MARGINS
SPECULATION
AND
PRICES
IN
GRAINS
FUTURES
MARKETS
For a number of years bills have been before the Congress which, if enacted, would provide authority to regulate margins on grain futures contracts traded on the commodity markets. The basic idea behind these bills is that low margins permit excessive speculation which produces erratic price fluctuations to the detriment of orderly marketing of commodities. None of these bills has been enacted.

To help test this idea, the Economic Research Service, with support from the Commodity Exchange Authority, initiated a study of the grain futures markets to learn more about the nature of speculation in grains, and to evaluate control of margin requirements as a tool for moderating undue fluctuations in prices of futures contracts. The study seeks to define and measure speculation and its relation to price fluctuations, and to measure the relation of margin changes to speculation and price movements.

This report was prepared by Robert R. Nathan Associates, Inc., Washington, D. C., a private research firm, under contract with the Economic Research Service. This report is the result of the Nathan Associates' work. It is published in this form to make the results of this part of the study available to the grain trade, students of grain marketing, government officials, and other interested people.

The report does not answer all the relevant questions. It does, however, shed substantial light on the operation of grain futures markets and it deserves careful reading. Although limitations of data and funds for carrying the work further at this time were handicaps to the study, it paves the way for further work.

The Economic Research Service deeply appreciates the work of Robert R. Nathan Associates, Inc., and the valuable and wholehearted cooperation of officials in the grain trade and in the Washington and Chicago offices of the Commodity
Exchange Authority. We deeply appreciate also the work of Dr. Allen B. Paul of ERS for his efforts in helping to plan this study and to facilitate its execution.

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MARGINS, SPECULATION AND PRICES
IN GRAINS FUTURES MARKETS

SUMMARY AND CONCLUSIONS

In this report we have presented the following principal conclusions:

First, the investigations of futures markets twenty years ago generally attributed to speculators an important role in price-making. Our investigation of markets since 1947 shows that the commitments of hedgers and spreaders have become relatively more dominant in the structure of open contracts in the larger, more active markets today.

Second, the price effects of speculation can be measured quantitatively. But for the effects of speculation to be isolated from many other factors influencing price, it is necessary to have a reasonably complete model of price behavior.

Third, for an extended period in 1947-48, high initial margin requirements probably did in fact help curtail very short-term price fluctuations.

Fourth, we have demonstrated that speculators' transactions often moderate rather than accentuate price volatility.

Fifth, margins entail costs which are passed back to the producer or forward to the consumer.

Sixth, given the present state of market data collection and analysis, CEA would find it difficult to determine whether, when, and how to apply margin controls to limit price volatility. Judicious decisions would be practicable only with significantly larger efforts in data collection, retention, and interpretation.
than have been made by the CEA during the past twenty years. Numerous and important administrative problems would exist for the CEA if it were to administer margin controls.

Further comments, still in summary form, are made concerning these findings in the following paragraphs.

* * * * *

This study had limited objectives which in turn restrict the application of the findings. The question posed was, "The nature of speculations in grains and their bearings on fluctuations in prices and whether minimum margin requirements by the CEA could be a feasible tool for controlling or helping to control excessive fluctuations."

Specifically excluded from consideration were the relations of margins and speculation to price levels ruling in the grain markets. Grain futures prices are a mechanism for allocating the supply economically over the market year before the new crop comes in and for signalling the need for increased or reduced supplies for the future. We did not attempt to assess the adequacy of market prices for this purpose. Our objective was to study the short-term fluctuations in prices between the points at which trends in prices became recognizable.

1. Nature of Speculation in Grain Futures Markets.

Speculation in grain futures was defined broadly as either the transaction (buying or selling) by any speculator or the holding of an open commitment over time by anyone whom the CEA would not classify as a hedger. However, we sub-classified speculation, using different, partial measures in order to adjust to the incomplete historical series of data which describe speculative commitments in wheat, corn, and soybeans futures markets.
since 1947. Our market review in Part I is an analysis based on periodic classifications of total open contracts, rather than comparisons of commitments by large (reporting) traders, and covers most of the period since the end of World War II.

It should be recognized also that much speculation that affects futures markets does not take place in that marketplace, nor can all forms of speculation be measured by available statistics -- for example, local cash grain sales and inventories.

Marked increases in the relative importance of hedging commitments have occurred in each of these commodity futures markets during the last few years. For example, classifications of total open contracts show that speculative holdings not required to accommodate unbalanced hedging in 1966 comprised a relatively small fraction of total open contracts. Adequate demand by speculators for futures contracts often contributed to short-run price stability. This effective demand frequently was insufficient to meet fully hedging requirements in many contemporary markets. These relationships clearly suggest that a significant change in market structure in both corn and soybean futures markets has occurred. Also, important data limitations precluded our making an adequate analysis of spreader's commitments.

We noted that fluctuations in the grains futures markets became marked when long or short aggregate commitments in speculation or hedging became unbalanced, with respect to offsetting positions in the same category. Price stability often occurred when long and short hedging positions were well balanced and when these positions represented approximately an equal share of total open contracts as did holdings by speculators other than spreaders.
We believe that spreading and matching positions should receive more detailed study than has been spent on them in the past. Along with hedging, they have become more important in recent years. Spreading and matching commitments probably are not neutral in their effect on the market. They can both stimulate and moderate price fluctuations. But an adequate analysis will not be possible until the statistics report net long or short positions held by spreaders in each future.

(2) Influence of Speculation on Futures Price Behavior.

Price behavior in Chicago corn, soybean and wheat futures markets was compared periodically with contemporary patterns in total open contracts held by speculators, hedgers, and spreaders. Explanations of various measures of price change in selected markets since 1947 were developed. These statistical models intentionally emphasized frequent tests of how price fluctuations were associated with concurrent shifts in the relative importance of open commitments held by speculators.

Original, objective analyses show that speculation explained part of short-term price ranges or changes in most of the market situations for which estimating procedures were developed. The relative importance attributable to speculation, compared with other explanatory variables, varied widely, as did its absolute price effect. Distinctively different relationships were noted, depending partly on: the type or scope of price fluctuations explained; seasonality; and the combined or joint effects attributable to supply-consumption factors and quantitative expressions of speculation and hedging. Day-to-day price changes, for example, were explained completely by net purchases or sales made by position traders (hedgers, speculators, spreaders), other trading activities, and small shifts in balances between total hedging and speculative commitments. Rigorous analysis of price ranges over longer intervals,
however, required the introduction of many supply and consumption ratios into multiple regression equations. These explanations suggest that most price behavior during short-term periods (one or several weeks) primarily reflects logical, objective market response to important new commodity statistics. While these factors, singly and jointly with the extent of divergence of market price from the effective loan level, were of prime importance in explaining inter-day price variance, price behavior also reflected the transactions by speculators and others. Finally, transactions by speculators on occasion had a measurable effect in moderating, rather than intensifying short-run price fluctuations.

Other, independent equations, presented in Part II, imply that certain (intra-commodity) spread positions are relatively important in influencing changes in price differences between contracts. Changes in aggregate holdings of spreads by large speculators between contracts within different crop years (e.g., long old crop - short new crop) consistently were closely related to logical, corresponding shifts in price spreads.

The precision attained in many regression equations presented in Part II reflects several innovations in price analysis of futures markets. Price response to the different forms of speculations was estimated separately. Price behavior was measured over selectively different, quite specific intervals of time. Standard statistical error tests presented in Appendix B generally support the accuracy of estimate attributed to the various regression equations in Part II.

Since these price behavior models, as developed, intentionally emphasize the relationships between price
behavior and concurrent changes in speculative commitments, their use as prediction equations of short-run price fluctuations is limited. However, these statistical tools could be of considerable practical help in frequently explaining price behavior, in subsequent markets, particularly if current market statistics representing all explanatory variables are collected frequently and published promptly.

(3) Feasibility of Use of Minimum Margins as a Tool for Moderating Excessive Futures Price Fluctuations.

Several multiple regression equations were developed to measure net regression relationships between minimum margins (on speculative positions) and contemporary price fluctuations and volumes of trading. Empirical methods presented in Part III enable one to estimate whether a contemplated specific margin increase would reduce current average daily price ranges and/or average daily volume of trading. Factors influencing outcome of these estimates include time (number of trading days) and volatility of present market (volume), as well as amount of margin increase. The limitations to the mathematical reliability of these equations as predictors (of outcome in any one case) are emphasized, however.

Empirical evidence confirming that raising margin requirements to traditionally high levels can in fact control or help to control prevailing price fluctuations was clearly indicated in 1947 and 1948. But corroboration of this finding was not developed by a rigorous analysis of price response following twenty-one margin increases prescribed by the Board of Directors of the Chicago Board of Trade, since mid-1948. Significant structural changes in corn and soybean futures markets since 1947 suggest that conclusions drawn from price response twenty years ago
probably would be irrelevant or misleading if applied
directly to contemporary markets. Although firm statis-
tical support is lacking a strong theoretical argument is
presented which indicates why margins should be an effective
tool for curtailing most transactions by speculators. How-
ever, restraining such speculation would not necessarily be
in the public interest, for reasons we bring out later in
this summary.

(4) Administrative Problems in Prospect Relative to CEA
Regulation of Margins.

Our review of the experience of the Federal Reserve
Board in controlling margins in the securities markets
emphasizes the difference between the purpose of margins in
commodities and equity markets. Securities market margins
are a direct measure of creation of bank credit, but there
is no necessary relation between the margin in a futures
market contract and the credit that may be involved in the
transaction. The futures market margin is a surety deposit
to guarantee execution of the contract. Also, stock market
margins have a collateral usefulness in cushioning liquidations in a (falling) market. Data adequate to test the hypoth-
thesis that higher margins would serve a similar purpose in
grain futures markets were not available.

Regarding administrative problems outlined in Part IV,
we believe that prime importance should be attached to the
difficulty in prescribing general criteria for identifying
promptly individual circumstances in which the CEA should
establish minimum margins. Equally important would be a set
of guidelines which would help the Administrator recognize
when to remove controls, once they had been established.
(5) Would Such Control of Margins be in the Public Interest?

A representative cross-section of producers, traders, processors, and students of the markets was consulted on this question. While all shades of opinion were expressed, we are certain that the preponderance of opinion is (was) opposed to the use of margins as a means of controlling price fluctuations. The bulk of the opposition was based on a conviction that margin controls ought not be used for any purpose but protecting the financial integrity of the market. A minority based their position on a belief that using margins, for purposes of price control, would not be effective. There was a substantial sentiment for reform in the futures markets, but it was directed toward discipline of unethical conduct and not toward dampening speculative activity.

Historically high margin requirements probably did restrict daily price fluctuations. However, unbalanced markets attracting inadequate speculation to meet active demands by hedgers often show the widest seasonal price swings. Furthermore, high margin requirements directly or indirectly increase the hedger's costs of merchandising and processing his inventories, and these costs are passed back to the farmer, or on to the consumer, in one form or another. Therefore, it would not be in the public interest to impose high margin requirements unless it were clear, in an individual market situation, that speculation discourageable by the contemplated increase was in fact the real cause of the excessive price fluctuations. The single criterion that whenever volume of trading and/or price fluctuations were "unusually" large, margins should be raised, would be entirely inadequate, and, at times, disruptive to the market's own self-corrective capabilities.
Prompt, accurate determinations of when and whether to apply margin controls in order to moderate "excessive" price fluctuations would require highly sophisticated systems of market data collection and tabulation by the CEA. This intelligence would need to be interpreted properly and quickly. In our opinion, the CEA's budgets would not have supported this effort during recent markets. Furthermore, administrative and operational problems would complicate the process of making sound determinations of when and under what circumstances margin controls should be applied. Pending such developments, our finding is that use of minimum margin requirements by the CEA to control price fluctuations would not be in the public interest. As a corollary to this conclusion, however, we suggest that capabilities, leading to complete market analysis, should be developed by the Authority (if it were provided with adequate funds).
INTRODUCTION

The question posed in this study is whether or not the regulation of margins in grains futures markets is a feasible means of moderating wide price fluctuations in those markets. The scope of the study was limited to the effect of margins on prices through their influence on speculation. No consideration was given to the possible extension of margin controls to hedging or other aspects of market operations. In part this was due to the fact that the Commodity Exchange Act exempts bona fide hedging from trading limits and permits special treatment for spreading. In order to orient the problem, for practical purposes it was necessary to consider the following questions:

1. Can "excessive" speculation be defined and measured?

2. Can excessive speculation be associated with "undue" price fluctuations?

3. Are mandatory margin requirements a feasible instrument for moderating such speculation and price movements?

4. If the answer to the foregoing is yes, to what extent would it be in the public interest for the Government to establish such margin requirements?

