SOFT WHITE AND SOFT RED WHEAT PRODUCTION AND MARKETING IN MICHIGAN: IMPORTANCE SUPPLY, DEMAND, PRICE BEHAVIOR, AND FUTURES MARKET RELATIONSHIPS

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INTRODUCTION

The Importance of Wheat Production to Michigan Farmers

The state of Michigan has the distinction of having one of the most highly diversified agricultural production systems in the United States. As evidence of this diversity, note that in 1975 there were only two enterprises that had a share greater than ten percent of the total cash receipts from farm marketings in Michigan, those being dairy with 22.4% and corn with 13.4%. Wheat ranked fourth with 7.9% and although this seems small in percentage terms, wheat's contribution to cash receipts totalled 130.7 million dollars.[1]

Although receipts from wheat have been increasing in recent years (1972-75), most of this increase can be attributed to rising prices rather than increases in physical output. Wheat production itself has not shown any recognizable trend over the past three and one-half decades. It appears that although some farmers quit producing wheat for short periods of time, they usually return to it. The fact that a less intensive crop, such as wheat, can maintain itself at the level it does in the Michigan economy is interesting in itself. Probably the most valid explanation of this phenomenon is that raising

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[1] John N. Ferris and K. T. Wright, "The Status of Michigan Agriculture: 1976," Agricultural Economics Report 299 (October 1976).

wheat complements raising other cash crops as the producer diversifies his cropping pattern. This occurs as a result of several factors.

Timeliness of operation is one factor with which Michigan farmers must be concerned. Producing wheat is popular in that it does not present any major conflicts in the seasonal timing of planting and harvesting of other farm enterprises.

Farmers are also attracted to wheat because there is a ready market available on which they can trade their product. This feature is not common to all enterprises undertaken by Michigan farmers.

Easily the most attractive feature that wheat production exhibits is the low labor requirement. This is especially relevant to Michigan farmers because of both Michigan's labor force and also because of the number of part-time farmers present in Michigan's agricultural production sector.

The industrial wage rate level in Michigan is second only to that of Alaska on a national level. This means that farmers in Michigan are at a competitive disadvantage with other producers in the hired labor market. The low labor requirement of wheat production minimizes or helps to eliminate this disadvantage.

The low labor requirement is also beneficial to the large number of Michigan farmers who are full-time, off-farm employees. These part-time farmers would find it very difficult to maintain enterprises that exhibited high labor requirements.

Because of these factors wheat production is extremely important to many Michigan farmers. Likewise, it is important to those food systems firms that market the wheat.

Objectives of the Study

Many different classes of wheat are grown in Michigan's agriculture sector but only two types of wheat are grown to any significant degree.[2] Easily the most dominant type of wheat grown is soft white wheat which is a sub-class of white wheat. The other class of wheat grown in Michigan is soft red wheat. Since these two wheat crops comprise consistently over 90% of the wheat acreage in Michigan this analysis will only be concerned with them.

The purpose of this study is to examine the trade-offs in producing and marketing soft white and soft red wheat in Michigan for the purpose of identifying optimal strategies for the participants.

In this analysis the uses of both types of wheat will be examined as well as the impact of new technology on the substitutability of soft red for soft white wheat. The export market for these two crops will also be examined. On the supply side, yield differentials and risk factors for the two classes will be analyzed.

The majority of this study will be concerned with the price behavior of soft red compared to soft white wheat. The traditional and current price differentials will be discussed, and with this information the effectiveness of hedging soft white on the soft red futures market will be analyzed.

Just as with any research project, the most important objective of this study, given the analysis of the production and marketing

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[2]The seven classes of wheat are: Hard Red Spring Wheat, Durum Wheat, Red Durum Wheat, Hard Red Winter Wheat, Soft Red Winter Wheat, White Wheat, and Mixed Wheat. Soft White Wheat is a subclass of White Wheat. See the Official U.S. Standards for Grain, U.S.D.A., A.M.S., December, 1975.

sectors, will be to make recommendations to both producers and market operators as to what their optimal strategies should be in the coming years.

Current Situation

For the most part, the trend of Michigan farmers substituting soft red for soft white wheat in the production process appears to be a logical response to both the market and production sector. Traditionally, soft white wheat received a price premium over soft red wheat. This fact, in addition to the belief by many Michigan farmers that soft white wheat would yield more bushels per acre than would soft red wheat, made the substitution of soft white for soft red wheat even more justified. Just as these two factors were the major contributors to the trend of substituting soft white for soft red, so have they helped to disrupt it.

In recent years the price premium that soft white enjoyed over soft red has disappeared. It is, from a price standpoint, no longer advantageous to produce soft white wheat. This fact, coupled with the introduction of new higher yielding varieties of soft red wheat raise many questions as to just what is the optimal strategy in the planting decisions.

From a marketing standpoint, soft red wheat producers enjoy the advantage of having a contract for their wheat to be traded on a futures market, while soft white wheat is neither traded in the futures market nor is it accepted for delivery toward filling any of the other wheat futures contracts. Growers of soft white wheat can hedge against price

uncertainty on the red futures market using the assumption that the price relationship is acceptably close. If the price of soft red and white wheat move together perfectly in all respects then this hedging strategy is just as good a tool in reducing price risk as could be obtained if there did exist a soft white wheat futures market. Hedging white on red as a risk reducing tool diminishes in quality as price fluctuations between these two crops take place.

