Chapter 1: Increasing Information Uncertainty in the US Wheat Market: The Case of No. 2 Soft Red Winter Wheat

Section 1.1: Introduction

Uncertainty, resulting from imperfect information, in any market tends to destabilize prices, and grain markets are no exception. Firms rely on the futures market to not only manage price risk, but also provide market signals. The process of price discovery for grains and oilseeds occurs in spot markets and futures markets. This process results in a commodity's price at a specific point in time and it is impacted by short run changes in the commodity's market. If this process becomes less efficient, price signals may not adequately reflect market conditions at a given point in time. Federal grades provide public information regarding the quality of US grain and are an essential part of the US grain marketing system. Government standards for grains and other agricultural products were imposed in order to increase the flow of information and provide a standard level of quality. Prior to the adoption of federal standards for grains by the USDA, the uncertainty surrounding the condition of grain upon delivery was a factor in determining the prices received by farmers. While federal grades and standards are only fully enforced by the Federal Grains Inspection Service (FGIS) in the export market, these federal grades are used as guidelines for price discovery in the spot and futures markets. However, the information provided by federal grades could become a source of uncertainty, as faster paced lifestyles and new concerns about nutrition dictate changes in American eating habits (Barkema, 1993).

In response to increasingly discriminating food buyers, food processors and exporters will become increasingly concerned with the end-use qualities of grain, such as soft red winter wheat, that are not included in the grading system. Seasonal prices and discounts based on the federal grades, will be impacted in two ways: (1) The grades enforced by the FGIS may not fully reflect the value of the underlying commodity or account for price differences based on end-use because the grading system does not include all end-use requirements of the food related industries; and (2) The futures markets may loose some of their efficiency as a tool used by grain producers to create price expectations and manage price risk because they may not reflect the current conditions in the physical market. Thus, the price of a commodity on the futures market may not equal the value of the physical commodity as an input in processed end-products. Producers price expectations based on futures market prices may under or over reflect the commodity's underlying value.

By providing a public standard for grain characteristics, such as test weight, foreign material, moisture, and heat damage, the grades increased grain quality (Hill, 1990). Once a base grade was established, discounts were imposed based on the differences between the desired condition of the grain and the actual condition of the grain upon delivery. However, federal grades have to be able to adapt to changes in related industries, especially as consumers force the food industry to “tailor food products for more precisely defined market niches (Barkema, 1993)”. In the absence of changes in federal grades that reflect changes in the demand for specific end-use characteristics, the uncertainty regarding the quality of grain that has been graded according to federal guidelines may increase. Thus, price quotes from the futures market, which are based on federal grades, may become “too fuzzy to transmit the more detailed information required in the modern food market (Barkema, 1993).”

In order for firms to find a niche in the modern food market, transactions costs may increase because in the future, efficient market information may rely more on personal interactions between producers and processors and less on public information. Transactions costs refer to the cost of doing business, including costs associated with transportation, storage, risk management, collecting information, and marketing. As a firm’s transactions costs increase at a faster rate compared to revenue, the firm’s net revenue (total costs - total revenue) will decline, providing an incentive to either decrease expenditures or increase income by adding value to their product through further processing. Thus, an increase in the magnitude of a firm’s transactions costs associated with a commodity, such as wheat, may impact the firm’s supply and demand schedule, especially if they respond to the increase in the cost of information by decreasing farm prices for grain or increasing consumer prices for end products.

Section 1.2: Development of Grain Grades

In order to understand how federal grades can contribute to the level of uncertainty in the US grain market, it is helpful to examine the development of national standards. The uncertainty surrounding the quantity and quality of US grain and its impact on prices has been a national issue since the 1880s. A uniform measure, the Winchester bushel, was defined by law as early as June 19, 1703, by the Colony of New York. It was clear to early Mercantilists that in order to negotiate a “fair” price, they needed a standard volumetric measure for grain. By 1836, both houses of Congress passed a resolution giving the Secretary of the Treasury the authorization to standardize the weights and measures used in the United States, including the Winchester bushel. By the 1850s, the debate over the standardization of the grain trade started to include questions regarding grain quality.

The Chicago Board of Trade (CBOT) was the leader in defining a grading system for US grain. As the grain trade expanded to a point where buyers and sellers no longer met face to face, the CBOT realized that without defined classifications for wheat, the price would be arbitrary. In 1856, the grades established by the CBOT were the only published set of numerical standards for wheat. The *Milwaukee Daily Sentinel* referred to the CBOT’s grade No. 1 when reporting wheat quality. By 1857, the CBOT had issued a plan for the first inspection system, “without the interference from the city or state, thus avoiding political pressures (Hill, 1990)”.

By 1860, the CBOT revised their grades for wheat and started to charge producers who sent "damp and dirty grain." In order to strengthen quality standards and to "cause buyers of wheat in our [CBOT] market to pay prices for wheat in accordance with its true value (Chicago Board of Trade, 1859)", a new grade was added, "Rejected." The Board's decision followed the logic that the discounts and new grade would provide the necessary price incentive for farmers to do a better job of cleaning and shipping grain.

Test weights were introduced on January 1, 1859 and by the end of the marketing year, the CBOT had instituted a set of test weights with corresponding wheat grades. The last step in the development of the CBOT's grading system was to standardize the inspection process. Finally, on May 17, 1860 the CBOT passed a resolution establishing inspection fees for all transported grain, not just grain in rail cars. At the end of the marketing year, the "CBOT reported that the grades for spring wheat had increased its quality and value. Rigid enforcement of the inspection rules and more stringent requirements for higher grades of spring wheat had increased demand (Hill, 1990)". For the first time in the CBOT's history, the price of No. 1 spring wheat approached the price of No. 2 red winter wheat.