5. What administrative problems might be anticipated in exercising such authority?

For practical purposes the study was limited to wheat, corn, and soybeans. These were the most important and active commodities. It was further limited to active markets in the
U.S. In effect this meant the Chicago Board of Trade with reference, in part, to the Kansas City Board of Trade and Minneapolis Grain Exchange. Insights into commodity futures behavior have been provided in the literature through the study of other commodities and other produce markets. These results were utilized in the study of wheat, corn and soybeans, although we did not directly investigate the other markets.

At the outset a definition of speculation was needed and this is not so simple as appears on the surface. Both the activity of buying or selling, or for that matter crying out bids and offers, and the holding of contracts are considered speculative activity according to the context. No single measure would suffice, so we resorted to several measures expressing different aspects of speculation. Rather than argue semantics about definitions, we have tried to be clear about our meaning in each instance.

"Excessive" speculation and "undue price fluctuations are subjective terms. It was necessary to adopt limits that seemed reasonable although not all readers will agree with us. Even if there is disagreement over the conclusion, the techniques developed here are available to test for whatever other definition of excessive or undue is considered preferable.

The terms of reference called for a finding on the public interest in the regulations of margins in futures markets. This is a political judgment that could not be arrived at in an objective study. We can do no more than point out and comment on the factors that must be taken into account in arriving at an opinion on the matter. Sometimes an observation on this subject may appear to be stated dogmatically. This does not mean that we do not recognize the limitations of our study, but rather that some opinions are so generally held that we did not wish to spend the time qualifying them. If we are wrong about the general acceptance, then at least we recognize the right of disagreement by the reader.
The study concentrated in large part in a rigorous statistical investigation of market price fluctuations and the market phenomena associated with them. In spite of the voluminous statistics on grains futures markets, the materials for the study of the margins and speculation problem were limited. The breakdown of the composition of open interest is only partial and is available for only two days of the month (the last market day on or before the 15th and 31st of the month). Margin changes in the past have not been directly comparable with those posed in the present problem so that the purely statistical answer is not wholly satisfactory. In spite of these shortcomings, we believe the results have been stimulating and that techniques have been developed which will be extremely useful in the future.

The second division of the study consisted of consultation with informed opinion in the subject of grains futures markets. This was carried out through personal interviews, correspondence, and study of the literature in the field. The interviews included a broad cross-section of traders, brokers, exchange officials, processors, and professional economists specializing in futures market studies. By special reference the experience of the Federal Reserve Board in regulating margins in the securities markets was included. This serves both to clarify the difference between margins in futures markets and in securities markets for the inexperienced reader, and to uncover any useful lessons that might be applied to futures markets.
PART I

RELATIONSHIPS BETWEEN SHORT-RUN CHANGES IN FUTURES PRICES AND THE SIZE AND COMPOSITION OF CONTEMPORARY HOLDINGS IN FUTURES CONTRACTS
MEASURES OF SPECULATION:
SELECTION AND DEFINITION OF TERMS

Speculation in commodity futures has been defined differently on many occasions. Far more often, its proponents and disparagers alike have discussed it authoritatively without first fixing its meaning. Since the accepted function of these speculators is accepting risks traditionally offered by hedgers, let us broadly define speculations as both the transaction by which the speculator assumes that risk (establishes a position), or terminates it, and the holding of an open speculative position in the interim. Both these transactions and the speculative holdings are valid, complementary descriptions of what the speculator does in hopes of gaining (profit).

Our objective in defining speculation is a practical one: we wish to measure it quantitatively, using the statistics routinely published by the CEA in order to do so. Since the Commodity Exchange Act does not define speculation, but does define "bona fide hedging" transactions, let us assume that speculation is any transaction which the CEA would not recognize as hedging, and/or the (speculative) holding of an open commitment by anyone who is not a hedger within the meaning of the Act. This will enable us to adapt to our own needs the routinely published classifications of reporting (large) traders commitments and trades, and also to use the special classifications of all open positions or all trades, when these are published as a result of special market surveys. The CEA records, then, will determine for us whether a given transaction is speculation. To this definition, we add a single exception. The CEA classifies all hedging, including long and short hedging in the same account which partly offset each other, as hedging. At least some of this matched hedging by small (non-reporting) traders will be included in our matching positions, which we will treat as speculative.

1/ Section 4a (3) of the Act, as amended.
Regarding the price effect of speculation, many observers have suggested that this influence varies with the quality -- timing or knowhow -- of the speculator (e.g., "informed" vs. "uninformed" traders). Until full details of trading activities are routinely published, this argument probably will not be reconciled. In this report, we accept the probability that speculation may have a qualitative as well as a quantitative influence. Therefore, and because most speculative transactions cannot be measured accurately with market statistics now and historically provided, we have to use several different, but somewhat interrelated, variables in order to measure speculation as fully as possible.

**Qualitative Distinctions in Speculation: Four Ratios**

*Used to Describe and Measure Relationships.* These ratios are used to distinguish between different combinations or balances of several classifications of total open contracts. We use many of these ratios in a wide number of tests reported in this and the following part of this report. Each ratio is defined separately below, and several remarks are then given to indicate its distinctive usefulness. Later, we also refer to the appendices in this part, which provide notes on how to calculate the more unusual relationships. Our terminology may seem strange: here we are introducing definitions of variables intended to measure speculation, and call them by hedging names. Partly, this is a matter of convenience, since total short and total long hedging calculations usually are required for other purposes, while their speculative counterparts -- total long speculation or total short speculation -- might not be calculated in certain situations. Secondly, if the three contract markets we will be examining in this part of this report are recognized as being primarily hedging markets, rather than speculative markets, our semantics will seem more appropriate. Many competent individuals insist that most large and moderate orders in business transactions are initiated
by hedgers, not by speculators; Holbrook Working (16)\(^1\) argued that speculation enters a futures market in response to hedging needs.

(1) Speculative Index. Direct measure of the amount of "excess" speculation that is not "needed" to carry the unbalanced hedging (usually short) in the market at a time when the total open contracts can be classified. This extremely important benchmark is discussed more thoroughly in the next section of this report and in Appendix A-II. The symbol we use is "T".

(2) Hedging Ratio, which equals total long hedging divided by total short hedging. This ratio is also approximately equal, in a given market, to the ratio of total short speculation divided by total long speculation. Either measures the balance between the long and short commitments in that category of open contracts, i.e., how well each category of open interest is self-balanced. In practice, this ratio will vary from a very small number (approaching zero) to a high figure of over 2.5.

(3) Total Hedging Load equals total long hedging plus total short hedging, expressed as percent of open interest. The sum of these two hedging categories is also proportional to the reciprocal of the total speculative positions, i.e., total long speculation plus total short speculation, plus total matching, likewise expressed as percentages of open contracts. Logically, this variable will be closely correlated with price change in markets where hedgers operate quite selectively, rather than automatically hedging their inventories according to the calendar or the harvest.

\(^1\) Numbers in parentheses refer to references in the Bibliography, page 244.
(4) Matching Positions (expressed as a percent of open interest) calculated as the matching contracts of each trader who has both long and short commitments in the same commodity and the same market. These include the short positions of traders net long, the long positions of traders net short, and the positions of traders even. Speculators, in this case spreaders, make up most of this category, but matched hedging can constitute between 10 and 15 percent of this big fraction of total open contracts. Another reason for isolating matched positions from other definitions of speculation is the likelihood that, as a group, these spread positions have a different price-making influence than do straight net long or net short commitments.

(5) First differences of these ratios, or changes in a ratio over a given interval of trading, also quantify distinctive characteristics of speculation. One, the change in the hedging ratio, may be a particularly sensitive barometer of "buying pressure" or "selling pressure". Note that if this ratio increases between two consecutive dates, it means that long hedging has increased more proportionately than has short hedging in this trading interval, and, all other things being equal, price should rise. However, an increase in the hedging ratio also means that short speculation has increased more than has long speculation. If the price did fall instead of rise, you would have a subtle barometer of market balance.

(6) The joint effect which several speculative ratios have on prices can also be tested. In many market situations, the combined effect of several variables logically could be expected to approximate the true price-influencing force of speculation. These joint variables have numerous possibilities but are somewhat difficult to define.
Volume of Trading - Open Contract Ratio

Here we have an indicator which gives us an appropriate comparison between: (1) all trading reported during any period specified and (2) the size of the contemporary open interest. High ratios reflect conditions within the market which often cause price instability, and very low ratios indicate a thin market, and sometimes indicate unpredictable price behavior. We cannot isolate the hedging fraction from this ratio. Therefore, we cannot call this indicator a true measure of speculation.
Estimation of Classifications of Total Open Contracts

Total open contracts in wheat, corn and soybeans futures on the Chicago Board of Trade were classified as either speculative (long or short), hedging (long or short) and matching. These classifications were developed from published CEA reports of percentages of total open contracts held by large or reporting traders on mid- and end-of-month dates. Statistical estimating equations attributed to Larson\(^1\) were used to classify the fractions of open contracts not previously classified by the CEA (i.e., non-reporting traders).\(^2\) Total open contracts were classified in this manner for these three commodities during ten consecutive crop years beginning in 1956. In addition, similar data were calculated for selected crop years for shorter intervals prior to July 1956. A relatively complete picture of how the structure of trader's commitments in futures contracts has varied during the last twenty years was the intended result of the tabulations.


\(^2\) For an example of how to classify total open contracts from the information published routinely on commitments of reporting traders by the CEA, see Appendix A-I.
Balances Between Speculative and Hedging Positions

The relative importance of speculative positions not needed to offset unbalanced hedging commitments was determined for each of the dates on which total open contracts were classified. These determinations were based on solutions of the equations for a Speculative Index developed by Holbrook Working.¹ This Index provided quantitative expressions of the ratio of speculative positions (long or short) not needed to carry unbalanced hedging compared with total hedging positions. However, matching positions, which the CEA defines as speculative holdings, are not reflected in Working's Speculative Index.²

Determination of Average and Unusual Values of Speculative Indexes

Simple monthly averages of this Speculative Index for each commodity were calculated for the entire nine crop year period beginning in 1956. Standard deviations were then calculated for each monthly average. Whenever the calculated Speculative Index was more than one standard deviation above or below the monthly average for that particular month, the contemporary market situation was noted for further analysis. If the index was more than one standard deviation above the monthly average, this instance was identified as a market situation containing a high level of unneeded speculation. If the index was more than one standard deviation below the monthly average, then the

²/ For examples of how to calculate Speculative Index values, given Larson's estimates of classification of total open contracts, see Appendix A-II.
contemporary market was classified as one involving low or inadequate level of speculative activities. The same criteria for identifying markets containing either high or low levels of unneeded speculation were followed during the entire twenty year period ending September 1966: each individual Speculative Index was compared with the 1956-65 monthly average. Two important changes in market structure determined the selection of the nine-year interval for which averages and variability of this index were determined. In July 1956, the Commodity Exchange Act was amended to permit processors or manufacturers to report certain purchases as anticipatory hedges; these positions would have been reported previously as speculative. In the early summer of 1966, enormous growth occurred in both the Chicago wheat and corn futures markets. Prospective contrasts between composition of open contracts in these markets and equivalent commitments during an "average" year would best be highlighted by excluding 1965-66 figures from the sample used to develop average market characteristics.

Special Analysis of Markets Containing High or Low Levels of Unneeded Speculation

Comparisons were made between average characteristics descriptive of markets containing either high or low levels of unneeded speculative positions. Various criteria of measurement were used to express short-run price fluctuations. In addition, quantitative calculations of the size of hedgings, matching, and unneeded speculative positions, and of monthly trading volume, were developed to provide alternatives in comparing market composition and size. The relationship between total long hedging and total short hedging was expressed quantitatively as a Hedging Ratio.1/

1/ The concept of a Hedging Ratio was also suggested by Working., op. cit. The Hedging Ratio is greater than 1.0 whenever total long hedging positions exceed total short hedging commitments. Furthermore, long speculative holdings total more than short speculation whenever the Hedging Ratio is less than 1.0.
Detailed results of what types of price fluctuations or extreme price ranges were associated with either high or low values of Speculative Indexes were made by visual inspection of graphs of these series. Additional comparisons were made of average price behavior associated historically with characteristics of markets containing contrasting levels of open contracts, trading volume, and size of unneeded speculative positions.
Soybean Futures, 1953-54, 1955-56. During twelve marketing years between September 1, 1953 and August 31, 1966 \(^1\) speculative positions were poorly balanced with hedging requirements about 32 percent of the time. Speculative positions other than matching were well in excess of contemporary hedging requirements on 52 occasions, or about 18 percent of the total number of dates on which open contracts could be classified. The margin of unneeded speculative commitments was quite low, and speculation therefore termed inadequate on 40 occasions, or about 14 percent of the time. Cases of unneeded speculation being either high or low were noted in each of the twelve crop years reviewed. However, nearly two-thirds of these cases fell within five crop years (1953-54, 1957-58, 1960-61, 1961-62, 1964-65). Speculation during the last four calendar years generally has been inadequate to meet hedging demands.

