belarus					2	
Belgium	2	1, 2	1, 2, 3		1	
Benin	1	1, 4, 5	2	1, 2	2	4
Bolivia			4	1, 2	2	2, 4, 5
Bosnia					3	2, 3, 4
Botswana			2			2, 4
Brazil		2, 5		2	2, 3	1, 2, 4
Bulgaria	2			2	3	
Burkina Faso		1, 2, 3		2	3	
Cameroon	2	2, 4, 5	3, 5	1		2, 4
Canary Islands		1, 4, 5		2		
Chile				1, 2	2, 4	2, 4
China	2	2, 5	1, 3, 5	2	2	1, 4
Taiwan	1	1	1	1	1	1
Columbia	2	1, 3, 4	2, 5	2	2	2, 4
Costa Rica	2	2, 3, 4, 5	3, 5	1	1	2, 4
Cuba			5			4
Cyprus	2	1, 2, 4, 5	2, 3, 5	2	2	4
Dominican Rep	2	2, 4, 5	2, 3, 5	2	2	4
Ecuador	2	3, 5	3, 5	2	2, 3	2, 4, 5
Egypt		3	3, 5	1	3, 4	2, 4
El Salvador	2	4, 5	3, 5	2	2	2, 4
Estonia					2	4

Appendix Table 2. Allocation of Individual Countries to Market Segments, HRS and HRW by Period

Country	HRS			HRW		
	1986-89	1991-94	1998-03	1986-89	1991-94	1998-03
	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**
Ethiopia	2	3		2	3	3, 5
Finland	2	1	1	1, 2	1	
French West Indies	2					
Gabon	2	1	1, 2, 5	2		4
Germany East	2					
Germany West	2					
Georgia					2	2, 4
Ghana	2	4, 5	3, 5	2		1
Grenada		2, 4, 5	5			
Guadeloupe		4				
Guatemala	2	2, 4, 5	2, 3, 5	2	2, 4	4
Guyana		4, 5	2, 3, 5	2	3	2, 4
Haiti	2	4	2, 3, 5	2	2	2, 4
Honduras	2	2, 4, 5	3, 5	2	2	2, 4
Hong Kong	1	1, 2		1	1, 2	
Iceland		1	3, 5			
India		2, 3		2	2	
Indonesia	1	2	1, 2	1, 2	2, 3	1
Iraq	2			2		3, 4
Ireland	2					
Israel		1, 2		2	2	2, 4
Italy	2	2, 5	2, 3			
Ivory Coast		1	1, 2			
Jamaica	2	1, 3, 4, 5	2, 3, 5			
Japan	1	1, 2, 5	1	1	1	1
Jordan				2	3	2, 3, 4
Kenya		4	2, 5	1, 2	2, 3	1, 2, 4
Korea	1	1	1, 2	1	1	1
Kuwait		2	2		1	
Kyrgyzstan					2, 4	1, 2, 4
Latvia					2	

Appendix Table 2. Allocation of Individual Countries to Market Segments, HRS and HRW by Period

Country	HRS			HRW		
	1986-89	1991-94	1998-03	1986-89	1991-94	1998-03
	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**
Lebanon		3	2, 3, 5	2	2	2, 4
Lee Winds Islands	2					
Lesotho	2	2				4
Liberia	2			2		
Malawi				1, 2		
Malaysia	1	1, 5	1, 2		1	2, 4
Mali		1	1		3	
Malta	2	1, 2, 3, 5	2, 3, 5		2	
Martinique		1				
Mauritania		3		2	3	4
Mexico	2	1, 3, 5	4	2	3	3, 5
Moldova					3	2
Mongolia			2		3	1
Morocco	2	3		2	3	2, 3
Mozambique		5	2, 3, 5	2	3	1, 2, 4
Namibia		5	3			
Nepal	2					
Neth. Antillies	2	2, 5	1, 5			2, 4
Netherlands	1, 2	1, 2, 5	1, 3		1	
New Zealand		1		2		
Nicaragua		2, 3, 4, 5	3, 5		2, 3	4, 5
Niger	2					
Nigeria	1	3, 4, 5	3, 5	2	2	2, 4
Norway	2	1	1, 2, 3	1	1, 2	2
Oman				1		
Pakistan					3	2, 5
Panama	2	2, 4, 5	3, 5	2	2, 4	1, 4
Peru	2	3	5	2	2	2, 4
Philippines	1, 2	1, 2, 5	1, 2	1	1	1, 4
Poland	2	3		2	3	
Portugal	2		3, 5	2		

