INTERMARKET PRICE DIFFERENTIALS FOR JULY WHEAT FUTURES CONTRACTS ON THE CHICAGO AND KANSAS CITY BOARDS OF TRADE, 1965-1974

By

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PREFACE

The intermarket price differentials between July wheat futures contracts on the Chicago and Kansas City Boards of Trade are investigated in this study. Determining the factors which are associated with changes in the intermarket price difference is the principal objective. Data concerning commitments of traders in commodity futures and several selected price series are used to explain the price differential. Weekly futures quotes from the Chicago and Kansas City Boards of Trade are analyzed using simple linear regression techniques.

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CHAPTER I

INTRODUCTION

There are many years when the wheat price has changed only twenty cents over the entire crop year. Two recent examples are the 1968 and 1970 crop years. However, the situation of extremely stable wheat prices eroded as huge government stockpiles of wheat diminished in the early 1970's. As wheat stocks dwindled, the lid on price came off. Farmers thus lost the price stability and production controls that had made marketing strategies and planning nearly obsolete. Traditionally most producers had sold the crop as it was harvested. There was little incentive to do otherwise. After the end of harvest, wheat prices typically would increase, reflecting storage costs, and then begin to decrease with the approach of the next harvest. A farmer who employed more involved marketing strategies seldom reaped a premium for his efforts.

Problem Setting

The scene changed rapidly in the 1972 crop marketing year. As the price of wheat increased dramatically, so did its volatilivy. Table I shows the standard deviation and the coefficient of variation of the cash wheat price series at the Gulf over the 1971 crop year to be 3.52 and 2.04 respectively. The standard deviation of that same series in the 1972 crop year increased to 31.32 and the coefficient of

TABLE I

MEAN, STANDARD DEVIATION AND COEFFICIENT OF VARIATION OF THE GULF WHEAT PRICES, CROP YEARS 1965-66 THROUGH 1973-74

Crop Year	Mean	Standard Deviation	Coefficient of Variation
1965-66	184.90	11.04	5.97
1966-67	198.67	10.07	5.07
1967-68	172.33	8.73	5.06
1968-69	152.63	4.77	3.12
1969-70	154.76	5.48	3.52
1970-71	171.98	4.55	2.77
1971-72	173.02	3.52	2.04
1972-73	264.63	31.32	11.84
1973-74	494.48	67.66	13.68

variation increased to 11.84. The increase was even more striking the next year as the measures of variation advnaced to 67.66 and 13.68 respectively. When the price of wheat tripled in two years as prices wildly fluctuated, it is of little wonder that there has been so much more emphasis on several different forms of marketing wheat.

Many managers faced with high price volatility have turned to forward contracting to alleviate some of the risk. There are several methods of forward contracting, and hedging on the futures market can perform this role.[1] As the debt load carried by farmers continues to increase, the relative security of hedging would seem desirable to both the farmer and his creditors. If the wheat producer chooses to use the futures market, there are five different contract months on four separate exchanges from which to choose. The primary emphasis of this study will be on Oklahoma producers and the opportunities open to them in choosing among the commodity exchanges that will accept delivery of hard red winter wheat against their futures contract. Both the Kansas City and Chicago Boards of Trade accept delivery of hard red winter wheat and the price differentials between these two markets will be the center of analysis in this study.

One problem facing producers is the selection of the exchange to be used for placing a hedge. Paul, Heifner and Helmuth [15] stated that generally the futures contract should be sold with a par delivery point closest to the cash market where the commodity will be sold. They further state that the first exchange to consider for hard red winter wheat is the Kansas City Board of Trade. This is certainly correct. They did not explain, however, that there are instances when it would be most advantageous to use the Chicago Board of Trade to place the hedge instead of the Kansas City Board of Trade. That was not the main extent of their paper. The futures quotes of the Chicago and Kansas City Boards of Trade are seldom identical and their difference is protean. At times the Chicago futures quote can be 10 to 15 cents above the Kansas City quote and at other times the inverse is true. An extreme case in point would be the 1972 crop year. Early in the crop year the Kansas City futures quote was 6.375 cents above the Chicago futures quote, but toward the end of the crop year the Kansas City quote was 24.25 cents under Chicago. This move of 30.625 cents is the amount that could have been made or lost by choosing to deal on the Chicago Board of Trade rather than the Kansas City Board of Trade. The relationships change from year to year. The very next year the short hedger could have earned 15 to 20 cents by hedging in September or October at Chicago instead of on the Kansas City Board of Trade and removing the hedge in May or early June. Thus a correct decision by the producer as to whether or not to place a hedge on a particular market can be as important as the decision to hedge.

Objectives

In reaction to increased price variability in recent years, many producers are attempting to reduce the risk of severe price changes by hedging on an organized commodity futures exchange. As the number of farmers using futures markets increase, more information needs to be available concerning the different markets with which to hedge and what factors affect the differences between the markets.

This study involves an analysis of how the intermarket price differentials between Kansas City and Chicago move and what major factors affect such movements. Immediately several questions come to mind. What is the direction of influence caused by each of the factors which significantly affects the spread? Are there certain "limits" which the intermarket price differential cannot exceed? Does the price differential move more freely in one direction than the other? It is in an effort to shed some light on these questions that this study was undertaken.

The primary objective of this study is to isolate and analyze the factors which are associated with changes in the intermarket price differentials between the Kansas City and Chicago Boards of Trade. If these factors and their effects can be determined, wheat producers and marketing firms could use the markets with more success in establishing future sales prices or in shifting risk of price changes associated with inventory earnings. Several divisions of the primary objective will be considered in the study and are as follows:

1) Determine the variables which have had a significant influence on the intermarket price differentials.

2) Analyze the consistency of effects of variables over time.

3) Separate the overall time period into several smaller time frames that are characterized by conditions existing during the period. Report changes in significant variables believed to be due to conditions existing during that period.

4) Construct models useful in the selection of which futures market to use for hedging or forward pricing under alternative sets of circumstances.

Linear regression techniques and weekly futures quotes from the Chicago and Kansas City Boards of Trade between 1965 and 1974 are the primary techniques and data used in the analysis.

FOOTNOTES

[1]Allen B. Paul, Ricahrd G. Heifner and John W. Helmuth, Farmers' Use of Forward Contracts and Futures Markets, United States Department of Agriculture, Economic Research Service Agricultural Economic Report No. 320 (Washington, 1976). The authors present and explain many types of forward contracts including the use of futures markets.

CHAPTER II

REVIEW OF PREVIOUS STUDIES

There are numerous studies available that are concerned with defining the major variables that influence the futures price of various commodities on different commodity exchanges. However, only a few dwell on the more precise topic of the relative price difference between exchanges. Most all books written about futures markets and commodity trading have a short section that discusses "spreading" either contract months or crop years, on a certain exchange. Some of these books continue by exploring "intermarket spreading", but most merely acknowledge its existence and offer no analysis, quantitative or otherwise.

Intermarket Price Differentials for Wheat

An article by Fredrick Clifton [2] is one exception to the aforementioned case. Clifton's article analyzes the price differentials arising from spreads among the Chicago Board of Trade, the Kansas City Board of Trade and the Minneapolis Grain Exchange. The 1965 study outlined the basic factors that he felt accounted for the market differences. One of the major influences was government policy. Differing support and loan prices for the three main types of wheat (hard red winter, soft red winter and hard red spring for this study) were quite important. Of greater importance were the government stocks of wheat. Although the government did not control much soft red wheat it was certainly an important price maker. The government's influence on "free" carryover and supplies was a factor influencing the spreads.

Other variables were outlined in the study, some of which could have current importance. Clifton stated that supply and demand forces for each class of wheat could bring about changes in the spreads nearly to the approximate freight differences before wheat would be moved from one terminal to another. He also noted that the Minneapolis and Kansas City futures contracts can only be filled by spring wheat and hard red winter wheat respectively. Thus, conceivably these markets could "run away".

Clifton mentioned several other factors he felt influenced the intermarket spread. These included size, type and location of the three wheats concerned, along with the shipping costs from one market to the other.

Gray [8], in a 1961 study, analyzed the relationship among three futures markets for wheat. Gray explained that all futures markets depend upon hedging for their existence, but the relative amounts of hedging vary from market to market. He stated that most hedgers in wheat futures would prefer to hedge on either the Kansas City or Minneapolis markets rather than Chicago so as to get a "closer" hedge. The hedge is "closer" in a geographical sense in that elevators and milling firms are more heavily concentrated in areas around Kansas City and Minneapolis than around Chicago. The hedge is also "closer" in that the smaller market's futures contracts require a certain class of wheat be delivered, which more nearly fills the needs of most hedgers.

In contrast the Chicago market's contract will accept delivery of various classes of wheat.

Gray then used the idea of hedgers preference of the smaller markets and much higher speculation at Chicago relative to the other markets and set up a simple framework for discussion. He suggested looking at the three markets assuming that Kansas City and Minneapolis were preferred by all hedgers and Chicago had all of the speculation. All matched hedging would go to the two smaller markets and all unmatched hedging would go to Chicago where it would be matched by speculation. Any additional speculation would be carried on in Chicago.

Gray hypothesized that if changes in the level of reported hedging were observed, open interest would change between Chicago and the smaller markets such that matched hedging would help business in the smaller markets and unmatched hedging would help business in Chicago.

Gray found that price disparities would show up when unmatched hedging began to build up at Kansas City or Minneapolis. When prices on the smaller exchanges are out of line with Chicago, hedgers tend to go directly to Chicago with their business, perhaps hoping to replace the hedge at the smaller market should the opportunity arise. This continuous surveillance tends to keep intermarket price differentials in line with what the trade feels are comparative values. Spreaders provide a link for speculation to flow from one market to the other when speculation on smaller markets is inadequate. However, Gray felt that hedgers were not willing to pay spreaders large profits in order to achieve a "closer" hedge. Beyond a certain point all unmatched hedging tends to go directly to Chicago. Gray stated it was clear that the level of unmatched hedging determined the amount of business at

Chicago and the level of matched hedging determined the amount of business in the smaller markets. Despite hedger's preference for the smaller markets, Gray felt that most hedging goes to Chicago because that market has a high price elasticity of demand for futures contracts. Stated differently, there is ample speculation to absorb the hedging.

Intermarket Price Differentials for Other Commodities

In a 1964 study, Toulemendale [20] analyzed intermarket price differentials among the London, Sydney and New York wool futures markets. The markets in New York and Sydney deal in the raw form of wool known as "grease wool". The London market deals in semiprocessed form of wool referred to as "wool tops". Toulemendale attempted to offer empirical evidence in support of a theory presented by Cootner [3] which suggested that in the case of commodities that were harvested, futures prices should rise after the peak of hedging has passed. This theory was proposed by Cootner as an alternative to the theory of "normal backwardation". Cootner felt that if inventories were low, hedging may be net long as an offset to forward contracts to deliver and speculators may be short. Under those conditions Cootner suggested that prices would have to fall if speculators were to make money. Though the sample period was very short, Toulemendale found an average profit per transaction using a trading scheme developed along the lines of Cootner's theory. Toulemendale's hypothesis was that from July 1 to December 1, the New York futures would gain relative to Sydney and London. Conversely he expected the reverse would occur from December 1 to July 1.