Figure 1.1 shows the variability in monthly averages for the Speculative Index in soybean futures during nine years. This chart also indicates which individual Speculative Index values during this period were more than one standard deviation above or below their particular monthly averages. The general seasonal variation in this index is plausible: pre-harvest-levels of unneeded speculation might be high, but should drop rapidly as new crop supplies are hedged. Likewise, the seasonal rise in the Speculative Index from

\(^1\), Crop year 1954-55 omitted.
MONTHLY AVERAGE SPECULATIVE INDEXES, $T'$, SOYBEAN FUTURES, 1956-65

Also shown: Each single classification report for which the Speculative Index, $T'$, was more than one standard deviation ($s_t$) above or below the monthly average, $T'$. See legend below.

Average speculative indexes, $T'$, based only on mid- and end-of-month classifications of total open contracts. (Simple monthly averages are based on classifications derived from all reports published between September 15, 1956 and August 31, 1965.)
February through May coincides with the lifting of many of these short hedges as hedged supplies are consumed. Intercrop year differences and the Speculative Index are highest at the end and beginning of the crop year.

Chicago Wheat Futures: 16 Crop Years Between 1948 and 1966. Individual Speculative Index values for 16 crop years were compared with the 1956-65 monthly average and standard deviations of this series. Between July 1956 and June 1965, speculative positions well in excess of contemporary hedging requirements were noted on about 16 percent of the total number of dates on which open contracts could be classified. The margin of unneeded speculative contracts was quite low about 14 percent of the time. Variability of individual Index values during six selected crop years before 1956 differed slightly; approximately 29 percent of these indexes were high, and about 14 percent were low, compared with the 1956-65 monthly average. During 1966, Speculative Index values were low on each of the eight semi-monthly dates on which total open interest could be classified, between March 15 and June 30.

Figure 1.2 shows the monthly average Speculative Index for wheat, based on 1956-65 figures, and identifies each single occasion on which the Speculative Index during 16 crop years was more than one standard deviation above or below this average. The pronounced seasonal variation in monthly averages for the Speculative Index is highlighted on this chart. Dispersion of observations about each monthly average was quite narrow from July to December and unusually wide between February and June. During the first quarter of the crop year, when open contracts in wheat futures normally increase, Speculative Index values were uniformly low and speculation in most years could be
judged as being barely adequate to match hedging requirements. In contrast, Speculative Indexes between early March and the end of May were relatively high, and prices after late January in many years might have been influenced significantly by speculative opinion.

Corn Futures: 1956-65. Speculative positions other than matching were found to have been in excess of contemporary hedging requirements about 15 percent of the total number of dates on which open contracts could be classified. The margin of unneeded speculative contracts was quite low on a similar number of occasions. On the average, this Speculative Index was considerably lower than the one developed for soybeans during the equivalent nine years. In particular, the simple average for the corn Speculative Index during 1956-65 was 1.111. This figure means that unneeded speculative positions other than spreading averaged less than 10 percent of the total hedging commitments and comprised about 6 percent of the total open contracts.

Figure 1.3 illustrates the seasonal variability of the corn Speculative Index and identifies each occasion on which the Speculative Index was more than one standard deviation above or below the monthly average for this nine year period. Except during the first and the final quarters of the crop year, dispersion of individual index values about the average was quite small. Speculation in corn futures did not show as high a degree of variability as did equivalent holdings in soybean contracts.
Soybean Futures: 1953-54, 1956-66. Weekly price ranges for representative contracts and Speculative Index values since January 1954 are plotted on Figure 1.4 Casual inspection will indicate that the correlation between these two series is not close. No inference could be drawn that an increase in the Speculative Index usually signalled a major price rise; price rises in major bull markets led sharp increases in Speculative Index values by approximately 3 months in 1954, 1956, and 1961. Highest values for the Speculative Index during each of these bull markets actually occurred between four and seven months after price started to decline. Since 1956, with the notable exception of the summer of 1961, most large swings in the Speculative Index occurred during periods of price stability. Finally, since 1961, moderate price swings have led Speculative Index values by 3 to 5 months. A notable single exception to these observations occurred in 1966, when the Speculative Index rose modestly; this trend paralleled quite well the rise in soybean prices that spring. Finally, this chart highlights the contrast over time in the level of unneeded speculative positions: the high levels of unnecessary speculative holdings during the summer of 1954 have not been approached since then; and since early 1963, most speculative commitments have been required to carry unbalanced hedging loads.

The contrasts in price behavior between groups of soybean futures markets containing high and low levels of unneeded speculation are emphasized in Table I.1. This summary classifies how often certain, specified kinds of price fluctuations were associated with either high or low levels of Speculative Indexes. The various columns
Figure 1.2
Wheat Futures Contracts, Chicago Board of Trade: Monthly Average Speculative Indexes, T', 1956-65
Also shown: Each single classification report for which the Speculative Index, T', was more than
one standard deviation (s_t) above or below the monthly average T', during each of the 16 crop
years between 1947-8 and 1965-6 indicated in the legend below. And: Index of seasonal variation,

Key to Crop Year Code Letters and Symbols
Explanation of symbols enclosing code letters:
- Two of these reflect the scarcity □ or
  abundance ○ of free wheat supplies
  relative to demand, especially during the
  final quarter of the crop year;
- The balance, associated with the
  symbol ■ are unusual situations discussed
  individually in the text.

Average speculative indexes, T', based only
on mid- and end-of-month classifications of
total open contracts. (Simple monthly
averages are based on classifications derived
from all reports published between September

Percent of Average Annual Cash Price,
No. 2 SRW Wheat, Chicago

1956-65 Average T'
MONTHLY AVERAGE SPECULATIVE INDEXES, $\bar{T}$, CORN FUTURES, 1956-65

Also shown: Each single classification report for which the Speculative Index, $T'$, was more than one standard deviation ($s_T$) above or below the monthly average, $\bar{T}'$. See legend below.

Average speculative indexes, $T'$, based only on mid- and end-of-month classifications of total open contracts. (Simple monthly averages are based on classifications derived from all reports published between October 15, 1956 and September 31, 1965.)

\textbf{CROP YEARS}
- 56-7
- 57-8
- 58-9
- 59-60
- 60-1
- 61-2
- 62-3
- 63-4
- 64-5

$T' = \text{Avg. } T'$, Sept. 15, 1956 thru August 1965

$T' \pm s_T$
Table I.1 Relationship Between Level of Speculation and Price Fluctuations: Soybean Futures, 1953-54, 1955-66

How often specified types of price behavior were associated with either high or low percentages of "unnecessary" speculative positions during twelve marketing years. Levels of speculation are based entirely on mid- and end-of-month classifications of total open contracts in soybean futures.2

<table>
<thead>
<tr>
<th>Description</th>
<th>High Speculative Index</th>
<th>Low Speculative Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of separate</td>
<td>Number of semi-</td>
</tr>
<tr>
<td></td>
<td>market situations</td>
<td>monthly classification dates included</td>
</tr>
<tr>
<td><strong>Extended market periods</strong>2/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associated with wide daily price fluctuations and/or extremely wide price ranges</td>
<td>1 (1954)</td>
<td>8</td>
</tr>
<tr>
<td>Market period included most of price range made during eight months of trading although entire price move was moderate when compared with major bull markets</td>
<td>1 (1957)</td>
<td>5</td>
</tr>
<tr>
<td>Narrow price ranges, small daily price fluctuations throughout most of market period</td>
<td>3</td>
<td>29</td>
</tr>
<tr>
<td><strong>Brief market periods</strong>3/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market period included very sharp price ranges and/or market period followed immediately by sharp price swing</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td>Market period followed shortly by major price rise</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td>Associated with declining prices following major price rises; daily price fluctuations sometimes large</td>
<td>1 (1956)</td>
<td>1</td>
</tr>
<tr>
<td>Narrow price fluctuations price ranges narrow compared with rest of contract prices</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>11</td>
<td>52</td>
</tr>
</tbody>
</table>

1/ Matching or spread positions are not included. Speculative Index values more than one standard deviation above or below monthly average classify market situation as either high or low, respectively.
2/ Including more than three consecutive semi-monthly dates on which open contracts could be classified, and therefore presumably lasting two months or longer.
3/ Including three or fewer semi-monthly classification dates; presumably shorter than two months.
in this table enable one to distinguish between independent
market situations and the relative frequency or importance
of these different relationships. Clearly, this evidence
does not support the hypothesis that "excessive speculation"
causes or is even associated historically with market
periods containing "unwarranted or undesirable price fluc-
tuation". Of the 52 separate, semi-monthly dates on which
classification of total open interest indicated that the
unneeded speculative fraction was high relative to hedging
requirements, 39 cases were identified as markets in which
prices showed little movement. However, in 36 out of the
40 cases for which the calculated Speculative Index was
low, price behavior was entirely different. Prices in
these particular markets moved over wide ranges, sometimes
rising and falling rapidly during a relatively short period
of time, and often showing wide daily price ranges over
an extended period of time.

Further reference to Figure 1.4 will identify the
individual market situations tabulated in Table I.1. For
each of the 92 mid-month or end-of-month dates on which
the Speculative Index was either high or low, this chart
also shows the Hedging Ratio (total long hedging divided
by total short hedging), and these components of total open
contracts: matching positions; total hedging (long and
short); and speculative positions (long or short) not needed
to carry unbalanced hedging loads. Visual comparisons of
these additional series with contemporary weekly price
ranges suggested the following general relationships in
these particular markets. The Hedging Ratio possibly
was more closely correlated with changes in price than was
the Speculative Index. However, changes in this ratio often
lagged price moves by as much as four to six months. Total
hedging loads, expressed as a percent of open contracts,
followed price moves quite closely, increasing concurrently with periods of price gains and decreasing in importance shortly before or after prices turned down. Unneeded speculative positions moved closely with changes in the Speculative Index, as would be expected, and lagged important price moves by many months. Changes in matching or spread positions were closely and inversely related to changes in total hedging positions. However, shifts in matching commitments probably did not lag corresponding price moves as noticeably as did equivalent moves in the Speculative Index series.

Chicago Wheat Futures: 1954-66. The typical seasonal pattern of cash wheat prices during the past twenty years is well known. Referring again to Figure 1.2, one notes that the seasonal price index -- represented by the heavy broken line -- moves parallel to (changes in) monthly average Speculative Indexes during most months. However, average prices showed little net change from January through April, when the Speculative Index usually made its spectacular seasonal rise. Since the margin of unneeded speculative positions in Chicago wheat futures during the first half of the crop year uniformly was quite low, attention should be concentrated on how price behavior and levels of speculative holdings were correlated during the January to June periods.

A simple correlation between price ranges for five day intervals and Speculative Index values was determined for the first four months of each of the nine years from 1956-65. Price ranges varied from slightly more than 1 cent per bushel to nearly 17 cents a bushel. Speculative Index values varied from 1.00 to 2.14. The simple correlation coefficient was statistically significant and indicated that about 31 percent of the variance in the five day price
ranges could be attributable to Speculative Index values. Figure 1.5 shows weekly price ranges of representative wheat futures contracts and Speculative Indexes since January 1954. Additional series, plotted for the January through June intervals only, illustrate the Hedging Ratios, and composition of various classifications of total open contracts. Disregarding the several occasions of abrupt price changes attributable to changes in effective loan rates, even the most casual inspection of this chart will emphasize the seasonal patterns in both prices and Speculative Index. Furthermore, during the second half of each crop year, changes in price level often were accompanied by similar changes in this Index.

This positive correlation, which was suggested for at least one-half of these twelve years, is in marked contrast to the relationships noted between soybean price moves and Speculative Index values. However, exceptions do show why, even in wheat, this correlation is not particularly close: in 1957, and again during each of the last three years, Speculative Indexes often moved in the opposite direction to prices, or lagged price moves by several months. An inverse relationship was particularly noticeable during the late spring of 1966. The margin of unneeded speculation was quite low in March and declined further, contra-seasonally, through June. This decline in the Speculative Index coincided perfectly with the sharp price rise and wide price swings which occurred in June.

Other relationships between short-run price behavior and changes in classifications of total open contracts may be noted in wheat futures since 1954. Figure 1.5 shows several of these relationships during the last half of each crop year. The Hedging Ratio showed a relatively close,
positive relationship to price moves well over half the time: one estimate indicates parallel movement in these two series over at least part of the six month periods during nine of the twelve years covered. Total hedging (long and short) probably was positively correlated with price movement during eight of these years: an inverse relationship was noted during four distinct periods in other years, however. Matching positions were inversely related to total hedging positions, which is quite logical. The relationship between matching and price trend apparently was too indefinite to be determined from this chart.