Appendix Table 2. Allocation of Individual Countries to Market Segments, HRS and HRW by Period

Country	HRS			HRW		
	1986-89	1991-94	1998-03	1986-89	1991-94	1998-03
	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**
South Africa	2	2, 3, 5	1, 3, 5	2	2, 3	2, 4
Romania					3	
Russia		4			1, 2, 3	2
Rwanda			5	2	3	
Saudi Arabia				2		
Senegal		1, 2	3	1		
Sierra Leone		4		1, 2	2, 3	2, 4
Singapore	1	1, 5	1, 3	1	1	
Slovenia		2				
Somalia				2		5
Spain	2		2, 3, 5	2		
Sri Lanka	1, 2	1, 2	1	1, 2	1, 2, 3	2, 3, 4, 5
St. Vincent		4, 5	3, 5			
Sudan	2	5	2	2	1, 3	2, 3, 4, 5
Suriname	2	4, 5	3, 5	1, 2		
Swaziland			5	2		2
Sweden			1			
Switzerland			1, 3			
Syria				2		4
Tajikistan					2	
Tanzania			2		3	4
Thailand	1	1, 2, 5	1, 3	1	1	1, 2
Togo	2	4, 5	5		2, 3	
Trinidad	2	4, 5	5		4	4
Tunisia	2	3		1, 2	3	5
Turkey	2		3, 5	2	3	2
Turkmenistan					2	
UAE			2, 5			2, 4
Uganda				2		2, 4, 5
Ukraine					3	
United Kingdom	1, 2	2	1, 2, 3			

Appendix Table 2. Allocation of Individual Countries to Market Segments, HRS and HRW by Period

Country	HRS			HRW		
	1986-89	1991-94	1998-03	1986-89	1991-94	1998-03
	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**	HQ=1**
Uruguay				2		
USSR	1, 2	2, 4		2	3	
Uzbekistan		3	5		3	
Venezuela	2	2, 5	2, 3, 5	2		2, 4
Vietnam			1, 3			1, 2, 4
Yemen		3, 4			1, 2, 3	2, 4
Yugoslavia	2			2	3	4
Zaire	2	2		2	2, 3	1, 2, 4
Zimbabwe			5	2	2, 3	4

*Number indicates the segment number defined in Tables 3 and 4.