The CBOT's experiment was successful in creating a pricing system based on desired grain characteristics and a defined level of quality. Their grading system was used as a model for other commercial organizations' grading systems. The Detroit Board of Trade, the Milwaukee Chamber of Commerce, the Cleveland Board of Trade, the St. Louis Merchants Exchange, and the New York City Merchants all developed similar grading schemes. The confusion that resulted because each organization had its own definition for each grade, based on local conditions, disrupted the gains made by the CBOT. The St. Louis Merchants Exchange No. 1 spring wheat could not be substituted for a Cleveland Board of Trade No. 1 spring wheat. The lack of **uniformity** between grading systems led to problems at every level of the grain trade.

By the beginning of the twentieth century European importers boycotted many US grain markets, eventually purchasing US grain only during periods of severe short supply. This was not a reflection on the quality of grain supplied by US farmers, but in response to diverse grading systems that provided "too great a risk for European buyers (Hill, 1990)". Grading systems that were enacted, to provide information and reduce the level of uncertainty in the wheat market, were now the source of an increased level of uncertainty. Despite the fact that a national, uniform, grading system was desired by a majority of the members in the US grain industry, it was not a reality until the passage of the US Grain Standard Act of 1916. USDA finally published the long awaited national grades for wheat in 1917. As a result, the flow of information improved, US grain quality increased, and US grain gained prominence in world markets.

The Federal Grain Inspection Service (FGIS) was established in 1976 by Congress in the amended US Grain Standards Act to oversee the inspection of US grains and its permanent advisory committee was established in 1981. An independent body of inspectors added to the credibility of the US grading system because it ensured that grain inspections were free from the bias of producers or grain processors. The FGIS and the grading system resulted in quality assurance by providing a public standard for grain characteristics, such as test weight, foreign material, moisture, and heat damage. Farmers were provided with information regarding what was expected on delivery and the criteria used to determine the value of their product. Food processors, feed processors, and exporters were provided with information regarding the quality of the wheat on delivery. Buyers knew what to expect when contracting for a specific grade of grain, such as No. 2 soft red winter wheat, and they used a set of discounts to protect against paying too much for lower quality wheat.

When public information, in the form of federal grades, regarding grain quality no longer accounts for significant grain characteristics desired by end-users, uncertainty regarding the quality of market information, as well as, the functionality of US grain increases. This new level of uncertainty in the market increases the risk to firms in the marketing system purchasing US grain because they may have to incur the additional transactions costs associated with an increase in personal contract negotiations needed to obtain desired grain characteristics. As long as all other factors remain constant, firms' will expect their marketing margins to decrease because of the uncertainty associated with the possibility of increased costs.

Section 1.3: Price Uncertainty & Marketing Margins

Farmers only make up one level of the agricultural marketing system. Gardner (1975) illustrated that the farm-retail margin for food items depends on marketing firms at the processing, wholesale, and retail levels. The margins at wheat mills and their need for large inventories plays a role in determining the farm-retail price spread in the wheat processing industry. Increased price uncertainty could reduce a competitive firms' price spreads. As the price spread narrows, the price at which millers are willing to buy US wheat may decline, which could ultimately result in reduced output at the farm level.

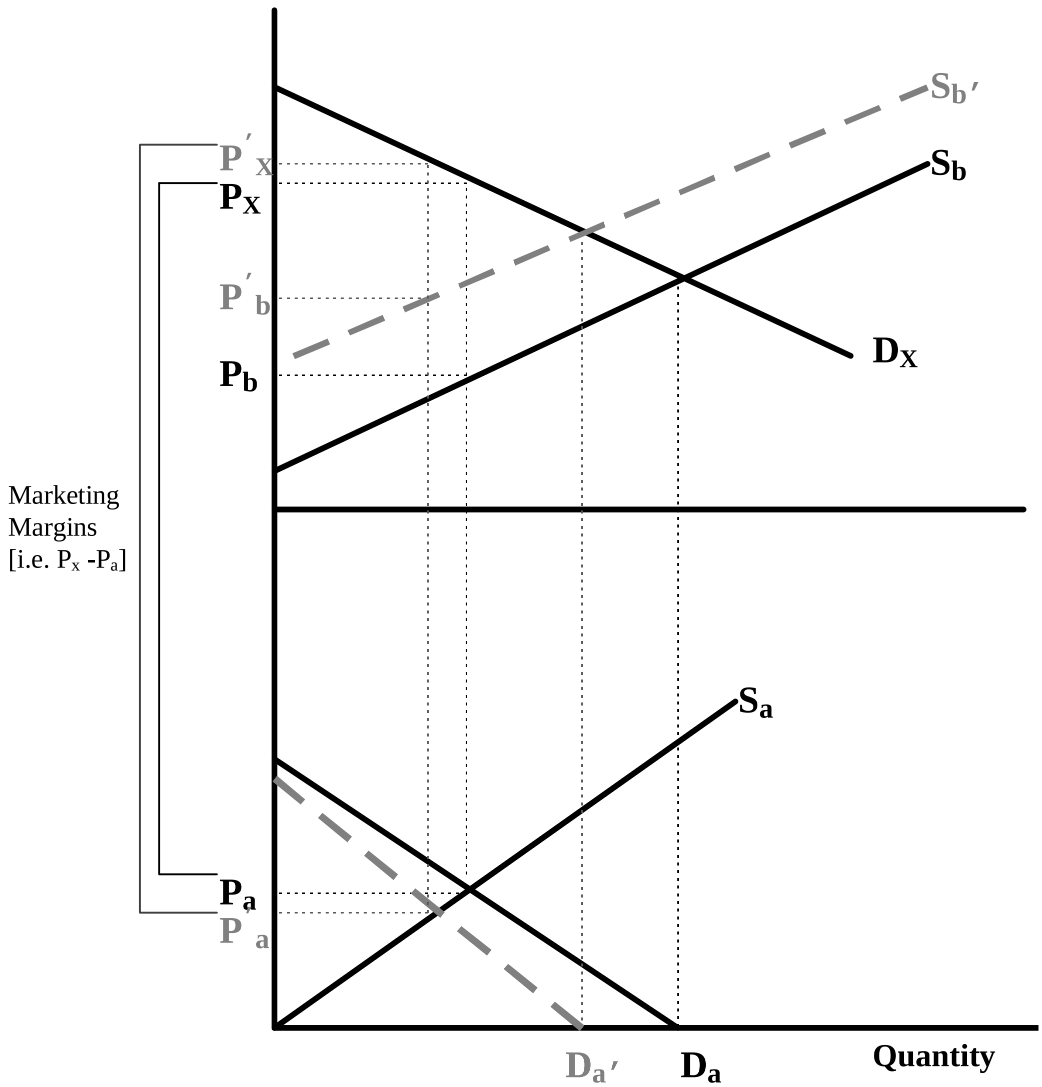
Gardner (1975) found that when marketing costs increase for the competitive firm, the marketing margins increase. The theoretical and empirical models found that marketing margins for a risk-averse firm react in a similar manner under increased input price uncertainty. In this case, the farm-mill and mill-retail margins increased when the uncertainty surrounding the information regarding the input price of wheat increased. The increased level of uncertainty may increase marketing and transactions costs. Figure 1-1 is similar to Gardner's example of a increased marketing costs due to a tax on marketing services. An increase in the transactions costs associated with wheat is illustrated by the shift in S_b on Figure 1-1. In this case, the increase in transactions costs is associated with the uncertainty surrounding the quality of public information. Eventually, the demand for US wheat as an input will decline (D_a) and the farm price will also decline (P_a). The marketing margins increased, which is indicated by the increased distance between the price of bread and the price of wheat on Figure 1-1.