Corn futures price behavior during 1956-65 was in marked contrast to that noted in the preceding paragraph. Monthly price ranges usually were quite narrow, when compared with contemporary price moves in other commodities or with price fluctuations in previous or subsequent corn futures markets. More specifically: monthly price ranges of important contracts exceeded 10 cents per bushel during only five out of these 108 months. Comparisons between levels of speculative positions and the degrees of price fluctuations indicated quite convincingly that monthly price ranges were not related to levels of speculative positions during this nine year period. Table I.3 summarizes the relationships which were noted. Apparently the level of unneeded speculation, as measured by the Speculative Index, did not influence the occurrence of monthly price ranges of less than 10 cents a bushel: both small and moderate price fluctuations occurred roughly in the same proportion of markets containing each of the three levels of speculation. The fact that no large price fluctuations were associated with high levels of speculation would cause one to question whether excessive speculation caused unnecessary price fluctuations in corn futures during this nine year period.
Figure 1.5
WHEAT FUTURES CONTRACTS
Chicago Board of Trade
1954 - 1966

Speculative indexes based on classifications of total open contracts, midmonth and month-end dates. Also shows, for January through June intervals only, ratio of total long hedging positions - total short hedges. Percentages of open contracts classified as hedges (long and short added together), matching, and other speculative positions (long or short) not needed to carry unbalanced hedging.

Nudging Ratio
\( N_5 = N_4 \)

Speculative Index (Left Scale)

Total Hedging as % O.C. (Right Scale) Long and Short

Matching (Right Scale)

Speculative Positions (minus unbalanced hedging) (Right Scale)

Total Hedging

Matching

WHEAT: WEEKLY HIGH, LOW, AND CLOSE OF NEAREST FUTURES CONTRACTS, Chicago Board of Trade

Cents per Bushel

Table I.2  Chicago Wheat Futures Markets, 1948; 1951, 1953-66

Comparisons of selected characteristics, by markets, with contrasting levels of "unneeded speculation", for 16 years

<table>
<thead>
<tr>
<th>Item of Comparison</th>
<th>Classification of Market[^1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speculative Index Values: Simple average, end of December through end of following April (nine observations per year)</td>
<td>Speculative Index High 1.6007 Speculative Index Low 1.1670</td>
</tr>
<tr>
<td>Price Ranges: Average price range for nearby contract during five trading days following semi-monthly dates for which Speculative Index values calculated</td>
<td>Price Range High 6.06/bu Price Range Low 3.64/bu</td>
</tr>
<tr>
<td>Volume of Trading - March and April</td>
<td>Volume of Trading High 170,006-523,834 Volume of Trading Low 106,027-355,504</td>
</tr>
<tr>
<td>Range, M bu</td>
<td>Range Low 340,989 Range Low 249,939</td>
</tr>
<tr>
<td>Simple average, M bu</td>
<td>Simple average Low 67,825 Simple average Low 74,512</td>
</tr>
<tr>
<td>Total open contracts - end of March and end of April</td>
<td>Total Open Contracts High 49,876-87,599 Total Open Contracts Low 43,497-125,937</td>
</tr>
<tr>
<td>Range, M bu</td>
<td>Range Low 67,825 Range Low 74,512</td>
</tr>
<tr>
<td>Simple average, M bu</td>
<td>Simple average Low 20,565 Simple average Low 10,800</td>
</tr>
<tr>
<td>Speculative positions not needed to carry net hedging</td>
<td>Speculative Positions High 12,987-26,465 Speculative Positions Low 5,835-18,038</td>
</tr>
<tr>
<td>Range, M bu</td>
<td>Range Low 20,565 Range Low 10,800</td>
</tr>
<tr>
<td>Simple average, M bu</td>
<td>Simple average Low 20,565 Simple average Low 10,800</td>
</tr>
<tr>
<td>Matching Positions: percent of total open contracts</td>
<td>Matching Positions High 40.66-50.12 Matching Positions Low 32.52-49.68</td>
</tr>
<tr>
<td>Range, M bu</td>
<td>Average Low 45.59 Average Low 39.66</td>
</tr>
</tbody>
</table>

[^1]: Speculative Index values are based entirely on mid- and end-of-month classifications of total open contracts. During January-April periods, Speculative Index values were more than one standard deviation above the 1956-65 monthly average in 28 instances and were low (more than one standard deviation below this average) on 23 cases.
Table I.3 Relationship Between Monthly Price Ranges, Selected Corn Futures Contracts, 1956-65
and Percent of Speculative Positions not Needed to Carry Imbalanced Hedging.

For comparison, frequency of occurrences of each classification of price fluctuation
and average level of speculation are shown.

<table>
<thead>
<tr>
<th>Item of Comparison</th>
<th>Level of Speculation: Number of times semi-monthly calculations at each level were associated with different classifications of contemporary monthly price ranges</th>
<th>Distribution of levels of price fluctuations</th>
<th>Number of times average level of speculation was associated with each level of price fluctuation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High(^2/)</td>
<td>Average(^2/)</td>
<td>Low(^2/)</td>
</tr>
<tr>
<td>Price fluctuations, as measured by monthly price ranges(^1/)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small: 5¢/bu or less</td>
<td>17</td>
<td>80</td>
<td>19</td>
</tr>
<tr>
<td>Moderate: more than 5¢ but less than 10¢/bu</td>
<td>15</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>Large: 10¢/bu or more</td>
<td>0</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

Distribution of three levels of Speculation:
Summary for all 108 months: Number of semi-monthly calculations of Speculative Index included in each level of speculation

| | | | | |
| Percent of total (of 216 semi-monthly Speculative Indexes) included in each level of Speculation | 32 | 153 | 31 | - |

\(^1/\) Monthly price range was determined by either July or December corn futures contract prices. Price ranges of either contract during delivery month were not considered. With this exception, classification of price fluctuations reflect the larger of the two monthly price ranges of these selected contracts.

\(^2/\) Level of Speculation is classified by the value of individual Speculative Index compared to the 1956-65 average of this Index for that month. High level of Speculation means that the Index was more than one standard deviation above this average. Low level means that the individual Index was more than one standard deviation below this average. Average levels included all other individual Indexes: these were within one standard deviation of the monthly average.
A brand-new contrast in relationships between Speculative Index and corn futures prices is offered by the 1965-66 crop year. Speculative Indexes were low on 16 out of the 24 semi-monthly dates on which total open contracts could be classified. The level of unneeded speculation other than matching contracts was negligible from May through September 1966, when wide price fluctuations and large price gains occurred. Last summer, then, Speculative Index values declined contra-seasonally while short term price fluctuations widened to historic levels.

Corn Futures: 1947-56. Levels of speculative positions during periods of wide price fluctuations in 1947-56 corn futures markets. Short-run price fluctuations between February 1947 and September 1956 often were relatively wide. Speculative Indexes were calculated whenever price ranges during the subsequent one and a half months of trading exceeded 10 cents per bushel.\footnote{1} Accordingly, a total of 123 (out of a possible 240) semi-monthly indexes were calculated for the period between the end of February 1947 and the end of September 1956. Eighty-five out of these individual Speculative Indexes were at least one standard deviation above the corresponding 1956-65 monthly average of the Index. Therefore, nearly 70 percent of corn futures markets between 1947-56 characterized by wide price fluctuations also contained high levels of speculative positions not required to balance net hedging loads. Also, certain individual Speculative Indexes were relatively high when compared to similar levels of speculative positions in contemporary wheat futures markets or in most soybean futures markets since 1955. These findings are in direct contrast to equivalent relationships noted in subsequent corn futures markets.

\footnote{1}{Basis either the July or December futures contract.}
HOW PRICE BEHAVIOR VARIED WITH OPEN INTEREST AND VOLUME OF TRADING

Can the numerous, important instances of price instability in futures markets containing low levels of unneeded speculative holdings be explained credibly by other factors? Under what specific market conditions is it plausible to imply that inadequate speculative holdings did, in fact, contribute to price volatility? The relationships considered in the preceding section intentionally oversimplified real market situations. In order to make comparisons between different years and different commodities, hedging, matching, and other speculative positions were expressed as percentages of total open contracts. Yet open interest, or the total number of bushels represented by futures contracts shown to be open as of the close of the market on a given day, does vary widely. So does volume of trading, or the amount of a commodity traded in a futures market during a specified period of time. Can these two factors be related to price behavior in such a way as to refine findings already reported?

Soybean Futures, 1953-54, 1955-56

How average total hedging and speculative commitments varied in soybean futures markets containing high and low levels of unneeded speculation. Comparisons between the 52 occasions when the Speculative Index was high and the 40 instances when this measure was low, show definite relationships between average size of the several classifications of total open contracts in these two market groups. Total open contracts held by speculators and not needed to balance net hedging were larger when the Speculative Index was high. The reverse was true about relative hedging.
positions. When the Speculative Index was low, average long hedging was nearly twice as large and average short hedging was approximately three times the average size of similar commitments in markets having a high Speculative Index.

Figure 1.6 enables one to make absolute or quantitative comparisons between hedging and speculative positions in any soybean market for which the individual Speculative Index was either high or low. Several important trends in Open Interest during the last ten years are clearly emphasized by this chart. The enormous growth in the number of open contracts since May 1956 is attributable almost entirely to increases in hedging and matching commitments: other speculative positions have been barely adequate to balance hedging demands in the huge markets developed during the last six years. Furthermore, use of this market by hedging interests has been highly irregular: seasonal hedging practices cannot explain why hedging loads were so large in 1961 and early 1965, nor why hedging interests elected to make little use of the futures market in marketing the large crops harvested in 1962 and 1965. Regardless, this chart clearly indicates that speculative commitments entering soybean futures markets since early 1963, other than spread (matching) positions, have been needed to meet unbalanced hedging. On the other hand, these matching positions, which the CEA considers as speculative holdings, cannot possibly be ignored, when considering market structure or estimating the price effects of speculative holdings.

Relationships between the volume of trading, total number of contracts, and levels of "unneeded" speculation. Table 1.4 clearly confirms that soybean markets in which a low level of unneeded speculation existed were considerably
larger, in terms of open contracts, than were contemporary markets with high levels of similar speculative holdings. This table also suggests a corresponding relationship between monthly volume of trading and Speculative Index values. While the ranges in both monthly volume and open contracts were wide for both classes of markets, the differences in these average characteristics are statistically significant. The annual volume of trading in all soybean futures contracts nearly quadrupled during the twelve years represented by these data; and during the last four calendar years, the total volume of trading in this market exceeded the total trade during the previous eight years.

**Corn Futures Markets: 1947-66**

The pronounced changes in speculative and hedging positions, price behavior, and other related characteristics of corn futures markets during the last 20 years are summarized in Table I.5. The marked change in unneeded speculation was identified in an earlier section of this report. Several examples are cited here to illustrate why contrast in this particular statistic is highly relevant to any analysis of the price effects of speculation. A Speculative Index of 2.46 reflected the composition of the corn futures market on July 31, 1948. This criterion indicated that 46 percent of open contracts were classified as long speculative positions not needed to carry the very small (14.3 percent) short hedging load. Also, matching positions equaled over 37 percent of the total open contracts. Therefore, at the end of July 1948, speculators not actually "needed" by hedging interests controlled 83 percent of the long side of the open interest. Here are the equivalent measures of the corn futures market on July 31, 1966: only 1.8 percent of the total open contracts represented long speculation not needed to balance the huge short hedging
Figure 1.6
CLASSIFICATION OF ONE SIDE OF TOTAL OPEN CONTRACTS, SOYBEAN FUTURES
Selected Dates, 1956-1966

Mid- and end-of-month dates between July 15, 1956 and August 31, 1966, whenever speculative
index was more than one standard deviation above or below 1956-65 monthly averages. When short
hedging was larger than long hedging, this chart shows composition of short side of open
contracts. On the relatively few (16 out of 83) occasions when long hedging exceeded short
hedging, the chart shows the long side of open contracts.

Classification of Open Contracts
is identified by position on bar
and by shading.

At Bottom: HEDGING:
- short or __ long
  whichever is larger.

In Center: MATCHING positions

At Top: Other Speculative Positions
- long or _ short, not needed
to carry unbalanced hedging.

HEDGING POSITIONS NOT SHOWN IN UPPER CHART
When short hedging was larger than long hedging,
commitments. On 16 other dates, short hedges are shown. For shading code to identify hedging,
see legend.
Classification of Open Contracts is identified by position on bar and by shading.

At Bottom: HEDGING:
- short or long -- whichever is larger.

In Center: MATCHING positions

At top, Other Speculative Positions
- long or short, not needed to carry unbalanced hedging.

HEDGING POSITIONS NOT SHOWN IN UPPER CHART
When short hedging was larger than long hedging, this lower chart shows total long hedging commitments.