** Indicates segment number for high quality segment in Tables 3 and 4.

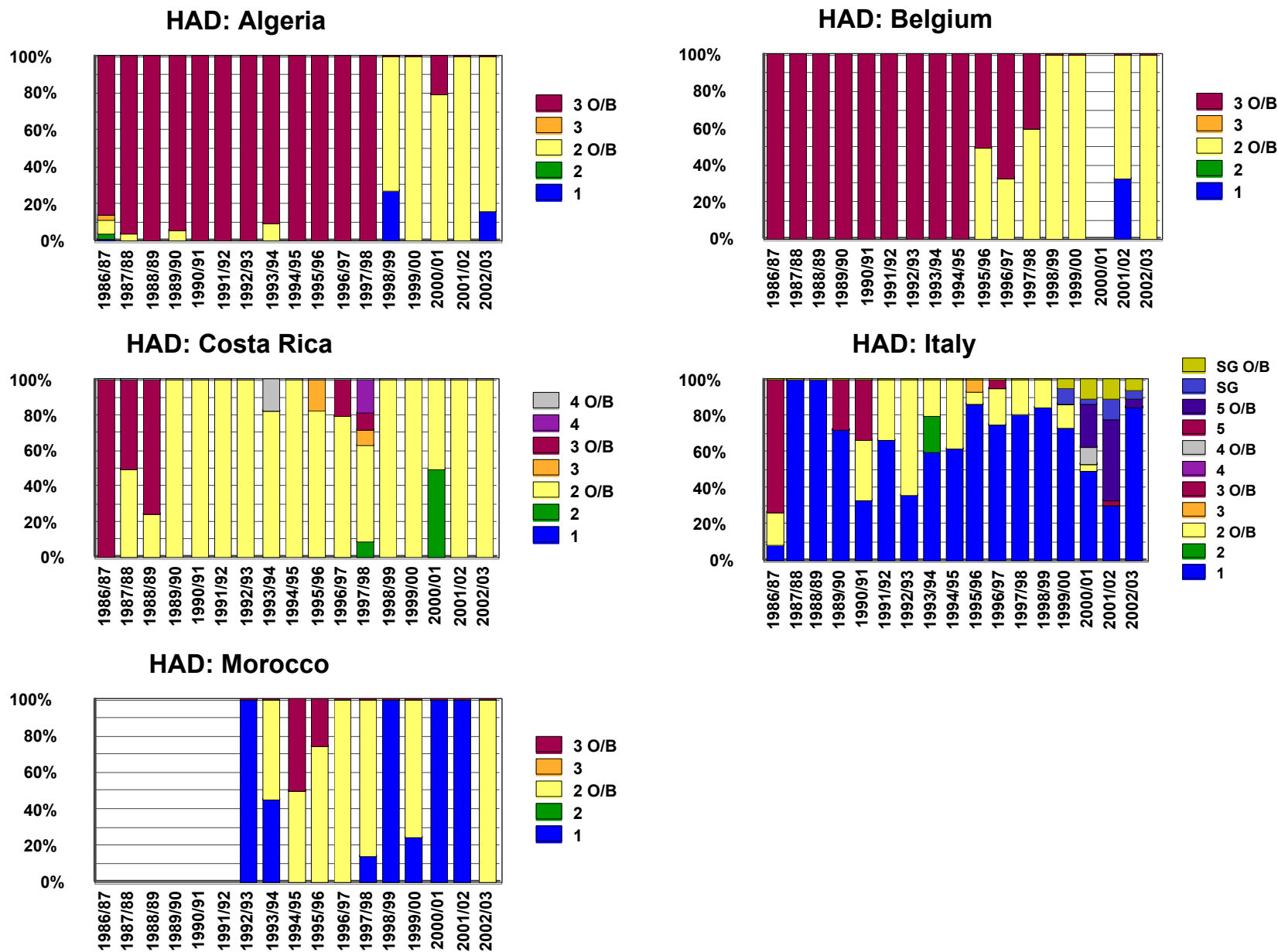
Appendix Table 3. Countries and Years within Clusters for HAD, 1998/99-2002/03

<u>Higher Quality Clusters</u>						<u>Lower Quality Clusters</u>			
Cluster 1		Cluster 2		Cluster 3		Cluster 4		Cluster 5	
Country	Years	Country	Years	Country	Years	Country	Years	Country	Years
Nigeria	4	Costa Rica	4	Honduras	5	Libya	1	Philippines	2
Taiwan	4	Morocco	2	Algeria	4	Italy	1		
Italy	3	El Salvador	2	Panama	4	Netherlands	1		
El Salvador	2	Switzerland	2	Dominican Rep	3				
Venezuela	2	South Africa	2	Morocco	3				
Costa Rica	1	Colombia	2	Tunisia	3				
Cyprus	1	Netherlands	2	Cyprus	3				
Netherlands	1	Ecuador	2	Spain	2				
Belgium	1	Nigeria	1	Switzerland	2				
Kuwait	1	Peru	1	Turkey	2				
Spain	1	Panama	1	Belgium	2				
Dominican Rep	1	Belgium	1	Venezuela	2				
		Algeria	1	Guatemala	2				
		Venezuela	1	South Africa	1				
		Italy	1	Israel	1				
		Dominican Rep	1	Ecuador	1				
				Netherlands	1				
				Poland	1				
				Botswana	1				