Speculation and Hedging

In a 1960 study Holbrook Working [27] put forth statistical evidence refuting the long held belief that futures markets are primarily speculative markets. He did so by showing that the amount of speculation, measured in dollar value of open speculative contracts, has differed greatly between commodities. Some commodities were found to have ten, twenty or even several hundred times as much speculation as others. The differences in the amount of speculation were basically dependent upon the level of hedging in the markets. A close correspondence was shown between changes in the respective levels of speculation and hedging. His analysis led him to the conclusion that speculation in all futures markets is primarily dependent upon the amount of hedging in that market. He further concluded that no market can exist without a sufficient level of hedging for support.

In a more recent study Gray [7] found that between two markets of equal stature and similar composition he would expect "net" intermarket spreading to vary randomly over a long time period and not be significantly different from zero on an average. He felt that the relative thinness of the Kansas City market in relation to Chicago would not change this a priori expectation but the fact that Kansas City has a much higher proportion of hedging than Chicago, and Chicago a much larger proportion of speculation in its open interest, would introduce factors suggestive of price-bias. Gray pointed out that in some years there is so much short hedging at Kansas City as to strain the market because of a lack of long hedging. When this situation is reversed it becomes a more delicate situation because what little speculation there is at Kansas City is not responsive to these hedging needs. Thus Gray notes that intermarket spreading is in effect a transfusion of speculation. The price effects of speculation inadequacy are implicit, Gray contends. The full price effect, which must be very substantial, would be that of all the hedging in Kansas City which goes to Chicago because of its greater hedging capacity.

Cootner [4] felt that a sufficient condition for the payment of risk premiums by hedgers as a group was that the price of a futures contract rise monotonically from the time that net short hedging first occurred to the time when it first became zero "and" the price decline monotonically from the moment net long hedging begins to the time it becomes zero. Cootner emphasized that this was clearly not a necessary condition.

In relation to the above statement Cootner hypothesized that prices of wheat futures contracts should rise and fall, on the average, during times of net short and net long hedging respectively. One problem in the 1967 study was that data were available only for a short period. Because of the lack of data Cootner used supply data as a proxy for hedging data. He felt that when supplies peaked it would be safe to assume that hedging was net short. Long hedging was then assumed to rise from some fixed data in the spring.

CHAPTER III

FUTURES MARKETS AND PRICE DISCOVERY

Determination and Discovery of Prices

Intersection of market supply and market demand curves determine price in the perfectly competitive market. This equilibrium price is the price at which the market will clear. No seller will be willing to accept less than the equilibrium price and no buyer will pay more, all else constant. One major assumption underlying this equilibrium is that of perfect knowledge. Percect knowledge means that all participants involved in the marketing of this commodity have total, complete and exact information concerning all things past, present and future.

A contrast can be made between this theoretical model and the real world. In the actual marketing of a commodity there is not perfect knowledge of supply and demand conditions etc. Knowledge of the relevant factors affecting supply and demand are usually estimated at various intervals before they are known with certainty. Available (imperfect) knowledge is used by the many participants involved in the market to help to "discover" price. That is, price is "determined" by the interaction of supply and demand forces in the theoretical model but price must be "discovered" by the informed market participants. The buyers and sellers in the real world markets do not have the advantage of having perfect knowledge concerning all relevant variables. They must then use available information and attempt to seek out the market clearing price through buying and selling activities. This process of price discovery is, in effect, the process of price forecasting.

The price discovery process is reflected in futures market prices. For example, consider the July futures contract for wheat. This is the first contract in the "new" crop year for wheat. In August the July futures quote should reflect the composite consensuses of traders as to what the price of wheat will be the following July. However the information that is available concerning the coming crop at that point in time is at best quite limited. Only expectations are available since no significant portion of the crop has been planted. Other factors such as weather and the amount of wheat grazed out can change the total production substantially. During the following months the information begins to improve. In December the United States Department of Agriculture issues the first official estimate of winter wheat production. In addition by December, processors, exporters, etc. have better ideas of the total demand for the crop. In theory the trader in the futures market determines what is believed to be the "correct" price for the commodity during the delivery months on the basis of existing information. If the current futures quote is above the traders expected price he will sell a quantity of futures contracts expecting to buy them back when the expected price is achieved. If the trader's judgment is correct he receives a profit of the difference between the two prices. This profit would be equal to the losses of the trader's whose judgment was incorrect. Therefore the collective actions of traders lead to the establishment of the "correct" price.

With each bit of new information, the market price is adjusted. There is, therefore, a continual balancing of the judgments of traders who believe that the current price is higher or lower than the price will be in the final analysis. As the information improves and the crop approaches harvest there is less and less uncertainty associated with the supply and demand factors. Finally the market price will be discovered when the contract matures and all the relevant information is known.

This analysis does, however, point up one problem. A futures contract has only one price at a given point in time. However, several different grades of wheat are deliverable on most futures contracts and some contracts allow for delivery of several classes of wheat. If a futures market is to serve as a reliable means of price discovery, the price of the futures contract must be related to one set of quality characteristics. It would be quite difficult to insure that a delivered price referred to a constant set of quality standards for only one class of wheat since wheat quality differs substantially among lots and even within individual lots. Commodity Exchanges have a set of premiums and discounts that are used if the quality or class of wheat delivered deviates from the one preferred for delivery. These premiums and discounts are generally set up to encourage delivery of the quality of commodity desired such as No. 2 hard red winter wheat. That is if the cash market normally pays a six cent per bushel premium for No. 1 wheat the futures contract might only offer four cents premium over No. 2 wheat. Through this mechanism a futures price tends to reflect the price of a commodity meeting certain quality characteristics.

Hedgers of a commodity buy and sell futures as a hedge against cash transactions. Through this action the hedger transfers some of the risk of a major price change to another participant in the market. Therefore the hedger reduces the possibility of obtaining windfall profits from a substantial price change but the possibility of incurring monumental losses has also been reduced. Hedgers may take positions in the futures market because of price expectations or in an attempt to remain completely hedged while their cash inventory is changing. Generally the other side of the hedge transaction is taken by a speculator who has anticipated receiving a favorable price change that will reap him profits. Thus futures markets combine the effects of price discovery, hedging and speculation with different emphasis at different times.

Theories of Changes in Futures Prices

There are several theories concerning the behavior of futures prices. Two of the more commonly held and widely discussed theories will be presented in the following segments.

Keynes-Hicks Hypothesis

Keynes [11] and Hicks [10] advanced one of the early hypotheses concerning the movement of futures prices. They viewed futures prices as downward biased estimates of expected spot prices. Their hypothesis is referred to as the theory of "normal backwardation". It is based on the idea that holders of the cash commodity can hedge themselves against price risk by the sale of futures contracts. Keynes and Hicks believed that since this was a valuable service to hedgers they were willing to pay others (speculators) to take long positions in the futures market thus bearing the risk of a change in price. It is evident that this hypothesis is founded on several premises. First and of major importance is that no forward market can exist without speculators, who will be net long, to accept the risk of a change in price. In addition these speculators are expected to be willing to buy futures contracts only if the futures price is below the expected cash price. Finally, hedgers are viewed as only interested in the futures market for the purpose of transferring risk. Thus speculators must make a profit or they will not engage in assuming the risk of a price change.

Under the theory of "normal backwardation" hedgers would expect to pay a risk premium for the protection they seek. This concept is similar to the payment of insurance premiums where the person desiring insurance must pay a small sum to be insured against the possibility of a large loss. The cost of the insurance increases as the possibility of a loss increases.

Keynes and Hicks concluded that speculators, as a group, should be making money through their risk-taking activities on the futures market. Thus an upward trend would be a normal characteristic of all futures markets. To test this hypothesis an upward trend of price during the contract year should be evident, especially as the delivery date approaches. If this trend exists it would imply that the level of futures contract prices is not a reliable estimate of the expected cash price. This theory has been widely discussed but current evidence tends not to support it. Working [28], Telser [17] and Gray [9] all have tested the hypothesis for harvest commodities and found that there is no tendency for futures prices to rise over the calendar year as a whole.

Random Walk Hypothesis

The random walk hypothesis was suggested by Holbrook Working [29] as early as 1949. He noted that time series data often possess characteristics similar to those of cumulated random numbers. The separate items of time series are by no mean random but changes between successive items tend to be largely random. The hypothesis came about as a result of studies into why futures prices seem to exhibit different responses at different points in time when economic factors appear to be consistent at these points in time. In addition the Hicks-Keynes hypothesis did not explain changes in futures prices. These points lead to the idea that price changes were caused, to a great extent, by pure random variation.

The random walk theory suggests that successive price changes in markets such as futures markets are independent and thus past history of a series generates no information that would be useful in predicting future price changes. For the random walk theory to hold, the market under consideration should be an "efficient" market. A market would be regarded as efficient if the market price was, at all times, the consensus of a large group of equally well informed individual traders, each attempting to maximize profits. In a theoretical market such as this, the price at any given time would represent all available information. This price would also reflect information concerning futures events (even though this knowledge is imperfect). According to the random walk hypothesis differences of opinion concerning the validity of the imperfect knowledge causes actual prices to move randomly about the "efficient market price". In addition, efficient market futures prices change in response to new information which is itself random. In this type of theoretical market a trader would be successful only if he were more adept at decoding currently available information than the average trader. In theory the futures market would make the process of price discovery more "efficient" through more accurate price forecasts. Thus futures markets should implicitly provide a larger quantity of widely dispersed and readily available information to all persons involved in the marketing of the commodity. This suggests that a smaller degree of unwarranted price variation might be expected in the presence of a future market for the commodity, all other things equal.

Random walk does provide an explanation of erratic changes in futures prices but does not explain the existence of trends in futures prices. Trends which occur infrequantly would not be inconsistent with the idea that futures prices represent the best available estimate of the price on the delivery date. Thus the random walk hypothesis does not disallow the existence of trends in a price series but the hypothesis would be invalid if consistent and regular trends were observable.

CHAPTER IV

PRICE DISCOVERY FOR HARD RED WINTER WHEAT

Aggregate Demand

The price of wheat is determined by supply and demand forces. The demand for wheat can be broken down into two broad categories, domestic demand and export demand. Domestic demand is made up of wheat used in the United States for food, feed, seed and in industrial uses. The export demand category is comprised of commercial exports and government program exports.

Domestic Demand

Food demand usually is the larger of the four domestic uses. Flour demand is the largest component of food demand, accounting for about 75 percent of the total. The major components of the non-food demand for wheat are wheat used in animal feed and wheat used for seed. An additional but much smaller segment of the non-food demand for wheat is the use of grain in industrial uses, primarily in the preparation of distilled spirits.

Most of the United States population consumes wheat in some form. Because of this trait the demand for wheat is ubiquitous and the areas of greatest population density will be the areas of greatest domestic demand. The largest demand is located north and east of the production center.

Domestic consumption of wheat has been extremely stable over the past few years. This stability has come about primarily because of the interaction of two factors. The decreasing per capita consumption of wheat has been mostly offset by increasing population levels. The non-food uses of wheat typically have been the areas that have caused the greatest variance in domestic use. When wheat prices get low enough relative to corn or other feed grains, wheat enters into competition as a feed ingredient. Large changes in the amount of wheat fed will cause shifts in the total domestic use.

Export Demand

The export demand for wheat is extremely important as a component of the total demand for wheat. For several years prior to the 1972-73 crop marketing year exports had been relatively stable. However, because of policy changes in some foreign governments and poor crops in several areas, exports began to increase in the 1972-73 crop year. Thus the export demand for wheat can be a very volatile element of the total demand. One reason for this volatility in exports is that many of the variables that effect export demand are exogenous to the United States wheat system. Some of these variables, such as weather, play an important role and are quite difficult to predict successfully on a long-term basis. The two major components of export demand are commercial exports and exports under government programs.