On 27 other dates, short hedges are shown. For shading code to identify hedging, see legend.
Table I.4 Soybean Futures Markets: Measures of Trading Volume, and Size and Turnover of Open Contracts, 35 Months When Speculative Indexes Were High Compared with 30 Months When Speculative Indexes Were Low

<table>
<thead>
<tr>
<th>Description of market</th>
<th>Volume of trading during month (thousands of bushels)</th>
<th>Total open contracts, first of month (thousands of bushels)</th>
<th>Indicator of rate of turnover of open contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple monthly average</td>
<td>Range</td>
<td>Simple monthly average</td>
</tr>
<tr>
<td>Speculative Index high²/</td>
<td>424,505#</td>
<td>192,100-1,090,400</td>
<td>109,293*</td>
</tr>
<tr>
<td>Speculative Index low³/</td>
<td>1,100,771#</td>
<td>181,700-2,002,100</td>
<td>197,613*</td>
</tr>
</tbody>
</table>

1/ Comparisons covered 1953-54 crop year and the eleven crop years between September 1, 1955 and August 31, 1966.
2/ More than one standard deviation above monthly average.
3/ More than one standard deviation below monthly average.
4/ Average of ratio of volume of trading during month to total open contracts, first of month.

# The difference in these averages is statistically significant. \( t = 6.108 \)
* These average characteristics also are significantly different. \( t = 4.906 \)
load; and 34 percent of the total open contracts were classified as Matching positions. This marked change in composition of open interest highlights the gradual shift in structure of "ownership" of corn futures contracts which had occurred during the last ten years. Referring again to figure 1.3, note that all the Speculative Indexes classified as high were before October 1962; and that all except one of the low Speculative Index values reflect markets since October 1961.

Table 1.5 indicates that widest average short-run price ranges in corn futures have been associated historically with both high and very low levels of Speculative Indexes. Rigorous analysis of this relationship, however, must include recognition of the joint or separate effects on prices attributed to the remarkable variation in the open interest in corn futures. During the past 20 years, the number of open contracts in corn futures has quadrupled. Shifts in market structure have been even more dynamic. Table 1.5 shows that average short and long hedging commitments have increased seven times during this period, while speculative positions (other than matching) not needed to carry unbalanced hedging loads were actually considerably smaller in 1966 than were equivalent commitments fifteen years ago. Figure 1.7 shows graphically how insignificant the number of unneeded speculative commitments other than matching has become since 1962. From a small, highly speculative market structure in 1947, the corn futures market evolved gradually during the next fifteen years into a much larger market in which hedging and matching positions now completely dominate the structure of open interest.

Chicago Wheat Futures Markets: 1948, 1951, 1953-66

Table 1.2 summarizes features (trading volume, open contracts, and speculative commitments) in two groups of
Table I.5 Chicago Corn Futures Markets, 1947 - 1966

Measures of Trading Volume, Size of Total Open Contract and Size of Speculative and Hedging Positions. Comparisons of selected characteristics for groups of markets of contrasting levels of "unneeded speculation" and average hedging loads.

<table>
<thead>
<tr>
<th>Item of Comparison</th>
<th>Classification of Market</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Speculative Index Values:</td>
</tr>
<tr>
<td></td>
<td>Range 1/</td>
</tr>
<tr>
<td>Speculative Index</td>
<td>1.08-2.46</td>
</tr>
<tr>
<td>Price Ranges:</td>
<td>7.6¢/bu</td>
</tr>
<tr>
<td></td>
<td>Average price range for nearby contract during five trading days following semi-monthly dates for which speculative index calculated</td>
</tr>
<tr>
<td>Range, M bu</td>
<td>259,790</td>
</tr>
<tr>
<td>Simple average, M bu</td>
<td>55,100</td>
</tr>
<tr>
<td>Total Open Contracts, 1st of month</td>
<td>34,295-80,632</td>
</tr>
<tr>
<td>Range, M bu</td>
<td>55,100</td>
</tr>
<tr>
<td>Simple average, M bu</td>
<td>55,100</td>
</tr>
<tr>
<td>Selected Measures of Speculation</td>
<td>Speculative Positions (long or short) not needed to carry net hedging</td>
</tr>
<tr>
<td>Range, M bu</td>
<td>3,282-22,144</td>
</tr>
<tr>
<td>Simple average, M bu</td>
<td>11,943</td>
</tr>
<tr>
<td>Matching Positions</td>
<td>Simple average, M bu</td>
</tr>
<tr>
<td>Simple average, percent of total open contracts</td>
<td>37.4</td>
</tr>
<tr>
<td>Hedging Loads</td>
<td>Short hedging, average, M bu</td>
</tr>
<tr>
<td>Long hedging, average, M bu</td>
<td>11,236</td>
</tr>
<tr>
<td>Ratio: Long hedging : short hedging, average</td>
<td>0.514</td>
</tr>
</tbody>
</table>

1/ The figures in this column do not represent measures of all corn futures markets between February 1946 and September 1956. Instead, these computations are based on 85 out of 123 semi-monthly Speculative Index values calculated for this entire period. A total of 240 Speculative Indexes could have been calculated; the 123 that were calculated were selected because they were associated with wide contemporary price fluctuations. Of the 123 Speculative Indexes calculated, 85 individual values were more than one standard deviation above the 1956-65 monthly average of the Speculative Index. None of the 123 values calculated identified Speculative Index lower than one standard deviation below the monthly average.

2/ This column represents averages and ranges of characteristics for 16 out of 24 semi-monthly dates during the 1965-66 corn crop year when the Speculative Index was more than one standard deviation below the 1956-65 monthly average.
Chicago wheat markets classified by Speculative Indexes. First, the top four figures are included to reaffirm the relationship we reported earlier on wheat markets since 1956; during the trading intervals covered, at least, higher Speculative Indexes were associated with wider average fluctuations in wheat prices.

Averages of other attributes in this table should be compared with equivalent characteristics for contemporary soybean and corn futures markets.\(^1\) Several contrasts in important features will be noted. In terms of open interest wheat markets with either high or low Speculative Indexes were quite similar in average number of open contracts. In contrast, soybean and corn (1956-65) futures with high levels of unneeded speculation were distinctively smaller, in terms of open interest, than were corresponding markets with low Speculative Indexes. Trading volume was noticeably higher in Chicago wheat markets with high Speculative Indexes. Again, high volume was the mark of corn and soybean markets with small speculative holdings not needed by hedging interests.

One method of estimating how fast open contracts "change hands" -- the ratio of volume of trading during any given trading interval to open interest -- demonstrates that Chicago wheat markets with high Speculative Indexes often had high trading volume -- open contract ratios: monthly volume was about five times the open contract figure. High values of this ratio were also attributes of soybean markets with low Speculative Indexes. Furthermore, all corn futures markets since 1956 and contemporary soybean markets with high Speculative Indexes had distinctively lower proportional relations of trading volume to open interest.

\(^1\) Table 1.4 and 1.5, respectively.
Unstable prices have often been associated with rapid increases in open interest and with indications that volume of trading was high compared to the number of open contracts. The previous section reported the definitive changes in classifications of open contracts in corn and soybean markets when open interest expanded rapidly: in recent years hedging and matching positions became exceedingly large compared with other speculative positions attracted into these markets. Price instability and high volume-open contract ratios are plausible in these markets: hedging orders simply are not met by the same proportion of speculators willing to take and hold net long or net short positions. These increased hedging loads are carried, but the rate of turnover in non-hedging commitments probably increases.

Seasonal variation in hedging requirements is very well known. In fact, many investigators suggest that hedges vary constantly with some measure of commercially owned stocks of the commodity, and that inter-year and intra-year differences in total hedging contracts are explained very well by variations in hedgable stocks (2,3,5,6,10,15). Do these large changes in hedge positions in recent corn and soybean markets reflect merely changes in "free" stocks of these commodities? How about the large increase in open interest in wheat futures which occurred in June of 1966? Since rapid changes in total hedging requirements have been associated with periods of price instability, do economic factors explain these record hedging loads, or has a measurable shift in hedging practices occurred?

Corn Futures in the Spring of 1966: Comparisons with 1965 and 1963

During the summer of 1966 corn futures prices advanced, rising rapidly during June and July and reaching levels in 54.
August not approached since September of 1956. This large price advance was accompanied by wide price fluctuations, high volume of trading, and a doubling of total open contracts. Speculative Index calculations show that speculative positions other than matching were barely adequate to carry the short hedges which entered this market during the early summer months.

The three graphs in Figure 1.8 show the general relationships between corn futures price levels, monthly and five-day price ranges, and contemporary size and composition of commitments in corn futures, for a 14-month period ending last October. The doubling of open interest early last summer was accompanied by monthly totals of trading volume which far exceeded comparable statistics in any historical corn futures market. Net short hedging increased approximately 150 million bushels during June, July, and August, and this increase occurred during three months when short hedges in corn futures presumably should decline.

All hedge positions in corn futures represented a larger fraction of total free corn stocks during the late spring and early summer of 1966, than did hedge commitments during equivalent months in 1965 and 1963. In other words, hedgers presumably chose to carry a larger percent of their somewhat larger inventories in 1966 as hedged rather than unhedged stocks, and this tendency increased rapidly, compared with earlier years, after June 1. Since "free" corn stocks were so large, a relatively small increase in the percent of this grain which was hedged resulted in a rapid expansion in open interest; on July 1, 1966, about 17 percent of total "free" corn stocks may have been hedged; at the end of June, 1963, less than 9 percent of the smaller "free" supply was represented by hedges. Apparently the seasonal hedging pattern was changed during 1966. This change in hedge requirements did not attract sufficient long speculation into the futures market at the time it was needed most, and the corn futures price structure remained unusually volatile most of the summer.
Figure 1.8
CORN FUTURES MARKET, AUGUST 31, 1965 - SEPTEMBER 30, 1966
Relationships between price level, price fluctuations,
and classification of total open contracts

MONTHLY PRICE RANGES AND CLOSING PRICES, SEMI MONTHLY

Closing price or monthly price range. Selected corn futures contracts. Cents per bushel

MONTHLY PRICE RANGES AND CLOSING PRICES, SEMI MONTHLY

Price range, July contract

Close, March Corn
Close, May corn
Closing price, mid- or end-of-month, basis nearby contract

PRICE FLUCTUATIONS:
5-day extreme price ranges following mid- and end-of-month dates.

Speculation not needed to carry unbalanced hedging.
Total Open Contracts

CLASSIFICATION OF ONE SIDE OF TOTAL OPEN CONTRACTS
21 out of 26 semi-monthly dates. Pre-10/29/65 shows long side because long hedges were greater than short hedges during this period.
Chicago Wheat Futures During Mid-1966: Comparisons of Hedging Practices with Hedges during 1961-65

The proportional increase in free wheat stocks during the last several crop years has become particularly apparent during late May and early June of each succeeding year between 1963 and 1965. During late spring and early summer of 1966, the sharp price rise in wheat futures prices generated the widest monthly price ranges, during comparable trading periods, seen in wheat contracts since trading was resumed in 1947. Monthly volume of trading in June tripled levels already considered large three months earlier, and open interest also doubled in size. Speculative Index values, which are shown in Figure 1.2, reached lower comparative levels than in any other final quarter of any of the 16 crop years for which this measure was calculated. Speculative positions (other than matching) not needed to carry unbalanced hedging represented approximately 10 percent of the open interest on April 30; by June 15 this component represented less than 6 percent of the open contracts.¹

Open interest increased about 54 million bushels between April 1 and June 15 of all three wheat contract markets combined. Approximately 47 million bushels of this increase probably were short hedges. Approximately half of these new commitments (24 million) were placed in Chicago. Did these new hedging commitments in late spring last year signal a significant new trend in hedging practices as quite plausibly occurred in the corn market last year?

Hedging commitments in all three wheat contract markets on June 15, 1966 were twice as large as they had been on the

¹ Spread commitments in Chicago wheat futures increased 14 million bushels between April 1 and June 15.
comparable date one year earlier; and this (inter-year) relative size of hedging positions held quite constant through late July.  

1/ July 1 stocks of "free" wheat, as estimated by SRS, were small, when compared with similar estimates of privately held wheat one year earlier.  

2/ However, free stocks, according to USDA accounting and estimating procedures for grain inventories, reflect, on July 1, only old-crop or carryover wheat. By the end of June 1966, total hedging commitments on all three wheat contract markets were far greater than the July 1 official estimate of privately held stocks of wheat suggested that they should be. However, this is a normal inconsistency between these two series of data: since most new hedging commitments will offset hedger's commitments in new crop (cash) wheat, these two series do not provide a creditable means of testing whether or not inter-year differences in hedging practices in wheat during the transitional mid-June to mid-July are statistically significant.  