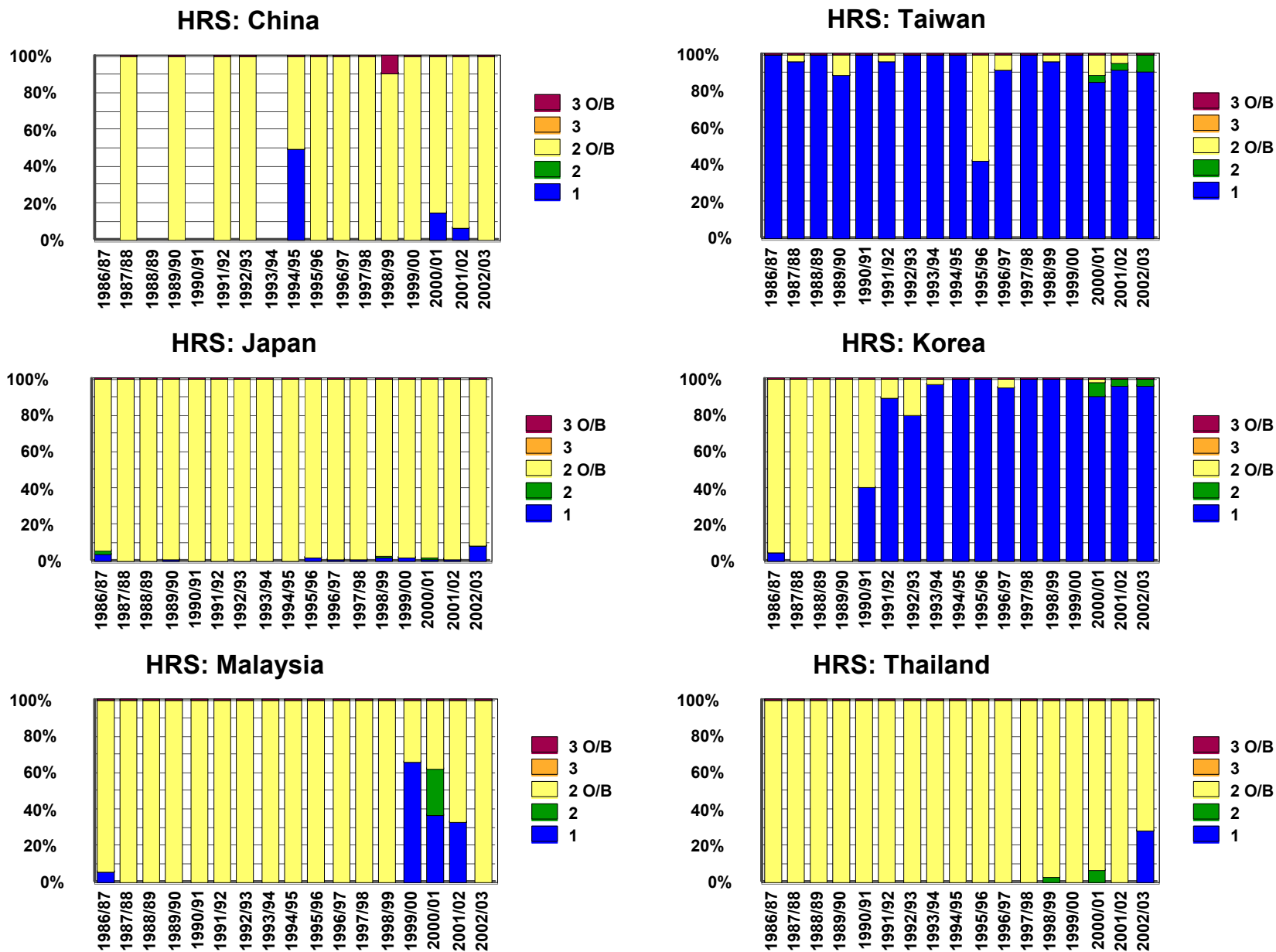
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Appendix Table 5. Countries and Years within Clusters for HRW, 1998/99-2002/03