Historically, the prices of these two crops, for the most part, have moved very close together but use of the red futures market for a hedging tool for soft white producers is not perfect in reducing price risk.

Given the additional price risk associated with producing soft white wheat as compared with soft red wheat and no compensation in the form of a premium in either price or yield, Michigan farmers are responding to the recently unfolding situation in a logical manner.

DEMAND SITUATION

Michigan soft red and soft white wheat are primarily used as inputs for the production of pastries, crackers, biscuits, cakes, cookies, cones, wafers, pretzels, cereals, and flour for home use. Naturally, it depends on the product, but overall no other type of wheat can satisfactorily be substituted for eastern soft wheat in products such as those listed above. One possible exception is western hard white wheat but because of shipping costs this substitution is not normally economically feasible.

Although different varieties of both soft red and white wheat have different characteristics, overall soft white wheat has a higher cookie and pastry quality than does soft red wheat. It has been argued by some that because of this quality differential, a price premium for white over red is justified. When market conditions are such that this premium exists, then processors can substitute soft red for the more expensive soft white wheat in the production process of certain goods. Given a premium for soft white over soft red, processors have two strategies they can follow.

Since red cannot substitute for white in all products processors can change the proportions of by-products, increasing the output of products where substitution can occur and decreasing output of products which need the color quality exhibited only by white. In products such as flour where color is not important given that bleaching occurs,

processors can change the proportions of red and white wheat used so as to use less of the more expensive white.

In recent years, the introduction of new technology known as air classification milling adds to the technical ease of substitution. The problem with this is that air classification is only available at a high capital cost and is not typically found in white wheat users' plants. Even if it were readily available at a low capital cost, it still might not be a feasible alternative for it is an expensive process to operate.

It appears that the substitution of red for white is a practicable alternative as the price differentials justify it, although the adoption of air classification, for the most part, does not seem to be a feasible method of adding to the technical ease of substituion. The only way that the expense of air classification could be justified is if the price of white exceeded red by a sufficient margin, and this margin was maintained in the market place over a long period of time. Given the past price patterns and the uncertainty of the future relative price fluctuations, the adoption of air classification appears to be a risky alternative if only used for the purpose of reducing price risk.

Export Situation

Michigan producers and processors should be concerned with the treatment that soft red and soft white wheat receive in the export market. This concern should not only be addressed to their performance as a group, but also the relative performance of one to the other. The

former helps to determine the price differential between soft red and soft white as a group to other groups of wheat while the latter helps to determine the price differential between soft red and soft white wheat individually.

To examine the total and relative performance of soft white and soft red wheat in the export market, data was collected from the Grain Market News (1974-77) published by the Agricultural Marketing Service of the United States Department of Agriculture. This data included weekly amounts of both white wheat and soft red wheat as well as the total volume of wheat inspected for export at the Pacific, Atlantic, Lakes and Gulf region ports. This publication lists these four port regions where inspection and exports take place and the amount of each class of wheat that leaves the United States for foreign countries. Soft red wheat is listed in a category by itself, but soft white wheat, as a sub-class, is lumped into the white wheat category, the majority of which is made up of western hard white wheat. To alleviate this problem it was assumed that wheat leaving the Pacific region ports was white wheat other than soft white wheat while the other three port regions exported only soft white wheat. In light of the geographical differences, production patterns, and transportation costs, this assumption seems both logical and realistic. Another aspect worth noting is that, given Michigan farmers produce the majority of soft white wheat, the export performance of this crop is especially important to the Michigan agriculture sector.

This data was collected for the period January, 1974 through April, 1977. Within each year the fifty-two observations were summed

in order to obtain a yearly total. More years of data would have been useful but unfortunately the recurring problem of data availability prohibits this.

Once the yearly totals computed for soft white wheat, soft red wheat, and the total wheat exported from the United States, these figures were compared to determine if any recognizable trend has occurred over the past three and one-half years. As can be seen from Table 1, there are several factors worth noting.

TABLE 1.--Exports (1,000 Bushels).

Year	Soft White	Soft Red	Total U.S. Wheat Exports	White as a % of Total	Red as a % of Total	White as a % of Red
1974	5,986	92,983	927,355	.6455	10.03	6.44
1975	21,699	155,296	1,136,788	1.9088	13.66	13.97
1976	2,563	173,645	942,541	.2700	18.42	1.476
1977*	203	17,748	218,349	.0930	8.13	1.144

Source: Grain Market News, USDA, issues from January 1, 1974 - April 29, 1977. Figures were computed.

*Through April 29, 1977.

The first is that soft white wheat as a percentage of the total U.S. wheat exported, with the exception of 1975, has been decreasing dramatically. This tends to indicate that the door to the export market for soft white wheat is slowly being closed. The exact reason(s) for this occurring were not investigated although several possible explanations come to mind. Perhaps the stocks of soft white wheat are so

small that either all of it is used domestically or there isn't enough soft white wheat to make it worthwhile to try and place orders overseas. Another possibility might be that the wheat lobbying groups have obtained enough political clout to battle it out with red wheat for export orders.