Commercial exports are heavily dependent upon world crop conditions and policy decisions of foreign governments. If world production is high and world price is low the United States commercial wheat exports have a tendency to be low. This type of situation comes about when wheat cannot be purchased for export at competitive world price because of government programs supporting wheat prices. Canada and Australia are also surplus producers and will have exports available in most crop years.

Exports under government programs, such as Public Law 480 have often accounted for 60 percent or more of the wheat exports of the United States. When the United States has large stocks of grain these government programs can become particularly important. This division of wheat export demand is thus highly dependent upon government action.

Aggregate Supply

The supply of wheat is typically thought of as beginning year carry-in plus production and imports. The importation of wheat is small in relation to the total supply and will not be considered separately. Thus carry-in and production remain as the important variables in forecasting the total supply of wheat in any one crop year.

Beginning Year Carry-in

The beginning year carry-in is synonomous with the ending year inventory of the past crop year. That is, carry-in is what remained of the past year's crop after supply and demand forces allocated the commodity. It is desirable to have an "adequate" level of carry-in in case of large scale crop failures or some other catastrophe. On the other hand an "excessive" carry-in will have a dampening effect on prices. The carry-in is dependent on the supply and demand factors that affected last year's crop. From the standpoint of price discovery, the supply and demand levels for the last year's crop are fairly well known by the beginning of the new crop year.

Production

The greatest area of wheat production in the United States comes from the states that make up the Great Plains, with the state of Kansas the leading producer. Hard wheat, which is especially suited for making bread flour, is grown mainly in this region. White wheat is grown in the northwest where the state of Washington is a leading producer.

The factors affecting wheat production are basically considered to be those variables that come about directly from the supply-demand relationships. However, this relationship may be altered slightly by several different factors.

Government action is one factor that is immensely important. A governmental decision to limit production is usually carried out in a program that affects the number of acres planted. Another factor, but one that is usually less important, is weather. Adverse weather conditions can reduce yields substantially. However, because wheat production is carried on over a wide area, the chance of a "total crop failure" is quite unlikely.

The United States Department of Agriculture makes production estimates for wheat during the crop year in the months of December, for winter wheat, and May for all wheat. Estimates are continued monthly after May until the estimate is made for that crop year's production of winter wheat in December. These estimates are usually issued around the 11th of the following month reflecting conditions of the last of the previous month.

Forecasting prices from estimates of demand and estimates of supply is required on a continuous basis by most firms involved in marketing wheat. Both cash and futures markets exist which assist in this discovery process.

Characteristics of Two Markets for Pricing Wheat

Chicago, Illinois and Kansas City, Missouri are two of the major markets for hard red winter wheat. Kansas City is located near the center of production. Chicago is located in the general direction involved in moving wheat from production areas to some of the major consuming areas of the central and eastern regions of the United States.

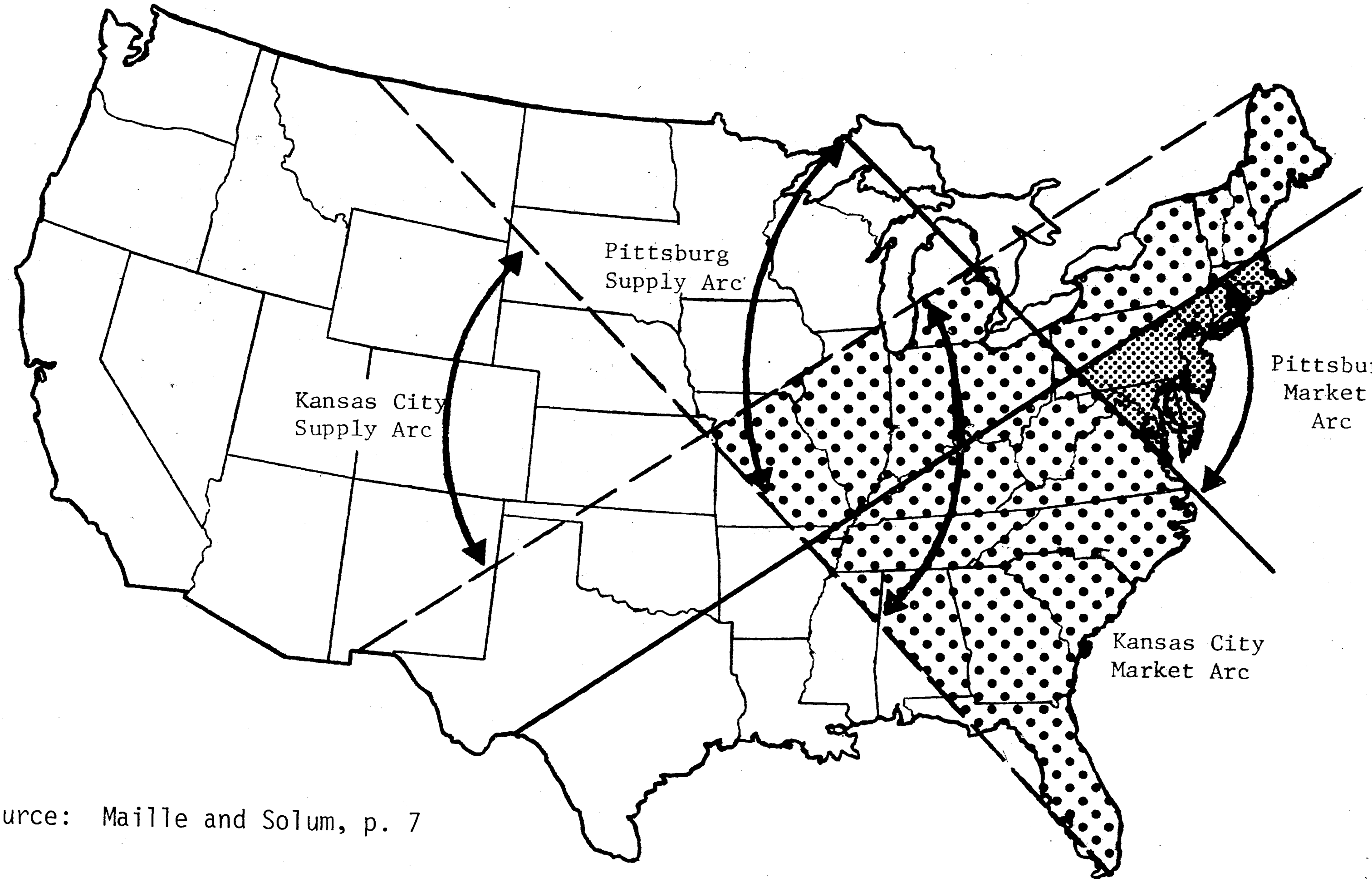
Location Differences

The marketing areas of the two locations under simplified assumptions of equal prices and transfer costs would be separated by a straight line equi-distant between the two locations and perpendicular to a straight line connecting the two markets. With major consumption located east of Chicago and major export points located south of Kansas City, simple analysis would show Chicago supplying the population centers with flour for domestic consumption with some chance for a small amount of exports. The Kansas City market would then serve all of the Gulf export points and some small amount of domestic consumption in that area. This analysis would be valid for ceteris paribus conditions.

Transfer Cost Advantages

In the "real world", however, all things are not equal. The "transit" system of rail rates changes the relative advantages of specific locations. The transit system of rail rates was designed to neutralize the advantage of flour millers located in production areas over the millers located in the population centers. Prior to the instigation of this system, flour and wheat moved at the same rates per hundredweight. Thus the reduction in weight by milling caused rates to favor those flour millers located in the regions of production. Under the transit system the total freight cost from wheat origin to flour destination would be equal regardless of the location of the flour mill between the two points. Transit privileges applied not only to milling but to storage as well. The system permitted millers in various locations to compete equally with regard to transportation costs.

However it did not make all mill locations equally competitive in a given market. A 1968 study by Mailee and Solum [13] resulted in the following illustration. Their study showed how the transit rate scheme had a suffocating effect on the eastern milling industry. Figure 1 shows the effect of transit privileges on the market areas of the eastern millers. This illustration involves Kansas City and Pittsburg as the two milling areas under consideration. The idea behind Figure 1 is that the transit privileges operate on only substantially straight lines between wheat production areas and flour markets. Thus Kansas City millers can more readily market flour in the area just west of Pittsburg because transit privileges would not be in effect for wheat



Source: Maille and Solum, p. 7

Figure 1. The Effective Marketing Area of Flour Mills Under the Transit Rate System

moving back west from Pittsburg. A Kansas City mill draws supplies from its transit arc to the west and can obtain transit rates on flour shipments within its arc to the east. The Pittsburg arc is arrived at in a similar way. Even though the Pittsburg market enjoys a much larger supply region than does Kansas City it is of little use becuase of the limited market area. Thus for markets west of Pittsburg or "off" the transit privilege line the Kansas City market has little or no competition from the Pittsburg market.

The analysis of Mailee and Solum can be changed slightly to show the effects of transit privilege upon the two markets of interest in this study. If it is assumed that the same relationships exist now as did during the Mailee and Solum study such that the areas where transit privileges are granted are delineated in a similar manner, the result would be as shown in Figure 2. In this example, the supply area for the Chicago mill is much smaller than for the Kansas City mill. The Kansas City mill has a smaller effective market area with which to work. In addition the Chicago mill serves a more densely populated area that would have much greater flour demands than the Kansas City market area. It is evident that even though both markets have equal transportation costs going east, the Chicago market must pay a higher rate to ship wheat or wheat products to the west or outside the area where the transit privilege pertains.

The major wheat exporting regions of the United States can be divided into four coastal areas. The basic divisions are the Great Lakes area, the Atlantic area, the Gulf area and the Pacific area. In terms of the level of export activity of each area the Gulf ports are certainly the leader. Over the past few years the Gulf ports have