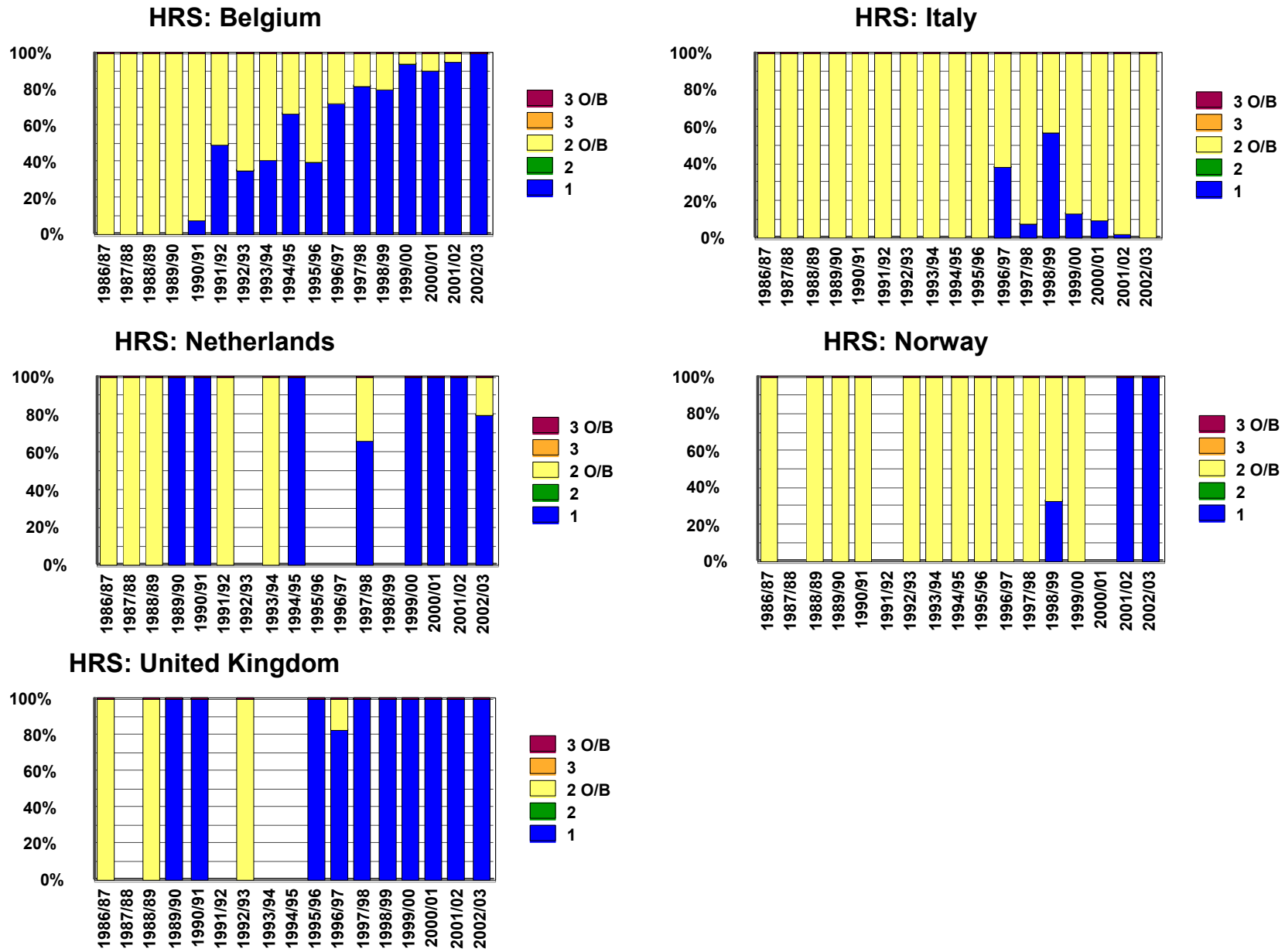
Higher Quality Clusters						Lower Quality Clusters					
Cluster 1		Cluster 2		Cluster 3		Cluster 4		Cluster 4 (Cont.)		Cluster 5	
Country	Years	Country	Years	Country	Years	Country	Years	Country	Years	Country	Years
Indonesia	5	Chile	3	Algeria	3	Belize	5	Afghanistan	1	Mexico	3
Japan	5	Congo	3	Ethiopia	3	Dominican Rep	5	Albania	1	Ethiopia	2
Korea Rep	5	Lebanon	3	North Korea	3	Guatemala	5	Armenia	1	Uganda	2
Taiwan	5	Russia	3	Mexico	2	Trinidad	5	Bahrain	1	Bahrain	1
Thailand	4	Sri Lanka	3	Morocco	2	Haiti	4	Bangladesh	1	Bolivia	1
Mongolia	2	Albania	2	Angola	1	Honduras	4	Benin	1	Djibouti	1
North Korea	2	Bangladesh	2	Bangladesh	1	Nicaragua	4	Botswana	1	Ecuador	1
Vietnam	2	Bosnia	2	Bosnia	1	Venezuela	4	Cape Verde	1	Erithrea	1
Bangladesh	1	Cape Verde	2	Djibouti	1	Barbados	3	China	1	Macedonia	1
Brazil	1	Colombia	2	Iraq	1	Brazil	3	Cyprus	1	Nicaragua	1
Cape Verde	1	Costa Rica	2	Jordan	1	Colombia	3	Estonia	1	Pakistan	1
China	1	Egypt	2	Libya	1	Costa Rica	3	Iraq	1	Somalia	1
Ghana	1	El Salvador	2	Sri Lanka	1	Ecuador	3	Kyrgyzstan	1	Sri Lanka	1
Kenya	1	Georgia	2	Sudan	1	Egypt	3	Lesotho	1	Sudan	1
Kyrgyzstan	1	Guyana	2			El Salvador	3	Libya	1	Tunisia	1
Mozambique	1	Israel	2			Gabon	3	Malaysia	1		
Panama	1	Kenya	2			Georgia	3	Mauritania	1		
Philippines	1	Nigeria	2			Guyana	3	Panama	1		
West Ban	1	Peru	2			Israel	3	Sri Lanka	1		
Zaire	1	Uganda	2			Jordan	3	Syria	1		
		Vietnam	2			Mozambique	3	Tanzania	1		
		Angola	1			Neth. Antilles	3	UAE	1		
		Bolivia	1			Nigeria	3	Uganda	1		
		Botswana	1			Peru	3	Vietnam	1		
		Brazil	1			South Africa	3	Yugoslavia	1		
		Cambodia	1			Angola	2	Zaire	1		
		Cameroon	1			Azerbaijan	2	Zimbabwe	1		
		Djibouti	1			Bolivia	2				
		Ecuador	1			Bosnia	2				
		Haiti	1			Cameroon	2				
		Honduras	1			Chile	2				
		Jordan	1			Congo	2				
		Kyrgyzstan	1			Cuba	2				
		Malaysia	1			Erithrea	2				
		Moldova	1			Kenya	2				
		Mozambique	1			Lebanon	2				
		Neth. Antilles	1			Madagascar	2				
		Norway	1			Morocco	2				
		Pakistan	1			Philippines	2				
		Sierra Leone	1			Sierra Leone	2				
		South Africa	1			Sudan	2				
		Sudan	1			Yemen	2				
		Swaziland	1								
		Thailand	1								
		Turkey	1								
		UAE	1								
		Venezuela	1								
		Yemen	1								
		Zaire	1								