By generalizing classical production theory a number of economists, such as Sandmo, Batra, Ullah, Ishii, and Hartman, developed the theory of the competitive firm under output price uncertainty. This theory provides useful insights regarding the impact price uncertainty has on production decisions. Ishii postulated that an increase in price uncertainty is associated with a reduction in a firm's output (Brorsen, Chavas, Grant, & Schnake, 1985).

In order to examine the competitive firm's behavior under price uncertainty, the behavior of a perfectly competitive marketing firm has to be examined theoretically and empirically. Sandmo's model was adapted and used as the theoretical model. Flour mills were considered competitive firms because of English's conclusion that flour mills have been operating on a small profit margin, regardless of the industry's high market concentration. Retail grocery stores were also considered competitive firms.

In this case the decision maker maximizes the expected utility based on the firm's wealth and makes production decisions according to the following model: $Max\ E(U)\big(w + py - (q'r + rx)\big|y = f(x,z)\big)$, where impartial wealth (w), output price (p), output level (y), revenue (py), specific input (x), price of specific input (r), vector of other inputs (z), vector of other input prices (q), and costs $(q'r + rx)$ all define the firms wealth. Adding price uncertainty in the form of margin uncertainty (M) with respect to y, changes the model, $Max\ E(U)\left(w + My - (q'z) + (q, y)\right)$, where the effective margin (M) equals the output price (p) minus the positive constant (k) times the input price (r). The optimal solutions are all risk-responsive input demand and supply functions. According to the theoretical model tested by Brorsen et al, as the decision maker becomes more risk averse, milling and marketing costs increase. In order to compensate for increased marketing costs, the competitive firm will take measures to increase the farm-mill and the farm-retail margins. An increase in input price uncertainty will also increase price spreads because the cost of gathering efficient market information increases, resulting in an increase in transactions costs.

Brorsen et al used an empirical model, which measured price risk with the moving average of the absolute value of price changes in wheat over a 12 month period. The *a priori* assumption was that the results would be in agreement with the theoretical model. The following equation was used in the empirical evaluation: $\overline{M} = \overline{p} - kr = m(w, q, \sigma, Y)$, where the expected output price ($\overline{p}$), positive constant (k), input price (r), impartial wealth (w), vector of other input prices (q), uncertainty (σ), and aggregated output supply (Y) define the expected margin under risk aversion ($\overline{M}$). The results were estimated using a seemingly unrelated regression model. An increase in input price uncertainty significantly increased both marketing margins, supporting the claim that the decision makers in the wheat marketing system are risk-averse. " The coefficient for milling costs in the farm-mill equation are not significantly different from one, indicating that a one cent increase in the milling costs results in a one cent increase in the marketing margins (Brorsen et al, 1985)".



Legend:
a = Wheat
b = Marketing Services & Transaction Costs
X = Bread
S = Supply
D = Demand
P = Price

Figure 1-1: Increased Marketing Margins Due to Increased Marketing Costs or Increased Input Price Uncertainty

Thus, increasing the price variability in the wheat market significantly increases marketing margins. The transmission of increased costs could go both ways, up to the consumer and down to the farmer. However, because pre-packaged breads are relatively interchangeable (i.e. Wonderbread and Rainbow), in order to successfully pass increased costs to consumers, bakers have to offer differentiated bread products. For example, fresh open hearth breads that sell at a premium, compared to pre-packaged sandwich bread, could compensate millers and bakers for the increased costs associated with purchasing higher quality wheat. The other alternative is to pay farmers less for wheat that is subjected to the current homogeneous grading system. The results are consistent with behavioral theory, because it implies that any risk-averse firm will want to take measures to reduce their losses, whether they are perceived or real.

Section 1.4: Factor Price Stabilization

A great deal of work has been done in the area of price uncertainty and its impact on the supply of agriculture commodities. Turnovsky's work illustrated the negative impact of decreasing factor price stabilization on a risk-averse firm, with *ex post* production flexibility and planned output. The market equilibrium theory states that the uncertainty associated with the price of a commodity affects both the supply side and the demand side because primary commodities are used as inputs in other industries. In a risk-neutral firm, Wright (1984) showed that as input price uncertainty increases (decreases) the optimal level of the quasi-fixed input decreases (increases).

Devadoss and Choi (1991) built on Wright's work by incorporating the impact of a risk-averse processor on *ex post* production decisions. In their study each firm is assumed to use a primary commodity, such as wheat, as an input. The study uses random input prices, bound by a price ceiling and a price floor. Factor price stabilization is achieved by a mean-preserving contraction of the price ceiling and floor. The short-run behavior of the competitive firm is analyzed using the first-order conditions for the equation $\prod = pF\left(k, X\right) - rX$, defined by the world price (p), random input price (r), and the quasi-fixed input chosen *ex ante* (X). It must be assumed that the price of the variable input is random with the specified density (*g(r)*) and the cumulative density function (*G(r)*).