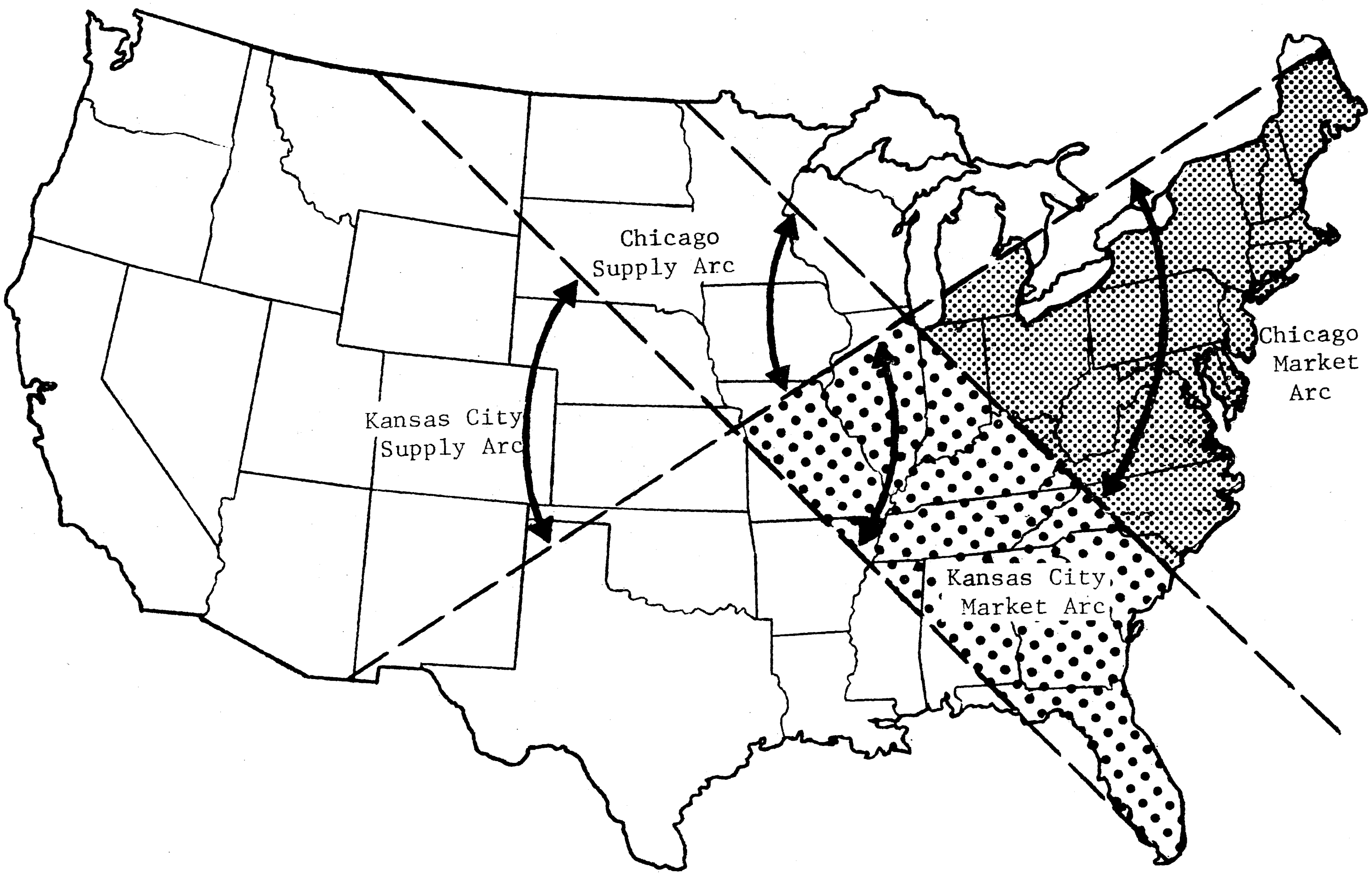


Figure 2. The Effective Marketing Area of Flour Mills Located in Chicago and Kansas City Under the Transit Rate System

seldom exported less than 50 percent of the total exports of the United States. The ports of Houston and New Orleans are of major importance in this area.

Grains being transferred by rail to points for export are able to receive lower rates than those for domestic movement. In addition the transit privilege is also applied here. If wheat is stored at some point between the export point and the point of production it may continue its' movement to the export area at some later date for the same cost per unit of distance as before. An example of this type of pricing is that wheat currently being moved from Kansas City to Houston for domestic use can be shipped for $1.44 per cwt. The same distance would cost $0.90 per cwt. if the wheat is going for export.

In past years there have been international agreements among several countries concerning the exportation and importation of wheat as well as other grains. Generally these agreements arrived at a world price for wheats of various qualities and origins. If the domestic price of wheat for export in the United States was higher than the net cost to buyers, government payments were made to exporters for the difference. Occasionally, the opposite situation came about such that the government received a refund from exporters. However, the domestic price was above the world price and the payment rate averaged nine cents per bushel over the entire 12 months of the 1971-72 crop year. In the first three months of the 1972-73 crop year the payment rate was 12, 33 and 18 cents per bushel respectively. In October of 1972 export payments were suspended for wheat.

The major question to be answered by this study arises again. How does the amount of wheat demanded for export affect the two markets relative to each other?

It has already been shown that a large percentage of the grain shipped for export goes through the Gulf port area. The grain exported through these ports is primarily hard winter wheat that was produced in the Great Plains area. Typically the grain moves from points of production to local elevators. From there it may go to the Gulf for export. The movement of wheat from local elevators to the Gulf is normally either done by truck, rail or barge. The Kansas City market area is quite fortunate in that it is both a major rail center and on a waterway to the Gulf. This factor makes Kansas City a logical market for the local elevators. Even if the grain is not sold in the Kansas City market it is often priced using the Kansas City market.

The Chicago market also has an export facility available. The grain is shipped out through the lakes. This shipping route is often more costly to most foreign destinations than is the route from the Gulf area. In addition the Chicago export route is closed several months during the winter.

Briefly, it seems that Kansas City is better located to take advantage of export demand than is Chicago. Periods of exaggerated export demand would appear to favor the Kansas City market relative to the Chicago market. Conversely, periods of slack export demand would be expected to favor Chicago relative to Kansas City, all other things equal.

Futures Market Contract Specifications

The Chicago Board of Trade is the major wheat futures market. During the time period of this study Chicago had from two to four times as many open contracts as Kansas City. Kansas City in turn is the second largest futures market. In contrast, the Chicago cash market is of secondary importance to Kansas City. Kansas City is both a hub of milling activity for the domestic market and a pricing point for the export market. A major portion of the wheat exported from the United States goes through the Gulf using Kansas City as the base for pricing.

Examination of the futures contracts of each of the exchanges indicates that the Kansas City contract calls for delivery of hard red winter wheat whereas the contract at Chicago allows for delivery of hard spring wheat and soft red winter wheat as well as hard red winter wheat. Number 2 soft red winter wheat is deliverable to Chicago or Toledo at par with the other classes deliverable through a set of discounts and premiums. At one time the Kansas City Board of Trade broadened its contract to allow deliveries of other contracts but the contract allowing delivery of soft wheats in Kansas City fell into disuse in 1953.[1] The contract was then made more selective calling for delivery of hard winter wheat only. This aspect of the Kansas City contract makes it highly desirable for hedging by millers of hard winter wheat if delivery of wheat is involved. In contrast, the Chicago contract is broad and can be used by all hedgers. Both markets, however, have advantages in terms of hedging.

FOOTNOTES

[1]Holbrook Working, "Whose Markets? Evidence on Some Aspects of Futures Trading", The Journal of Marketing, July 1954.

CHAPTER V

ANALYSIS OF CHICAGO-KANSAS CITY JULY INTERMARKET PRICE DIFFERENTIALS

In this study the price differential between the two markets was defined as the Chicago closing wheat futures quote less the Kansas City closing wheat futures quote on the same day in the contract month. This was done as a matter of convenience. The price differential could have been defined in the opposite way with direction of influence of the variables simply reversed.

Identification of the directions of effect of variables on the price differential is somewhat more difficult than on the price itself. Economic theory provides one basis for determining the direction of influence of variables which affect the price of wheat. Thus the relationships between the futures price at Kansas City and selected variables may be straight forward. However, the relationship of these same variables with the price differential often may not be clear.

Thursday Price

There are several reasons for choosing Thursday's price for use in the model. The use of one day of the week as a representative of the entire week should restrict the analysis to a midweek price. On Friday there may be a lot of liquidation of contracts by people who do not wish to hold their position over the weekend. This is in contrast to Monday when speculative reaction to weekend news may be greatest. Having removed both Monday's and Friday's price from consideration there was little difference among the other three choices of the week. However Thursday's price was selected because of the availability of data on related variables. Grain Market News, which was mentioned earlier, contains Thursday's price of all cash price series that were used. Some non-price data are available that are not recorded on Thursday. One of these is the level of inspections of wheat for export within the next thirty days which is reported on Friday of each week.

The data that were not available on Thursday were put into the model so that the effect would be felt on the Thursday directly following its release. One problem in this area was the question of when to input the commitments of traders data. The observations were taken at midmonth and month's end but later in the study only at month's end. However the information is typically not released to the public until about ten days after the observations were taken. The question becomes whether to put the data into the model on the day the observation was taken or the day the information was released to the public. It was decided that since an explanatory equation was being formulated the data should be introduced on the day the observations were taken. If a predictive equation were desired it might have been more interesting to note the reaction of traders to the new information on the date it was released.

July Contract

This study will focus primarily on the intermarket price differentials of the July contract. Several factors contributed to the choice of July as the contract month to study. First the July contract (along with the May) has been the most heavily and consistently traded of the contract months. The use of this contract month, therefore, had less chance of encountering missing data than some of the other contracts. A second factor which weighed heavily in the selection of the contract month to study was the need to find a contract which was used heavily by hedgers of hard red winter wheat. The contract month chosen by the hedger depends on when the wheat is to be marketed. Paul, Heifner and Helmuth [15] stated that normally the hedger should sell the contract that calls for delivery just after the planned storage interval is terminated. This would indicate the July futures contract should be used to hedge any wheat that is to be sold at harvest or shortly thereafter. In Oklahoma, the largest percentage of monthly wheat marketings occur in June (Table II). Thus the July contract could be used in the hedge and is of interest in this study.

A final factor that attributed to the selection of the July contract for use in this study was the month of July facilitated easy division of the study into crop or contract years. Prior to June 1, 1976 the wheat marketing year or crop year was defined by the United States Department of Agriculture as July 1 through June 30. Due to "technological developments in wheat production" which caused a greater portion of the crop to be harvested prior to June 30, the wheat marketing year was changed to June 1 through May 31. The marketing year begins before any major amount of wheat is harvested and ends just prior to the next year's harvest.

The contract futures quotes for July, on the other hand, span the crop year. Trading in the old July futures contract terminates on

TABLE II

MONTHLY FARM MARKETINGS OF OKLAHOMA'S WINTER WHEAT EXPRESSED AS A PERCENTAGE OF THE TOTAL SALES, CROP YEARS 1965-66 THROUGH 1974-75

Crop Year	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
						(Percent)						
1965	4	36	8	4	4	5	6	10	11	5	5	2
1966	2	41	7	4	5	3	5	10	7	6	7	3
1967	6	33	8	3	3	4	4	13	13	6	5	2
1968	2	39	10	5	4	7	6	7	8	4	4	4
1969	3	38	9	4	4	5	5	10	9	5	5	3
1970	2	28	6	8	16	6	4	6	8	5	5	6
1971	2	39	8	6	5	6	5	7	9	5	4	4
1972	8	29	13	18	8	2	3	5	7	3	2	2
1973	2	30	18	16	8	4	3	5	7	3	2	2
1974	3	21	10	8	13	11	5	7	6	5	6	5

Source: United States Department of Agriculture and Oklahoma Department of Agriculture, _Oklahoma Agricultural Statistics_, Oklahoma Crop and Livestock Reporting Service, 1966-1975 issues.

the eighth trading day before the end of the Month (July). Even though a "new" July contract may be traded several months before the "old" July contract expires, the "new" contract will not be examined in this study until the "old" contract expires. The contract year therefore refers to the quotes for the July contract during the period beginning the first week in August and continuing through the third week of July. The amount of wheat not utilized during the current crop year is reported as the next year's carry-in of stocks.

The July futures price should reflect the "best current estimate" of what the price of wheat will be in July as the contract matures. If everyone had perfect information the expected July price would remain constant throughout the year. However, since this is not the case and the information available changes over time, the price of the futures contract fluctuates. Also since the July contract matures in the next crop marketing year, it is influenced both by the expected size of next year's wheat crop and by the size of the current carry-over supplies.

Throughout the study the terms crop year and contract year will refer to the year from the first Thursday in August to the third Thursday in July. If another meaning is intended it will be mentioned.