Appendix Figure 1. Percent of U.S. HAD Imports by Grade for Selected Importing Countries, 1986/87 to 2002/03.

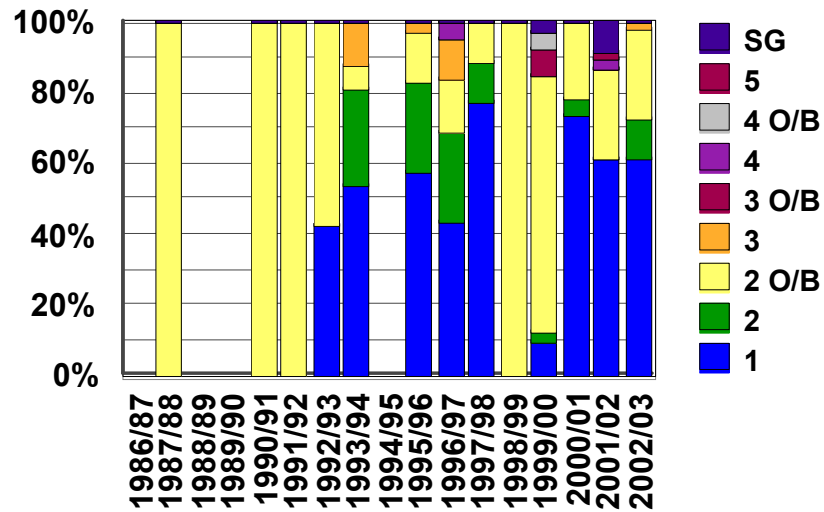


Appendix Figure 2. Percent of U.S. HRS Imports by Grade for Selected Importing Countries, 1986/87 to 2002/03.