The results indicated that as *r* decreases the optimal level of capital spent on a quasi-flexible input increases. In the case of a single input model, indicated by the equation, output also increased. However, in realistic production scenarios the increased output would depend on the substitutability of the cheaper input for other *ex post* inputs.

Devadoss and Choi (1991) expanded the model in order to incorporate risk aversion, $Max\ EU\left(\prod\left(K, p, r\right)\right) = U\left(\int\left(K, p, r\right) - cK\right) \mathrm{d}G(r)$, where *K* denotes the capital spent on the quasi-flexible input, and both first order and second order conditions were met. Their results indicated that in a risk-averse firm the substitutability between capital and the variable input play a significant role in determining optimal solutions. If no price floor or ceiling exists, the risk-averse firm will use *K* to maximize utility. Devadoss and Choi use government programs as a justification to allow a price minimum (p_m) and a price maximum (p_x) to be set. Before the passage of the Federal Agriculture Improvement and Reform (FAIR) Act of 1996, target prices for wheat were established by law and farmers participating in government programs received a deficiency payment based on the difference between the target price and the higher of the national market price or the nonrecourse loan rate. The FAIR Act eliminated target prices and the ability to create expectations for price floors using government programs. However, firms that use agricultural products have access to the futures market, which provides information regarding the supply, demand, and price of commodities in the physical market. This information can be used to create expectations regarding price floors and ceilings. The model and its results would be the same, only the justification for setting minimum and maximum prices would change.

If a risk-averse firm is faced with a maximum factor price instead of a purely random input price (r), and K and X are substitutes, then p_x results in an increased optimal level of K. If the partial derivative dk/p_x indicates that K and X are compliments, the optimal level of K will decrease. In the case of a guaranteed price floor, the optimal level of K cannot be determined because the sign of dk/dp_m is ambiguous. It can be hypothesized that a price floor on variable inputs simply indicates the least amount that could be spent on that commodity, not the optimal level of capital that could be spent on the commodity.

In the case of No. 2 SRW wheat the implications of Devadoss and Choi's work are two fold. First, a risk-averse flour mill's *ex post* response will be to examine alternatives to buying No. 2 SRW wheat and decrease the amount of K spent on No. 2 SRW wheat. For example, millers and bakers will still spend an equivalent amount of K on wheat but they may prefer, depending on transportation costs, to import wheat associated with a known end-use performance, such as varieties of Canadian wheat. Wilson & Preszler (1992) found that "the expected values of end-use performance for US wheats have variances which exceed those of Canadian wheats." If millers and bakers respond to a decrease in factor price stability by substituting Canadian wheat for their primary input, US wheat, eventually demand for US wheat will decline.

Second, in response to the decrease in demand, risk-averse farmers will make decisions regarding the use of *ex post* inputs used to manage production based on expected revenues. If the price of their commodity becomes destabilized and they can no longer rely on government programs or the futures market to manage price risk, expected profits may decline. The end result will be a market signal to producers to produce less No. 2 SRW wheat.

Section 1.5 The Futures Market & Price Risk

When a flour miller buys a futures contract for No. 2 SRW wheat, he is paying a price based on the quality characteristics specified by the Federal grading system because futures contracts are based on this homogeneous grading and handling system. The futures price does not take into account adjusted flour yield or any other contract specification not included in the existing grades. Price expectations based on wheat futures (markets) prices can potentially provide misleading market signals, and undermine both a processor's and a producer's ability to manage price risk. The futures market may only be able to provide general information regarding the supply, demand, and quality of the wheat in the physical market.

By hedging or using options, the futures market can be used to manage the price risk associated with handling agricultural commodities. Hedging allows producers of a specific agricultural commodity to ensure that they will not lose potential revenue if the cash market price falls before they sell their wheat in the physical market. Hedging allows producers to lock in the price they will receive at a specified point in time. For example, if a producer sells a July futures contract for No. 2 SRW wheat in November, at planting time, at $4.25 per bushel and the cash price falls to $3.75 per bushel by early July, without hedging the producer would have received $3.75 per bushel at harvest. A producer with a short position in the futures market, would buy the futures contract back at the lower price, gain the positive difference in futures income, equaling the loss in income per bushel in the cash market, less transactions costs.

One draw back to hedging, is the fact that if the spot price were to rise above the $4.25 per bushel contract price, the producer would have to buy the futures contract back at the higher price but the producer would also gain from cash market sales, again, hedging locks in the price per bushel. Hedging can only protect agricultural producers from declining commodity prices. Firms that purchase No. 2 SRW wheat, such as elevators or flour mills, may also use hedging to manage their price risk. However, hedging only allows firms who buy agricultural commodities to manage costs by protecting them against increases in commodity prices. For example, a flour mill with a long position in the futures market, would sell the futures contract back at the higher price, use the gains in the futures market to offset the higher cost of wheat in the cash market. In this case, hedging would control input costs by locking in a lower price for No. 2 SRW wheat.

Using options on futures is another way producers (processors) can manage price risk without forfeiting the potential benefits of an increase (decrease) in commodity prices. Options provide producers (processors) with the opportunity to establish a futures position at a specified price. The price at which the option can be exercised is the strike price. A producer of No. 2 SRW wheat may purchase a put option for a premium based on the price per bushel, which guarantees the producer a minimum price per bushel, less the premium cost. A put is in-the-money when the strike price is greater than the current market price. "Exercising the put option would allow you to sell at a price above the current market price (Chicago Board of Trade, 1989)". Once the put is exercised, the producer has taken a futures position an locked in a price per bushel. If a put remains out-of-the-money (strike price < current market price), the producer can let the option expire. In this case, the producer can fully benefit from higher current prices, minus the cost of the option. Firms who purchase agricultural products set a price ceiling by purchasing call options. A wheat processor will exercise a call option if the current market price rises above the call's strike price. When a call is in-the-money (strike price < current market price), it can be exercised and the processor will have locked in a futures price in order to control input costs. However, if the call remains out-of-the-money (strike price > current market price), it will be allowed to expire.