Secondly, soft red wheat as a percentage of total wheat increased from 1976-76, but in the current year has fallen behind. Since the export patterns of wheat are not known, the last part of 1977 may bring the export level of soft red up to where the increasing trend continues. Nevertheless, it appears that soft red wheat is enjoying either stable or increasing success in the export market.

The third and possibly most important aspect is that soft white wheat as a percentage of soft red wheat, again with the exception of 1975, has been declining. Just what impact this has on the relative prices is difficult to determine, but economic theory would lead us to believe that, everything else held constant, this would increase the price of soft red relative to soft white wheat.

Exactly what is causing the decline in soft white exports is difficult to determine and not within the scope of this analysis. Regardless, given that Michigan wheat farmers concentrate on the production of soft white wheat and given that the majority of all soft white wheat is produced in Michigan, this is an issue with several important implications that should not be ignored. If this decline is a result of changing demands of importing countries away from soft white wheat, producers might be better off producing soft red, depending of course on how this impacts on the price differential between the

two crops. If this decline is due to some other factor, then we are more than likely dealing with a political issue.

Naturally, because of the pricing mechanism, producers desire to maximize exports of their crops while processors desire to minimize exports of the crops that they utilize in the production process. The former objective increases the chances of more favorable relative prices to producers of the particular type of wheat in question while the latter increases the chances that processors, who utilize that crop in the production process, will have to pay a higher relative price. If in fact this is a political issue, it would appear that Michigan soft white producers are being made worse off while processors who utilize soft white wheat in the production process are being made better off. The existing political power structure as it relates to the export market is one aspect that needs to be examined further. This structure contains not only those elected officials who decide on export policies, but also those lobbying groups who influence their decision-making process. Although this issue is possibly a political powder-keg, it would surely help to explain the price fluctuations of soft red and soft white wheat as they relate to one another.

SUPPLY SITUATION

Past Trends in Acreage Utilized for Wheat Production in Michigan

Although several different classes and sub-classes of wheat have been produced by Michigan farmers over the last 25 years, soft red and soft white wheat are easily the only two significant classes selected for production. As can be seen from Table 2, the percentage of Michigan's acreage utilized for soft white wheat production, although fluctuating up and down, showed an increasing trend in the years 1939-1969 as farmers substituted the production of soft white for soft red wheat. In 1974 this trend experienced a dramatic disruption. The percentage of Michigan acreage in soft white wheat dropped by 8.9% while soft red wheat increased by 6.4%. This disruption has many interesting implications. The possibility exists that some factor(s) in either the production sector or the market sector (or both) are causing the trend of white replacing red in the production process to reverse itself. Alternatively, this might be just an interruption in the trend and the acreage utilization will return to the level it experienced in 1969. From this level soft white could continue to replace soft red wheat in the manner it did previous to this disruption.

Yield Differentials Between Soft White and Soft Red Wheat

On the supply side there seems to be the feeling that Michigan farmers can obtain higher yields per acre with soft white wheat as

TABLE 2.--Estimates of the Percentage of Total Wheat Acreage Utilized for Soft Red and Soft White Wheat, Michigan, 1939-1974.

Year	Soft White Wheat	Soft Red Wheat
1939	53.5	42.9
1944	65.8	34.0
1949	86.6	11.3
1954	81.9	16.9
1959	85.8	13.8
1964	80.1	19.6
1969	82.9	17.1
1974	74.0	23.5

Source: Frank Gomme, E.R.S., U.S.D.A., 1976, phone conversation.

opposed to soft red wheat. Yield data indicates that it is not possible to make this generalization with respect to all Michigan counties as some have an absolute advantage with white wheat while with others it is red. Not only does the absolute advantage between white and red wheat change between counties, but also yields per acre of different varieties of white and red change. In one county one variety of white will out yield the other varieties of white, while in another county yet a different variety will possess the highest yield.

This fact is demonstrated in Tables 3, 4, and 5. In Table 3 by using the Tuscola County mean yield for six years, it can be seen that the red variety Arthur was outyielded by the white varieties Yorkstar and Ionia. In Huron County the red variety Arthur demonstrated a higher five year mean yield than the four white varieties. Table 4 shows that red outperformed all white varieties in Ingham County while the reverse was true in Kalamazoo and Ionia Counties. Table 5 indicates that in Berrien, Monroe, and Lenawee Counties red Arthur outperformed white Genessee and Avon varieties while white Yorkstar and Ionia were superior to the red Arthur. Consequently, the selection of the variety, whether it be white or red, is the key decision variable.

New high yielding varieties of soft red wheat have been introduced in recent years which could be a possible explanation for the disappearance of traditional yield advantages of white over red. The red variety Arthur was introduced by the Purdue Experiment Station in 1968. Given the variations among varieties of both soft white and soft red and also between red and white in general, it appears each producer, given his particular area, should have his own planting strategy.

TABLE 3.--Michigan Regional Soft Winter Wheat Yield Trial--1966-1972--Thumb Area.

