Introduction

A high proportion of the discussion about futures trading, particularly at the legislative level, is centered on the effects of futures trading on the level and variability of commodity prices. Generally speaking, futures trading has been accepted as a useful device for the shifting of risks, securing of financing, and facilitating trade through collection and dissemination of market information, particularly price quotations. Speculators have been accepted as necessary offsets to hedgers but beyond this point they have been generally castigated. Substantial legislative effort has been devoted to limiting the scope of activities of speculators because of their alleged effects on prices and price variability.

The bulk of the opposition to speculators has centered in the Congress and in the CEA. This effort has recently culminated in the passage of a law prohibiting futures trading in onions. In passing this prohibition the Congress recognized the extensive use of onions futures as a hedging medium and expressed doubt that the general level of onion prices or the general variation of onion prices was affected but concluded that there were instances of wild price gyrations, unrelated to the supply and demand situations, that were caused

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by excessive speculation in onion futures. This conclusion is typical of a long standing congressional attitude. It doubtlessly reflects the suspicious attitude that farmers have long had toward futures markets.

The thinking of the Commodity Exchange Authority has been very similar to that of the Congress. Typical is the following comment by J. M. Mehl: "It is recognized that in the Commodity futures markets there is need for some speculation. Merchants and processors hedge their inventories by making short sales of futures against these inventories and holding the short contracts until the cash commodity is sold. Some of the short contracts of hedgers, of course, are offset by the long hedging contracts of other merchants or processors whose forward cash sales exceed their inventories. Under most conditions, however, members of the trade as a group are net short in the futures markets. Speculators, by buying the offsetting contracts of hedgers, assume the risk of price changes, and merchants and processors thus obtain the equivalent of insurance against price risks, which in turn enables them to operate on smaller margins of cost . . . .

"It is not believed that speculation is a basic factor in determining the general level of prices in the long run. It is believed, however, that an undue amount of speculation tends to make price fluctuations more erratic and at times accentuates price trends. We know from the number and

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38 See D. Hearings: Committee on Agriculture and Forestry of the Senate on H. R. 6772, April 1936; Joint Committee on the Economic Report, November 1947; Committee of Agriculture and Forestry of the Senate, February 1948 on S. 1881; Report of the Subcommittee on Futures Trading in Perishable Commodities of the House Agriculture Committee, September 24, 1956.
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character of traders entering the market that at times specula-
tion does have a short-run effect upon prices.”

A later comment by CEA is in the same vein,25 “After
reaching its high of $2.20 per 50-pound sack on February 4,
the price of the March future on the Chicago Mercantile
Exchange registered a low of $0.85 on March 6. Since that
date there has been a substantial recovery with the future
expiring on March 22 at $1.58 to $1.60. Price movements
such as this cannot be justified by supply and demand factors
and must be attributed either to manipulative activity, or,
as appears to be the case in this instance, to a wave of exces-
sive speculation.”

At the other end of the range are some professional stud-
ents of futures trading as Holbrook Working, Baer and Sax-
on, and Henry Bakken.26 These men discuss the stabilizing
influence of futures trading in terms of risk assumption at
seasons of heavy crop movement that encourages the carry-
ing forward of inventories, the informed discounting of ex-
pectations about future developments affecting commodity
prices, and the stabilizing influence of a large number of
buyers and sellers and a large volume of trading.

Economists generally, after rather casual observation, line
up in a position rather close to that of Thomsen27, “The most
conclusive indictment of futures trading is participation by
uninformed traders, both large and small, who make no
real effort to evaluate supply and demand conditions but
follow market trends and play the psychology of the market.

25 USDA, CEA, Speculation in Onion Futures, January-March 1957, p. iv.
26 See Working, American Economic Review, May 1949, Baer and Saxon, Commodity
Exchanges and Futures Trading, and Bakken, The Theory of Markets and
Marketing.
27 Thomsen, F. L., Agricultural Marketing, p. 211.
The difficulty in rectifying such a condition is in separating the sheep from the goats.

"On the other side of the picture, proponents and defenders of futures trading have claimed that it 'furnishes a continuous market' and tends to stabilize prices. But continuous markets exist also for seasonably produced commodities which are not traded on futures exchanges, and there is no proof that the cash markets would not absorb current offerings of grain or cotton in the absence of a futures market. Of course, the inability to transfer risks through hedging operations might result in larger handling margins. As for price fluctuations, there are some reasons for believing that they are greater rather than less because of futures trading. Some important commodities not traded extensively on futures exchanges seem to experience no greater fluctuations than do grain and cotton prices. Some analysts have attempted to prove that price variability increases directly with the volume of futures trading, but such findings are no more conclusive with respect to cause and effect than the old theory that volume of trading is necessary in order to keep prices stable."

In spite of the extensive legislative interest and the many thousands of pages of legislative testimony as well as other literature in substantial volume there has been little attempt made to specifically address the question of the affect of futures trading on commodity prices and arrive at a definitive answer. This is a truly remarkable state of affairs that does not speak well for the exchanges, the Commodity Exchange Administration, or economists generally.

Three steps need to be taken: (1) the speculative pricing

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The most advanced approach to the problem seems to be that of Holbrook Working in the American Economic Revision, May 1958, "The Theory of Anticipatory Prices."
function of commodity exchanges should be described, (2) the general theory of the influence of speculation on prices should be established, and (3) a system of empirical analysis of the speculative influence should be devised and applied to the question. This paper is a first approximation to this triumvirate of needs. It is far from final. A seminar of this kind here in progress has the disadvantage of exposing one's incompleting work to easy criticism. It has a much greater advantage of getting incompleting thinking out of the files and available for building upon.

Speculation

The speculative pricing function. The prices of seasonally produced commodities are speculative. The total of the crop is harvested during a brief period of time and is used throughout the entire year. Further, varying amounts are carried over from one crop year to the next. There are, in the marketing of seasonably produced commodities, two sources of demand. There is the conventional demand for consumption, the taking of a continuous flow of product at a series of prices. The rate of this flow (the different quantities taken at different times) depends upon the prevailing prices and upon shifts of the demand schedule right and left through time.

The second source of demand is the demand for inventory. There is always present a willingness to hold commodities out of the consumption flow at some price or other. Similarly there is always present a willingness to put commodities into the consumption flow at some price or other. The rate of flow of a commodity into consumption depends upon interaction of the two demands. As the price of the commodity increases, ceterus paribus, the consumption flow is decreased and the flow out of inventory, again all other things remaining equal, is increased. The demand for inventory
is the short-run supply function and it takes the up-sloping supply schedule form.

Accordingly, in the short-run the rate of flow into consumption, the price is established by the location and slope of the inventory demand schedule. Now, the location and slope of this inventory demand schedule depends upon the expectations of inventory holders regarding prices at times in the future. As they anticipate that prices will remain unchanged in the future the schedule remains immobile and prices remain unchanged except as consumption demand shifts. As inventory holders expect that prices will be higher in the future the schedule shifts to the left, forcing prices higher and thus reducing the flow into consumption. As inventory holders expect that prices will be lower in the future the schedule moves to the right lowering current prices and increasing the consumption flow.

The propositions are true regardless of whether the intra- or inter-seasonal effects are considered. The bulk of the speculative problem has to do with the rate of flow of products into consumption between harvests; however, it has also to do with the quantities that are carried forward from crop season to crop season. As prospective production is reduced, the inventory demand schedule shifts to the left, cutting down the consumption flow and increasing the carryover.

The general level of the price of a commodity in the long run is determined by the production and the consumption demand for the commodity. If we exclude the effect of carryover demand (or assume that it is constant) we can say that the season's average price is determined by production and demand for the commodity and that the season's average price is not affected by inventory demand. Thus it becomes clear that the influence of inventory demand is limited to interim prices. It is equally clear that inventory demand is
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of major importance in determining interim price, that is, in determining the pattern of prices about the season's average price.

Inventory holders are speculators. He who takes a market position, whether long or short, stands to profit or lose as the price changes. He who takes a market position is influencing inventory, either withholding inventory from the consumption flow if he is long or supplying inventory to the consumption flow at the current price if he is short. And finally, he who influences inventory affects the interim price.

There are speculators outside of futures markets, notably producers, merchants, and processors, and there are speculators in futures markets. Speculators in futures markets influence interim prices in proportion to their importance in the total inventory structure.

The speculative pricing problem. The problem of speculators (inventory holders) is to determine the price level at which production and consumption demand will be at equilibrium; the price at which the existing supply will be great enough to last until the next harvest and yet be used down to the necessary carryover level. This is a problem of anticipating well in advance what the supply will be and finally determining what it is after the harvest is complete, of anticipating demand and changes in demand and finally determining what the level of demand is, and of deciding what price will equate supply and demand once they are both known.

The problem is not a simple one. The supply situation cannot be accurately anticipated because of the vagaries of production and is never finally known with exactness. Demand for even the simplest of commodities is fantastically complex so that it is difficult to measure. In addition, demand is dynamic so that the use of historical relationships to
estimate the level of demand in a given season is extremely difficult. New demand factors continually enter the market and many of them are nonrepetitive. Short-term demand is frequently inelastic so that minor errors of estimate result in major errors in forecasting what the equilibrium price will turn out to have been.

The objective of speculative pricing is to estimate the equilibrium price and to adjust inventory activities so that the equilibrium price is immediately achieved and maintained. Such is the theoretical objective. However, it is doubtful that the objective in the real world is this simple. The consumption demand schedule is likely less than a perfect continuum. It is doubtful that consumers, being something less than perfectly informed and immediately responsive economic men, react fully to small changes in price so that a price adjustment must be exaggerated to obtain the necessary consumption response. This is, if the price needs to be adjusted upward it must, in the real world, be adjusted upward beyond the equilibrium level to later fall back. This is to say that perfect inventory speculation may result in something other than perfectly stable prices.

The futures market speculator. The responsibility for interim price determination is cast upon futures market speculators as a result of the development of futures markets as risk shifting mediums. Futures markets developed out of the need and desire of the holders of cash commodity inventories to shift the price risks of ownership.28 The way that this process works out can be clearly shown by an examination of the structure of the open contracts.29 Risks are transferred from hedgers to speculators. This process results in the development of very little new ownership risk. The open in-

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28 See especially Irwin, H. S., Evolution of Futures Trading.
29 Hieronymus, T. A., Appropriate Speculative Limits on Soybean Oil and Lard, Chicago Board of Trade, 1953.
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Interest in futures contracts is of nearly the same size as the inventories out of producer and government hands. The short hedges, which predominate, are of the same general magnitude as the open interest, spreads subtracted. It is a very interesting phenomenon that futures markets are built on hedging rather than speculation. They do not succeed and persist in the absence of a substantial hedging interest.

Futures markets are not primarily pricing systems, operating for the purpose of establishing speculative prices. Their pricing function is secondary. Speculators in futures markets necessarily influence the prices of the inventories that they control as a result of the risk shifting process. It is an empirical fact that they do not go beyond this point except by rather narrow margins. Such a margin is essential to the liquidity of trading.

As risks are shifted to speculators the control of the flow of inventory into consumption also shifts to speculators. The owners of inventory control inventory. The owner of a physical inventory that is hedged in futures is not an owner as ownership relates to inventory control. He is a custodian and as such has no influence on the flow of the commodity into consumption. As effective owners, futures market speculators are important in establishing the location and shape of the inventory demand (interim supply) schedule.

The same kind of price influence exercised by long speculators is also exercised by short speculators. By taking a short position in futures a speculator is committing existing inventory to the consumption flow at the current price. The nature of his influence is precisely the same as the long speculator except that it is opposite.