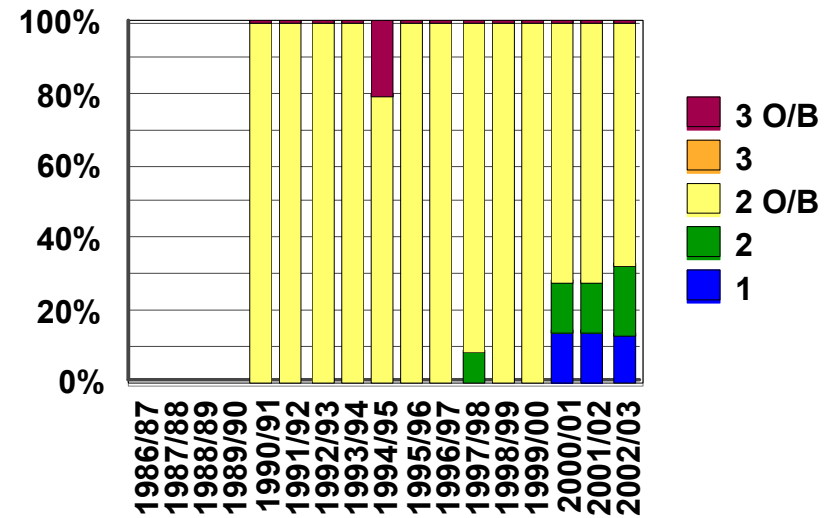


Appendix Figure 2 (continued). Percent of U.S. HRS Imports by Grade for Selected Importing Countries, 1986/87 to 2002/03.