County	Year	Soft White Winter Wheat Yield - Bu/Acre				Soft Red Winter Wheat Yield - Bu/Acre
		Genesee	Avon	Yorkstar	Ionia	Arthur
TUSCOLA	1967	45.3	53.3	56.8	51.1	47.4
	1968	63.0	61.5	67.5	63.6	55.8
	1969	72.5	70.1	74.5	72.0	73.0
	1970	59.6	62.2	67.4	70.3	61.6
	1971	38.7	40.4	48.1	43.1	46.0
	1972	41.9	42.5	39.1	38.7	47.2
Co. Mean Yield - 6 years		53.5	55.0	58.9	56.5	55.2
Percent of Genesee		100	103	110	106	103
HURON	1967	65.9	62.4	64.6	69.8	71.0
	1968	73.5	73.5	81.3	75.4	70.0
	1969	76.1	60.0	87.4	77.4	80.7
	1970	62.4	59.5	59.9	64.6	61.9
	1971	39.5	35.4	45.2	42.5	57.9
Co. Mean Yield - 5 years		63.5	58.2	67.7	65.9	68.3
Percent of Genesee		100	92	106	104	107
Regional Mean Yield - Bu/A 11 nurseries		58.0	56.5	62.9	60.8	61.2
Percent of Genesee		100	97	108	105	106
Regional Mean Test Wt. 10 nurseries - lb/bu		58.9	59.4	56.4	59.3	60.7

SOURCE: Everett Everson, Department of Crop and Soil Sciences, Michigan State University.

TABLE 4.--Michigan Regional Soft Winter Wheat Yield Trials--1966-1972--Central Michigan.

County	Year	Soft White Winter Wheat Yield - Bu/Acre				Soft Red Winter Wheat Yield - Bu/Acre
		Genesee	Avon	Yorkstar	Ionia	Arthur
INGHAM	1966	67.5	60.6	70.3	71.8	78.9
	1967	46.6	45.4	51.6	48.5	64.0
	1968	45.5	37.6	43.3	42.4	55.6
	1970	48.2	47.1	48.8	56.1	62.2
	1971	55.5	58.3	72.5	62.6	57.5
	1972	47.2	61.0	62.9	52.4	51.4
Co. Mean Yield - 6 years		51.8	51.7	58.2	55.7	61.6
Percent of Genesee		100	100	112	108	119
IONIA	1967	36.2	36.5	34.9	46.6	52.3
	1969	54.1	61.9	66.7	60.2	50.4
	1970	62.5	61.5	45.0	69.1	47.0
	1971	46.2	48.6	51.2	45.4	38.9
	1972	32.1	41.1	46.2	44.1	36.2
Co. Mean Yield - 5 years		46.2	49.9	48.8	53.1	45.0
Percent of Genesee		100	108	106	115	97
KALAMAZOO	1967	50.5	48.9	53.7	49.7	42.6
	1968	56.8	51.0	52.8	56.1	42.1
	1969	44.0	43.7	53.8	46.8	38.1
	1970	49.2	40.7	40.6	59.5	42.3
	1971	36.8	39.5	47.8	40.8	35.8
	1972	43.8	42.7	47.5	44.1	37.3
Co. Mean Yield - 6 years		46.9	44.5	49.3	49.5	39.7
Percent of Genesee		100	95	105	106	85
Regional Mean Yield - Bu/A 17 nurseries		48.4	48.6	52.3	52.7	49.0
Percent of Genesee		100	101	108	109	101
Regional Mean Test Wt. 17 nurseries - lb/bu		58.6	58.4	56.0	58.7	60.0

SOURCE: Everett Everson, Department of Crop and Soil Sciences, Michigan State University.

TABLE 5.--Michigan Regional Soft Winter Wheat Yield Trial--1966-1972--Southern Michigan.

County	Year	Soft White Winter Wheat Yield - Bu/Acre				Soft Red Winter Wheat Yield - Bu/Acre
		Genesee	Avon	Yorkstar	Ionia	Arthur
BERRIEN	1967	49.3	53.2	49.3	48.6	50.7
	1968	52.6	56.0	59.2	55.3	54.4
	1969	58.1	62.0	65.3	67.6	65.9
	1970	44.1	42.3	44.5	54.9	39.8
	1971	35.1	40.7	46.5	42.2	46.0
	1972	63.0	57.8	69.2	61.3	57.0
Co. Mean Yield - 6 years		50.4	52.0	55.7	55.0	52.3
Percent of Genesee		100	103	111	109	104
MONROE	1967	56.5	55.1	61.6	59.7	53.9
	1969	36.1	39.8	32.2	34.7	41.3
	1970	45.1	37.6	35.8	52.7	39.8
	1971	47.5	49.3	62.2	57.4	52.4
	1972	53.7	51.1	62.1	57.9	60.9
Co. Mean Yield - 5 years		47.8	46.6	50.8	52.5	49.6
Percent of Genesee		100	97	106	110	104
LENAWEE	1967	51.6	52.3	47.6	54.1	57.5
	1970	39.9	42.4	40.4	51.4	47.6
	1971	39.4	45.8	47.4	45.0	38.4
	1972	46.9	43.1	62.2	50.5	50.2
Co. Mean Yield - 4 years		44.4	45.9	49.4	50.3	48.4
Percent of Genesee		100	103	111	113	109
Regional Mean Yield - Bu/A 15 nurseries		47.9	48.6	52.4	52.9	50.4
Percent of Genesee		100	101	109	110	105
Regional Mean Test Wt. 15 nurseries - lb/bu		58.6	58.2	55.5	58.7	60.4

SOURCE: Everett Everson, Department of Crop and Soil Sciences, Michigan State University.