The Time Period

The 1965-66 through 1973-74 crop marketing years were selected for the study. Data are available on all the variables to be included in the study on a continuous basis. The period covers several years in which there were large government surpluses and as many years as possible were the government-held stocks were low. In addition a time period encompassing nine full crop and contract years should allow for significant changes in the relatively slow moving variables.

One slow moving variable was the magnitude of unbalanced hedging at Kansas City. From the early to middle 1960's, net hedging at Kansas City was heavily unbalanced by an exceptionally large amount of short hedging. However, in the early 1970's the trend began to change to more nearly balanced hedging. This type of phenomena would be expected to affect the spread and permit the Kansas City market to carry a greater hedging load. Ideally the time period should be as long as possible to reflect trends in variables such as net hedging.

Intermarket Price Correlation

The futures prices at the two markets, are highly interrelated. Over the aggregate time period, the simple correlation coefficient between the futures closing prices at Chicago and Kansas City on Thursday of each week was 0.99. However, one particular variable may affect one market more than the other. An example might be the cash price of wheat at the Gulf. A change in this price would be taken into account both at Kansas City and Chicago but the greatest affect could be registered at Kansas City because of its geographical proximity and the fact that wheat for export at the Gulf is often priced on the basis of Kansas City price. Conversely a change in the cash price of soft wheat in Chicago probably could have a larger effect on the Chicago futures market than on the Kansas City market. In some cases there are variables which do not have a theoretical basis for determining the direction of effect.

Model

The explanatory model of the intermarket price differential for July wheat closes between the Kansas City and Chicago Boards of Trade is shown below in Equation (1). It is made up of nine variables that are thought to be economically significant.

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9) \qquad \text{Equation (1)}$$

The variables included in the above model are summarized with the unit of measure accompanying each designation as follows:

Y = Chicago-Kansas City intermarket price differential of the July contract's Thursday close (cents per bushel)

X_1 = The Gulf price of No. 1 Hard Winter ordinary protein wheat (cents per bushel)

X_2 = Inspections for export (1,000,000 bushels)

X_3 = The Gulf basis (cents per bushel)

X_4 = Wheat-corn price ratio at the Gulf (both prices in cents per bushel)

X_5 = Long hedging by reporting traders on the Kansas City Board of Trade (1,000,000 bushels)

X_6 = The ratio of short hedging, reported by large traders at Kansas City, to total open interest

X_7 = Short reported spreading at Kansas City less long reported spreading at Kansas City (1,000,000 bushels)

X_8 = Total open interest on the Chicago Board of Trade (1,000,000 bushels)

X_9 = Short reported speculation at Chicago less long reported speculation (1,000,000 bushels)

Correlation Among Independent Variables

Multicollinearity or linear dependence among vectors of independent variables in a multiple linear regression analysis can have serious effects on the estimation of parameters. Mason, Gunst and Webster [14] note that poor precision in the estimation of individual parameters does not necessarily imply that the estimated model is a poor predictor. In addition if the estimated model is restricted to situations where the multicollinearity holds, at least approximately, the prediction equation often works quite well. That is, individual parameters may be estimated poorly but the linear combination may be estimated well.

The following segment of this chapter will look into the correlation problems that may be present, first in the price related variables and then in the variables taken from the commitments of trader information.

Price Variables. The three price-related variables that were included in this study (Gulf price of wheat, wheat-corn price ratio and the Gulf basis) do occasionally display high degrees of correlation within a crop year. However, it was deemed important to include not only an absolute level of the cash wheat price but the level of wheat price relative to that of corn. A change in relative prices such that wheat became competitive as a feed grain could be an important indicator of a change in potential utilization. In addition the Gulf basis may indicate the relative strength of demand for exports at the Gulf. The Gulf price of wheat indicates this to some extent but may not encompass the full effect of changes in export demand. Several other price related variables were analyzed before omitting them from the final model.[1]

Commitments of Traders Variables. Several transformations of the commitments of traders information were studied but not included in the final model.[2] Some were not included because they added little to the statistical quality of the model and others were excluded because of high correlation with other independent variables. For this study, no commitments of traders variables or transformation of those variables were used in the final model if the simple correlation coefficient between the two was greater than 0.80 over the complete time period. A correlation coefficient of 0.80 was simply a rule of thumb employed.

Explanatory Equations

The explanatory equations of each of the nine crop years included in this study are presented in Table III. Statistical coefficients were estimated to determine the equations used in explaining the movements of the intermarket price differential within each respective crop year. In addition to the equations for each crop year, Table II also includes the explanatory equation for the aggregate period which encompasses the 1965-66 through 1973-74 crop years. Beneath each regression coefficient is its' associated t-value. The average value of the intermarket price difference is included for each crop year. The coefficient of determination (R^2) for each model is also presented in the last row of the table.

Criteria for Selection of Equations

Results reported in this chapter are based on the "best" explanatory equations arrived at for each crop year. The "best" explanatory equation was the equation which explained the largest amount of variation in the price differential and had all of the regression coefficients statistically significant at the 80 percent level. The coefficient

TABLE III

STATISTICAL COEFFICIENTS FOR REGRESSIONS OF SPECIFIED VARIABLES ON CHICAGO-KANSAS CITY JULY WHEAT FUTURES PRICE DIFFERENTIALS, CROP YEARS 1965-66 THROUGH 1973-74

	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	Aggregate
Average Price Differential	2.091	-2.858	1.860	-1.551	4.517	7.960	1.426	8.245	-2.578	1.690
Intercept	27.086	1.952	-42.423	46.254	39.792	33.400	29.013	1.289	24.975	8.128
Variables*										
X_1 Gulf Price	-0.185	0.108	0.208	-0.179	0.481		-0.265	0.124		-0.005
	(9.41)	(3.38)	(8.45)	(1.70)	(3.18)		(3.33)	(7.17)		(1.55)
X_2 Exports	-0.071		0.051							0.395
	(1.40)		(1.59)							(9.82)
X_3 Gulf Basis		0.211		0.512	-0.307		0.299	-0.081	-0.100	0.022
		(4.28)		(2.76)	(1.87)		(4.64)	(2.19)	(3.39)	(1.46)
X_4 Price Ratio W/C		-12.898	-11.997	-34.765	-11.807	-20.428			9.129	-18.767
		(2.01)	(4.26)	(6.00)	(1.71)	(4.97)			(2.14)	(11.72)
X_5 Long Hedging	-0.385	-0.173	-0.052	0.400	0.160			-0.189		0.022
	(4.85)	(1.91)	(1.47)	(2.89)	(3.30)			(7.12)		(1.54)
X_6 Short Hedging Ratio	13.798	-15.035	24.470		-5.684		10.493	-2.459		15.555
	(3.04)	(3.78)	(6.90)		(2.23)		(2.27)	(1.81)		(5.12)
X_7 Net Spreading	-1.493							-3.937	-7.824	0.869
	(6.24)							(3.22)	(3.29)	(6.43)
X_8 Chicago Open Interest	0.014		0.013	0.040	-0.092	-0.042		0.123	-0.277	
	(1.41)		(2.76)	(3.75)	(4.36)	(4.36)		(3.22)	(5.92)	
X_9 Chicago Net Spec.		-0.150	0.137	0.085	-0.220	-0.197				-0.099
		(4.75)	(4.17)	(1.61)	(2.48)	(3.64)				(3.54)
R^2	.928	.895	.963	.627	.841	.586	.510	.904	.445	.558

*Gulf Price = Gulf price of wheat, Exports = Wheat inspections for export, Gulf Basis = Gulf price of wheat less the July Kansas City futures close on the same day, Price Ratio W/C = Gulf price of wheat divided by the Gulf price of corn, Long Hedging = Long reported hedging at Kansas City, Short Hedging Ratio = Short reported hedging at Kansas City divided by total open interest, Net Spreading = Short less long reported spreading at Kansas City, Chicago Open Interest = Total open interest at Chicago, Chicago Net Spec. = Short less long reported speculation at Chicago.

of determination (R^2) was used to measure the share of variation explained. Student's t statistics were used to test the null hypothesis H_0: B=0 against the two tailed alternative H_a: B≠0.

Variables

Delineation of each of the nine variables' expected influence and its' actual relationship with the intermarket price difference, within crop years and over the entire period, will be discussed below.

Average Price Differential

The average intermarket price difference between the Chicago and Kansas City Thursday closing quotes over the entire period was 1.690. However, the average price differential during the crop year was close to this only twice while ranging from -2.858 to 8.245.

Cash Price of Wheat at the Gulf

Expectation. The cash wheat price series at the Gulf (X_1) is for No. 1 hard red winter wheat, ordinary protein content. The price is reported in cents per bushel f.o.b. track. The data were collected from Grain Market News, published weekly by the United States Department of Agriculture. The cash grain market and the futures market are very closely related. Futures bids, especially near month, are based on many of the same variables that determine cash prices. As the cash price declines so may the futures price. However, the question is which of the two futures markets move more as the cash price at the Gulf changes. It is hypothesized that the cash wheat price at the Gulf and the intermarket price differential would be negatively related if the Gulf price were the only wheat price related variable in the model. That is, if the price of wheat at the Gulf increases in response to favorable export news, the Kansas City futures price would be expected to increase more than the Chicago futures price, all other things equal. Undoubtedly a change in the Gulf price of wheat would also be reflected in the Chicago futures price to some extent.

Result. The cash price of wheat at the Gulf (X_1) was included as a significant variable in seven of the nine crop-year equations. The regression coefficient on this variable was -0.185 during the 1965 crop year. This suggests that during the 1965 crop year if the Gulf price of wheat rose by one cent per bushel, a 0.185 cent per bushel decrease would be expected in the intermarket price difference. An inverse relationship was expected if the Kansas City futures quote was assumed to be affected more by a change in this variable than was the Chicago futures quote. A positive relationship would suggest a greater change in the futures quote at Chicago. This variable was not consistent as to the sign on the regression coefficient. In the seven crop years in which the variable was included it carried a positive sign four times and a negative sign three. This inconsistency is manifest in the aggregate model where X_1 has a relatively low t-value and the magnitude of the coefficient is quite small due to an averaging effect. It is evident the Gulf price of wheat often affects the intermarket price difference. Usually one market will react more than the other throughout a crop year. However neither market seems to react consistently with respect to the other.

Inspections for Export

Expectation. Under the U. S. Grain Standards Act, grain must be inspected before it is allowed to be exported. The quantity of grain inspected for export (X_2) is published each week in Grain Market News. This calculation does not include truck or rail shipments to Canada or Mexico. It is hypothesized that an increase in exports would increase the activity in both markets but would increase activity in the Kansas City market more than in Chicago because of its geographical proximity to the export areas of the Gulf. Exports are expressed in units of 1,000,000 bushels.

Result. Only three times was the export variable (X_2) included in explanatory equations. The variable was included in two crop-year equations (one positive and one negative relationship) with low levels of statistical significance. The variable was included in the aggregate equation and was highly significant carrying a t-value of 9.82. The regression coefficient on X_2 of 0.395 in the aggregate model indicates that an increase in the intermarket price differential of nearly 0.4 cents per bushel would result from a 1,000,000 bushel increase in inspections for export during the aggregate time period. The fact that inspections for export were highly significant over the entire study period but not within the crop year indicates that weekly export inspections offer little information useful in explaining the intracrop year price difference but the level of exports throughout the year are quite helpful in explaining the change in the price differential over crop years.