*Question of influence on price.* With the position of the futures market speculator thus in its context of the speculative

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[Schonberg, J. S., *The Grain Trade*, Chapter XII.]
pricing job that must be done, the question of the influence of futures trading on prices becomes: Is the quality of the job of speculative pricing improved or decreased by the activity of futures market speculators? If the objective of speculative pricing is price stability, as we may reasonably assume it to be, the question is: What is the influence of futures market speculators on price variability?

But pricing is only one of the two functions of speculators, the other being the assumption of risks. A second appropriate question is: What is the influence of speculative activity on the level of prices?

Theoretical Development

It is extremely difficult to determine the effects of futures trading on the price of a commodity. The question cannot be subjected to laboratory experiment. The essence of the question is: What average prices and price patterns would have existed had there not been futures trading? There is no doubt that prices vary in the presence of futures trading nor any that they vary in the absence of futures trading. The heart of the question is whether variation is greater or lesser in the presence than in the absence. To finally and conclusively say that futures trading decreases or increases prices and price variation one must first describe the prices and price patterns that would have existed in the absence of futures trading and compare these patterns with the patterns that have actually existed in the presence of futures trading. Methods for such an analysis have not been developed.

Two approaches to the question of the effect of futures trading on prices can be made. One is logical and the other is empirical. The logical, or theoretical, approach follows. In this consideration five separate areas need to be considered: (1) average levels of prices, (2) interseasonal variation, (3) seasonal variation, (4) month-to-month variation, and (5)
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day-to-day variation.

Average prices. Futures trading increases the average of prices received by producers and reduces the average of prices paid by consumers. Because merchants and processors can hedge they are able to work on smaller margins than they otherwise could. More generally speaking, as futures markets enable specialization in risk assumption and risk financing, the total cost of these functions is reduced. If speculators in futures markets were not willing to carry risks at a smaller cost than producers, merchants, or processors, hedges would not be placed.

Speculators are able to reduce the total of the risks of price change by balancing risks in holding one commodity against risks in holding other commodities. Most speculators trade in more than one commodity. They balance one position against others so that the total of the risks assumed is less than that of the parts separately considered. This is the principle of averaging out that is used by insurance companies in underwriting risks of loss of life, by fire, etc.

The effect of the cheaper cost of risk assumption as the result of futures market is most clearly shown by considering harvest sales of producers. Producers sell substantial proportions of all crops at harvest. For some crops as much as 70 percent is sold directly from the fields. These commodities must move into storage and be owned by agents in the marketing process. In the absence of futures markets they are purchased only as prices are low enough that the risk of loss is reduced to a point at which marketing agents are willing to speculate.

A good illustrative example is found in onions. Prior to futures trading the harvest over-run onions were purchased by merchants at prices low enough that they considered their risks of loss through decreasing prices negligible. They did
not bid what they *thought* onions would be worth later, but rather what they were *certain* were prices that would later be exceeded. That such merchants now pay more than they would in the absence of futures trading is clearly shown by the fact that merchants shift risks by hedging. If they were willing to assume the risks at as high prices as speculators, they would not hedge. Because harvest time is the peak grower sales period, the weighted average price received by growers is increased.

An active futures market keeps merchants, warehousemen, and processors from preying on producers by maintaining a competitive balance. Merchants and others buy as cheaply as possible. The main opposition that they face in their efforts to buy cheaply at harvest is offered by speculators in futures markets. They offer competition to merchants by bidding prices up to levels at which merchants no longer consider commodities cheap and so hedge. In addition, they offer producers opportunities to hedge instead of selling.

Futures market quotations are widely disseminated as is all market information pertaining to growing conditions, crop size, storage stocks, rates of use, etc. The existence of futures markets increases the knowledge of producers about market conditions and thus puts them in a more equal bargaining position with purchasers.

Insofar as futures trading stabilizes prices it increases the size of the markets for the various commodities. Consumers get more utility from products with stable prices than from those with variable prices. Merchandising programs can be developed better if the supply is regular and the price is stable.

The average prices that consumers pay for the end products of commodities are reduced as the costs of marketing, in this case the cost of risk assumption, are reduced. In this regard the lower costs of marketing resulting from cheaper
risk cost is shared by producers and consumers.

The costs of getting risks assumed in the absence of effective futures markets is large. I once reckoned this at 25 to 35 cents per bushel for soybeans.\(^2\) That comparable risk premiums are not discernable in futures markets is a substantial tribute to the effectiveness of such markets in risk reduction.

**Interseasonal variation.** Futures trading can affect the variation in prices from year to year by influencing the size of the carryover of the different commodities from crop year to crop year. Only in rather unusual instances is the size of the carryover out of producer and government hands above minimum levels. Accordingly, futures market speculation has very little effect on annual price variation. Occasionally, as growing conditions are adverse, old crop futures are lower than new crop, encouraging the carrying of hedged stocks forward.

Futures market speculators play an important role in the usual downward adjustment of old crop to new crop prices. Spreading operations of speculators influence the rate at which stocks in commercial inventory are reduced and thus influence the transition of prices.

**Seasonal variation.** The usual seasonal variation in the prices of the different commodities is reduced by futures trading. The long position of speculators builds up to a peak at harvest and is gradually liquidated throughout the season. On the other side of the equation the short positions of hedgers make an opposite pattern, reaching a maximum at harvest. This maximization of long positions of speculators and short positions of hedgers occurs at the season of the year when downward pressure is greatest and prices are, on average, at the seasonal lows.

Without the inventory accumulation and holding of speculators, prices would go lower than they do. Someone would buy and hold inventories, but only at prices lower than those at which futures market speculators buy. This must be true because if it were not, futures market speculators would not be the high bidders and thus not able to buy.

Futures market speculators do not consume commodities. The inventories that they take off of the market are later put back. As they put them back, available for consumption, the price is lower than it otherwise would be. This process of releasing inventory is regular and gradual and proceeds from the time of harvest.

The effect of this seasonal counter pressure is to force the price higher at harvest and lower in the winter than it otherwise would be, thus reducing the seasonal variation in price.

Month-to-month variation. The month-to-month changes in commodity prices are reduced by futures trading. In the first place, the additional market information generated out of the futures mechanism results in a more complete, hence presumably more accurate, appraisal of the market factors affecting price. These are quickly discounted into current prices. The market acts with more foresight, hence more accuracy. If the crop is large so that the rate of consumption needs to be increased from that of the preceding year, this becomes known early and the price level adjusted. If disappearance is at a faster rate than can be maintained, the price is adjusted upward quickly. Adjustments in price made soon are less extreme than adjustments that are made late.

In the second place, the presence of speculators gets market information implemented into price changes that are consistent with the market information. In the absence of willing speculators the known market facts may not be implemented into price changes or the actual price changes may be in the
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wrong direction. For example, if supplies are put on the market by producers for reasons of lack of storage, or funds, or because of taxes and bought by merchants and these merchants are unwilling to take market positions, the effect may be to depress prices at a time when they should be rising. That is, there is a speculative function that must be performed. Insofar as market participants are nonspeculators, acting automatically, the speculative function is not performed.

In the third place, the larger the number of speculators, the more stable will be the price. The forecasting of prices is extremely difficult. Individuals make large errors. Accordingly, a large number of judgments results in greater stability than a small number of judgments if the quality of the judgments of the individuals in the large group is as good as the quality of the judgments of the individuals in the small group.

Fourth, and finally, speculators in futures markets are logically better forecasters than producers, merchants, etc. In the absence of futures markets, producers and merchants are forced into the business of speculation as a result of their primary production and marketing activities. They may or may not be capable of forecasting and speculating skillfully. If the ability to speculate skillfully is a relatively rare talent, it follows that a rather small proportion of producers and merchants are capable of skillful speculation. The proportion of this group may be, and probably is, larger than in the population at large, but none the less small.

Logically, speculators in futures markets are fairly skillful. Why should barbers, shoe clerks, physicians, lawyers, and housewives be skillful forecasters and speculators? Generally speaking, they are not, but only those who think they are, enter into futures trading as speculators and only those who.
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actually are, remain. The unskilled lose their money and quit and the skilled make money and take on a larger role. The business of speculation in commodity futures acts as a continuous spelldown. However illogical it may seem that a particular group of speculators be skilled, the fact is they have to be good to last.

Day-to-day variation. Day-to-day price variation is reduced by futures trading. The same forces that are at work to reduce month-to-month price change are also at work in precisely the same way to reduce day-to-day price changes. The information attendant to futures trading gets each new change affecting prices discounted into the price structure immediately. It is likely that the number of price changes is increased by futures trading, but the size of each change is reduced so that the total of price change is reduced.

Futures market trading reduces price changes resulting from automatic actions of nonspeculating merchants. There is a substantial number of merchants who automatically sell upon purchase of cash commodities. In the presence of futures markets, they hedge. In the absence of futures markets, they would be forced to sell to other cash interests. It is clear that because they hedge they can sell at smaller price changes than would result from their sales if there were no hedging facilities.

In this connection the liquidity function of futures markets is especially important. In an active futures market there is present a group of traders known as scalpers. These people stand ready to sell at a price moderately higher than the last traded price or buy at a price moderately lower than the last traded price. They accommodate the sellers until buying orders come in and the buyers until selling orders come in. Their actions have a stabilizing effect on price that does not exist outside of futures markets.

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The stabilizing effect of scalpers is limited to the intra-day period. Slightly removed from the actions of scalpers are those of floor traders who perform the same function between days. By absorbing waves of producer and merchant selling until longer term speculator buying enters and by absorbing speculator buying until selling enters, they tend to stabilize prices.

The key to a liquid market is a large volume of trading. The greater the ratio of volume of trading to the open interest, the more liquid and hence, the more stable the price will be. It has been observed many times that as price changes become frequent and substantial the volume of trading increases. Most of the persons observing this tendency have concluded that a large volume of trading and much variation are associated and some have even gone so far as to suggest that a large volume of trading causes much price variation instead of being caused by the price variation. This readily apparent short-run association has obscured the longer-run opposite association.

Just as in the case of month-to-month price changes, the day-to-day changes are reduced by having a large number of judgments influence the price rather than having a small number. With a large number of participants, the price is less subject to individual errors than it otherwise would be. There is an absorption of errors effect that has a stabilizing influence on price.

Possibilities of manipulation. A futures market is less subject to manipulation than a cash market. The possibilities of manipulation of futures markets have always been of major concern. However, very seldom has a comparison of the manipulative possibilities of cash and futures markets been made. Futures trading is subjected to much supervision and regulation. There is not comparable supervision and regulation
of cash markets. Futures market positions larger than a certain rather small amount must be reported to the Commodity Exchange Authority daily, and positions longer than specified amounts are prohibited. It is illegal to manipulate a futures market. The practices that are considered manipulative in futures markets are not prohibited or restricted in cash operations.

Futures markets are less subject to individual influences than are cash markets. There is a greater concentration of positions in cash markets. The broader the futures market, the less it is subject to the action of individuals.

Futures markets are open, public, competitive markets. About the closest approximation to the classical concept of pure competition there is to be found in our economic system is in futures markets. Competition is the antithesis of manipulation.

Destructive influences. Thus far the theory of constructive influences of futures trading on prices have been discussed. There are possible destructive influences; ways that futures trading may add to price variation or distort futures prices from equilibrium levels. Four principal areas should be distinguished.

First, cornering or engrossing the supply. In this operation a speculator takes a long position in futures in excess of the deliverable supply and buys up or takes delivery on the total supply forcing the shorts to buy futures or cash from him at whatever price he names, distorting the price above ordinary commercial levels.