3/ Meaningful comparisons between hedging

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1/ All comparisons are limited to the Chicago Board of Trade transactions and commitments, unless otherwise specifically stated. During June the amount of hedging -- new hedging commitments which enter any contract wheat market -- obviously is highly dependent upon the rate of new crop harvest and short-term farmer selling or holding policies. Weekly rates at which these hedging commitments increase vary widely, within a given year as well as between years, during this transitional period to "new crop conditions." Rapid, but temporary changes in long hedging positions dominate hedging commitments in Chicago wheat during June of some years.

2/ Fifty-three million bushels versus 97 million. Source: Wheat situation July 1966, ERS, USDA: Table 21; figures for 1966 are preliminary.

3/ This exercise was completed in order to compare these relationships during the past 6 years. Ratios of the estimated total hedging commitments at the end of June on all three contract markets combined to the USDA's contemporary estimate of free stocks of "old crop" wheat, with both series expressed in millions of bushels, showed the following: 1961, 1.91; 1962, 1.17; 1963, 2.65; 1964, 3.00; 1965, 0.80; 1966, 2.71. Hedger's commitments in 1966 may look aggressive, when compared with 1965; but they appear quite similar to hedging practices in 1964 and 1963.
practices through late July probably would be impractical, if not outright impossible to construct: existing series on wheat inventories and wheat movement presumably never were intended to distinguish between new and old crop supplies.

Therefore, hedging practices by the wheat trade may or may not have shifted significantly at the beginning of the 1966-67 marketing year. Furthermore, this shift, even if it did occur, may be temporary, applicable only to the hedger's temporary merchandising problems during mid-summer of 1966. Two distinct differences should be noted, when comparing the phenomenal increases in hedging in corn and wheat transactions last June: first, the buildup in wheat hedging paralleled a normal seasonal characteristic, while the equally large increase in corn hedges was entirely contra-seasonal; second, hedger's positions at the end of June 1966, represented only a relatively small fraction of "hedgable stocks" (approximately 17 percent), in corn, while hedger's transactions in the wheat market during June and early July reflect that these commitments were larger, relative to supplies that could be hedged, in many years.

Since 1948, on the Chicago Board of Trade, hedging commitments in wheat often were distinctly different during Springs of consecutive years. The inter-year variance noted during the 1963-66 period probably was no wider than similar contrasts which show up over the entire sample of 16 years.

Prime Reason for Unusual Hedging Demands in Chicago Wheat During the Final Six Months of Any Crop Year: The Supply of Privately-Held Stocks

During January, and continuing for the next three months, Speculative Indexes for Chicago wheat usually rose rapidly: the close, stable balance between the hedging and speculation, which had existed during the previous six months of trading, often
broke down completely. More specifically: referring again to figure 1.2, one notes that this Index rose rapidly during nine years, and remained low (i.e., was below its seasonal average) during seven years.¹/

Most of this wide variability in the Speculative Index, between years, was directly related to the contemporary supplies of "free" wheat, compared with recent consumption rates of privately-held stocks. In fact, during six of the nine years in which the Speculative Index rose more rapidly than average, these free supplies were "scarce"; during five of the seven years in which the Speculative Index remained below average, privately held wheat stocks were ample to meet requirements during the balance of the crop year. Naturally, speculators and hedgers reacted differently to these supply-consumption balances in free wheat. Apparent scarcities encouraged speculators to take positions (mostly long); hedgers, under similar circumstances, refused to hedge inventories they did not own or business they did not contemplate before June.

Hedge commitments on the Chicago Board of Trade, in terms of millions of bushels, varied widely during these intervals. Appendix table A.1 presents, in tabular form, quantitative comparisons between hedging and speculative holdings during the last half of each of these 16 wheat marketing years. However by comparing the highest values in this table with the graphic presentations of classifications of open interest in contemporary corn and soybean futures,²/ we note that peak wheat hedging loads were small, when compared with hedger's use of the other two markets.

¹/ During one year, 1950-51, the index was high at the end of February, but was low for the balance of the crop year after mid-April. This is one of the "unusual situations" which we will discuss shortly. Also, during the spring of 1961, the Speculative Index remained quite close to its seasonal average.

²/ Figures 1.7 and 1.6, respectively.
How and why the stable balance between speculation and hedging was often disrupted during the spring will be illustrated by a brief review of parts of five crop years -- those years which the legend on figure 1.2 identifies as "unusual situations". 1947-48. The Speculative Index was high at the beginning of the crop year and low at the end of March. During the interim, wheat prices moved over a range which is probably without parallel in Chicago wheat trading; yet, during these six months, "average" balances between speculation and hedging were maintained in the market. 1950-51. The substantial increase in exports generated by the Korean War contributed to high harvest prices and lower use of the government loan by farmers. No real free wheat scarcity ever developed: short hedges remained large and unusually constant in amount through June. The con-"a"-seasonal decline in the Speculative Index during April and May resulted from the liquidation of unneeded speculative positions and the concurrent increase in short hedging.

1957-58. The demand for cash wheat during the last half of the crop year was tempered by widespread recognition of two facts: the prospective 1958 crop was huge; and the loan rate on this crop was lower. Short hedges declined 50 percent from January through mid-May, while long hedges increased; therefore, hedging commitments came into rather close balance. The Speculative Index remained high through March and unneeded long speculation remained substantial through mid-April. This particular high Speculative Index reflected the fact that the hedges did not need these speculative services at that time. By the end of the crop year, however, the hedging balance had changed completely: high hedging ratios signalled that long hedging interests had established a record commitment for any final quarter during these 16 years: long hedges even exceeded privately held stocks on July 1. 1959-60. Carryover at the end of June
1960 was substantially the same as the carryout had been a year earlier. Much more of this wheat was in private hands, yet short hedges declined 80 percent from January through May. Substantial unneeded long speculation remained until mid-May -- the Speculative Index was high this time because short hedges left the market and were not replaced. Hedgers elected not to own stocks in the spring of 1960; this reflected their recognition of the lower loan on a 1960 crop and the good prospects for this crop. In fact, short hedges in mid-May of 1960, at approximately 10 million bushels, represented only 17 percent of the free wheat carryover 1 1/2 months later. The high Speculative Index in the spring of 1960 did not reflect a scarcity of free wheat, as much as it did a complete lack of hedgers' interest in this market. However, it is interesting to note that this lack of hedging business was temporary; by mid-August of 1960, 70 percent of the larger wheat futures commitments, or 80 million bushels, represented short hedges.

1965-66: The unusually large short hedging positions which remained in the market from January through May were doubled during June, obviously reflecting the hedgers' strong demands for cash wheat. The Speculative Index indicates that this demand was not accompanied by an equivalent increase in new speculative positions. Here, the hedgers' attitude was in contrast to their 1960 position; hedging positions in Chicago wheat were twice as large as the free wheat carryover.


The apparent close, positive relationship between soybean price moves and the percentage of open contracts controlled by hedgers was noted in an earlier section. Figure 1.4 also identifies one recent exception to this relationship: during the second quarter of 1962, hedgers' commitments rose. Price moves, however, were modest compared with corresponding moves
in 1961, late 1964 and 1965, and mid-1966. Comparisons between the total hedging commitments and "free" soybean stocks show the following: significantly larger proportions of free stocks were carried by hedges during the first quarters of 1961 and 1965 than in 1962, and these hedged portions increased in size throughout the first quarters of the former two years; "cheap" beans were not hedged during the first five months of 1962, when free stocks were actually smaller than they were on corresponding dates in 1961 and 1965, due to the enormous inventories owned by the CCC or under price support. Finally, total hedging, and percent of free stocks carried as hedged stocks, rose contra-seasonally during June of 1962, 1965 and 1966, as did the hedging ratio (long hedging divided by short hedging) in each of these three markets. Price response in June of 1962 was modest, possibly reflecting the fact that ample beans were still controlled by the CCC on July 1 of that year. In contrast, during June 1966, soybean prices advanced approximately 65¢ per bushel during that month. All hedgers concurrently bought the equivalent of approximately 22 million bushels in futures, while all speculators, during the same month, sold (closed out long commitments and/or sold short) the equivalent net quantity.
The nature of speculation in grain futures can be determined and described. Objective estimates of the effect of speculation on price behavior should be both practical and useful, within carefully prescribed limits. Selection of historic markets to provide data, with which to develop (econometric) models of futures price behavior under this contract, required the brief, informal analysis of over 15 years of trading in wheat, corn and soybeans on the Chicago Board of Trade. A review of this scope would not have been practicable, however, without the adoption of Larson's techniques for estimating total hedging and speculative open contracts.

Selection of particular market situations for further analysis in this section was based on a single criterion: was the level of speculative positions other than spreading historically high or low, for that commodity, and for that particular season, when compared with total and unbalanced hedging? Holbrook Working's Speculative Index provided our tool for making these selections. Initially, the use of his Speculative Index for comparing groups of futures markets in this study seemed particularly appropriate. Historically, Commodity Exchange managers have fixed minimum initial margins on long or short speculative positions at distinctly different levels than contemporary margins on spreads. Therefore, one obvious prerequisite for considering the likely effectiveness of a prospective increase in speculative margins, in order to limit price fluctuations in any given market, would be the determination and recognition of the distinctive readings furnished by this Index. How important are speculative position traders in this particular market? How large, relative to total open commitments, have been recent changes in net holdings by speculators? Have these net changes in speculative
holdings been well balanced by new hedging business, or have new unbalanced hedging orders increased considerably faster than the speculation which has been attracted in this market? Is speculation now unusual, by historic "norms", for this market, at this time of year? Would further restriction of attracting new speculative business actually dampen current price fluctuations? Or does this particular market need more commitments by speculators in order to carry effectively recent or prospective hedging?

The Speculative Index has other distinctive merits which should recommend its consideration as a benchmark in any study intended to estimate the price effect of speculation in futures contracts. No other prospective tool would enable one to quantify the importance of net long or short speculation in recent markets, when hedging balances changed so dramatically. Working pointed out that, if the market is to function efficiently as a hedging market, the actual margin of speculation not needed would become narrow whenever short hedging became so large as to strain the available supply of long speculation and the contemporary long hedging requirements. In such markets, when the Speculative Index is low, the carrying capacity of long speculation becomes progressively less adequate, and price (at which hedged stocks will be carried) depends relatively heavily on the amount of long hedging present. Price instability, we have noted, has become a marked attribute of such markets since 1961. Conversely, Working defines the several circumstances under which his Speculative Index would be high: whenever the hedging load is light relative to the amount of speculation in the market; or when moderate or light hedging is relatively well balanced. In such markets, Working suggests that prices are determined mainly by speculative opinion. Short-run price behavior in such markets has again confirmed his hypothesis. Seasonal speculative dominance of certain wheat futures markets quite recently, and of corn and some soybean futures prices before the mid-1950's, was signalled
clearly by very high Speculative Index values; in these markets, erratic price behavior could correctly have been attributed to speculative transactions.

**Prime Prerequisite for the Determination of Speculation:**
**Capability to Classify Frequently the Total Open Contracts as Speculative or Hedging**

The price effect to attribute to speculation in grain futures - or empirical evidence to support an hypothesis that speculation does not have any measurable influence on price fluctuations - must be related to one of two properties of speculation: either the speculative transaction (establishing or closing out a position) or the holding of an open commitment over time. The only conceivable way in which a speculator could have an influence on futures prices is by either buying, selling, or retaining a position in the market. Periodic classifications of total volume of trading into speculative and non-speculative purchases or sales are not made by the CEA. Measurement of any speculation other than day trading and/or scalping, therefore, depends on aggregate statistics: the net or gross holdings of speculators and others at the close of business on a given day; and/or apparent changes in these total commitments over the trading interval during which the price effect of speculation is to be estimated.

The precision by which this speculation is measured can be no greater than is the degree of accuracy with which the estimated or reported changes in total and speculative open commitments reflect the actual trades consummated. Larson's estimating equations presumably included only four full market surveys of total open interest in Chicago Board of Trade contracts (out of a total of 26 in the sample of observations on which each of his regression equations were based); and this sample exhausted the entire number of Special Market Surveys called by the CEA, on all Regulated Contract Markets, between
the end of World War II and late 1960. Since 1961, the CEA has compiled two additional Full Market Surveys in both Chicago corn and Chicago wheat, and RRNA was provided with a copy of the (unpublished) survey of total market positions in wheat, corn and soybeans as of the close on February 7, 1949. These seven separate market surveys constitute the only additional tests as to the accuracy of Larson's estimating equations in Chicago Board of Trade contracts.