Gulf Basis

Expectation. Gulf basis (X_3) is usually defined as the difference between the cash wheat price at the Gulf and the most current futures month trading that is not in the delivery month. However, for this study the Gulf basis was defined as the difference between the cash price of wheat at the Gulf and the Kansas City July futures contract close on the same day. With the Gulf basis defined as such, it is obvious that if the Gulf wheat price were assumed constant an inverse relationship would exist between the Gulf price and the Kansas City futures quote. However the relationship of interest is the one between the Gulf basis and the intermarket price difference. It is expected that the relationship will be a negative one for the most part. A change in the Gulf basis is expected to affect the Kansas City futures quote more than the Chicago quote because of Kansas City's proximity to the Gulf ports. This should be especially true in periods of peak export demand. The Gulf basis is also of interest at Chicago and in some instances Chicago could react more to this information than Kansas City causing a negative relationship.

Result. The statistical coefficients associated with the Gulf basis (X_3) were not consistent in their relationships to the intermarket price difference over the crop years. In the six explanatory equations that included X_3, three times the sign on the coefficient was positive and three times it was negative. In the aggregate equation the regression coefficient was of smaller magnitude and lesser significance than the same coefficient for any of the separate crop years. This situation is similar to the one for the Gulf price of wheat (X_2). Normally in a crop year one of the futures markets was affected more by a change in the Gulf basis than the other. However over the long run neither market was clearly a consistent leader. It should be noted that two of the three negative coefficients occur during the 1972 and 1973 crop years. The third, the least statistically significant, occurred during the 1969 crop year. Thus the two coefficients with the highest significance level occurred in the crop years when the coefficient of variation associated with the Gulf price of wheat went from 2.037 in the 1971 crop year to 11.836 and 13,683 in the 1972 and 1973 crop years respectively. The regression coefficient on X_3 during the 1966 crop year of 0.211 indicates that as the Gulf basis increased one cent per bushel, during that year, an associated 0.211 cents per bushel increase came about in the intermarket price difference.

Wheat-Corn Price Ratio at the Gulf

Expectation. The wheat-corn price ratio (X_4) is determined by dividing the cash wheat price at the Gulf, discussed earlier, by the cash price of No. 2 yellow corn at the Gulf. Both of these prices are in cents per bushel. An inverse relationship is expected between the wheat-corn price ratio at the Gulf and the intermarket price differential. For illustration assume that the price of wheat at the Gulf increases relative to the corn price and moves away from a feeding value of wheat because of increased export demand. If the Kansas City price reflects this increase in export demand more than Chicago, a negative relationship would exist between the price ratio and the intermarket differential. On the other hand, if the ratio is declining (wheat becoming cheaper relative to corn) this would reflect pressure on wheat prices to move toward feed prices which should be reflected in lower Kansas City prices relative to Chicago prices and an increase in the differential. The resulting relationship is again negative.

Result. The wheat-corn price ratio at the Gulf (X_4) was an important explanatory variable both in the individual crop-year equations and the aggregate period equation. No other variable was significant in as many crop year equations as X_4, while showing as much consistency in the direction of influence as it did. In three of the six crop-year equations that included X_4, it showed higher statistical significance than any other variable. This ratio was also the most significant variable in the aggregate crop-year equation. The wheat-corn price ratio was included in six explanatory crop-year equations and the aggregate equation. Only once (1973) was the sign of the regression coefficient not as expected (positive). The magnitudes of the regression coefficients, other than the positive one, ranged from -11.807 to -34.765. The consistency in the magnitude of the coefficient across crop years is important. In addition the coefficient in the aggregate period equation was quite similar in magnitude to those in the crop years while being the most statistically significant variable in the equation. An interpretation of the regression coefficient on X_4 over the aggregate period would show that during this time period if the ratio increased from its mean level of 1.316 to 1.448 an accompanying decrease of 1.877 cents per bushel would come about in the intermarket price difference.

Reported Long Hedging at Kansas City

Expectation. The long hedging series (X_5) is derived from the positions of all traders on the Kansas City Board of Trade who have been classified as hedgers and whose long positions in the market are in excess of the required reporting level. The reporting requirements are set by the Commodity Futures Trading Commission (CFTC). For wheat, the reporting level currently is 200,000 bushels. The series, in 1,000,000 bushel units, was used for the monthly or twice monthly intervals as the data were available. Long reporting hedgers may have estimated that prices would move higher and decided to enter the market or they may have acted to maintain their fully hedged positions. The variable would have a negative relationship with the differential if the net effect were to strengthen the Kansas City price. The causality of effect could be in the opposite direction. That is, a narrowing differential could attract long hedging at Kansas City from Chicago.

Result. The statistical coefficients for long reported hedging at Kansas City (X_5) were negative in four of the six crop-year equations in which they were included. The negative relationships were expected but the two positive relationships can be explained by the fact that a narrowing differential could attract long hedgers from Chicago to place their hedges with Kansas City. The regression coefficient for long reported hedging at Kansas City during the 1965 crop year would suggest that during that year an increase in the level of long reported hedging at Kansas City was associated with a decrease in the price differential of 0.385 cents per bushel. As was the case with several of the previously discussed variables the regression coefficient in the aggregate crop-year equation showed the affects of averaging all the yearly coefficients and thus the magnitude of the coefficient during the aggregate period was much smaller than those for each crop year as was its' significant level.

Ratio of Short Hedging to Open Interest at Kansas City

Expectation. The short hedging-open interest ratio is calculated by dividing the total positions of short hedgers, who hold positions in excess of CFTC position limits, by the total open interest for the Kansas City Board of Trade as is reported in commitments of traders information. This variable does not indicate absolute levels of short hedging. However, it does give information concerning changes in short hedging. If short hedging and open interest increase by the same amount, the change in the ratio will be quite small. If short hedging increases at Kansas City and open interest remains unchanged there has been a change in the mix of contracts held. It is expected that large short hedgers would enter the futures market based on long inventory positions which would decrease the futures price at Kansas City. A positive relationship between the intermarket price difference and this ratio would be expected, assuming Chicago futures price constant.

Result. The ratio of reported short hedging to total open interest at Kansas City (X_6) was included in explanatory equations for six of the nine crop years and in the aggregate equation. In the explanatory equation for the aggregate. The regression coefficient on X_6 was 15.555. This coefficient suggests that during the aggregate period an increase in X_6 from its mean level of 0.847 to 0.889 was associated with a 0.777 cent per bushel increase in the intermarket price difference. The signs of the regression coefficients were not consistent. Half of the crop-year equations had positive coefficients and half negative. However the coefficient on X_6 in the aggregate period equation was approximately the same magnitude of other positive coefficients in the equation. In addition its associated t-value showed that the variable was statistically significant.

Net Intermarket Spreading at Kansas City

Expectation. The commitments of traders information gives the level of long and short spreading that is reported at Kansas City. The information includes each trader's long and short positions, to the extent they are balanced, without regard to which crop year or market is involved. Therefore the long and short spread positions will differ by the amount of intermarket spreading. Net intermarket spreading for this study was calculated by finding the difference between long and short reported spreading in 1,000,000 bushel units. The calculation used in this study does include spreading between Kansas City and Chicago and spreading bewteen Kansas City and Minneapolis but assumes that all spreading is applicable to the Chicago market. Gray [7], in his 1967 study, also assumed that all intermarket spreading involved Chicago as one market. He stated that this probably was not literally true but felt the assumption was justifiable on the following three grounds. First, he held discussions with traders who actively engaged in intermarket spreading and they doubted the existence of any substantial spreading between the two smaller markets. Second, he found no correlation between net spreading for Kansas City and Minneapolis but each had an inverse relationship with Chicago. Last, net spreading at Kansas City was typically a much larger figure relative to Minneapolis which would allow for only a small portion to be spread to Minneapolis. Gray went on to explain that he felt intermarket spreaders did not attempt to forecast prices. He stated that intermarket spreaders were more "hedge anticipators". Thus he concluded that if the intermarket difference bewteen Kansas City and Chicago were "out of line", spreading positions should not be expected to reflect this unless the hedging positions had brought about the the misalignment.

If Gray's findings are accepted, the sign on the intermarket spreading variable would be expected to be ambiguous. Thus, this variable might not be useful in a predictive equation but could be useful in an explanatory model as indicative of the direction of price misalignment at a given point in time which has resulted from hedging needs in the Kansas City market. If intermarket spreading results from a downward pressure on Kansas City prices from another variable, then spreading and price differentials will be positively correlated. On the other hand if intermarket spreading results from a downward pressure on Chicago prices, the correlation will be negative.

Result. Net intermarket spreading at Kansas City (X_7) was included in only three of the crop-year explanatory equations. In each of these three instances the resultant relationship between X_7 and the intermarket price difference was an inverse one. However, whenever the variable was included in the aggregate period equation the sign on the regression coefficient was positive. This is consistent with a priori expectations that the sign on the variable might be indeterminate. The coefficient on X_7 during the aggregate period indicates that during this period an increase in net spreading at Kansas City of 200 contracts (1,000,000 bushels) resulted in an increase of 0.869 cents per bushel in the intermarket price differential.

Open Interest at Chicago

Expectation. A futures contract is considered open if it has been entered into but not yet liquidated by the purchase of an offsetting contract or by delivery. Contracts that are open are referred to as open interest. The aggregate of all long open interest is equal to the aggregate of all short open interest. The variable used in this study is reported in 1,000,000 bushel units. The level of open interest on the Chicago Board of Trade is expected to be an indicator of market activity. An increase in open interest indicates increased market activity but gives little indication of the direction of influence on the spread.

Result. The estimated regression coefficients associated with open interest at Chicago (X_8) carried negative signs in three crop years and positive signs in four. The variable did not meet the significance requirements for inclusion in the aggregate explanatory equation and was the only one omitted. The variable was used as an indicator of the level of market activity. Therefore over the long run it would not be expected to have a large effect on the price difference. Within a year however the level of market activity could have a significance effect on the price differential. During the 1965 crop year the regression coefficient indicates that for every 200 contracts that open interest at Chicago increased, the intermarket price differential increased by 0.014 cents per bushel.

Net Speculation at Chicago

Expectation. Net speculation on the Chicago Board of Trade, as used in this study, is defined as the total of large non-hedging positions. Speculation then encompasses both the spreading and long or short speculative positions. The level of net speculation at Chicago in 1,000,000 bushel units was reported either monthly or twice monthly and computed as the number of bushels in long positions subtracted from the number of bushels in short positions. If, on the average, large speculators at Chicago forecast lower prices and enter the market short, based on these expectations, a net increase in short positions would lower the Chicago futures price and increase net speculation, a negative relationship. Since this variable is anticipated to have very little effect on the Kansas City futures price, a negative sign would also be expected for the relationship between net speculation and the intermarket price differential.

Result. The coefficients associated with net speculation at Chicago (X_9) had a negative relationship with the intermarket price difference twice and a positive relationship three times in the crop-year equations when X_9 was included. The sign on the coefficient from the aggregate explanatory equation carried the expected negative sign. During the aggregate study period if the net speculation at Chicago increased by 200 contracts (1,000,000 bushels) a decrease in the intermarket price differential of -0.099 cents per bushel was the result indicated by the regression coefficient, all other things equal.

Coefficient of Determination

The coefficient of determination (R^2) was reported in the bottom row of Table III. In general these coefficients were larger in the earlier years of the study. Three of the last four years had small coefficients in relation to the others. The 1973 crop year had an R^2 of 0.445 which was the lowest of all the crop years. This indicates that the four variables in the 1973 crop year equation explain over 44 percent of the variation in the intermarket price difference.