Section 1.5.1: Changing Grain Characteristics & Managing Price Risk

Both hedging and options are acceptable ways of managing price risk; however, to manage price risk effectively, there should be a close correlation between characteristics of grain traded on the futures market and grain characteristics demanded in the cash market. Futures and options on futures specify the Federal grade deliverable against the contract. If producers and food processors are specifying different characteristics in their spot market contracts, the expectations created using futures prices may become less efficient. The ability of the futures market to manage price risk may lessen because grain that could be delivered against the specifications of a futures contract may not be deliverable against any new specifications in the physical market. Thus, the reliability of price signals supplied by the futures market for specific types of wheat may be reduced. Producers would have to know the difference between the price offered by end-users (elevators, miller, and bakers) and futures price for a specific grade of wheat.

Market signals regarding end-use grain characteristics may be very difficult to determine because there is a lack of information regarding the demand for these characteristics. It is even harder to determine the value of end-use characteristics if they are not included on the discount sheets. Market participants would be creating expectations based on perceptions, not efficient information. It is therefore assumed that by not adding certain measurable characteristics to wheat grades, the uncertainty surrounding wheat prices will increase, resulting in a less efficient price discovery process for wheat.

Section 1.6: Renewed Debate Surrounding Federal Grades

The renewed debate surrounding the Federal standards for grains concerns the ability of the grading system to account for the *intrinsic value* of the grains. The idea that the *intrinsic value* of grain influences its true value is not new. Millers and bakers in eighteenth century Paris "visually selected varieties of wheat that would produce the quality of bread desired by discriminating Parisian palates (English, 1978)". Because of changes in technology and changes in consumers' tastes and preferences, the grain characteristics demanded by food processors has changed (Barkema, 1993).

The grades enforced by the Federal Grains Inspection Service no longer take into account all of the grain characteristics desired by end-users. For example, millers are concerned with the varying percentage of flour yields in wheat. When millers purchase No. 2 soft red winter (SRW) wheat they are receiving a mixture of different varieties. Because the different varieties are mixed together, there is no way to predict the flour yield associated with No. 2 SRW wheat. This is cause for concern by the producer and end-user because it detracts from the ability of information provided by federal grades to effect market clearing (resource allocation). The level of uncertainty surrounding the quality of grain will increase in the absence of personal communication between the buyers and sellers of wheat, regarding additional attributes not included in grades and standards.

The North American Export Grain Association (NAEGA) and the US Wheat Associates created a national task force in 1986 to examine the need for expanding the characteristics used to delineate grades. The report included 13 recommendations for evaluating grain quality. End-use value tests and developing a wheat classification system were two suggestions intended to improve wheat grades that were not implemented. Wheat would not be the first grain with a national association whose recommendations are incorporated into current federal grades and whose grades reflect end-use. "The American Malting Barley Association makes recommendations on barley varieties for malting purposes, which are adopted by the grading system (Wilson, Scheping, Cobia, Johnson, & Demacy, 1993)". The federal grades for barley are based on variety, class, and end-use. Federal grades for barley are based on either malting or non-malting, and two-rowed, six-rowed, six-rowed blue, or class barley.

In order to adopt specific end-use requirements, the NAEGA report suggested that the FGIS should develop "practical tests and methods that are meaningful in determining end-product yield and quality (Bruckner and Finney, 1992)". The outcome of end-use value tests would appear on the grade certificate. Wheat classifications should be expanded beyond simple visual kernel characteristics. The report suggested that identification should include end-use requirements of the food related industries, such as protein, kernel hardness, and loaf size.

Due to the high costs of equipment, questionable accuracy, speed of analysis, and the political process surrounding amending federal grades, these recommendations have not been implemented. However, determining end-product yield and quality is becoming more relevant, especially with the increase in consumption of wheat as food.

Figure 1-2: All US Wheat Used as Food, illustrates the steady increase in the use of wheat in American food products. Between 1991/92 and 1994/95, the disappearance of US wheat attributed to use in food rose 11.6%, or approximately 91 million bushels.