This is not easy to do. It can be attempted only when supplies are very small. At the conclusion of the corner the speculator has a supply of the cash commodity that has cost him more than he can sell it for and on which he loses money. (If he did not overpay for it or hold it too long he has not dis-
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torted the price.) A corner is illegal and the exchanges and CEA watch for this kind of practice and force the speculator to give up the corner before it can be worked. Most of the short positions represent hedges on which delivery can be made. Position limits make a corner virtually impossible. It is extremely difficult to find an effective corner in the modern history of commodity futures markets.

A more moderate version is the squeeze in which longs take delivery of all of the supplies at the delivery market forcing shorts to purchase additional supplies and move them into delivery position. This operation can only force the futures price up to the country price plus the cost of putting supplies in delivery position. If the terms of the futures contract are correct, the futures price should represent the country price plus the cost of putting supplies in delivery position. Only a market in which the terms of the contract need adjustment can be squeezed.

The second possible distortion is that of bear raiding. Here cash interests put large supplies in delivery position and by tendering and retendering, they force the price down to distress levels. If the cash price is forced below its commercial value someone will simply take delivery. In a bear raid only the price at the delivery point is affected. The outlying price will not follow the futures down. A bear raid can be worked only through continued and vigorous selling and by catching long speculators by surprise. Long speculators watch the delivery situation carefully and are hard to catch. The raider is very apt to have committed himself very deeply below the equilibrium level and suffer a net loss in extricating himself.

When there is a precipitous decline in the price during the delivery month it is usually because the price is too high to absorb the existing supply. The delivery situation brings
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this fact to light. The real test of whether the situation in futures caused a price decline or not is what happens to the price after futures trading has stopped.

Both squeezes and bear raids are thought to exist very much more than they actually do because futures markets are focal points at which underlying forces find expression. It appears that observers frequently look at the direct forces affecting prices without looking at the underlying forces that cause the situation in futures to exist. That is, futures trading is taken out of its cash market context and placed in a vacuum for observation. Accordingly there is a tendency to ascribe to futures trading price behavior that is actually the result of underlying economic factors.

A good case in point has to do with wheat at Chicago in the spring of 1959. A large and apparently concentrated long interest was built up and, of course, an offsetting short interest. The price increased rather sharply. There was much conversation about a squeeze and how high the price might go. At the peak of the confusion I spent some time in Chicago discussing the situation with interested and informed trade people. The conversations generally had to do with who was long, how much May wheat, how much delivery would be taken, what it would cost to bring in additional supplies, action that the Exchange and the CEA might take, and how large deliverable supplies were in relation to the concentrated long position. That is, the conversation had to do with the technical situation as it existed in the futures market. One could easily gain the impression that this was a battle among futures traders and that their milling and thrashing about was causing substantial gyrations in wheat prices. In the end the prices declined back below the level from which it started.

Was this a squeeze that failed? Were these price gyrations
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A product of futures trading? I think not. As I pressed people for their opinions about how the contest that they described would end, those who thought the price would be strong said that the fairly large stocks of wheat in deliverable position would be shipped out for export and those who thought the price would collapse said that the deliverable supply could not be sold out of Chicago because of the limited export demand and comparatively large stocks in more favorable export position than those in Chicago. In the final analysis the question of the direction of price depended upon export demand. As it finally turned out, the market made an error and the price was bid too high. But had the very uncertain export demand materialized, the price would have gone on up. The result was the putting of the price about half way to where a vigorous export demand would have forced it.

A fairly similar situation existed in wheat in the spring of 1958. In this instance harvest of the new crop was delayed by rain so that old crop supplies had to be stretched out. In the face of large export sales this could be accomplished only by a substantial price rise. In 1958 the outcome of the futures market contest depended on whether or not delivery would be taken which in turn depended on the rate of harvest.

I have observed many futures market contests while they were in process and always found that some commercial situation of uncertainty lay behind and was responsible for the technical situation in futures. Failure to put futures trading in its commercial context and look at the underlying market factors and at the extreme uncertainty of those factors has been responsible for the bulk of criticism leveled at futures market speculation.

The third possible distortion is what is sometimes called coat tailing. It is a follow-the-leader, movement trading system. It is said that a rise or fall in price feeds on itself. There
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has not been enough study of systems of trading to know how much, if at all, this is a factor. Insofar as movement trading puts the price where it is going anyhow, it is constructive. Only if prices make false starts and frequent reversals of direction does this kind of activity have a destructive influence.

It is doubtful if there is such a thing as movement trading in the aggregate; that is, for everyone who trades with the price movement there is likely someone who trades against it. For every sale there is a purchase. For everyone who thinks the price is going up, someone else thinks it is going down. In this context it is difficult to ascribe much importance to movement trading.

The fourth possibility of distortion is that of waves of excessive speculation. Speaking of the extreme fluctuations in onion futures prices in late January and early February 1957, the CEA said, "Price movements such as this cannot be justified by supply and demand factors and must be attributed either to manipulative activity or, as appears to be the case in this instance, to a wave of excessive speculation," and further, "In summary the rise in onion futures prices in the January 15-31 period was accompanied by a substantial amount of speculative activity. Large speculators bought net, all futures combined, 166 carlots. Small traders sold net, 485 carlots, and large hedgers had net purchases of 319 carlots. Hedgers, for the most part, were getting out of the onion market by covering their short positions, although there were some new hedging sales in the March future consisting largely of transfers from the February future. The marked increase in the average daily volume of trading in the January 15-31 period further reflected the speculative fervor in the onion futures market."

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United States Department of Agriculture, Commodity Exchange Authority, Speculation in Onion Futures January-March 1957, p. iv and 7.

[142]
How much speculation is excessive? How much is just right? How much is too little? For that matter, what is speculation and how is it measured? Speculation is properly measured by the open contracts minus the net of offsetting hedged positions. It is not measured by the volume of trading. One speculates by taking a market position; by being long or short. It is, of course, not possible, but if it were, and one bought and sold the same contracts simultaneously, one would not be speculating; one would neither profit nor lose by his trading activity. One is speculating precisely one-half as much if one buys one contract on Monday and sells it on Tuesday as he is if he buys one contract on Monday and sells it on Wednesday. One is speculating twice as much if he holds two contracts as he is if he holds one contract.

At an absolute minimum the amount of speculation must be equal to the net of the hedged positions. If it is at this minimum, the market will be seriously lacking in liquidity and lose attraction for both hedgers and speculators. No criteria have been established by which the ratio of open contracts to the net hedged position should be measured. If this ratio is too small the market will not be liquid. If there is a large speculative position in excess of that needed to assume the hedged risks, unnecessary risks are created which is, presumably, a wasteful process. There is no reason to think that a larger than necessary speculative position distorts prices so long as the delivery terms of contracts force the futures market values to reflect the cash trading values.

What is the influence of a wave of speculation on prices? Again, it seems well to point out that for every buyer there is a seller; for every long, a short. If a group of speculators descend on a market and take positions, for everyone who thinks the price is too low and will increase, another thinks the price is too high and will decrease. This, in and of itself,
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cannot have any effect on price. Only as speculators change their expectations about the future level of prices and change their market positions in line with their changed expectations are prices changed. The thing, then, that causes prices to change is the changed expectations of market participants. On what are these price expectations based? It is not unreasonable that expectations are in part based on recent market trends. But, again, among our theoretical group of new speculators, there must be an equal number of longs and shorts. For everyone who thinks the price will continue up because it has been going up, there must be one who thinks the trend has gone too far and will shortly reverse. More likely speculators look at the more ordinary factors of production, stocks, and disappearance in forming their price expectations.

If there is a wave of speculative activity, it must show up as part of the open interest. It is interesting to note that in the January-February 1957 period when the extreme variation in onion prices was blamed on a "wave of excessive speculation" the amount of speculation was actually declining. Examination of the open contracts during the period in question shows a regular and smooth decrease. During the January 15-31 period, open contracts decreased by 601 carlots. The largest reduction was 407 contracts in small trader long holdings. This is the group that is most often blamed for speculative excesses. They were liquidating positions in a rising market!

It is a matter of belaboring the obvious, to suggest that it is doubtful that, inasmuch as there was not a wave of speculation, the price change in question was caused by a wave of speculation.

This example appears to take the full measure of the changes about the influence of so-called waves of speculation.
EFFECT OF FUTURES TRADING ON PRICES

Some Empirical Exercises

The foregoing discussion of the theory of the effects of futures trading is fairly conclusive. However, the time is long since past when forward steps in search of definitive answers to the relationships of futures trading and price variation should have been taken. Following are some first steps that may be of use as a basis for generating serious work in the area.

The general pattern of examination that I have taken to date is to fragment the areas of examination into effects by various time periods: (1) seasonal, (2) month-to-month, and (3) day-to-day. There is no good theoretical reason for such fragmentation. The effects of futures trading are logically the same for all time periods. First, the degree, if not the direction of effects may vary by time periods. That is, futures may be better (or worse) discounting systems for different time periods. Second, the traditional distinction made in much of the literature mentioned at the outset of this paper should be observed in empirical analysis to determine whether such a distinction is justified.

The empirical exercises described in this paper pertain to onions. They were selected because I have done more work in this commodity than any other.

Seasonal variation. A first step in testing the influence on seasonal variation has been presented by Gray,* in which he compares seasonal price patterns for three time periods, one before futures trading, a second while the volume of futures trading was quite small, and a third since there has been substantial volume of futures trading in onions.

I repeated this exercise with the results that are shown in Figure 3. Three nine-year periods beginning in 1931 and

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[145]
FIGURE 3. SEASONAL VARIATION IN U.S. FARM PRICE OF ONIONS, 1931-1958
EFFECT OF FUTURES TRADING ON PRICES

extending through 1958 were selected and an index of seasonal variation of farm prices of late summer onions was computed for each of the periods. The last nine years, 1949-58, is the period in which there was futures trading in onions in substantial amount. During the middle nine years there was a very small amount in the last seven and more in the first two. There was no futures trading in onions in the 1931-40 period.

The seasonal variation in onion prices was substantially larger in the 1931-40 period than it was in the 1949-58 period. That is, the price went lower at harvest and higher in the spring, before futures trading than it did after volume futures trading was achieved. One thing that may have accounted for the reduction in seasonal variation was the development of an active futures market. But it is possible that other factors entered into the reduction. These other factors could have been improved market reporting, improved financial position of onion growers, and better country storage facilities. Had the difference in seasonal variation been ascribable to these latter three factors the reduction in seasonal variation would have occurred gradually over the total of the 27-year period. But it did not. The seasonal variation in the second of the nine-year periods was quite as great as in the first. Thus the reduction in seasonal variation did not occur until the advent of a large amount of futures trading and so must be ascribed to futures trading rather than to other factors.

The results obtained in this exercise were consistent with the general theory of futures trading which says that speculators are better buyers of farmers' commodities at harvest than are cash merchants. The indexes of seasonal variation by periods were as follows:

<table>
<thead>
<tr>
<th>Period</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1931-40</td>
<td>.605</td>
</tr>
<tr>
<td>1940-49</td>
<td>.687</td>
</tr>
<tr>
<td>1949-58</td>
<td>.348</td>
</tr>
</tbody>
</table>
FIGURE 4. RELATIONSHIP OF SEPTEMBER PRICES AND OPEN CONTRACTS, ONIONS, 1947-58

SEPTEMBER PRICE AS PER CENT OF SEASON'S AVERAGE PRICE

SEPTEMBER 30 OPEN CONTRACTS
EFFECT OF FUTURES TRADING ON PRICES

The seasonal variation in onion prices was only a little over half as great after futures trading as it was before.