Other Factors

Unbalanced Hedging at Kansas City

In an analysis of the three major wheat futures markets, Gray [8] concluded that as one of the smaller market's hedging load became more and more unbalanced, at some point the unbalance would be reflected in price disparities relative to Chicago. As the hedging load on the smaller market becomes more unbalanced hedgers will tend to take their business directly to Chicago.

Hedging at Kansas City is much more important, relatively, than at Chicago. On the average, reported hedging at Chicago makes up less than 50 percent of the total open interest whereas reported short hedging at Kansas City rarely makes up less than 80 percent of the total open interest. Because Kansas City does not have a vast reservoir of speculation similar to that of Chicago, unbalanced hedging is particularly important. An unbalanced hedging load at Chicago is not nearly as important because the high levels of speculation can offset the difference in the hedging levels.

The simple statistics of data for each crop year indicate that a significant change had taken place in the distribution between long and short reported hedging positions on the Kansas City Board of Trade. During the 1965-66 through 1969-70 crop years, net reported hedging at Kansas City (short less long positions) was heavily net short. Reported hedging at Kansas City was, on the average, net short by 9.4 million bushels (nearly 1,900 contracts) in the 1969-70 crop year and by 18.4 million bushels (nearly 3,700 contracts) in the 1967-68 crop year. Values this large indicate a problem of matching hedging with speculation at Kansas City. The situation eased slightly in the 1970-71 crop year.

In the 1971-72 through 1973-74 crop years, the average net hedging at Kansas City became quite small and even turned net long by 2.3 million bushels in the 1973-74 crop year. The 1970-71 crop year seems to stand alone as somewhat of a transition year bewteen years of balanced and unbalanced hedging at Kansas City.

The measurable effects of the change from unbalanced hedging in Kansas City to more nearly balanced hedging is first evident in the 1970 crop year equation. In this equation neither of the variables concerning hedging at Kansas City (X_5 for long hedging and X_6 for the ratio of short hedging to open interest) came in as statistically significant. In the earlier years both X_5 and X_6 were included except for 1968 (X_6 not included). The 1970 crop year also reflected a substantial decrease in the coefficient of determination, down to 0.586

from 0.814 for the 1969 crop year. In the following three crop years, X_5 was included in two crop years (1971 and 1972). When both were included in 1972 the coefficient of determination was 0.814. The highest coefficient of determination for the other years using the available variables was 0.627.

Reduction of Government Stocks

Wheat carry-over as of July 1, 1965 was slightly over 900 million bushels. Approximately 75 percent of these stocks was under governmental control, either under loan to the government or owned by the Commodity Credit Corporation (CCC). Throughout the crop years of this study, governmentally controlled stocks were rarely below 50 percent of the total stocks. On July 1, 1972 the stocks of wheat totaled 985 million bushels and over 70 percent of this was under governmental control. However some political decisions were made during the 1972-73 crop year and the end result was a reduction of the level of government stocks. Roughly concurrent with this, another political decision was made in the Soviet Union calling for massive importation of grain, expecially wheat. Subsequently, exports of wheat from the United States greatly increased. Average yearly exports during the 1965 through 1971 crop years beginning July 1 had been approximately 700 million bushels. In the 1972 crop year beginning July 1 exports of wheat were 1,131 million bushels and this figure advanced to 1,217 million bushels the next year.

The 1972 and 1973 crop years stand out as different in the analysis because of two main variables the Gulf basis (X_3) and the wheat-corn price ratio (X_4). A preliminary group of equations were estimated using the same variables as in this study except that the Gulf price of wheat (X_1) was excluded. In these preliminary equations, the Gulf basis (X_3) was included in the equation for every year from 1965 through 1969. The sign of the regression coefficient was positive. Gulf basis was not included for the 1970 crop year. In the 1972 and 1973 crop years, Gulf basis was a significant variable but the signs on the regression coefficients were negative. The implementation of a policy to reduce government stock levels accompanied by the large increases in exports, apparently had changed the relationship from positive to negative. That is, Kansas City was affected more than Chicago by changes in the Gulf basis. This would be expected since the Gulf ports would handle a large percentage of the export sales, most of which would be hard winter wheat. A similar situation occurred in the preliminary study for the wheat-corn ratio at the Gulf. This variable had been consistently negative in effect and then in the 1972 and 1973 crop years the signs of the regression coefficients changed to positive. Thus as the price of wheat moved away from a feeding value based on corn prices, the Chicago futures quote gained on the Kansas City quote.

FOOTNOTES

[1]The price related variables that were analyzed but subsequently not used in the final model were the weekly change in Chicago and Kansas City futures closes, Thursday's trading range at Chicago and Kansas City, and cash corn price at Kansas City and the Gulf.

[2]The variables relating to the commitments of traders data that were studied but not included in the final model were total open interest at Kansas City, reported short hedging at Kansas City, reported short and long speculation and hedging at Chicago, reported long and short spreading at Chicago and Kansas City, net reported hedging at Kansas City and Chicago, the ratio of long hedging to total open interest at Kansas City, the ratio of long hedging to short hedging at Kansas City, net reported spreading at Chicago and the sum of net reported speculation and hedging at Chicago.

[3]Robert L. Mason, R. F. Gunst and J. T. Webster, "Regression Analysis and Problems of Multicollinearity". Communications in Statistics, Vol. 4, No. 3, pp. 277-292. This article provides useful information concerning multicollinearity.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The relatively low but stable cash wheat prices during the mid- to late 1960's gave way to the historically high, vacillating prices of the early 1970's. Increased price variation brought about renewed interest in wheat marketing strategies. The use of forward contracting increased as producers attempted to reduce the risk of price changes. Hedging on organized commodity exchanges was one method which facilitated forward contracting.

There are several futures markets on which inventories of wheat can be hedged. However, only two of these markets will accept hard winter wheat as deliverable under current contract specifications. The Chicago Board of Trade, by far the largest wheat futures market in terms of the total number of contracts traded, allows for delivery of hard winter wheat, northern spring wheat and soft red wheat. The Kansas City Board of Trade, in contrast, allows only for delivery of hard winter wheats against their futures contract. This aspect of the Kansas City futures market is particularly desirable to hedgers who might be interested in accepting delivery of the wheat and who have specific needs for hard winter wheat.

If hedging is the tool chosen to use in forward contracting, the question is then one of which market should be used in placing the hedge. One general rule to follow could be to place the hedge with the market whose par delivery point is closest to the cash market where the commodity will be sold. Using this simple rule, hedgers in Oklahoma would place their hedges on the Kansas City Board of Trade. However, if this rule were followed consistently there would be times when losses would be incurred relative to using the Chicago Board of Trade for the hedge. By placing hedges with the correct market in the 1972 and 1973 crop years, the hedger could have made about 20 to 30 cents more on one market than the other. A correct decision by the hedger concerning the market in which to hedge could be as important as the decision to hedge itself.

The model of the intermarket price differential that was employed in this study suggested that the weekly difference between Kansas City and Chicago July futures price quotes could be explained, to a large extent, using nine variables. Three of these variables were related to various wheat price series, one concerned inspections for export and the rest were taken from information concerning commitments of traders in commodity futures. Weekly futures quotes of the Chicago and Kansas City Boards of Trade were analyzed using simple linear regression techniques. An explanatory equation was estimated for each crop year and the total period. The "best" equation was then presented. "Best", as used here, refers to the explanatory equation which explained the largest amount of variation in the price differential and all of the regression coefficients were statistically significant at the 80 percent level. The coefficient of determination (R^2) was used to measure the share of variation explained.

Conclusions

Two statistically significant coefficients of the aggregate period were inspections for export (X_2) and the wheat-corn price ratio (X_4). Inspections for export was not a highly significant variable, statistically, in any of the crop-year equations even though it was included in two years (1965 and 1967). However it was highly significant in the aggregate equation. This indicates that weekly inspections for export offer little help in explaining the intermarket price difference but the yearly average of this variable is quite important. An increase in weekly inspections for export of about 2.5 million bushels can cause a one cent increase in the price of Chicago futures relative to Kansas City, ceteris paribus. This would be an increase of approximately 125 million bushels during the course of a crop year if the increase were sustained throughout the year.

The most consistent variable in the entire study was the wheat-corn price ratio at the Gulf (X_4). It was statistically significant in six of the crop-year equations and in the aggregate equation. The sign on its associated regression coefficient was positive only once (1973). The absolute magnitude of the coefficient and the relative size of the associated t-value are quite similar to those within the crop years. The consistency of this relationship was reflected in the regression coefficient on X_4 of -18.767 in the aggregate equation. This would suggest that if the wheat-corn ratio were assumed to be at its mean level of 1.316, an increase in the ratio of just over 5 percent would cause a once cent increase in the Kansas City futures price relative to Chicago. This could come about by corn price staying constant and wheat price increasing from tis mean of \$2.19 to \$2.30 per bushel.

Only three other variables (X_7, X_6, X_9) displayed statistical significance in the aggregate equation. Net intermarket spreading (X_7) entered into only three crop-year equations--the 1965, 1972, and 1973 crop years. The sign on the coefficient was negative all three times but the coefficient in the aggregate equation was positive (0.869). This suggests that over the entire period it would take an increase of slightly more than 1,000,000 bushels (200 contracts) of net short spreading to increase Chicago one cent per bushel relative to Kansas City, ceteris paribus.

The ratio of short hedging to open interest (X_6) also had inconsistent signs on the regression coefficient across crop years. However, in the aggregate equation the regression coefficient was positive (15.555) and significant. This was the expected sign assuming that short hedgers forecast price and then take positions in the market accordingly. The ratio would have to increase from its mean of 0.847 to 0.901 for the Chicago futures price to gain one cent per bushel relative to the Kansas City price, other things equal. This would be equivalent to the open interest remaining constant and the short hedging at Kansas City increasing from its mean of 34.547 to 36.750 million bushels, about 440 contracts.

Net speculation (X_9) was included in the 1966-70 crop-year equations and the aggregate equation. A regression coefficient of -0.099 during the aggregate period suggests that for Kansas City to gain one cent per bushel relatively on Chicago, net speculation at Chicago would have to increase by 10,000,000 bushels (2000 contracts). Thus the intermarket price difference was not extremely sensitive to changes in the level of net speculation at Chicago.

Three other variables (X_1, X_3, X_5) entered the aggregate equation by just meeting the minimum requirements of statistical significance. Cash price of wheat at the Gulf (X_1) was included in seven of the crop-year equations and in the aggregate equation. The sign on the regression coefficient was positive in four of the crop-year equations and negative in three. The inconsistency of the relationship between X_1 and the intermarket price difference is noticeable in the aggregate equation. The opposite signs had an averaging effect which reduced the absolute magnitude of the regression coefficient and the associated t-value.

The Gulf basis (X_3) suffered from many of the same problems as the Gulf price of wheat. This variable was statistically significant in six of the nine crop-year equations and in the aggregate equation. The regression coefficient was positive three times. Some of the inconsistency may be due to the presence of the Gulf price of wheat in the equation. A preliminary study was made in which the selected variables were the same as in the present study except that the Gulf price was not included. In that analysis, the Gulf basis entered the crop-year equations in every year but one (1970). Each year, with the exception of the 1972 and 1973 crop years the sign on X_3 was positive.