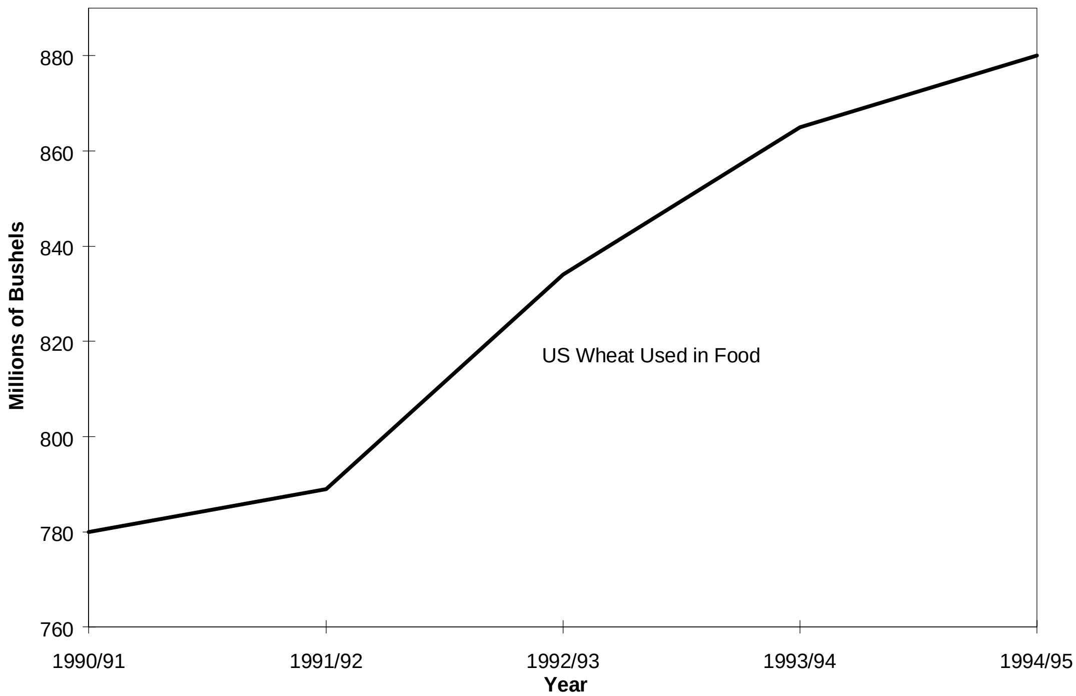


Figure 1-2: All US Wheat Used as Food, 1990/91 - 1994/95

Source: *Wheat Yearbook (Stock #88008B). ERS. USDA.*

Section 1.7: Soft Red Winter Wheat (SRW Wheat)

Adding the characteristics desired by millers and bakers to the grading system would increase the flow of information regarding supply and demand of wheat as an input in specific end-use markets, which could potentially lower transactions costs; while, improving the reliability of price signals in associated spot markets. SRW wheat was examined because of changes in consumer tastes and preferences and because SRW wheat is the class grown in Virginia. Any attempt to incorporate end-use value tests and wheat classifications in the grading system for wheat will affect SRW wheat grades and impact Virginia's wheat market.

With only one exception, 1991/92, starting in the mid-1980s both total US production and disappearance for No. 2 SRW wheat have been increasing (Figure 1-3).[1] The sharp increases from 1988/89 to 1989/90 and the decrease from 1989/90 to 1991/92 can be explained by changes in government programs. Acreage left idle because of participation in the acreage reduction program fell from 22.5 million acres in 1988/89 to only 9.6 million acres in 1989/90, reducing the constraints on No. 2 SRW wheat production. Over the same time period, US exports of SRW wheat rose by approximately 600 million bushels.

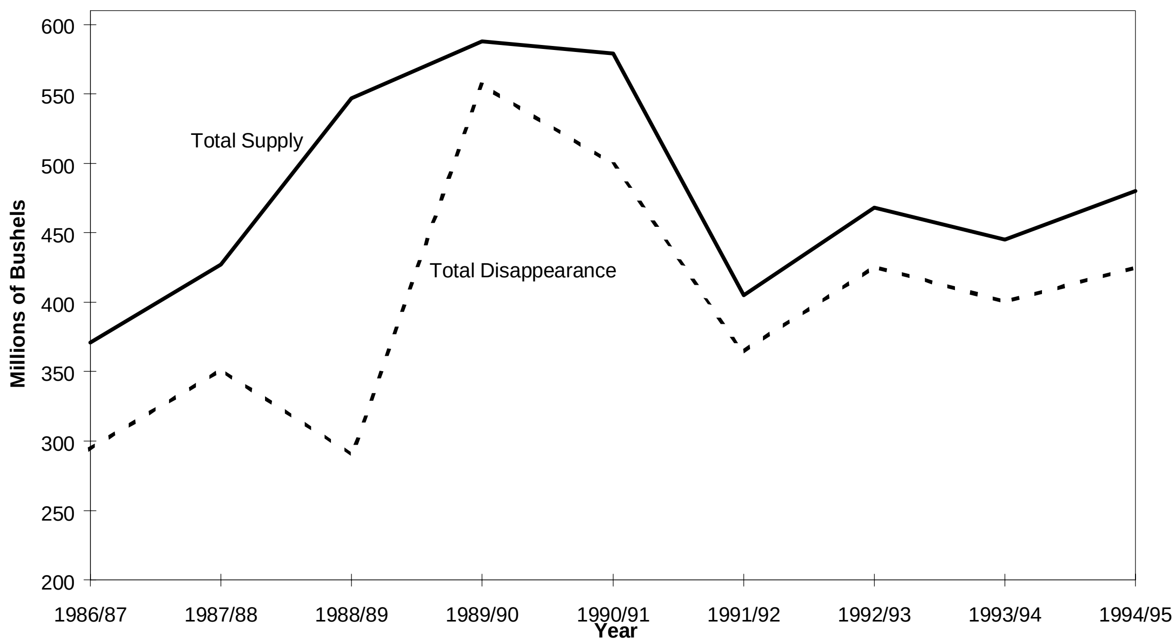


Figure 1-3: Supply & Disappearance of No. 2 Soft Red Winter Wheat, 1986/87 - 1994/95

Source: *Wheat Yearbook (Stock #88008B). ERS USDA*

By 1990/91, carry over stocks for wheat rose to 35.4% of total use and US exports only accounted for 28% of total exports, the lowest market share in 20 years (Hoffman, Schwartz, and Chomo, 1995). The Food, Agriculture, Conservation, and Trade (FACT) Act of 1990 targeted wheat surpluses and wheat exports. Through the use of the acreage reduction program, the Conservation Reserve Program, and the Export Enhancement Program, the FACT Act succeeded in balancing the aggregate US wheat market by reducing the gap between available US wheat and its use years (Hoffman, Schwartz, and Chomo, 1995). By 1991/92 carryover stocks were less

[1] No. 2 SRW wheat was examined, opposed to No. 1 SRW wheat, because No. 2 SRW wheat is the grade of wheat grown in Virginia that is deliverable against the CBOT's contract for wheat. It represents the expected quality of SRW wheat in the US market.

than 20% of total wheat use and US exports captured 32% of world exports, rebounding from a of 28% in 1990/91. Between 1991/92 and 1994/95, the total disappearance of No. 2 SRW wheat increased 16.8% and total supply increased 18.5%.