Also on the supply side it should be recognized that, although breeding programs are aimed at the problem, soft white wheat is more susceptible to sprout damage than soft red. As a result soft white wheat is often discounted in price because of lower market grade. The introduction of this added risk factor is something that must be considered by everyone in the marketing channels from producer to processor. Yield and/or price advantages of white over red can easily be negated when and if this sprouting occurs in white and not in red.

Another important measure of production risk is the risk related to yield variability of soft white wheat versus soft red wheat. After calculating the variances in yields for all years and all counties listed in Tables 3, 4, and 5 it was determined that neither soft white nor soft red wheat have clearly higher variances. Consequently risks as measured by variances are nearly equal for soft white and soft red wheat varieties.

PRICE BEHAVIOR OF SOFT WHITE COMPARED TO SOFT RED WHEAT

Eastern soft wheats historically have dominated wheat production in the state of Michigan. Producers are mainly concerned with yields and prices while processors' concerns are mostly concentrated on the price differentials of the two crops. As discussed earlier, a generalization regarding yield differentials is not valid throughout each county in the state of Michigan. Each producer should make production decisions based on yield differentials in his particular area. For the most part, price differentials are uniform throughout the state at a given point in time. Since price differentials appear to be the major decision variable faced by producers and processors alike, the majority of the analysis that follows will be devoted to that subject.

The price differences between these two crops were obtained from time series data records of prices quoted for Michigan Field crops from the period of July 1965 - June 1975.[3] By posting prices for every Tuesday, plus the price quote nearest mid-month and at the end of the month for red and white wheat in the same trade area, an estimate for average marketing year annual price for each class of wheat was derived. The price differential is the difference between the two average estimates. The results are contained in Table 6.

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[3]Raw data was obtained from George Dike, Department of Agricultural Economics, Michigan State University. Figures were rounded to the nearest cent. Data from Michigan Elevator Exchange price cards.

TABLE 6.--Average Yearly Price Difference Between Soft Red and White Wheat in Michigan.

Market Year	Michigan Soft White Wheat Average Annual Price ($/Bushel)	Michigan Soft Red Wheat Average Annual Price ($/Bushel)	Difference White Over Red (¢/Bushel)
1965-66	1.6047	1.5589	4.58
1966-67	1.6597	1.6516	.81
1967-68	1.3469	1.3426	.43
1968-69	1.1933	1.1901	.32
1969-70	1.3332	1.3529	-1.97
1970-71	1.5893	1.5541	3.52
1971-72	1.4863	1.4220	6.43
1972-73	2.2780	2.2403	3.77
1973-74	4.7640	4.7553	.87
1974-75	3.9060	4.0036	-9.76

Source: George K. Dike provided raw data. Above figures were calculated.

As can be seen from these results, soft white wheat has traditionally received a premium over soft red wheat in all years with the exception of 1969-70 and 1974-75. Especially alarming is the nine cent differential of red over white realized in the 1974-75 crop year. In this crop year the price difference between the two crops was not only the greatest but also it was a reversal of the traditional relative prices. Producers who used historic price relationships in their decision framework received a startling surprise. Given the percentage

of Michigan acreage utilized for wheat production was much higher for soft white than red, this surprise was not a very pleasant one. Processors were also affected and forced to seriously consider the possibility of substitution discussed earlier. Overall, the negative aspects of the price reversal were felt more by the Michigan farmers than the processors.

Currently producers and processors alike are faced with the problem of how to handle the price differential situation. Producers are assumed to be seeking a planting strategy that will maximize their profits. In the same context processors want to minimize the cost of their inputs. These facts plus the fact that there doesn't seem to be a reliable price difference between the two crops on a yearly basis has some serious implications for producers and processors alike, especially given the differences of the two markets.

Soft red wheat has an added attraction of enjoying the advantage of having a futures market contract which can be traded while soft white wheat does not, and as a matter of fact is the only class or subclass of wheat not deliverable against some wheat futures contract. Because of increased price variability, the lack of a futures market has become especially important since the early 1970's.

The increased price variability in the market sector in addition to the existing yield variability in the production sector has increased the risk of producing wheat.

On the production side, producers face risk as measured by yield variability in that they are more or less at the mercy of natural

forces when it comes to yields. Weather, insects, fire, etc. all have the influence of creating variations in yields from year to year.

With respect to market structure, wheat producers, like most agricultural producers, have the unique distinction of closely approximating what economists call perfect competition than any other segment of the economy. In this regard producers are subjected to the role of being "price takers" rather than "price setters." The uncertainty of prices throughout the production process is a factor that cannot be ignored by market producers.

It is commonly recognized that most people are risk averters in that they will undertake methods to reduce risk as measured by variability for the same level of production. This of course is subject to cost constraints, but nonetheless, producers faced with both production and price risk have responded in a manner to transfer this risk to others in the market place who are both more able and more willing to carry this risk.

Previous to the 1970's production risk was the main concern of producers since price was near the support price fixed by Federal legislation. Producers responded with various forms of insurance coverage, pesticides, herbicides, irrigation projects, etc. to either help eliminate or transfer it to others. Although these tools reduced risk, they have not eliminated it.

Since the beginning of this decade there has been increased awareness of the price risk associated with the production process. This has occurred because price variability of wheat has increased dramatically. This is mainly a result of modified government programs,

reduced crop inventories, variation in world production, and changing foreign demands. Just as producers responded to production risk, they are now in the process of responding to this increased risk. As a result there are now increased demands for risk-bearing tools which will either reduce, shift, or otherwise manage price risks.