Prerequisite for Measurement of the Price Effect of Speculation: Recognition of the Diversity of Speculation

Data limitations precluded our serious consideration of developing or adopting a single benchmark, a "speculative statistic", which would quantify speculation and contribute consistently and rationally to explanations of futures price behavior of an extended period of time. Even if the concept that speculation could be precisely defined by a single statistic is acceptable in theory, such a historical series simply could not have been developed and tested. Therefore, our only practical alternative was to adopt several measures, most of which were somewhat related, but each of which, in a given market and over time, expressed the speculation fraction of the open interest in a different context. Another quick review of figures 1.4 and 1.5 should confirm our hypothesis that speculation, as it is now practicable to measure it, is indeed a many-sided thing: no single series plotted was closely correlated with price moves, in a manner that would support a reasonable hypothesis. Yet, with exceptions (previously reported in this section), each of these measures of speculation was somewhat correlated, in a conceptually sound manner, with price change. Also, these benchmarks often showed their mutual independence by changing in opposite directions from one another.
Holbrook Working's Speculative Index came close to qualifying for this single statistic. At least two limitations, or omissions, in his equations for this measure, suggest that Professor Working did not intend to provide us with a true index of total speculation. Instead, he offered a clear measure of the relative size of total hedging requirements to the net long or short speculative commitments not needed to carry unbalanced hedging. The Speculative Index does not distinguish between markets in which long speculative holdings exceed short speculation, or vice versa. Therefore, changes in this index, when compared with contemporary price moves, tell us only that this unneeded speculation is becoming more or less important relative to unbalanced hedging. The direction of change does not tell us what we would really like to know: is long speculation declining in importance compared with long hedging or unbalanced short hedging; or is long speculation really increasing, but at a slower rate than unbalanced short hedging, which is replacing speculative short coverers? Dr. Working recognized this limitation: his Hedging Ratio clearly provides a precise measurement of the balance between long and short hedges, and, therefore, an index which is proportional to the ratio of total short speculation to total long speculative positions. A much more important limitation of the Speculative Index is that it ignores spread or matching positions: in fact, Working's definition of speculation\(^1\) may have indicated that he did not consider intramarket spreads in the same commodity as speculation. Nevertheless, we consider that spread or matching positions must be introduced into any measure which purports to reflect the nature and extent of speculative commitments, and especially in an index expressing the capability of speculative positions to carry unbalanced hedging.

\(^1\) "The holding of a net long or net short position for gain". Working, *op. cit.*, p. 187.
Our complementary series for defining speculation (hedging ratio, total hedging, and matching, expressed as percent of open contracts) are useful in correcting the deficiencies which precluded our acceptance of the Speculative Index as a single true index of speculation. However, their accuracies as well as the precision of the relationships expressed by the Speculative Index, are dependent on Larson's techniques for estimating the classification of total open contracts.

Furthermore, the exact composition of the matching fraction will remain an enigma, even though its proportional importance (percent of total open contracts) is estimated correctly. Larson's matching positions are directly proportional to spreading by large (reporting) traders, as routinely reported by the CEA. The CEA publishes nothing concerning the breakdown of these spreaders' commitments: all that we know is the total amount by which non-hedgers (speculators) had partly offset their gross long or short open positions, as of the close of business on the particular date for which CEA tabulates and publishes this figure.\(^1\) The distribution of the long and short sides of these spreads among the various contracts is not reported; such a procedure would require publishing classifications of commitments by reporting traders by contract (future), which the CEA has not done during the twenty year period we examined in this section. Precise measurement of the nature of speculation, and demonstration of its price effect, in many market situations will be impossible until this unhomogeneous mass of commitments in futures is sub-classified into several more meaningful components.

Aggregate matching positions, which also include varying percentages of matched hedging, are much larger than is spreading by reporting traders and we have absolutely no guidelines to estimate how its composition varies, seasonally and between

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\(^1\) Intermarket spreads in the same commodity are included, which explains why reported long and short spreading at each contract wheat market are never equal.
different crop years (i.e. with different supply-consumption balances). We are, however, certain of two things. First, these commitments constitute a huge part of open interest in these contracts. Second, successful spreaders place their commitments to take advantage of anticipated price moves. Accordingly, there can be no justification for ignoring or omitting these positions whenever one evaluates the price effects of speculation. Indeed, why should the price effects of a spread, as the CEA defines spreads for purposes of classifying open contracts, be any different than for any other classification of trade? Regardless of his timing, whether both sides of his position are taken or closed out simultaneous, or within an hour of one another, or whether he, much later, by a separate trade, "converts" a net long or net short position into a spread, the spreader acts according to his best judgment: he buys the contract he thinks is too low in price, and he sells the contract he considers to be too high.

The price effect of any particular spread position could be estimated with adequate precision, if the answer to one specific question were available: what was the price of the contract which was bought, compared with the price of the contract which was sold? In other words, does the spreader expect the price spread to widen or to narrow? Net spread positions (long or short) calculated for each future, therefore, could represent the net price influence of spreads open at any one time. Because we do not have this information, we kept Matching positions "isolated" from other classifications of open interest in this study. This compromise undoubtedly will reduce our capabilities to explain futures price behavior. As a single example, note that Matching positions increased in relative importance (percent of open contracts) and in the aggregate (millions of bushels) during the entire bull and bear market in soybeans during the first nine months of 1961. The apparent

1/ Figures 1.4 and 1.6
relationship between price change and change in total matching commitments in this case obviously is meaningless.

Finally, if one assumes that the principal, measurable price effect of speculation is not caused by the holding of a speculative position over time, but, instead, by the immediate market reaction to the transaction (buying or selling) itself, then no combination of measures which reflect merely the net changes in "ownership" of open contracts can adequately explain the real price effect of speculation. Volume of trading, the only full measure of buying and selling consummated over any period of time, if classified by various categories of speculators and hedgers, could provide data appropriate for the development of practical estimating procedures for classifying total purchases and sales, from trades by reporting traders. These relationships would prove even more useful than have Professor Larson's regression equations (for classifying open contracts). Volume of trading, properly classified, would reflect what really happened in the marketplace, not merely the trading which resulted in net changes in "ownership" of commitments among long and short speculators and hedgers. Unfortunately, an adequate sample of complete classifications of purchases and sales on any given day has not been called for, or retained by, the CEA.

The ratio of volume of trading to open contracts, which we used, with considerable reluctance, to compare contrasting groups of markets earlier in this report, must be regarded as a poor substitute for any real classifications of total purchases and sales. In fact, because this ratio does not classify trading as speculative or hedging, its use as a single index of speculative activity in any given market obviously is not valid. In this study, we subsequently do use this ratio, sometimes as an explanatory variable in models of futures price behavior. We also test
its influence in our regression analysis of the effect of margin increases on price fluctuations. In each case, however, we have used this factor in an appropriate and extremely limited context. In this section of the report, our objective for introducing this ratio was simple: to emphasize the importance of the price effect of the many transactions in futures which are not reflected by routinely published statistics.

To recapitulate, then, our capabilities to describe or measure speculation fully in futures transactions is somewhat limited. By taking full advantage of CEA reports on the commitments held by large (reporting) traders, we can periodically estimate the classifications of total open interest and calculate the relative or absolute net changes in total commitments by long and short speculators and hedgers. But these properties - size and net change in size - are meaningless, in the case of the largest single component, Matching positions. By translating changes in open contracts into trades, or purchases and sales, by these different groups, we can identify which of these groups, in the aggregate, did what proportions of about 15 to 20 percent of the total business done in the market. Again, however, between one-fifth and one-quarter of the transactions which we can identify, will be done by Matching interests. The price effect to attribute to these purchases and sales by spreaders will remain a riddle until we learn whether, on balance, this group was purchasing the higher priced contract(s) and selling the lower priced one(s), or vice versa. However, the trading which we can identify - the purchases and sales by speculators and others which change the balance of open contracts - possibly are important price-influencing transactions. Many of those which we are unable to identify (day trading and/or scalping and trading by position traders which is not reflected by these subtle changes in balance between long and short speculation and hedging) possibly are
not of equal proportional importance. Furthermore, price behavior is probably best explained by a number of independent factors acting singly and jointly with one another. Disregarding the influence of supply and consumption balances on price, for the moment, we would suggest that most shifts in the structure of "ownership" of open commitments, as well as the trading that brought this shift about, would constitute important indicators of "buying pressure" and "selling pressure". Different combinations of the several independent measures we have adopted to quantify speculation, or changes in these variables (first differences), and/or joint functions of these factors, add up to an impressive set of analytical tools, especially if speculation does in fact have qualitative as well as quantitative characteristics.

Selection of Specific Markets for Further Analysis

Our selection of specific market situations in wheat and soybeans for which to develop statistical models of futures price behavior was based largely on the findings reported in this section. This analysis confirmed our selection of variables by which to express speculation and validates our earlier hypothesis: appropriate examination of speculative activities and related price behavior over a wide sample of market situations would identify circumstances under which speculation quite likely was a measureable price-making factor. Equally important, from a practical point of view, was that such a diagnosis indicates which broad groups of market situations did not warrant further attention: either because some major changes in market structure suggest that this group is no longer representative of contemporary markets in important qualities; or because this cluster of markets uniformly was dull, from the price analyst's point of view.
Chicago wheat market situations from January through April, and again during June, were selected as being particularly appropriate for more rigorous analysis. This selection was quite clearcut: no other broad groups of market situations during the last twenty years, in any of the three commodities reviewed, suggested such consistent, highly plausible price response to speculation. Likewise, no other pair of groups of market situations offered the unique opportunity to develop two similar models under such contrasting patterns of change in balance between unneeded speculation and hedging. During January through April, the Speculative Index usually rises notably, and we may assume that speculative holdings are acquiring, or at least retaining, larg(er) commitments, while hedging interests are gradually closing out short hedges. A completely different shift in balance between speculators and hedgers takes place in June: then, speculators commitments normally are lower than they were several months earlier, and huge hedging demands enter the market. If the Speculative Index was high in May, it inevitably drops very rapidly during June; if the Speculative Index did not rise seasonally, and speculation already is inadequate, at the end of May, to carry unbalanced hedging, this index drops still lower during June, as new short hedging orders absorb the carrying capacity of all net long speculative commitments attracted into the market. Both these groups of markets, then, represent contrasts in the dynamics of changes in "ownership" of futures commitments. Conversely, it should be clear why the development of a statistical model to explain wheat futures price behavior from July through December would be somewhat superfluous, to any study purporting to examine the price effect of speculation in futures transactions. The Speculative Index invariably was low in August, and, except for one year out of the 16 analyzed, remained low through December. This lack of seasonal variation in a Speculative Index over a six-month interval is a pattern unique with the Speculative Index for
Chicago wheat. To us, it suggests that a search for measureable price effects of speculation in wheat futures, during the first half of the crop year, would be quite fruitless.

In the case of corn futures, selection of markets for further analysis likewise was simple. Corn futures markets between 1947 and 1956 resemble wheat during January through June trading many years. The difference, however, is that these corn markets are in direct contrast, by many measures of market structure, to current and prospective corn futures; the significance of the marked increase in use of this futures market by hedging interests can not be over estimated. Apparently, a new breed of corn hedgers have appeared during the last few years; or else the current generation in the corn trade took a new, hard look at their merchandising practices and prospects. Regardless, the huge open interest generated in June of 1966 may not seem exceptional, if corn inventories controlled by exporters and processors continue to grow. Likewise, the price behavior of the corn futures market during the late 1950's and early 1960's suggests that there is little to interest us here: Speculative Index values usually were low, most of the time, compared with equivalent measures of contemporary markets in soybeans, and showed very small variation from year to year, except during the summer months. Even then, "unnecessary or unwarranted" price fluctuations in corn futures were hard to find.

Selection of a soybean futures market situation on which to develop and test a statistical model of price behavior presented something of a challenge. Speculation as a price-making force seemed to show up where it was not supposed to be: in the smaller, duller markets nobody else was using. Yet, when big price rises started and hedging requirements doubled, speculative commitments, now badly needed by the soybean trade, increased at a much slower rate than did total hedging. However, much of this inverse relationship between
price moves and comparisons between speculative and hedging interests presumably is explained by inter-year differences in supply and consumption balances in this dynamic, growth industry. A statistical model of price behavior in soybean futures during the late spring and early months, using the "explanatory powers" of appropriate expressions of inter-year differences in supply and consumption, will reflect much more accurately the true net correlation between price change and changes in speculative commitments, than will direct relationships between these two variables.

We have seen that the aggregate or selective price effects of speculation on daily price ranges could not be estimated from data routinely tabulated and retained by the CEA. Fortunately, the CEA did tabulate and retain many important additional statistics on commitments by reporting traders, and on contemporary scalpers' trades, in soybean futures contracts, for February and March 1961. These additional data enabled us to develop a statistical model explaining daily price changes.

Finally, this analysis emphasized to us the importance of attempting to isolate one particular fraction of commitments from the rest of the large, unhomogeneous positions routinely reported as spreads held by reporting (large) traders. This fraction, the net balance of spreads held by reporting traders classified as either long old crop - short new crop futures, was in fact estimable from unpublished reports retained by the CEA for 1958 through 1963.