Public and private variety testing of SRW wheat have included assessments for the following milling and baking qualities: milling quality score, baking quality score, percentage of flour protein, adjusted flour yield, alkaline water retention capacity, and softness equivalent. One study by Brunker and Finney found that all of the milling and baking qualities analyzed were significant, except for the percentage of flour protein. Their study also identified as least two bulk populations with "no deficiencies in terms of adjusted flour yields (Brunker & Finney, 1992)". Identifying the end-use characteristics of specific wheat types is important because millers and bakers will want to purchase varieties that will enhance their processing efficiency and improve the quality of their end-product. If SRW breeding programs succeed in identifying varieties of SRW wheat that are associated with a number of desired qualities, such as increased crop and four yields, then the demand for these identified varieties will increase. Varieties that lack identifiable milling and baking qualities will not be preferred by end-users in food related industries. This change in end-user demand for SRW wheat would be illustrated by different prices offered for different varieties of SRW wheat. Prices based on variety would have to provide the incentive to move away from a homogeneous grading and storage system. Food processors will either have to pay a premium for varieties with the desired characteristics or discount varieties that do not have these characteristics. The premiums, for example, would have to compensate grain elevators for any additional costs associated with separating wheat by variety. Under the present homogeneous handling system, quality characteristics based on milling and baking qualities will have to be specified in individual contracts and this wheat will have to be kept separate from the aggregated No. 2 SRW wheat.

Contracting for desired qualities that are not included in the soft red winter wheat grades has a number of implications, such as (1) transactions costs would increase because of the time and expense of one-on-one interaction; (2) the increased risk associated with contracting for characteristics that are not included futures contracts; and (3) creating price expectations will become more complex because the discovery process may not be able to rely on quotes from the futures market. The end result would probably be an increase in the level of uncertainty regarding the price, quality, supply and demand of soft red winter wheat.

If characteristics, such as adjusted flour yield or baking quality score, become easy to test, and they are not included in federal grades for wheat, the increased uncertainty is theoretically expected to result in misleading price signals. Figure 1-4 and 1-5 illustrate the difference in prices with regard to the end-use of No. 2 SRW wheat in Virginia. The end-use was based on the major use of wheat in each geographic area reporting price quotes.

The prices reported in Figures 1-4 and 1-5 are based on No. 2 SRW wheat spot market price quotes for four of the eight regions in the state published by the Virginia Commodity Newsletter. The Norfolk Terminal price was used as a proxy for the export price of Virginia No.

2 SRW wheat. An average of the Culpeper/Winchester price quote and the Wakefield price quote was used as a proxy for the feed price of Virginia No. 2 SRW wheat. It was assumed that a majority of the wheat purchased in the two regions would be used for feed because Culpeper/Winchester is located near Virginia's large poultry producers and Wakefield is located near large hog producers. No. 2 SRW wheat is not used in the flour mill in Culpeper, which processes hard durum wheat for use in pasta. Because of the location of Roanoke City Mills, Ronaoke's price quote was a proxy for the price of Virginia SRW wheat used in food production. The price quoted in Roanoke was for No. 1 SRW wheat, indicating tighter processing requirements in the food market. It was discontinued in August of 1994.

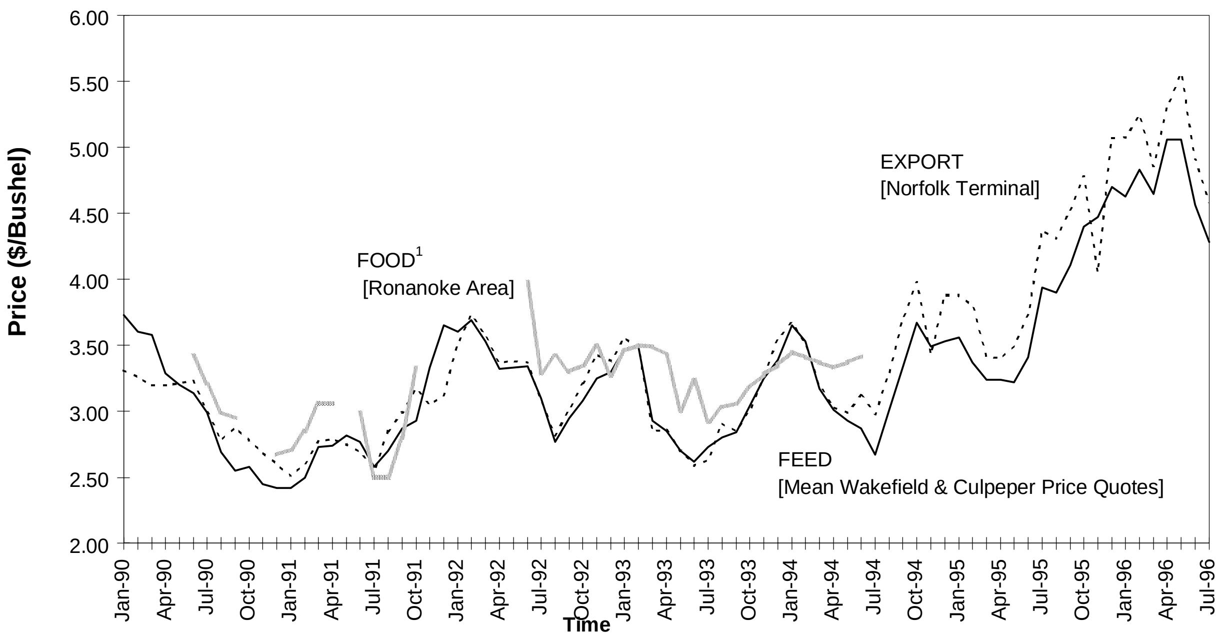


Figure 1-4: Average Monthly Prices for No. 1 and No. 2 Soft Red Winter Wheat, Based on Grade and Primary End-Use in Specific Locations, 1990 - July 1996