A second measure of the seasonal effect of futures trading is a reduction in the harvest period price depression.\footnote{Holbrook Working refers to this as "anticipatory bias." Op. cit., # 28.} I divided the September price of cash onions in the Chicago wholesale market by the season's average price and related the resulting coefficient to the number of open contracts in onion futures on September 30 for each of the crop years, 1947-48 through 1957-58. The result is shown in Figure 4. While it is not a close fit there is a marked tendency for the September price to be high in relation to the season's average price as the number of open contracts is relatively large.

It is certainly to be expected that factors other than open contracts affect the September average price in relation to the average for the season; left in are all of the errors of forecasting that the market makes. Until such time as we can isolate the factors affecting the making of these errors we must be content with a loose fit.

A third test of seasonal variation was made for onions. The most difficult speculative job with which I am familiar is anticipating the season-end onion situation. Onions are not carried over from year to year so that prices must be such that supplies and use come out even on the day that early spring onions become available. The demand for onions is extremely inelastic resulting in the need for large adjustments in price at the end of the season as the result of comparatively small forecasting errors made early in the season. The timing of the spring crop is indefinite, being affected by spring weather conditions in Texas. In addition, the statistics of existing stocks are less than perfectly accurate.

The market attempts to forecast the season's end situa-
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tion and discount it back into earlier prices. It does not do this very accurately. But the key question is whether it does it more accurately in the presence of futures trading than it does in the absence. I made some before- and after-futures trading comparisons of the December to March price changes. These are shown in Table III.

Table III. — Change in the monthly Means of Cash Wholesale Prices of Onions at Chicago from December to March

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent March of December</th>
<th>Year</th>
<th>Percent March of December</th>
</tr>
</thead>
<tbody>
<tr>
<td>1931</td>
<td>80.0</td>
<td>1948</td>
<td>171.4</td>
</tr>
<tr>
<td>1932</td>
<td>198.7</td>
<td>1949</td>
<td>90.3</td>
</tr>
<tr>
<td>1933</td>
<td>132.4</td>
<td>1950</td>
<td>32.1</td>
</tr>
<tr>
<td>1934</td>
<td>93.6</td>
<td>1951</td>
<td>123.6</td>
</tr>
<tr>
<td>1935</td>
<td>217.3</td>
<td>1952</td>
<td>168.9</td>
</tr>
<tr>
<td>1936</td>
<td>60.4</td>
<td>1953</td>
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</tr>
<tr>
<td>1937</td>
<td>175.0</td>
<td>1954</td>
<td>56.2</td>
</tr>
<tr>
<td>1938</td>
<td>79.6</td>
<td>1955</td>
<td>75.3</td>
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<tr>
<td>1939</td>
<td>113.4</td>
<td>1956</td>
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<tr>
<td>1940</td>
<td>190.2</td>
<td>1957</td>
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<td>1941</td>
<td>125.0</td>
<td>1958</td>
<td>185.8</td>
</tr>
<tr>
<td>M</td>
<td>133.2</td>
<td>M</td>
<td>104.9</td>
</tr>
</tbody>
</table>

In looking at the variation that existed during the futures trading period one can easily understand why it is frequently suggested that onion futures trading does a poor job of discounting. However, the average December to March change fairly closely approaches zero in the latter period while there is a marked upward change in the earlier period.

The means of the changes (deflated) were of the same general order, being only slightly, and not significantly, larger in the earlier period. However, the summation of the changes squared was .77 times as large in the second period as in the first.

It appears that in the second period the forecasting of onion prices was a zero sum game, while in the first there was an upward bias. The price of onions is subject to great variation from December to March. The summation of the variation does not appear to have been changed by futures; the ex-
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FIGURE 5. INTERRELATIONSHIP OF FUTURES TRADING AND PRICE VARIATION

[Diagram showing interrelations between number of floor traders, stocks, inventory, volume trading, average open contracts, liquidity ratio, price variation, timing of new crop, changes in production, changes in use rate, preceding experience, errors of estimate, and errors of forecast.]

[151]
tremes of change appear to have been reduced. It is doubtful that the influence of futures trading can be isolated until some of the other influences can be removed. For example, the sharp increase in 1958 was the result of a cold, wet spring in Texas that delayed the crop. This was unforeseeable. The essential problem is to separate the foreseeable and the unforeseeable which as yet escapes me.

**Shorter-term relationships.** Figure 5 is a model of futures trading and price variation. The model was developed from the general theory of the influence of speculation via futures trading on price variation. The parts of the model with which we are most concerned are the center four: price variation, open contracts, volume of trading, and the liquidity ratio. The directions of causation were based on the theoretical consideration involved. On the left of the model, I have listed six exogenous sources of price variation, factors causing price variation that the speculative system must take into account in establishing price. The skill with which this is accomplished will determine, finally, the extent of price variation.

Also, exogenous to the system is the stocks in commercial position. The larger the stocks the greater the short hedges; hence, the greater the number of open contracts. The model is primarily designed for description of intra-seasonal variation. In this connection, inventory policy of merchants is exogenous to the system. Inventory policies for a given season are established before the price variation within that particular season is known. They are, however, based on historical price variation.

The number of floor traders is a function of the size of the futures market which is basically measured by the number of open contracts. Within this framework the number of floor traders (including scalpers) is partially dependent upon
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the volume of trading; the number affects the volume of trading; hence, the dual lines of causation.

Within the inner four factors the average of open contracts is the only independent variable. It is a function of stocks and inventory policy. It is only affected by price variation in longer periods than a crop season. Accordingly, lines of causation must run away from open contracts. Such relationships as there are between open contracts and price variation must be ascribed to open contracts.

The size of the speculative market is measured by the number of open contracts. The volume of trading is developed out of the existence of open contracts.

The relationship of price variation and volume of trading is a dual relationship. Increases in price variation result in more changes in position than occur when prices are stable; speculators have more occasion for changing evaluations of their market positions. The relationship cannot run the other way. Prices can only be affected by position and volume is not position.

Volume of trading has an indirect effect on price variation. As the volume of trading is large in relation to the number of open contracts, orders can be executed readily and with small price concessions. Volume of trading is divided by the open contracts to obtain the liquidity ratio. If the average of open contracts remains constant the relationship between volume of trading and price variation is both positive and negative.

This then is approximately the model that needs to be tested. A meager beginning of testing follows. The first problem encountered in attempting a statistical description of the interrelationships was that of the appropriate measure of price variation. Three different measures were used in examining the variation for the different time periods: vari-
Variance is a very standard statistical measure that submits nicely to statistical manipulation and that has broad acceptance. Nonalgebraic change is, I think, conceptually better in a futures trading context. There are two conceptual differences between the two measures. Variance measures deviations about a mean and the large deviations are more important than small ones because of the squaring process. Nonalgebraic change is computed by totaling the price changes without regard to sign. It measures the total distance traveled during the time period involved and weights all changes equally. My preference for this measure is that it treats prices as a part of a continuum, each price being a function of the preceding price. Prices are a part of a pattern that is usually headed in some direction or other. The deviations about the pattern may well be random. Prices are not random deviations about a mean as the use of variance assumes.

Range has a great deal of conceptual merit as a measure of how well forthcoming events are discounted into current prices. It has the major fault that the bulk of the range for a given period may be made in a very short part of the period. Suppose that we are concerned with a season of eight months. Say that during the first month the price falls from $3.00 per unit to $1.00 then recovers to $1.50, still in the same month, and remains in the $1.40 to $1.60 range for the balance of the season. The season's range is, of course, $2.00. But price variation and the quality of discounting is very different than had the price repeatedly fluctuated over the entire range or taken all season to move from one of the range to the other.

Linear multiple regression equations were used to examine the relationships. This method precludes the use of the liquidity ratio in the same equation with open contracts and volume of trading because it is a function of the other two. Obvious-
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ly, volume of trading and open contracts cannot be held constant while liquidity varies. A system of equations analysis will be required before the quality of the relationship of volume of trading and price variation can be tested.

The results of one series of analyses are shown in Table V. Seven different price variation measurements were used; three kinds and three different combinations. These were:

1. $X_2$, the annual average price of onions, the basis being that the level of price affects the absolute magnitude of variation,
2. $X_3$, the average number of open contracts,
3. $X_4$, the season's total volume of trading, and
4. $X_5$, the ratio of volume of trading to open contracts which I call the liquidity ratio.

The first pair of equations, seeking to relate the variance of monthly mean prices to open interest and volume of trading was without result. The relationship was small and the standard errors of the regression values were very large. So, while the signs of the regression values for $X_3$ were consistent with the model shown in Figure 5, they were of no significance.

The second series of four equations relates the total change in price from month-to-month in each season to the four independent factors. When the annual average price was included the coefficient of determination reached acceptable levels. The signs of the relationship of price variation to open contracts were erratic and the standard errors again very large. The same observation applies to both volume of trading and the liquidity ratio.

The third series of four equations relate the annual range in price to the four independent variables. The positive relationship with annual average price was confirmed. The results with the other three variables were again nil.

From these three blocks of equations we must conclude that no relationship between the level of futures trading
Table IV. – Results of Multiple Regression Analysis Interrelationship of Price Variation, Cash Onion Prices Chicago Wholesale, and Futures Trading Factors, 1947-49 through 1957-58 where $X_2 =$ Annual Average Price, $X_3 =$ Season's Average Open Contracts, $X_4 =$ Season's Volume of Trading, $X_5 =$ Ratio of Volume of Trading to Open Contracts

<table>
<thead>
<tr>
<th>Equation</th>
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<th>$X_4$</th>
<th>$X_5$</th>
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<td>Beta</td>
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<td>Beta</td>
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<td>.92406</td>
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<td>.37518</td>
<td>.55078</td>
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</tbody>
</table>

$X_1 =$ Variance of Monthly Means of Prices

$X_1 =$ Summation of Nonalgebraic Change From Month to the Next

<table>
<thead>
<tr>
<th>Equation</th>
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<th>$X_4$</th>
<th>$X_5$</th>
<th>$X_1$</th>
<th>$X_2$</th>
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<th>$X_4$</th>
<th>$X_5$</th>
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<td>.25857</td>
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</table>

$X_1 =$ Annual Price Range of Monthly Means

$X_1 =$ Annual Variance of Daily Prices Minus Variance of Monthly Means

<table>
<thead>
<tr>
<th>Equation</th>
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<th>$X_4$</th>
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<td>.05010</td>
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</table>
Table V. — Results of Multiple Regression Analysis, Interrelationship of Price Variation, Cash Onion Prices Chicago Wholesale, and Futures Trading Factors, 1947-49 through 1957-58 where \( X_2 \) = Annual Average Price, \( X_3 \) = Season’s Average Open Contracts, \( X_4 \) = Season’s Volume of Trading, \( X_5 \) = Ratio of Volume of Trading to Open Contracts (Concluded)

| Equation | \( X_2 \) | | \( X_3 \) | | \( X_4 \) | | \( X_5 \) | |
|----------|----------|----------|----------|----------|----------|----------|----------|
|          | Regression | Standard error | Beta | Regression | Standard error | Beta | Regression | Standard error | Beta | \( R^2 \) |
| \( X_1 \) = Summation of Nonalgebraic Day-to-Day Change Minus Summation of Month-to-Month Change | \( X_1 \) = Variance of Daily Prices, Entire Crop Season | \( X_1 \) = Summation of Nonalgebraic Day-to-Day Change, Entire Season | | | | | | | | |
| 1.234    | +2.08272  | .10943    | .53065   | -.12468  | .09668    | .52756   | +.00176  | .23046   | .27334   | .669 |
| 1.235    | +2.32861  | .11127    | .59330   | -.06574  | .06097    | .27517   | -1.27798 | .04584   | .07119   | .646 |
| 1.34     | - .23923  | .08718    | 1.01225  | +.00373  | 2.3752    | .57921   | +5.26060 | .04973   | .29360   | .425 |
| 1.35     | - .12126  | .06548    | .51307   | + .71188 | .22249    | -25.13079| 1.3680   | 1.40000  | .789 |
| 1.2345   | +1.94050  | .09488    | .49441   | -.55090  | .24659    | 2.33010  | + .01431 | .71188   | 2.2249   | .254 |
|          |          |          |          |          |          |          |          |          |          | .257 |
|          |          |          |          |          |          |          |          |          |          | .579 |
| 1.34     | - .00018  | .12960    | .61630   | + .00001 | .355165   | .17161   | + .02919 | .06944   | .13256   | .588 |
| 1.35     | - .00013  | .09125    | .45668   | + .35069 | .17106    | + 3.77992 | .06673   | .15613   | .305 |
| 1.34     | - .25870  | .18347    | .81167   | + .00485 | .37698    | .55889   | + 9.76081 | .07329   | .40318   | .314 |
| 1.35     | - .09553  | .09649    | .29972   | + .35069 | .17106    | + 3.77992 | .06673   | .15613   | .305 |
activity and the month-to-month change in price has been isolated. If there is in fact a relationship it should show up in these computations except as it may be very small. This does not mean that futures trading does not affect month-to-month variation. It may be that once the level of futures trading activity exceeds some necessary minimum, additional amounts have no effect.