Not only are producers concerned with the use of risk-bearing tools, but so are processors who are faced with price fluctuations of their inputs. For both of these groups the use of the futures market is probably the most feasible alternative means of transferring price risks.

Since the soft red wheat futures contract is the only one of regional importance which can be traded, growers of soft white wheat can only hedge against price uncertainty in the soft red futures market. The effectiveness of this hedging strategy is somewhat questionable given the fluctuating price differentials associated with these two crops.

Time series data for prices of both soft red and soft white wheat in Michigan for the period 1965-76 were analyzed to determine the feasibility of hedging white wheat on the soft red wheat contract. Using July to February, July to April and August to April as typical hedging periods, the mean differences in price and the standard deviations of those respective mean prices for the eleven year period were calculated. This was done for both soft red and soft white crops individually and then for the price differentials between these two crops. The results of those calculations are in Table 7.

TABLE 7.--Price Differences and Deviations for Two Typical Hedging Strategies.

Time Period	Mean Price Difference Between Two Periods (¢/Bushel)	Standard Deviation (¢/Bushel)
White		
July to February	46.62	105.40
July to April	9.66	43.47
August to April	4.71	37.35
Red		
July to February	48.75	106.32
July to April	10.82	17.98
August to April	6.55	39.62
Difference White over Red		
July to February	-2.1461	4.65
July to April	-1.1700	4.13
August to April	1.9254	4.29

Source: George K. Dike provided raw data. Above figures were calculated.

Two things are worth noting. First, as can be seen in Table 7, it seems peculiar that the mean price difference for both red and white is greater for the July-February hedge than the July-April and August-April hedge. After re-examining the data it was found that most of this large difference could be attributed to one missing observation for the month of April for both red and white wheat. This normally would not have been that critical, but this observation was for April 1974. During this hedging period the price increased by $3.43 for white and $3.49 for red. Although the July-April and August-April mean price difference was calculated with one less observation, this

observation distorted the results for both the July-April and August-April hedging strategies.

The second and most important factor worth noting, as can also be seen by the results, is that the price risk as measured by the standard deviation is greater for soft white wheat than it is for the difference between soft white and soft red wheat. This is also true for the July-April and August-April hedge figures which are biased downward. This suggests that while price uncertainty of soft white wheat can be greatly reduced by hedging on the soft red wheat futures market, it cannot be totally eliminated. Because this hedging strategy is not totally effective, many have argued for the creation of a soft white wheat futures contract, or at least to permit soft white wheat to be delivered (at some standard discount or premium) against other wheat futures contracts. Further analysis needs to be conducted to determine whether this argument is valid.

This analysis has demonstrated that hedging soft white wheat on the soft red wheat futures market is not a perfect hedge. However, it is not clear whether the price differential fluctuates enough to justify the creation of a soft white wheat futures market or to allow soft white wheat to be deliverable on other existing contracts. Several factors need to be determined before this question can be fully answered.

It is not clear whether there would be sufficient demand for the contract by the industry. Nor is it clear if there would be sufficient long hedging in the market, enough that is to prevent the possibility of an easily cornered market. It has not been determined whether the growers would exhibit enough interest in hedging. Also there needs

to be a sufficient number of speculators interested for the market to remain liquid.

Once these factors have been determined the costs and benefits associated with a soft white wheat contract or allowing it to be deliverable against another contract need to be analyzed. Costs would include such things as the cost of providing a trading pit and contingent services, commissions, and education that might be necessary to stimulate sufficient interest to make the market viable.

Depending on the outcome of this analysis it could be determined whether the existing situation is optimal or if a soft white contract or permitting delivery against some other contract is optimal. This can only be determined through further analysis.

CONCLUSIONS AND RECOMMENDATIONS

As stated earlier, the major objective of this paper is to use the previous analysis to make recommendations to both producers and market operators. Although the main important recommendations are either evident or laid out in the analysis, nonetheless, it might prove beneficial to briefly restate the more important features of this analysis as they relate to both groups.

Producers, because of the nature of their business, are especially vulnerable to risks. On the production side it appears that no generalization can be made with respect to which class of wheat will outyield the other. Each producer should examine the relative yields of both crops in his particular area, keeping in mind that because of the fact that soft white wheat is more susceptible to sprout damage, it is therefore more risky. With this in mind they then must make some projection as to what they feel relative prices will be. Once planting has been undertaken, producers have the option of reducing price risk. For soft red wheat producers' use of the soft red futures contracts on the Chicago Board of Trade futures market is a relatively effective tool in locking in an acceptable price. For soft white producers who wish to transfer price risk, they too can use the soft red futures contract. While this hedging strategy is not as effective as hedging in soft white futures contracts might be, it does greatly reduce price risk. In either case it should be recognized that by locking in a price for

either soft red or white wheat on the soft red futures market not only will windfall losses be avoided in the case of a price drop, but so will the possibility of windfall gains in the case of price increases. The extent to which each individual producer utilizes this risk-reducing method depends on the risk-preference function for that individual. This in turn is a function of many factors including the age and goals of the producers, the extent to which the business can stand possible losses, future expectations, etc.