Apparent and True Relationships Between Margins and Changes in Futures Prices

Initial minimum margins for speculative trades, expressed in cents per bushel, for Chicago wheat and corn, varied from a low of five cents up to approximately $1.00 for wheat and nearly 90 cents for corn in 1948; initial
margins for soybeans have been set as high as 40 cents and as low as five cents by the Board of Directors of this Exchange on several occasions since 1953. For reasons suggested elsewhere in this report, new minimum speculative margins, when fixed by the Exchange managers, are closely related to the price level of the relevant commodity. Quite probably new margins also reflect recent price fluctuations, or price fluctuations which the Board considers imminent. Therefore, it should be no surprise that these two series, prices and margins, could be shown consistently as having been directly (positively) correlated during the last 20 years. Now, the nature of this relationship does not bother the economist; he recognizes that price behavior caused the Board of Directors to fix new margins. But, this close historic correlation does annoy the statistician. Whenever he uses margin level, as one of several independent variables in a multiple linear equation to explain short-run price fluctuations, he finds that the solution to this equation invariably includes margins as an explanatory or "causitive" factor, and always with a positive regression or correlation coefficient. This is why we did not plot margin levels on the price charts in Figures 1.4 and 1.5: the relationships between prices and margins would have been much closer than were the apparent relationships between the variables we selected to measure speculation and prices!

For similar reasons, we either omitted or carefully "muzzled" margin levels as an independent variable in the multiple regression equations developed to explain price behavior. We do estimate net regression relationships between variations in margins and changes in futures prices, which is one of the principal tasks assigned to the contractor under this research contract. But we do not present these estimates until a later part of this report. Appendix Table A.2 lists, in chronological order, the occasion of each speculative margin change in these three commodities for a 20 year period.
PART II

SHORT-RUN PRICE BEHAVIOR OF FUTURES CONTRACTS
WITH SPECIFIC REFERENCE TO THE PRICE EFFECTS OF
SPECULATIVE HOLDINGS AND TRANSACTIONS BY SPECULATORS
Search for Appropriate Empirical Models; Selection of Distinctive and Representative Price Fluctuations; Selection of Appropriate Explanatory Factors

Reasonable, complete explanations of price behavior in wheat, corn, and soybean futures markets probably exist, but they rarely have been published in the professional literature, nor do they appear in the more widely circulated writings for and by the grain trade. The excellent market reviews by USDA economists Hoffman(3), Howell(4), and Irwin(5), suggested many generalized explanations for futures price behavior in markets before World War II. Unfortunately, most of the statistics offered to support their conclusions are no longer relevant: institutional changes which have occurred in Exchange organization during the past 20 years, and amendments to the Commodity Exchange Act during the same period have reduced the pertinence of much of the research done on futures trading before the Korean War. The authors of the series of technical bulletins on the demand and price structure for leading agricultural commodities, published by the USDA during the mid-1950's, limited their inquiries on price behavior to the cash market, and restrict themselves to explaining average annual cash prices. Short-run price flexibility is a far better measure of price behavior in futures contracts; average annual prices are of no interest to most speculators and many hedgers. Purely theoretical models of futures price behavior have been introduced more recently (8, 12), but we found that qualitative or subjective expectations concerning prices and price relationships were of limited practical use in developing a model of price behavior which can be tested in today's markets. Holbrook Working again suggested the best, practical guideline: that futures prices are reliably anticipatory; that is, that they represent close approximations to the best possible current appraisals for the future; and, most important, that price changes are mainly appropriate market responses to changes in information on supply and demand prospects (15).
Our selection of appropriate series of data to represent the dependent variable recognized the importance of time as one criterion in price analysis work in general, and in estimating the price effects of speculation in particular. Also, our selections were somewhat arbitrary; the term "price behavior" is highly subjective; and it probably would be hard to reach a consensus as to its meaning. Fortunately, both limitations in routinely published price series and the infrequency of the regularly published reports by the CEA on commitments of reporting (large) traders simplified our decisions as to how to define price behavior.

Selection of appropriate independent variables likewise was simplified by our discrete definitions of price behavior over specified time periods, and by the availability of data. We made full use of each of the CEA's routinely published statistics during the time periods covered by the analysis. Whenever we were measuring price changes over periods longer than one day, we restricted our consideration of changes in information on supply and demand prospects to those important, pertinent statistics contained in contemporary USDA reports of crop production, quarterly inventories, and selected information concerning current consumption rates and the size of stocks owned by the CCC.

**General Comments on Analytical Procedures Used**

Use of stepwise regression program to determine relationships between variables. Stepwise Multiple Linear Regression Program, IBM 360/40, SRS program no. 2003, Version 04, was used to determine the "best" solutions to the equations developed. Full use was made of this program's capabilities to transform variables and to solve for coefficients, up to a maximum of 55 independent variables. Many of these variables included
expressions of joint regression effects. Also, inter-class differences in the Y-intercept (a constant) and slope (regression coefficient) were tested by using zero-one (dummy) variables.

Limitations on analysis imposed by the availability of data. The infrequency of reports of commitments of reporting traders has already been commented upon. Complete or full market surveys providing benchmarks by which to classify trades (purchases and sales) have been practically non-existent; while semi-monthly tabulations retained by the CEA would provide figures of the trading activity of reporting traders on those dates, no techniques have been developed to provide for classifications of total trades among hedgers and speculators, based upon this reporting fraction. Finally, price series reflecting intra-day price fluctuations are incomplete. Little importance was attached to developing a model to explain such price behavior, since reporting practices on the Chicago Board of Trade have precluded the collection of intra-day details of volume of trading, timing of specific trades, or making meaningful comparisons between periodic, intra-day, volume and price fluctuations. Finally, we usually eliminated consideration of price movements of any future during its delivery period. First, the price effects of speculation during such intervals probably would be completely unrepresentative of how speculative transactions influence prices in other contracts and during other trading periods. Second, sophisticated series of data would need to be developed in order to demonstrate that, on a particular occasion, speculation (or a group of speculators) was in fact manipulating price. Therefore, our analysis does not seek out and identify corners, squeezes, "bear raids", "bull traps", etc. By ignoring the particular "spectacular" trappings of speculation, we do not imply that they do not exist, or, at least, did not exist years ago. We are merely suggesting that, with available data, we would be unable to recognize price manipulation on the Chicago Board of Trade.
EXPLANATIONS OF DAILY PRICE CHANGES

Method of Analysis: Factors Influencing Intra-Day Price Changes

The shortest time interval over which price behavior was measured, then, was one trading day. Difference between the closing price and the opening price of the same futures contract was selected as the measure of price change to explain. Personal consultations with responsible persons in the Trading Division of the CEA indicated that these officials considered this particular measure an appropriate indicator to use. The hypothesis most appropriate to test, in comparisons of daily price changes, could be expressed this way: variance in consecutive daily price changes is explainable mostly by measurable trading (purchases and sales) attributed to principal classifications of traders, and to small changes in prevailing balances between aggregate holdings of long and short speculators and long and short hedgers. Also, unexplained variance may be a function of trading activity of day traders and/or scalpers, or be partly attributable to transactions which are not reflected in changes in classifications of open contracts. Finally, if comparisons of consecutive daily price changes are limited to periods between the release of important USDA supply-consumption statistics on that particular commodity, then the effect of market response to changes in information on supply and demand prospects should be minimized.

The selection of the market situation in which to test such an hypothesis was extremely simple. During February and March 1961, the CEA collected and retained daily reports of the classification of reporting traders in soybean futures, as of the close of business, on a series of consecutive days during which price fluctuations and volume of trading varied widely. Concurrently, they obtained daily aggregate figures on the trading and open positions cleared through a constant sample 84.
of clearing members recognized as being well patronized by
the scalping trade and other day traders. From the daily series
of commitment reports of reporting traders, we classified total
open contracts at the end of each trading day according to
Larson's estimating equations and calculated daily changes in the
speculative index and other ratios used to measure apparent
shifts in "ownership" of open contracts. We translated these
changes and classifications of open contracts into purchases
and sales made by hedgers, reporting (large) speculators who
were either long or short, and other speculators, both long and
short. Changes in matching or spread positions, in terms of
total increase or decrease in these positions during a day's
trading, were estimated, using Larson's equation and the daily
statistics on reported spreading. Day trading activities were
estimated directly from the sample of reports selected and
previously retained by the CEA; these were adjusted to eliminate
trades cleared through these members which represented changes
in commitments by position traders, rather than purchases and
sales by scalpers and/or day traders. Total purchases and
sales attributable to each of these classifications of traders
were then expressed as percentages of each day's total volume
of trading. Finally, since it was realized that only a small
fraction of the total transactions had been identified (class-
ified) by these exercises, the ratio of total trading volume to
open contracts was calculated each day.

Figure 2.1 shows how net purchases and sales attributable
to selected groups of position traders varied with both daily
price range and net daily price change (open to close), during
36 trading days in February and March 1961. Visual comparison
of these charts will suggest: (1) no single group, in the
aggregate, consistently sold when prices declined and bought
when prices rose, or vice versa; (2) inter-day difference in
percent of volume attributable to these groups of position
traders was quite wide (it varied from 2 percent to about 8 percent of total volume); (3) most of the transactions taking place each day were not reflected in the net purchases and sales attributable to our selected groups of position traders.

Results: Two Multiple Regression Equations Explaining Daily Price Changes, May Soybean Contract, During February-March 1961. The solution of one multiple regression equation estimating how net daily price change was affected by various classifications of identifiable trading and daily changes in aggregate balances between hedging and speculative interests is presented, in tabular form, in table 2.1. The second column lists the net regression coefficient for each independent variable in the "best" of several solutions to this particular "set" of equations. Other measures of regression and correlation are presented in the rest of this table. The independent variables to which the various coefficients apply are identified in detail in table 2.3.

Table 2.2 presents, in the same manner, the results of a solution of a similar multiple regression equation. The principal difference between these two solutions was intentional; the independent variable representing volume of trading -- open contract ratio (X-51) was eliminated (excluded) from the set of equations solved in order to show the relationships given in table 2.1. On the other hand, in table 2.1, variable X-41 (the percent of total volume of trading attributable to scalpers) did enter the solution, with a particularly high partial correlation coefficient. It was not included in the "final" solution of the second set of equations.

Table 2.4 shows how well this second equation explained both the direction and amount of net daily price change, on each of the 36 dates in February and March 1961 which are identified in the first column.
Interpretation of the Results. Both these regression equations show that, during these two months of trading, net daily price change was significantly related to the percentages of total buying and selling attributable to each of several aggregate classifications of traders, daily changes in the hedging ratio, and a joint expression of changes in this ratio and values of the ratio itself. In addition, in the first equation, net price change was significantly related to the percentage of trading attributable to a specific sample of scalpers and day traders. In the second equation, the dependent variable is also significantly related to the volume of trading-open contract ratio and another variable expressing changes in market balance (X-17): the sum of the net change during the day's trading in matching positions and the net change in the Speculative Index during the same period of time. In both equations, the computed regression coefficients are, with only two exceptions, statistically significant. We cannot offer reasonably high probabilities that these coefficients fall within a reasonable percentage of the corresponding values, for other occasions when daily price behavior would be explained by either equation. However, we can say that, within the framework of relationships shown in table 2.1, there is a reasonably high probability (P=0.95) that the regression coefficient for the percent of total volume attributable to scalpers (X-41) is within 32 percent of its corresponding value, for other occasions, in similar markets, when net daily price changes for soybeans would be explained by these factors. Likewise, in the equation represented by table 2.2, the net regression coefficient for X-51 (volume-open contract ratio) has a similar probability of being within 23 percent of its corresponding value, in other explanations of price changes in similar markets.

Many interesting inferences may be drawn from these two sets of net regression coefficients, as they now stand. First,
any given percentage of trading (purchases or sales) attributable either to hedgers or to small or large speculators had nearly the same effect on price change. Second, although some daily price change was explained by "unbalanced" trading between the five classifications of position traders, much of the additional variance was explained by four other factors, each of which represents a particular measure of market balance or depth.

(1) Net price changes usually were considerably smaller when the percentage of total volume attributable to scalpers was relatively high.

(2) Conversely, daily price changes were larger whenever the volume-open contract ratio for that particular day was relatively high.

(3) Changes in the hedging ratio, and the joint effect of changes in this ratio and the value of the ratio itself, explained a large part of net price change on certain days. More specifically, either or both of these latter two functions contributed to net price gains whenever the change in hedging ratio, during that day of trading, was quite large, regardless of the sign of this change. On the other hand, this variable had little effect when changes in the hedging ratio were negligible.

(4) The net regression coefficient for X-50, in table 2.1, \(^1\) again illustrates the effect of changes in market balance, in either direction, on price behavior. The influence of this joint relationship was minimal when the sum of the net change in Matching and Speculative Index was small. These two variables exerted a much larger joint effect whenever the value of this function was relatively large, regardless of its sign.

\(^1\) The square of the sum of the changes in matching positions and the change in Speculative Index.