The fourth series of equations relate the net daily variance to the other factors. Net daily variance was computed by subtracting the variance of the monthly means from the total daily variance. Having found negligible relationship of monthly variance to futures trading I assumed that month-to-month variation was necessary or unavoidable. The question then becomes one of examining the relationship of variance that was in addition to the necessary variance. This we can best describe as the unnecessary wandering of the daily prices about the month-to-month deviation. The net daily variance was about 20 percent of the total variance.

The results were again inconclusive. The three regression coefficients were negative but the standard errors were very large. The relationship between variance and volume was positive but the standard error was very large.

In the fifth series of equations the summation of the non-algebraic change from day-to-day minus the summation of month-to-month change was used as the dependent variable. By taking the change in price from the first of one month to the first of the next as necessary or unavoidable change and subtracting the total change within the month, I isolated the intra-month variation for each year that might be affected by futures trading.

When the annual average price was included the coefficients of determination were Respectably large. In all equations the signs of the open interest regressions were negative.
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The important change from the earlier experience was that the standard errors were very much smaller. The chances are fairly high that the relationship is actually negative. Conversely they are quite small that the relationship is positive.

The relationship of volume of trading and price variation was indicated as positive but again the standard errors were quite large. As volume of trading was dropped and the liquidity ratio added to it took the same sign as volume of trading.

For the amusement of the seminar and to satisfy the curiosity of those of you who knew that I would eventually be drawn to the flame, I included the results of equation 1.2345 in Table V. If it were but statistically plausible it would be a most interesting result. The coefficient of determination is large, the regression signs are the same as those in the model, and, with the exception of volume of trading, the standard errors are of reasonable size. It is especially interesting to note that, as volume and liquidity were both included in the same equation, the regression values of both increased and the standard errors of both decreased.

In the final two sets of equations the total annual variation and the total day-to-day change were used as $X_1$. The results were an approximate combination of the separate examinations of month-to-month and day-to-day variation.

In 20 of the 24 equations in which open contracts were used the regression sign was negative. There appears to be a reasonable basis for thinking that as the number of open contracts increases prices become more stable. There is no basis for thinking that price variation increased as open contracts increased.

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There was a tendency for the regression values of volume of trading to be positive. They were, however, so unstable as to be inconclusive. The liquidity ratio tended to substitute for volume of trading when it was included.

In some of the equations net regression values for the futures trading factors were computed. In all instances this was negative, tending to indicate that an increase in the amount of futures trading reduces price variation.

To further examine the place of volume of trading it was designated the dependent variable in an equation including $X_2$, average of open contracts, and $X_3$, net daily change in price, the coefficient of determination was .642. The regression values for open contracts and price variation were both positive. The result was consistent with the theoretical model.

The results of the empirical examination, while not finally confirming the hypothesis that futures trading reduces price variation, make an hypothesis that futures trading increases price variation, particularly in short periods, completely untenable.

Conclusions

The overall conclusion indicated by both the theoretical and empirical considerations is that the variation of prices is reduced by an active futures market. Conclusions to the contrary regarding particular markets and commodities must be based on inadequate numbers of contracts or insufficient open interest and volume of trading.

Empirical exploration of futures trading in onions indicates that the price influences ascribed to “waves of speculative activity” are without any basis.

Empirical exploration indicates that there is not a “stabilizing influence on seasonal patterns and unstabilizing influence from day-to-day.” Quite the contrary, the stabilizing influences of futures trading appear to be greater from day-to-day
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than from month-to-month. For my part, we can now bury the textbook notion so long accepted.

There are great areas of unknown and unexplained in systems of speculative pricing. A better understanding of the speculative function, criteria for measuring its performance, and methods of evaluation need to be developed.
Effects of Futures Trading on Prices

Richard M. Withrow

It is with a mixture of pleasure and a feeling of responsibility that I take part in this seminar. It is assuredly a pleasure to meet with such an impressive group of professors and other speakers. I will be listening hard and hope to learn a lot. I feel a responsibility to see that the practical viewpoints of the grain trade are given consideration in these proceedings. As a discussant, one can snipe away at the main speaker's contribution from a position of comparative sanctuary, but if I take advantage of this position there is always the question period to help balance accounts.

Professor Hieronymus, in the early part of his paper stated the topic under discussion. He says the question of the influence of futures trading on prices is as follows: "Is the quality of the job of speculative pricing improved or decreased by the activity of futures market speculators?" To my mind this states the problem except that he tends to limit the activity of the futures market to speculators, while I feel sure he means to include all futures market activity, including hedging. He further refines the matter at hand as to what influence the futures market speculator has on price variability. Putting the main issue in this form seems to assume that price stability (or a minimum of price variation) is in itself desirable, and that if futures market activity reduces price variation it is necessarily good. Here I take issue. The discussion should go one step further than this. Stability of prices cannot be set up as an absolutely desirable end in itself. Freedom of prices to fluctuate as long as they reflect basic changes in supply and demand and are fully warranted by economic events is, to my mind, the desirable end. In other words, the discussion of the effect of futures trading
on prices should revolve around the point of whether futures trading allows or impedes prices in their adjustment to the economic facts of life. If we say that price stability is in itself the principal aim to be achieved, we are merely seeking a thermometer that always registers normal, even though the patient may be ill with a high fever, and recognition of the illness and remedial action are really the pressing requirements.

Professor Hieronymus is well aware of the importance of price fluctuations to reflect basic economic changes. I quote a small portion of his recent talk in August before the American Soybean Association Convention in St. Louis when he said, in part, while talking about meal prices in the coming season—“these several considerations point to an increase in meal requirements of about 5 percent, possibly a little more. They indicate a crush of about 425 million bushels. If supplies are not large enough to provide this increase, the price of meal will have to go up to levels that will cut back meal use by hogs.” No talk of price stability here but of price change to properly adjust to supply.

While in disagreement with the posing of the question at hand, I am impressed by the persuasive manner in which the main speaker points out the effects of futures trading on average prices, interseasonal prices, month-to-month and day-to-day price variations. Claims that futures trading take the wrinkles out of prices seem well substantiated. There have been a number of studies to prove that futures trading allows the marketing of farm crops at a narrow price spread between producer and consumer. In other words, the average price received by producer is raised and the average price paid by consumer is lowered. Likewise, seasonal, month to month, and day to day price variations are reduced.
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At the beginning of the paper there is a discussion of the attitude toward speculation and futures trading generally held by government officials, the CEA and students of futures trading. There is a notable absentee, and the Professor would have done well to mention the attitude toward futures trading apparently held by the thousands of executives of America's largest corporations dealing in food and fibre — companies such as our largest flour mills, soybean processors, elevators and merchandisers and exporters of grain and grain products, cotton and other commodities — who are free to use or not to use futures markets for hedging protection during the period that they are marketing or processing commodities. I think it would have been well to have mentioned the rather universal use of futures market for price insurance on the part of this large segment of the American economy.

A number of studies have been made to test the influence of futures trading on prices. One of the most extensive was completed in the 1920s when a survey of prices for 81 years, including over 100,000 entries, was made. J. E. Boyle divided his study into two periods, 1841-60 and 1871-1913. During the earlier period there was no futures trading in wheat, while during the latter period it was an established practice. He found that during the earlier period the average seasonal range in price was 17¢, while in the latter period when wheat futures trading was active the range was only 9¢. However, there were enough extraneous factors including improved communications, transportation, improved methods of grading, etc. that entered into the picture that the results of this study are far from conclusive; and other studies of price relationships of the same commodity during periods of futures trading and no futures trading, or studies of similar commodities, one of which has a futures market and the other does not, are equally inconclusive. There are many cases where com-
modities for which futures trading was in effect actually fluc-
tuated more widely than those for which no futures markets
were established. But it is important to point out that fu-
tures trading often developed for commodities where hedg-
ing protection was needed due to the inherently large sea-
sonal price swings in these commodities.

In spite of the fact that most evidence points toward the
inconclusiveness of such studies, I just had to get into the act
and made a comparison of wheat and rice price variations
based on the average price received by farmers for each crop
over the past approximately thirteen years. When I picked
these two commodities I had no idea what the results would
show. You may argue with the choice. They were selected
because they are commodities used predominantly for human
consumption; they are consumed over large areas of the world.
Rice has no futures trading of importance, while well estab-
lished futures markets for wheat have existed for a long period
of time. For the period from August 1946 to and including
March 1959 the

Average percentage deviation of rice prices was — 10.91%
Average percentage deviation of wheat prices was — 5.98%

It is unfortunate that our speaker has used the onion mar-
ket as his example for the purposes of this discussion. The
Grain Exchange Institute text book “Grain and Its Market-
ing” specified four important criteria which make a commod-
ity suitable for futures trading. The first mentioned is that
the product must be durable and suitable for storage over
reasonable periods of time without change in quality or de-
terioration. Secondly, the commodity must have adaptability
for grading into distinctly and definitely standardized classifi-
cations. Third, the product should be one which is produced
seasonally, necessitating storage over a period of time for or-
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derly marketing, and fourth, the product should be produced by a large number of producers and used by a large number of consumers. Many commodities admirably meet all of these tests but, unfortunately, this is not true of onions.

Now to return again to this fetish that is sometimes made of stability of prices and the apparent enthusiasm for small price variation. We can sit around and hope that supply and demand factors will be such that price changes between seasons, during the season, on a month-to-month or day-to-day basis may be small, and thus industries, merchandisers and exporters, etc. may carry on their activities with a minimum of mental strain. However, often times price changes must be violent to awaken new demand or attract supplies, as your main speaker has pointed out, and I quote, "It is doubtful that consumers, being something less than perfectly informed and immediately responsive economic men, react fully to small changes in price, so that a price adjustment must be exaggerated to obtain the necessary consumption response." There is plenty of historical evidence to point out that the price of any commodity in common usage will, under conditions of short supply, rise by a different ratio from the percentage relationship of supply to the normal or average; and, conversely, when the supply of a commodity is in excess of normal requirements, the price will decline more than the percentage relationship of the supply to the normal requirements. Gregory King observed this phenomenon during a series of famines in England and embodies his observations into what has come to be called "Gregory King's Law of Prices."