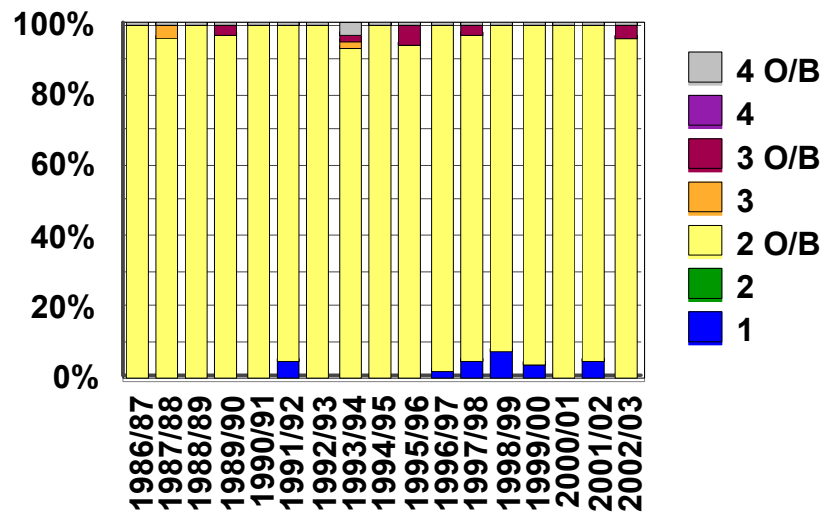
HRS: Mexico



HRS: Nicaragua

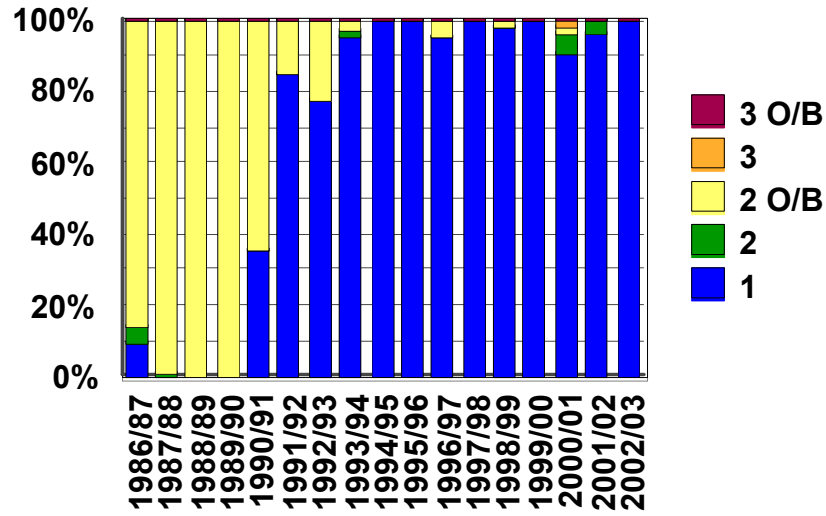


HRS: Venezuela

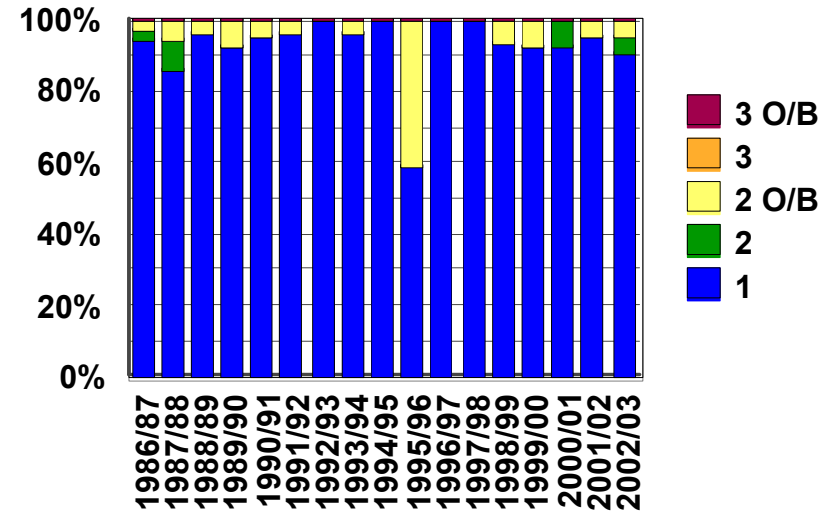


Appendix Figure 2 (continued). Percent of U.S. HRS Imports by Grade for Selected Importing Countries, 1986/87 to 2002/03.

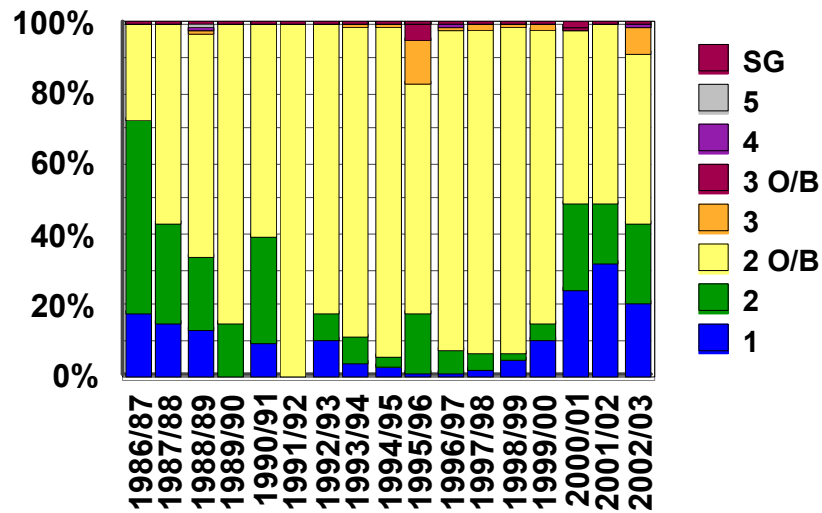
HRW: Korea



HRW: Taiwan



HRW: Mexico



Appendix Figure 3. Percent of U.S. HRW Imports by Grade for Selected Importing Countries, 1986/87 to 2002/03.