Long reported hedging at Kansas City (X_5) was significant in six of the crop-year equations, five of the equations prior to the 1970 crop year. This is of interest because the 1965-70 crop years were characterized by unmatched hedging at Kansas. Later in the study as hedging became more nearly balanced at Kansas City, the variable was significant in only one crop year (1972). However this variable was inconsistent in its relationship with the intermarket price difference.

Total open interest at Chicago (X_8) had a negative relationship with the intermarket price differential in three crop years and was positive three years. This was the only variable that did not meet the minimum requirements for inclusion in the aggregate equation.

Over the entire study period the largest observed price differentials were Kansas City 12.25 cents per bushel over Chicago and Chicago 24.25 cents per bushel over Kansas City. Thus the maximum observed range of the price differential was 36.5 cents per bushel.

Table IV and Table V in the appendix present equations that estimated linear trends for the Gulf price of wheat and the intermarket price difference respectively. It is evident that the signs on the slope coefficients of estimated equations on both of these data series were the same in six of the nine crop years studied. Thus in 66 percent of the years covered in this study, if the Gulf price tended to trend upward during the crop year so did the intermarket price difference. When the Gulf price of wheat was going up, the Chicago futures quote tended to increase at a faster rate than Kansas City. When the Gulf price of wheat was trending downward, the Chicago futures price tended to go down at a faster rate than Kansas City. These results were not expected.

The hedging load at Kansas City was heavily unbalanced to the short side during most of the period covered by this study. Reported hedging at Kansas City was, on the average, net short 9.4 million bushels per observation (nearly 1900 contracts) in the 1969 crop year and 18.4 million bushels (nearly 3700 contracts) in the 1967 crop year.

This is, of course, more unmatched hedging than could be matched easily by speculation at Kansas City. In the 1970 crop year the situation of net short hedging eased slightly. Then in the 1971 through 1973 crop years the average net hedging became much more manageable and even net long by 2.3 million bushels in one year, 1973.

The effects of the unbalanced hedging load at Kansas City are noticeable in the crop-year equations. In the 1965 through 1969 crop years long hedging at Kansas City (X_5) was included in every equation and the short hedging ratio (X_6) was included in all but 1968. In the following four crop years X_5 was included only once and X_6 twice.

Implications

This study offers information concerning the effects of selected variables on the intermarket price differentials. However in an effort to offer greater assistance to wheat producers and marketing firms in selecting the most advantageous market to use for hedging wheat the following general guidelines are presented. The guidelines are based on findings of this study. No general guideline can be used to make a correct decision in every specific instance. The problem is much more complex than that. These general guidelines however, should offer assistance by serving as a starting point in the hedge placement decision.

As a reference point from which to begin this analysis recall that in six of the nine crop-year equations if the Gulf wheat price series showed a positive trend the Chicago price of wheat increased relative to Kansas City. If the Gulf price of wheat showed a negative trend the opposite was true. Therefore some expectation is needed concerning the trend of the cash price of wheat at the Gulf over a crop year. Several sources of this type information are available including University Extension personnel, commodity brokers and others.

It is important at all times to be aware of the actual price differential. Obviously if the differential were near either of the maximum differentials the difficulty of the decision could be diminished. However, it would not be impossible for the intermarket price difference to exceed the "limits" found during the present study.

The next step would be to arrive at some expectation for exports. If exports were expected to be larger than last year, Chicago would be expected to gain on Kansas City. If the inverse were true Kansas City should gain on Chicago.

The final two factors considered here would be expectations concerning the Gulf basis and the wheat-corn ratio at the Gulf. These two factors will tend to represent positive and negative relationships respectively with the intermarket price difference. However in periods of heavy exports, relative to the recent past, both these relationships change. Assuming a period of relatively "normal" exports, an increase in the Gulf basis would suggest that Chicago will gain relatively on Kansas City. This variable would not be easy to project. Therefore a better method would be to simply keep track of the movements of the Gulf basis and try to notice trends as they occur.

The wheat-corn price ratio is also difficult to predict. However some information can be obtained from the simple statistics associated with the variable. The mean of the series over the entire period was about 1.3. The maximum value was around 2.0 and the minimum about 1.0. This ratio is affected by supply and demand conditions for the two grains.

An example of market selection for hedging might be similar to the following. If the Gulf price of wheat is expected to trend downward over the next crop year, producers whould be extremely interested in hedging their wheat crop. For reasons mentioned earlier, the Chicago futures quote could be expected to decline relative to Kansas City. Thus a short hedge should be placed in the Chicago market. However several other factors should be analyzed. The present intermarket price differential is one. If it is within a "normal" range then the next variable to look at is estimated exports of grain relative to last year. If the estimate represents a decrease from last year then this study would reinforce the decision to use the Chicago market for placement of the short hedge.

The Gulf basis and the wheat-corn ratio can also be used to shore up the decision or possibly cast doubt on it. If wheat prices were high relative to corn and expectations were for the ratio to decline, this would suggest the use of Kansas City rather than Chicago for the short hedge. In contrast, an expected decline in the Gulf basis would mean that the Chicago futures might be used most effectively in the short hedge. The opposite markets would have been selected in the above example for placing a long hedge.

Of utmost importance is the fact that for all the variables to indicate the use of the same market at any one time could be a rare occurrence. The information available must be analyzed and hedge placements made after careful thought and analysis.

Suggestions for Further Research

Due to the date this study was undertaken, no years were analyzed in which the government controlled virtually no stocks of wheat and only two years of data were available for the period of increased export demand. Currently more information is available, thus making possible the analysis of a larger group of years that could be characterized by large export levels (relatives to the pre 1970's) and low levels of governmentally controlled stocks. In the analysis, predictive equations should be estimated and the results tested in an effort to see how well the established criteria predicted the correct market with which to place the hedge.

Current research is needed to help explain and predict the movement of the basis (difference in cash and futures price). Hedgers of inventories are constantly aware of the basis and its movements. When inventories are hedged, the risk of a price change is greatly reduced but the basis risk remains. Research that would offer insight into the factors affecting the basis would be quite helpful. Potential hedgers with more complete information concerning the cash futures relationships could make better decisions concerning hedge placement.

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APPENDIX

TABLES

TABLE IV

STATISTICAL REGRESSION COEFFICIENTS ASSOCIATED WITH THE TREND IN THE WEEKLY GULF PRICE OF WHEAT, CROP YEARS 1965-66 THROUGH 1973-74

Crop Year	Average Gulf Price	Intercept	Time	R^2
1965-66	184.902	169.692	0.585 (8.95)	0.620
1966-67	198.667	213.271	-0.562 (10.38)	0.687
1967-68	171.333	182.103	-0.376 (5.83)	0.410
1968-69	152.627	155.955	0.128 (3.04)	0.159
1969-70	154.860	152.674	0.086 (1.63)	0.052
1970-71	171.780	169.271	0.098 (2.19)	0.091
1971-72	173.020	171.563	0.056 (0.95)	0.056
1972-73	264.627	218.891	1.759 (10.62)	0.697
1973-74	494.480	530.709	-1.393 (2.25)	0.094

TABLE V

STATISTICAL REGRESSION COEFFICIENTS ASSOCIATED WITH THE TREND IN THE WEEKLY CHICAGO-KANSAS CITY JULY WHEAT FUTURES PRICE DIFFERENTIAL, CROP YEARS 1965-66 THROUGH 1973-74

Year	Average Price Differential	Intercept	Time	R^2
1965-66	2.091	6.094	-0.154 (5.34)	0.368
1966-67	-2.858	1.340	-0.161 (15.02)	0.822
1967-68	-1.860	2.935	-0.184 (12.60)	0.764
1968-69	-1.551	-3.669	0.081 (4.31)	0.275
1969-70	4.517	1.248	0.128 (10.62)	0.702
1970-71	7.960	6.237	0.068 (4.37)	0.284
1971-72	1.426	3.626	-0.085 (4.16)	0.261
1972-73	8.245	-3.810	0.464 (15.40)	0.829
1973-74	-2.578	-0.027	-0.098 (1.86)	0.066

TABLE VI

SIMPLE STATISTICS FOR DEPENDENT AND INDEPENDENT VARIABLES, CROP YEARS 1965-66 THROUGH 1973-74

	Variables*									
	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Statistic	Price Differential	Gulf Price	Exports	Gulf Basis	Price Ratio W/C	Long Hedging	Short Hedging Ratio	Net Spreading	Chicago Open Interest	Chicago Net Spec.
					1965-66 (n=51)					
Mean	2.091	184.902	15.338	27.978	1.318	12.786	0.712	-1.560	125.593	-13.808
Std. Dev.	3.774	11.040	3.493	3.559	0.062	2.703	0.058	0.762	23.698	5.131
					1966-67 (n=51)					
Mean	-2.858	198.667	12.733	24.402	1.320	13.010	0.824	-3.318	166.288	-1.398
Std. Dev.	2.648	10.073	3.690	3.663	0.035	2.737	0.044	1.562	12.340	7.248
					1967-68 (n=51)					
Mean	-1.860	172.333	13.230	21.037	1.376	21.959	0.795	-2.960	179.187	-0.517
Std. Dev.	3.136	8.728	3.613	5.110	0.061	4.070	0.090	0.990	51.600	7.624
					1968-69 (n=51)					
Mean	-1.551	152.627	8.962	18.686	1.220	14.869	0.831	-2.247	168.902	-4.465
Std. Dev.	2.310	4.771	4.124	3.549	0.105	5.262	0.053	1.467	49.331	-6.416
					1969-70 (n=51)					
Mean	4.517	154.860	10.298	22.222	1.129	15.087	0.865	-0.250	97.070	-6.132
Std. Dev.	2.232	5.455	2.980	4.818	0.068	4.304	0.075	0.751	19.562	3.162

TABLE VI (Continued)

	Variables*									
	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Statistic	Price Differential	Gulf Price	Exports	Gulf Basis	Price Ratio W/C	Long Hedging	Short Hedging Ratio	Net Spreading	Chicago Open Interest	Chicago Net Spec.
					1970-71 (n=50)					
Mean	7.960	171.780	12.764	22.427	1.065	23.281	0.869	-1.366	81.414	-1.231
Std. Dev.	1.848	4.761	3.376	4.564	0.044	5.103	0.037	1.004	13.992	3.467
					1971-72 (n=51)					
Mean	1.426	173.020	11.184	30.770	1.321	20.213	0.864	0.082	68.176	-0.898
Std. Dev.	2.461	3.524	3.277	3.931	0.065	4.634	0.061	0.201	11.650	2.493
					1972-73 (n=51)					
Mean	8.245	264.627	22.771	50.252	1.419	62.161	0.903	0.225	106.660	-4.073
Std. Dev.	7.571	31.320	5.442	12.782	0.177	24.018	0.040	0.653	12.959	2.605
					1973-74 (n=51)					
Mean	-2.578	494.480	20.603	77.137	1.668	47.669	0.873	-0.002	126.582	0.671
Std. Dev.	5.688	67.660	7.456	56.834	0.229	2.976	0.071	0.364	24.823	8.572

*Gulf Price = Gulf price of wheat, Exports = Wheat inspections for export, Gulf Basis = Gulf price of wheat less the July Kansas City futures close on the same day, Price Ratio W/C = Gulf price of wheat divided by the Gulf price of corn, Long Hedging = Long reported hedging at Kansas City, Short Hedging Ratio = Short reported hedging at Kansas City divided by total open interest, Net Spreading = Short less long reported spreading at Kansas City, Chicago Open Interest = Total open interest at Chicago, Chicago Net Spec. = Short less long reported speculation at Chicago.

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