Note that your main speaker has remarked on the fact that futures trading often increases as a result of large price changes. This can be observed in the day to day activities
of the Grain Exchange where above normal price changes are frequently accompanied by increases in the volume of trading. Let's face the facts — the average speculator is interested in trading in a commodity that moves. If oats are fluctuating within a range of $\frac{1}{4}$ to $\frac{1}{2}$ cent and soybeans have a range of 2 to 3 cents per day, the speculation is going to be attracted to the soybean market. In this case it is obvious that accelerated futures trading is not the cause of wide price swings but is the result of the wide price swings. I am glad that Professor Hieronymus has pointed out that the elimination of futures trading does not eliminate speculation. His mention of the speculation that takes place in cash markets and the fact that cash markets are unregulated, whereas futures markets are subject to tremendous regulation, is a most welcome contribution in this discussion. We have all heard of the farmer who produced a crop of wheat or soybeans and, when confronted with the idea of hedging his products in the futures market and waiting for a more favorable basis to sell his cash crop, abhors the idea on the grounds that to trade in the futures market is "rank speculation." Meanwhile, he sees nothing inconsistent with carrying an unhedged crop for a long period of time.

Now I have wandered a little bit in attempting to comment on the main speaker's paper and, of necessity, have injected some of my own ideas. It is time here to say that I am in general agreement with Professor Hieronymus' conclusions with the exceptions already noted. I have tried to stress the point that price variation is not evil if it is the logical outcome of changing economic forces. Now the question arises — is there excessive price variation that is the result, not of supply and demand fundamentals, but rather the result of excessive speculation or faulty futures trading. I do not know any way in which one can prove that futures trad-
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ing does not distort the normal flow of prices as they would be shaped by economic events. My own experience of some twenty-one years of close association with grain marketing on the Chicago Board of Trade is that price distortion, as a result of futures trading, or speculative activity, if you prefer it, is infrequent and, where present, is a factor over the very short run only.

It is interesting to note the conclusion of the CEA in their study “Speculation in Onion Futures — January to March 1957” in which they stated as point #8 in their summary and conclusions as follows: “It is clear that futures trading in onions has widened and accentuated price movement of short periods of time within a marketing season. Price behavior since January 8, 1957, is an example. No evidence has been found, however, that would justify the conclusion that the average season prices received by producers for cash onions have been materially affected by futures trading.” In this regard I quote the following from “Futures Trading on Organized Commodity Markets in the United States” by G. Wright Hoffman, former professor at the University of Pennsylvania and consulting economist for the USDA: “Futures prices do serve to indicate, when compared with spot prices, the probable course of prices in the future, but conditions change rapidly so that it is doubtful whether any effective discounting or forecasting is done beyond the limits of a very few weeks. It is doubtful too whether the focus of trading interest by speculators as a group fall much beyond two or three weeks ahead.”

When first apprised of the subject matter to be discussed, namely the effect of futures trading on prices, and before I had a chance to read your main speaker’s paper, the events surrounding futures price changes in wheat during the spring of 1958 and again in the spring of 1959 came to mind, and
I was interested that Professor Hieronymus also used these situations in his paper. He stresses the point that the cash wheat situation was the basis for futures activity in both of these instances. You will recall that wheat futures rose in the spring of 1958 — in fact the May wheat went off the Board at the season's high. Large elevator and merchandising interests were heavily on the long side of the futures market in that case, with cash wheat sold for export. Here was a situation in which the demand for export actually existed, the harvesting of the new crop was delayed by rain, and thus the economics of the situation called for a price rise and it was substantial and sustained. In the spring of 1959 the March and May wheat futures were also in an up-trend that began about late December but here, however, the dominant long represented large speculative holdings and the export business that they hoped for failed to materialize. Thus a precipitous drop in prices occurred about mid-April. Futures activity was rather heavy in both cases and, while some short-run distortions may have taken place, prices of futures contracts bowed to the inevitable and conformed to the essentials of the cash situation. I believe that you could take any number of seasoned futures traders, cash grain handlers, and others directly concerned with prices of commodities actively traded on futures exchanges, and they would agree to a man that, while the effects of futures trading might at times cause some short-run price variation not consistent with the law of supply and demand, over any extended period prices established by futures trading must be such as to be fully warranted and justified by the fundamentals of the cash grain situation. We have recently had a very good example of the adjustment of futures values to known cash grain statistical factors. Prior to the August 11 government crop report last month, there was widespread feeling among traders that the soybean crop
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estimate would be down in reflection of drought conditions suffered in the main belt in early July. In fact, if my memory serves me, the average guess of a number of Board of Trade members was 511 million bushels. However — when the report was released the soybean estimate was 531 million bushels. The drop in bean prices the following market day, October 12, was nearly 6 cents, with closing prices 4\(\frac{1}{4}\) to 4\(\frac{3}{4}\) lower for the day, and subsequently prices drifted still lower. I submit that speculators may have wished the market higher, but wishing could not make it so in the face of the government's production estimate.

Quoting again from the main speaker, "it is extremely difficult to determine the effects of futures trading on the price of a commodity. The question cannot be subjected to laboratory experiment." In spite of this clear statement, our main speaker launches into a group of what he calls "linear multiple regression equations," in connection with his model of futures trading and price variations reproduced in Figure 5. Rather than becoming critical of this approach to the problem I am going to defer to the other discussants whom I hope can approach this part of the talk with a greater insight than I — only to say, if we are to provide readable material for people who are interested in the effects of futures trading on prices we must use a more common approach to the subject. It appears to me that my good friend Tom, in the latter part of his speech, is guilty of a certain amount of virtuosity. By page 154 in the speech it was evident that here was a man who, when asked "what time is it?" proceeds to tell how the watch is made.

In summary, although being harsh at times, I am in general agreement with friend Tom's conclusions. Along the way he has dropped a number of gems. For example, his comment that the "business of speculation in commodity fu-
tures acts as a continuous spell-down” is so apt in describing the continuous erosion that takes toll of commodity specula
tors, while at the same time, more skilled operators make money and assume a larger role in the market place.

I have two main points I would like to leave with you. The first one is that I believe that variation of prices is not to be scorned if it is consistent with the fundamental economic forces at play. Freedom of prices to fluctuate, unimpeded by restraints, ceilings and floors, in their continuing effort to reflect the balance between supply and demand, is essential. The government, in its price support philosophy (including the impositions of ceilings after the war) shows too great a reverence for price stability — as embodied in the now disputed parity price concept. The shrewd retail merchandiser is not so bound by the idea of fixed prices. When he has a surplus he has a sale, cuts prices drastically and clears the shelves. The second point is that when futures trading influences prices in an opposite direction from the fundamental factors in the cash market it is normally for the short-run only.

It has been a pleasure to participate in this seminar. Thank you for your attention.
Effects of Futures Trading on Prices
Reynold P. Dahl

Professor Hieronymus points out that his paper is a first approximation to three needs, namely, a description of the speculative pricing functions of commodity exchanges, the establishment of a general theory of the influence of speculation on prices, and a system of empirical analysis of the speculative influence. Few would argue that these objectives are not worthy. It is fortunate, however, that he admits his paper to be "an approximation" that is "far from final". He further qualifies the paper by stating that his work is incomplete and, hence, is open to easy criticism.

Although my comments contain some elements of criticism, as the author anticipates, such criticism is made in good faith in hopes that it may be useful in strengthening his final product.

The quote from J. M. Mehl which Hieronymus cites in the opening paragraphs of his paper does not warrant his conclusion that the Commodity Exchange Authority is against the speculator. The Mehl statement is reasonable and I'm sure many, including myself, would be willing to accept it as fact. Certainly there is little in this paper which would disprove it. In fairness to Mr. Mehl a quote from his statement in the hearings on futures trading in onions is appropriate. "I appear in behalf of the Chicago Merchantile Exchange in opposition to the pending bills to prohibit trade in onions for future delivery. As you might expect, I have over the years acquired certain personal convictions regarding the economic value of organized and orderly speculation in agricultural commodities. One such conviction is that constructive and orderly speculation is possible only through the medium of trade in contracts for future delivery." 37

Hieronymus points out in his discussion of the speculative pricing function that there are two sources of demand in the marketing of seasonally produced commodities, namely, the conventional demand for consumption and the demand for inventory. He goes on to say that “the demand for inventory is a short-run supply function and it takes the up-sloping supply schedule form”, and “in the short-run the rate of flow into consumption, hence, the price is established by the location and slope of the inventory demand schedule.” I have difficulty in understanding how a demand schedule can take the form of a supply schedule. Hieronymus seems to be writing new theory in this section of his paper without regard to the internal consistency of the theory.

His statement that “inventory holders are speculators” is difficult to reconcile at a seminar where the economics of futures trading are being analyzed. Major roles played by a futures market are to make it possible for inventory holders to minimize price risks and to facilitate the economic distribution of supplies through time. A futures market performs these functions through the hedging medium.

Hieronymus' discussion of inventory demand would have been less “fuzzy” if it were related to cash-future price relationships. I'm sure he recognizes that merchants and processors look to cash-future price relationships as a guide to their storage operations, although direct reference to this point is not made in his paper.

It is useful to consider the difference between the cash and futures price as representing the price of storage. A positive price and hence a positive return can be earned from storage when the futures price exceeds the cash price. When the cash price exceeds the futures price storage has a negative price and hence earns a negative return. These results are predicated on the principle that the cash and futures prices equalize
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during the month of delivery. When supplies are abundant they are reflected in the market through positive carrying charges, which in turn induce merchants and processors to carry these stocks forward. When supplies are scarce, however, inverse carrying charges discourage the carrying of stocks. This reasoning appears to have escaped Hieronymus. His concept of "inventory demand", considered without reference to cash-futures price relationships, is meaningless.

Working states the economic significance of the price of storage as follows: "It is through supplying a direct measure of the return to be expected from storage, and a means, through hedging, of assuring receipt of that return, or of approximately that return, that a futures market makes its most direct and powerful contribution to the economical distribution of supplies of a commodity over time." 38

Further in his "description" of the speculative pricing of commodity exchanges, Hieronymus makes the statement that futures markets are not primarily pricing systems, operating for the purpose of establishing speculative prices. Their pricing function is secondary." It is not clear from his subsequent discussion what the major role of a futures market is if it is not pricing. Perhaps the author did not intend for this statement to be taken literally or had some other point in mind which he did not clarify in his paper. Most students of futures trading certainly recognize that pricing is the major function of a futures market. One competent student has stated that "The business of a futures market, so far as it may differ from that of any other, is to anticipate future developments as best it may and to give them due expression in present prices, spot and near futures as well as distant futures." 39


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Several statements made by Professor Hieronymus leave the impression that futures market speculators buy and sell commodities as well as contracts. For example, "Without the inventory accumulation and holding of speculators, prices would go lower than they do. Someone would buy and hold inventories, but only at prices lower than those at which futures market speculators buy." I'm sure he recognizes that futures market speculators deal in contracts and do not accumulate inventories in their capacity as speculators. They offer competition to merchants only by making it possible for other merchants to reduce their price risks through the medium of hedging.

The author also draws the conclusion, without supporting evidence, that "speculators in futures markets are logically better forecasters than producers, merchants, etc." He submits the qualification that the "unskilled lose their money and quit and the skilled make money and take on a larger role." While it is true that the unskilled who lose will quit, is there not also good reason for believing that others will take their place. One study led to the conclusion, as a statement of historical fact, that "speculators in wheat futures as a group have in the past carried the risks of price changes on hedged wheat and have received no reward for the service but paid heavily for the privilege."

His statement that speculators are better forecasters than producers, merchants, etc., also reflects an inadequate view that hedgers are mere risk-shifters who have no price ideas. A speculator who finds himself outsmarted by a soybean crusher — a not unrealistic example — would be able to muster at best a wry smile at being informed that he is "logically a better forecaster than a hedger."