For the processor who is faced with fluctuating price of inputs, both in real terms and in relative terms, two strategies seem feasible. For fluctuations in relative prices of soft red and soft white wheat substitution between the two crops appears to be a possible alternative. When white is commanding an excessive premium, proportions of by-products can be changed in the short-run to minimize the cost of inputs. This, of course, is done with the risk that this premium could grow even larger. The use of air classification milling to add to the technical ease of substitution between these two crops sounds nice, but overall it does not appear to be economically feasible as a short-run solution. With respect to reducing price risks of both crops, the processor has the same tool available to him as the producer; only in the processor's case his strategy is just the opposite of the producer's. Rather than using the producer's traditional short hedge, the processor can reduce risks by going long in the futures market.[4] Although the mechanics are

[4]This strategy would involve four steps: (1) sell flour or food contract, (2) buy futures at price that permits him to do (1), (3) buy wheat at market price, and (4) sell futures contract. Steps (1) and (2) take place first and at the same time. Steps (3) and (4) take place at same time and occur when processor wishes to acquire additional stocks of wheat. This, of course, is constrained by the length of the contracts.

just reversed, the final outcome is the same in either case. Regardless, the processor is faced with the same decision framework that the producer is. Only the individual can decide whether the optimal strategy is to transfer price risks or carry those risks themselves.

Finally, it is important to point out that if at one time, any producer or processor sought means to shift the burden of price risk, the evidence shows these risks to be more pervasive than ever. Probably the majority of people in the market for soft red and soft white wheat are now searching for ways to carry the additional risk that appears to be increasing. In this regard, producers and processors of soft red wheat have an effective tool for transferring price risks. For those associated with soft white wheat production, the soft red futures market offers a somewhat effective tool. The traditional way of handling additional risk--that is, widening or adding to carrying charge--seems too severe a tax not only on the producer but also on the industry as a whole. In this context producers and processors alike have a real incentive to push for a soft white wheat futures market opportunity in the years to come. It seems apparent that this fact has been recognized by many as the push for the delivery of soft white wheat against futures market soft red wheat contracts has already begun.

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TECHNICAL APPENDIX

During the course of the preceding analysis of the soft white and soft red wheat industry in Michigan, an attempt was made to build an econometric model in hopes of gaining some insight into the price structure of these two crops. As previously discussed, the price difference between soft red and soft white wheat is critical to Michigan farmers as they can produce either crop. Originally, it was hoped that this model would help explain why price differentials occurred in the manner they have over recent years. Unfortunately, the results obtained were very discouraging. The purpose of this technical appendix is to discuss some of the problems encountered, the model building and estimation, the results obtained and their interpretation. This is done with hopes of aiding future researchers who may wish to study these two crops.

The biggest obstacle encountered was the availability of data for these two crops. Even though soft red and soft white wheat do not belong to the same class, they are nonetheless grouped together and termed eastern soft wheat. An extensive search failed to produce a source that separated these two crops with respect to production figures. The closest information related to actual production figures obtained for the two crops individually was the estimated percentage of acreage planted to both crops in Michigan. Taking these estimated percentages and multiplying them by the total Michigan production yields estimates on the separate production of each. There are two problems with this technique. First, the estimates are only taken every five

years, forcing the assumption that a linear relationship between each five year interval exists. Secondly, this technique assumes that yields per acre between these two crops are equal. As discussed earlier, no generalizations can be made with respect to yield differentials. Consequently, it is important to realize that an error in measurement with respect to production estimates could have been introduced.

The data on prices omitted the fractions from the prices. This decreased the accuracy and introduced a measurement error with respect to prices. Another limitation was that price data only went back ten years which is somewhat shallow in a statistical sense.

Realizing the limitations of price and yield data, attempts were made to build a model. In doing this, the first decision to be made was which variables should be included in the model. The procedure used here was to go to economic theory. With economic theory, the variables can be separated into three classes: (1) definite inclusion, (2) questionable inclusion, and (3) definite exclusions. By first using market information and then statistical tests, the above three classes can be separated to the point where a model can be built.

In the initial stages, possibilities for inclusion in the model were as follows: soft white wheat price and production, soft red wheat price and production, difference in price and difference in production of two crops. This data was for Michigan only.

Before beginning regression analysis, the simple correlation coefficients were examined in anticipation of problems to come. Two correlation coefficients stood out immediately. The first was a

correlation of .99948 between the red and white price. The second was a correlation of .84708 between the white and red production.

Given the six variables previously mentioned, the first decision in building the model was which variable to make the dependent variable. Usually the criteria for selecting a dependent variable is to choose the one that you are most interested in predicting. Since price is of major concern here, it was selected. But since red price and white price had a correlation coefficient of .99948, making one an independent and the other a dependent variable could very well introduce the problem of non-independent "independent" variables. That is, since the dependent variable is related to the disturbance term and since prices are so highly correlated it seems likely that the independent variable would be correlated with the disturbance term. Because of this--and also because price difference prediction was the major concern in this analysis--price difference was chosen as the dependent variable.