Source: Virginia Commodity Newsletter

[1] Food was the only end-use that used No. 1 Soft Red

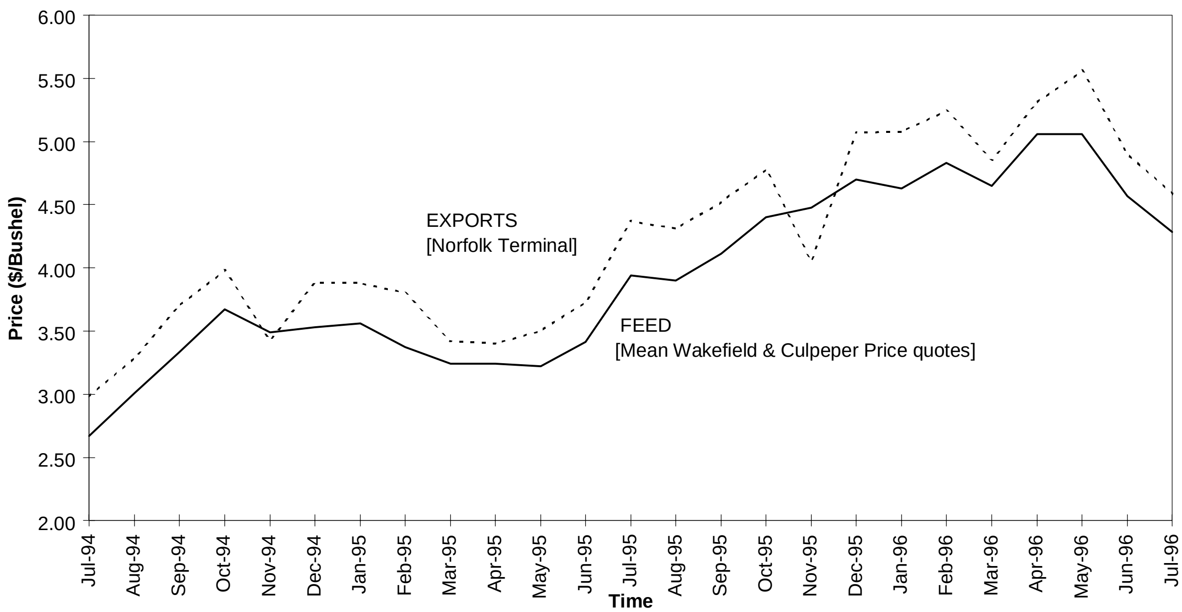


Figure 1-5: Average Monthly Prices for No. 2 Soft Red Winter Wheat, Based on Primary End-Use in Specific Locations, July 1994 - July 1996

Source: Virginia Commodity Newsletter

Based on Figures 1-4 and 1-5, it can be assumed that producers in Virginia are already faced with spot market prices that are based on the end-use of their wheat. No. 2 SRW wheat used in feed is consistently priced lower than exported No. 2 SRW wheat. By demanding the No. 1 grade, food processors in Virginia are sending two signals through the marketing system: (1) that food processors want a higher level of quality wheat to use in their products; and (2) that food processors are willing to pay for the increased quality. A food processor may expect that the higher test weight associated with No. 1 SRW wheat, compared to No. 2 SRW, would capture processing costs savings because it would be expected that the heavier bushel would result in an increase in flour yield per bushel. Thus, the premium paid for No. 1 SRW, compared to No. 2 SRW wheat, would be equivalent to the expected savings associated with processing a denser, less damaged wheat. However, not even No. 1 SRW wheat guarantees food processors improved output potential because milling and baking qualities are not included in the Federal grade for any SRW wheat.

Section 1.8: Implications

The US grain marketing system is dependent on the federal grades to provide a certain level of public information regarding grain quality. The national grading system evolved out of the need for a more efficient flow of reliable information regarding grain quality. However, it is possible for these grades to become outdated and become the source of renewed uncertainty.

The demand for SRW wheat has been driven by the consumers' desire for pre-packaged, baked goods. Because of increased consumption of US wheat as food, millers and bakers are interested in identifying intrinsic grain qualities that will improve SRW wheat's productive output in the mill and at the bakery. Flour mills operate on a small profit margin and identifying varieties with higher flour yields would lower production costs. Thus, due to on going work by plant breeders it may be feasible in the near future to incorporate end-use value tests and wheat classifications into the grading scheme. Until then, it is possible for the specifications for wheat in the physical market to become mismatched with the specifications of futures contracts. If this results in increasing the transactions costs for millers and bakers, in the long run, the farm price may decline (see Figure 1-1).

Another aspect to consider is the increased importance of the input price of wheat in the long-run, when the food industry exhausts other cost saving technology and when risk management strategies cannot adequately offset price variability. For example, assume that the futures contract for No. 2 SRW wheat, based on the homogeneous grading system, lacks correlation with the grain characteristics desired in the spot market, and as a result the prices in the futures market and in the spot market also lack correlation. Up to a certain point millers and bakers could offset increased costs associated with the factor price uncertainty of wheat by adopting labor saving technology. The capital saved on one input, labor, could be used to compensate for the uncertainty associated with SRW wheat. However, once the current cost saving technology has been adopted, leaving the price of wheat as the only significant variable costs of production, uncertainty surrounding US wheat would have a greater impact on the firm's decisions regarding capital expenditures. In response to uncertain market information, millers may substitute Canadian wheat for US wheat or they may decrease the price they are willing to pay for US wheat. In both cases, the US SRW wheat market will be faced with a decrease in demand and farm price.

US grain producers could offset the potential decrease in demand and farm price due to an increase in uncertainty by adding value to their product. For example, producers could enter into agreements with a grain elevator to plant a minimum amount of a specific variety of SRW wheat in return for a minimum level of compensation. In order to provide the incentive to move away from homogenous storage systems, the grain elevator could enter into agreements with different mills for the varieties of wheat specified in the contracts between grain producers and the elevator. Producers could also develop a vertically integrated cooperative where members would receive proceeds from milling and baking activities. SRW wheat producers would be able to sell their wheat in the form of flour, dough, or bread, adding value to the product that generates their income. A vertically integrated cooperative would decrease the impact of information uncertainty because members would be able to control the varieties of SRW wheat planted, stored, and then processed. Therefore, by taking the initiative to develop alternative marketing strategies, it is possible for grain producers to decrease the impact of information uncertainty on demand and farm prices.