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The paper indicates that the author has a keen appreciation for the importance of adequate speculation to a well-functioning futures market. He also recognizes the absurdity of some of the charges about too much speculation; but he deplores the absence of criteria for judging the adequacy of speculation. In this connection it is interesting to note that Roger Gray provided such criteria in his paper yesterday. So what one of the speakers has pointed out as being needed another speaker has provided. This certainly represents nice coincidence.

In his analysis of the influence of a wave of speculation on prices Hieronymus reasons as follows: “For every buyer there is a seller; for every long, a short. If a group of speculators descend on a market and take positions, for everyone who thinks the price is too low and will increase, another thinks the price is too high and will decrease. This, in and of itself, cannot have any effect on price.” This statement and various paraphrasings of it seems to imply that prices cannot change, since every time someone wants to buy there is someone wanting to sell and these forces necessarily cancel out. Since prices do change in futures markets, such reasoning is fallacious and can hardly be cited as evidence that speculation cannot affect prices.

In his “empirical exercises” where Hieronymus studies the effect of futures trading on onion prices, he verifies Gray’s analysis which shows a reduction in the seasonal price variability in onions since futures trading in onions became an important factor in marketing. This is a significant contribution to the economics of futures trading because it is the first time that such a beneficial effect of futures trading has been demonstrated.

A second measure of the seasonal effect of futures trading on onion prices where he relates the September price of cash
onions divided by the seasons average price of onions to the number of open contracts does not show anything not revealed by the analysis of seasonal price variability in the three nine year periods. The relationship here is not close, as he points out, and this "exercise" may detract attention from the previous measure of seasonal influence.

From his analysis of the ratio of the March to December price changes in onions before and after futures trading he concludes that the forecasting of onion prices appears to be a zero sum game during the period of futures trading. I don't quite see why this should be the case. In fact, it shouldn't be a zero sum game because it does cost something to carry onions from December to March.

When Hieronymus turns to the analysis of the effects of futures trading on intra-seasonal price variability he "shifts gears" and resorts to multiple regression analysis. This is difficult to understand because the same technique used in the analysis of seasonal price variability could have been used in studying day-to-day and month-to-month variability. Would it not be interesting to compare the day-to-day, week-to-week, and month-to-month price variability between the same three nine year periods used in the seasonal analysis?

In the model which the author sets up on the interrelationships between futures trading and intra-seasonal price variability he considers such factors as changes in production, timing of the new crop, and the level of stocks as exogenous variables and hence does not include them in his regression equations. Certainly he recognizes that these are major variables that tend to induce price variability and they cannot be ignored just because they are considered exogenous in his model. It is not surprising that his regression coefficients were low and the standard errors high with the variables used.
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He reasons that variations in commercial stocks are accounted for in his regression analysis through variations in open contracts. While it is true that open contracts vary directly with stocks in commodities where futures markets are used extensively for hedging, this association in onions may be imperfect because many onions are not hedged.

The reader may be puzzled, with some justification, as to why so much attention is given to onions in this paper rather than to better established and better organized futures markets such as that in wheat. After all, most would agree that onions are scarcely a good example of highly developed futures trading. Why pay so much attention to them? The only reason advanced by the author is that he has done more work in this commodity than any other. It would have been appropriate to point out that onions are a particularly fruitful topic for research. Since futures trading in this commodity is of recent origin, one can study price variability before and after futures trading to ascertain changes. To the extent that changes are observed, it is reasonable to ascribe them to futures trading if they cannot be explained by other factors. If certain price effects of futures trading in onions can be isolated, it is reasonable to ascribe these same effects to futures trading in other commodities. This would be an important contribution in the understanding of the economics of futures trading.

In conclusion a few remarks aimed at redirecting our attention to the basic problem under discussion in this paper are appropriate. As I previously mentioned, Professor Hieronymus has done a good job in pointing out the importance of speculation in futures and in calling attention to the need for criteria to judge the adequacy of speculation. He has also discussed some "destructive influences" such as squeezes which may tend to distort prices and add to price variability.
However, he does not feel they are important because they are usually explained by some commercial situation of uncertainty. Further analysis of such influences is needed. Futures markets may not be perfect and ways of improving them should not be overlooked.

In analyzing the problem under discussion in this paper, accepted theory and previous research results are useful as a guiding framework. The author has not drawn upon such material as adequately as he might have. A review of this paper supports the author's admonition that it is "an approximation" that is "far from final".
Effects of Futures Trading on Prices

Geoffrey Shepherd

Tom says in his paper: "Two approaches to the question of the effect of futures trading on prices can be made. One is logical and the other is empirical. The logical, or theoretical, approach follows." After that comes the empirical approach.

The "logical or theoretical approach" turns out to be a series of sections, each one beginning with a categorical conclusion concerning the effect of futures trading on prices. The first section, for example, starts out: "Futures trading increases the average of prices received by producers and reduces the average of prices paid by consumers." The rest of the section consists of Tom's opinions in support of this conclusion. Another section starts out: "Day to day price variation is reduced by futures trading," although he points out later in this section that "as price changes become more frequent and substantial the volume of trading increases." No statistical facts are adduced; this is all, as he says, theoretical. The other sections follow the same pattern.

But then, about half way through the paper, the author tells us that the preceding pages have given, not the theory of the effects of futures trading on prices, but "the theory of constructive influences of futures trading on prices." He gives us next the theory of "destructive influences; ways that futures trading may add to price variation or distort futures prices from equilibrium levels." Again there comes a series of assertions as to how this may be done, but in this case the opinions and arguments which follow are designed to demolish the assertions.

If conclusions could be substantiated by armchair theorizing of this character, the author could have stopped right
there, although that would have left the reader with an uncomfortable feeling that he had heard only one side of the case. But Tom goes on and devotes the rest of his paper to "some empirical exercises."

If his theory is based on facts, it does not need further empirical exercises to support it. If it is not based on facts, it is not a theory but only a collection of hypotheses to be tested empirically against the facts. Scientific method starts out, not with conclusions to be supported, but with hypotheses to be tested. So the best we can do is to say "Well! Tom has given us some hypotheses, not conclusions. Let us see how they stand up under the empirical tests he speaks of."

**Empirical Exercises**

*Effects of futures trading on seasonal variation.* Tom reproduces Gray's chart which shows that the seasonal variation in onion prices after World War II was only a little over half as great as it was during the war and before the war. He realizes that other things than futures trading were happening too, and could have caused this reduction; but he ascribes it to futures trading.

This *post hoc ergo propter hoc* kind of analysis can be quite misleading. When a dozen or more factors are affecting prices, and you are interested in only one, it is a natural mistake to ascribe the change in prices to the factor you are interested in. But another investigator will as naturally ascribe it to a different factor that he is interested in. Both cannot be right.

A few years ago, one of our most respected agricultural economists, Elmer Working, found a reduction in the variation of corn prices after the war.\(^4\) But he was interested in the effects of the CCC loan program, so he ascribed this re-

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duction to the loan program. It didn’t occur to him that futures trading might have been the reason and, as a matter of fact, it probably wasn’t. In fact, shifting what he called “the post-loan period” (and which Tom would call instead “the futures trading period”) by only one year showed that the post-war variation was almost as great as the prewar variation after all. The before-and-after method is not reliable in cases like these. Futures trading in onions may well have reduced seasonal price variation after the war. But Tom ad­duces no evidence which shows that it did.

The same sort of thing is true of Tom’s Table IV. It shows the effects of all of the dozen or more factors that affected onion prices, but Tom implies that the reduction in price variation was all due to futures trading. The data actually do not support what Tom claims. He says that the extremes of change appear to have been reduced; but the extreme (range) in the “pre-futures” period was 156.9, and in the “futures” period, 153.7 — a reduction of only 2 per cent — certainly not statistically or otherwise significant. Furthermore, the high ratio for 1958 does not fit in with his pre-con­ ception that futures trading reduced price change, so he ex­ plains it away by a cold wet spring in Texas; but he does not do this for any of the “pre-futures” years, when undoubtedly Texas had much the same climate as it had after futures trading in onions began.

The seasonal variability of egg prices decreased to less than half their prewar variation, as onions did. Tom might ascribe this to increased trading in egg futures. I would be more in­ clined to attribute it to the reduction in the seasonal variation of production that took place, or the increase in the storage of frozen eggs at a lower cost than for shell eggs. I suspect that similar non-futures factors accounted for a good deal of the decline — perhaps all of it — that took place in the seasonal
variation in onion prices.

Just for fun, I looked up what happened to hog prices over these years. The average variation for hogs decreased from 116.9 in 1931-41 to 106.5 in 1948-58, a reduction of 10 per cent. I would not ascribe this to an increase in futures trading.

**Simple Correlation Study**

Tom’s Figure 4 shows some positive correlation between the harvest period depression and the number of open contracts on September 30th. He calls this a “marked tendency”, and concludes that the open contracts are one of the factors that reduce the harvest period price depression.

Now actually, correlation tells us nothing about causation or the direction of causation. One could equally well draw the opposite conclusion from this study — that a large harvest period price depression causes an increase in open contracts. But neither conclusion would be justified merely by the correlation.

In any case the relationship is too low to be significant. It is not significant at the 1 per cent level, and is only significant at the 5 per cent level. If one dot (No. 9) is omitted, the relationship decreases greatly; it is non-significant then at both levels. We have seen so many correlation studies, with high correlations (significant at the 1 per cent level) fail to stand up, that we would like to warn Tom against relying on the result of a study that is not significant, or whose significance depends upon only one dot.

**Multiple Correlation Study**

Tom makes a real attempt to use scientific method in the last part of his paper. He sets up hypotheses in the form of a model and proceeds to test it by multiple correlation analysis.

His model is one of many different models that could be set up. Other investigators would be likely to think up dif-
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ferent models to test. But without raising questions here about his choice of factors and measures of variation, let us go along with his model and see how it tests out.

His Table V shows that the first 3 groups of equations, as he says, show no relation between futures trading activity and month-to-month change in price.

The fourth group, showing net daily variance, also yields inconclusive results.

The last 3 groups, dealing also with day-to-day price variations, yield large positive regressions with annual price, small negative regressions with open interest, and still smaller positive regressions with volume of trading.

One might conclude incautiously from this that high annual prices have a strong tendency to unstabilize prices, open commitments have a small tendency to stabilize prices, and trading has a still smaller tendency to unstabilize them. But Tom ignores the large regression with annual price, and bases his conclusions only on the small regression with open interest. This is odd, because when you look at the size of the 15 X 3 (open interest) and X 4 (volume of trading) regression coefficients, you see that almost all of them are so small compared with their standard errors that they are statistically insignificant. This is not a matter of judgement, but of standard statistical tests. A coefficient must be 2 or 3 times as large as its standard error before it can be considered statistically significant. Only one of the 15 is twice as large as its standard error; none of them is 3 times as large. Two of the open-interest regressions, where the average price variable is left out, are only one-tenth of 1 per cent as large as their standard errors. The standard errors of the volume of trading regressions are fantastically large. These things mean that

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42 This omits the coefficients for equation 1.2345; as Tom points out, it is not reliable, because it includes one variable which is the quotient of two of the others.

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Tom has been unable to show any relation between day-to-day variation in prices and open interest and volume of trading, much less any causation. Thus his analysis contradicts his own earlier flat conclusion that day-to-day price variation is reduced by futures trading.