In choosing the independent variables there were several ways to go. The first step taken was to make red and white production the independent variables. The estimated equation was as follows:

$$Y = \alpha + \beta_1 X_2 + \beta_2 X_2 + U$$

with Y = price difference, white over red (cents/bushel)

X_1 = Michigan white production (million bushels)

X_2 = Michigan red production (million bushels)

Using ordinary least squares regression, the following equation was estimated:

$$\hat{Y} = \underset{(3.44764049)}{11.25497912} + \underset{(.00028774)}{.00026964}\ X_1 - \underset{(.00107629)}{.00306270}\ X_2$$

This equation demonstrates the impact on the dependent variable, price difference, that the independent variables have. The figure below the coefficient is the standard error of each estimate.

The $\bar{R}^2$ of this equation is .6050 which means 60.5% of the variance of the dependent variable can be accounted for or associated with the independent variables.

When comparing the actual dependent variable with the one the model predicts it was determined that it picked up the largest movement in 1974 quite well, but on the average was not a very good predictor.

The Durbin-Watson statistic for this model is equal to 1.59 which suggests that there does not appear to be any problem with serial correlation. This is because D_{upper} is less than 1.59.

This model does have one serious problem. As mentioned earlier, the correlation coefficient between red and white production is .84708. Because this correlation is so high there exists a problem of less than perfect multicollinearity.

There are several potential alternatives available to deal with this issue. Three alternatives that were not attempted were to use ridge regression, to realize that large variances existed and to live with them and to enlarge the sample size. Deleting a variable was tried

realizing a bias has been introduced so as to accept the trade-off between less variance for bias. These results will be discussed later.

Another method tried before pursuing the above was to take the two production figures and find their difference. Price difference was made the dependent variable and production difference the independent variable. This yielded the following results:

$$\hat{Y} = \underset{(4.9288)}{7.92030021} - \underset{(.00029076)}{.00043022}\ X_1$$

$$\bar{R}^2 = .1167$$

When comparing actual with predicted price differences it was found this model not only had a lower $\bar{R}^2$ but also did an even worse job of predicting and there were hints of serial correlation existing within it. What seemed to be a good idea was not, so it was decided to delete a variable from the first model.

Looking at the model with price difference the dependent variable and red and white production the independent variables a decision had to be made as to which variable to eliminate. If a variable whose true coefficient value is in fact zero is eliminated, it will reduce the variance while not introducing any bias. Therefore, the coefficients' significance level were examined. The coefficient associated with white production was significant at .38. This means that α must equal or be greater than .38 in order to reject the hypothesis that true coefficient equals zero. The coefficient associated with red production was significant at the .025 level. With this information it was clear that the

coefficient associated with white production was much more likely to be equal to zero, so it was deleted from the model.

Using ordinary least squares, regression was run with price difference, the dependent variable and red production the independent variable and obtained the following estimated equation:

$$\hat{Y} = \underset{(3.12686708)}{12.56612236} - \underset{(.00056764)}{.00220835}\ X_1$$

$$\bar{R}^2 = .6110$$

This model is just as good a predictor as the model with multicollinearity and has a larger $\bar{R}^2$. As would be expected, the standard error of the coefficients were less in this model. By deleting a variable less variance and a higher $\bar{R}^2$ were obtained, but the possibility of bias was introduced. These two models were by far the best of any set up.

Earlier, it was stated that there was a possibility of measurement error in both price and production. Using the last model as an example, if this is true, then both α and β are biased. If there is only measurement error with respect to prices, then α is biased and β is unbiased. If measurement error exists in the production figures, then α is unbiased as long as the mean of the X is unaffected and β is biased toward zero.

At this point, it is important to realize all of the problems that exist with these models. These problems, while being significant, are small relative to the major problem that each model exhibits: the signs of the regression variables are the reverse of expectations.

This concluded the preliminary analysis. It was originally hoped that a feel for what was occurring in the market could be obtained, but the results were very discouraging. After experiencing failure with this analysis, further analysis was conducted as more data were collected for possible independent variables. These new independent variables were then added to the analysis. New data collected included U.S. wheat carryovers, exports, supply and disappearance.

Leaving price differences between soft white and soft red wheat the dependent variable, many of the possible permutations of the independent variables were attempted. The results again were discouraging. These is little need to present all the different results. Rather what follows is the best of those that were tried.

Using ordinary least squares, regression analysis with price difference as the dependent variable and production difference, carryover and exports as the independent variables were run. The equation to be estimated was:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + U$$

with Y = price difference, white over red (cents/bushel)

X_1 = U.S. production difference white over red (1,000 bushels)

X_2 = U.S. wheat carryover (million bushels)

X_3 = U.S. wheat exports (million bushels)

The results of O.L.S. were:

$$\hat{Y} = \underset{(5.93777652)}{-15.21047037} - \underset{(.00011433)}{.00027201}\ X_1 + \underset{(.00467382)}{.01289939}\ X_2 - \underset{(.00504018)}{.00722006}\ X_3$$

$$R^2 = .6432 \qquad \bar{R}^2 = .4291$$

The significance level for α, β_1, β_2, and β_3 were .051, .063, .040, and .211.

This equation suggests that price difference, white over red, is negatively related to production difference and U.S. wheat exports, and positively related to U.S. wheat carryover. The first case is expected while with the latter two, it is not known what to expect.

These results were the best obtained during the course of the analysis. The inclusion of more than three independent variables was tried but problems arose with respect to degrees of freedom.

It is unknown what the possibilities are for future model estimations, though it does appear to be fruitless. The major constraint in this regard is the ever present problem of data availability.