Only 9 of the 24 equations in Table V show statistically significant $R^2$. A study including 4 variables, each with only 11 items in the series, has only 7 degrees of freedom. In that case, according to the standard test of statistical significance, any $R^2$ less than 0.44 is not significant. Only 4 of the 24 $R^2$ are higher than 0.64, the level regarded as highly significant, and those 4 only barely exceed this figure. When you look at the size of the betas in Table 2, you see that nearly all of the size of the $R^2$ results from the one factor, the annual average price, which Tom ignores in his conclusions. When this factor is left out, the $R^2$ are all smaller than 0.5, and some are smaller than 0.3. So the most the table indicates is that high price variation goes along with high annual prices. This tells us nothing about the effects of speculation.

These tests of significance apply to random data (to samples of independent data taken at random from the same universe). Economists recognize that economic time series are not random. So an analysis including economic time series, like Tom's here, is still less significant than the tests indicate. G. U. Yule got a correlation of 0.95 between Church of England marriages and mortality rates over a period of 45 years, for which anything over 0.29 would be significant; but as he pointed out, all he really had, "in non-technical language, was a fluke".  

We need to remember also that a correlation coefficient shows only relation, accidental or otherwise. It does not show

\[G. \text{ Udny Yule, "Why Do We Sometimes Get Nonsense Correlations Between Time Series?" Journal of the Royal Statistical Society, Vol. 89, No. 1, 1926, pp. 1-64.}\]
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causation. One may choose price variation as the dependent variable; this does not make it the dependent variable in actual fact. The same variables could be set up in reverse order, with volume of trading as the dependent variable. Tom does this later in his analysis, and comes out with an $R^2$ about as high as any he got in his Table 2. This does not prove that the other factors cause the volume of trading. Similarly, Tom's study does not prove that the factors he selects affect prices, especially when his coefficients are so low.

You can get high positive correlations between school children's writing ability and the size of their feet, but that doesn't prove that size of feet affects writing ability, nor does it prove that writing ability increases the size of the writer's feet; it only indicates that some other factor, in this case, age, affects both. Similarly, you can get high correlations between the number of storks in European towns and the number of babies born; but I can't believe that this proves that the babies were brought by the storks.

Correlation does not prove causation, even when the coefficients are high, and certainly not when they are low as they are here. Tom's conclusions are quite unsupported by his multiple correlation analysis. In fact they are contravened. His analysis shows no significant relationship between futures trading and price variations, and no causation at all. But he ignores this, and concludes first that "the variation of prices is reduced by an active futures market"; and second, "that there is not a stabilizing influence on seasonal patterns" (which doesn't fit well with his earlier conclusion that speculation reduces seasonal variation); and third, that "there is no unstabilizing influence from day-to-day". Tom's conclusions are partly inconsistent, and in any case, he has shown no evi-

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dence which supports them. L. D. Howell's conclusions, which are similar to the conclusions reached by several other careful and impartial analysts, and by Mr. Withrow just now, are that futures trading "increases the frequency of changes in grain prices and may at times increase the amounts of these changes over relatively short periods." This conclusion remains unscathed. Like Mark Twain, the reports of its death and need to be buried have been grossly exaggerated.

The "Wave of Speculation" in 1957

Tom says that there was not a "wave of speculation" in the onion market in January and February of 1957.

He says that "if there is a wave of speculative activity, it must show up as part of the open interest", and concludes that in January and February "the amount of speculation was actually declining", because the open contracts were declining.

Table VI shows that actually it was only the open interest

<table>
<thead>
<tr>
<th>Date</th>
<th>1957 Feb.</th>
<th>1957 March</th>
<th>1957 Nov.</th>
<th>1957 Jan.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1,037</td>
<td>2,587</td>
<td>19</td>
<td>3,861</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>417</td>
<td>2,795</td>
<td>48</td>
<td>3,260</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>1</td>
<td>2,508</td>
<td>48</td>
<td>2,888</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>6</td>
<td>2,877</td>
<td>65</td>
<td>3,055</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>7</td>
<td>2,819</td>
<td>65</td>
<td>2,970</td>
<td></td>
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<tr>
<td>February</td>
<td>6</td>
<td>2,626</td>
<td>120</td>
<td>2,792</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>14</td>
<td>2,437</td>
<td>208</td>
<td>1,659</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>6</td>
<td>741</td>
<td>293</td>
<td>1,050</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>15</td>
<td>255</td>
<td>449</td>
<td>730</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>22</td>
<td>43</td>
<td>527</td>
<td>656</td>
<td></td>
</tr>
</tbody>
</table>

*Total includes 218 carlots open in 1957 January future.

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in the February future that was declining. I don't know what else one would expect, since February, the delivery month, was at hand. The open interest in the dominant crop-year-end March future was rising, not declining: it reached a peak on February 12th, by which time prices were past their peak.

In any case, I cannot follow Tom in his flat statement that speculative activity must show up as part of the open interest. The facts of the matter do not seem to follow him either. Speculative activity consists of buying and selling, or in one word, trading. The best measure of the volume of trading I know of is the volume of trading. Figure 3 shows that the volume of trading increased several times over during the period. In view of the simple facts of the matter, I do not see how Tom can conclude that the price change could not have been caused by a wave of speculation because there was not a wave of speculation. Clearly there was a wave of speculation, and clearly there was a sharp rise and subsequent decline in prices, at the same time. Both are shown in Figure 3. I am not going to fall into Tom's error and conclude merely from this correlation that the one was the cause of the other. But the positive correlation between the two is obvious.

I wish I could express more agreement with Tom's paper, for we are good friends and colleagues. But it really would be no kindness to a man just to pat him on the back and not point out weak spots in his car, so that he can strengthen them before he gets out on the highway, and it is in this spirit that I offer my comments.

At least, I am relieved to be able to close on a note of agreement with him. I can agree completely with the last sentence of his conclusions: "A better understanding of the speculative function, criteria for measuring its performance,
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and method of evaluation need to be developed.” I hope Tom and others will develop them.

Much competent work has already been done; I hope that more will follow, to show more clearly what kinds of speculation stabilize prices, what kinds unstabilize them, and how the one can be sorted out from the other. As I have shown elsewhere, speculation can be a stabilizing and margin-narrowing force. I hope that Tom and others will continue their studies to this end, and show how the performance of the futures market can be still further improved.

I hope that these studies will include such new and forward-looking questions as these: What has been the effect of the huge CCC price-support programs on speculation? Reynold Dahl has been studying this question at the University of Minnesota. Then: What has been the effect of the CCC programs on grain prices? Have they stabilized grain prices? Have they stabilized them more than futures trading would have stabilized them in the absence of CCC programs? If the CCC programs were greatly reduced or abandoned in the future, would excessive storage capacity show up? If so, where, and what would need to be done about it? We have been investigating this question at Ames. And could futures speculation pick up the load if the CCC got out of the picture? Would a great increase in hedging and speculation be required? Or is more and more of our feed grain supply going to be fed close to home, as Fred Maywald believes, so that less of it will enter commercial channels and less trading in cash and futures will be required? The great importance of the answers to these questions to the Board of Trade and other grain agencies is obvious; these are some of the really big questions that need to be explored.

Effects of Futures Trading on Prices

Discussion

MILNER: Time is running down and I am quite sure that you would like to have a chance to ask as many questions as possible. And so, with a good leader and three very good discussants, I assume that you may want to question any of the four. Professors Dahl and Shepherd, will you take these chairs and be in position to be asked questions as well as Tom.

Who has the first question?

GRAY: This isn’t a question; I just want to welcome Tom to the club. (Laughter) And tell Allen Paul it is not too late to get out of town. (Laughter)

MILNER: By consent we had arranged that we would not have rebuttals; but Tom has very properly asked for 30 seconds.

HIERONYMUS: I would hate to pretend that I could rebut all that has been said in 30 seconds; but two things occur to me that I would comment on.

One. I think that between Mr. Withrow and myself there is a problem of understanding exactly what we were talking about in that area of price. I do not think there is other disagreement.

And a lot of Mr. Dahl’s criticism hangs on how he is defining inventory. We have some difference in definition, but I think there is no real difference in thought.

The thing that the remaining 20 seconds is for is a matter of the term significance. And no respectable statistician will claim me in the fraternity — because I do very cavalier things; but I simply say that the tests Mr. Shepherd referred to are tests of statistical significance. “Significance” is very different in what it means in the ordinary usage of the English language and in tests of statistical significance in which we
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rule out items on the basis of extraordinarily rigorous standards.

Now, I am a short odds player myself. You don't have to give me 20 to 1 before you get me to bet on a point. And I should say that to take the very arbitrary levels of significance the statistical fraternity uses and say that something is of no value because it doesn't meet those particular standards, impresses me only very negligibly.

SHEPHERD: Insignificantly.

HIERONYMUS: Yes.

(Laughter)

BLACK: I just want to remark that the rigors of the qualitative analysis that goes along with it needs to be taken into account — is it reasonable in a real rigorous qualitative analysis.

Now, on these examples of correlation that you mentioned, like the size of the feet and the age. You must take qualitative considerations into account as well as quantitative statistical tests.

SHEPHERD: Yes. Mr. Black is well-qualified to raise a question with me since he was my major professor at Harvard.

GOLD: Tom, I'm not in the mood for attacking it. I think this is something we ought to take up once and for all, though. I think it is time we stopped excusing the price manipulation that is taking place in the futures market. I think it is time we stopped trying to find excuses for them by saying that if we go into the economics departments we can find reasons for them.

At any moment and time we can find reasons for either a bullish or bearish result after it has taken place. The fact remains that we have had price manipulation in wheat, we have had it in onions and potatoes. And the fact that the
exchange invariably takes the position of opposing investigators instead of trying to beat them to it, I think, is going to help destroy any public acceptance in the futures market.

Now, the fact is we want speculators in there. They invariably get beaten as the statistics would indicate. Let's at least try to give them a fairer shake by trying to avoid the manipulative aspect when they become dominant.

I think that it is no secret that an attempt at manipulation in the wheat spread was known weeks before any official cognizance was taken. I think that the exchange should have been the one to start taking action first.

I think we cannot continuously say this doesn't exist because the public knows it exists. And just as Mr. Bakken said, the courts were behind the public.

In certain aspects I think the professors are behind the public in trying to shield what is to me a major shortcoming that must be overcome.

HIERONYMUS: I'm not sure what really the question is. I can construe it this way; Why do I labor so hard to excuse manipulation?

Now, with regarding the May wheat thing this past May, I don't want to make any categorical statement because I would like to look at the details and eliminate the possibilities. But I said that the manipulation of futures is illegal; in the cash market manipulation is perfectly legal. I took the position that futures manipulation doesn't exist as often as is thought, if it exists at all. Further you have a devil of a time finding a provable instance of manipulation in the modern history of futures trading, nay, history. There is one time in the history of onions. And, interestingly, I suspect there was a collusionary activity that could be construed as manipulative; and darned if it wasn't a manipulation in the opposite direction than people thought it was, and it failed.
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Just off hand, I don't think there was manipulation in May wheat. And I think one of the reasons I doubt it is I estimated the outcome correctly.

WITHROW: Your point is that why are your excuses being made, et cetera. I think as you look into the situation that every effort is being made by the exchange and by the C.E.A. to prevent manipulative practices at all times.

And if you don't think that they are looking for these things — I write a market letter two or three times a day, or at least twice a day; and many times I have made very innocent remarks which I felt had no influence at all, or were just simply calling the shots as I saw them; and I would get a call from the C.E.A.

I was very strongly impressed by the fact that there was somebody looking over everyone's shoulder, not just mine, to see that these things didn't occur.

Now, they have occurred in the past, nobody will argue with you there. But I think that there are strong organizations — strong within the exchanges, within the C.E.A. — to try to prevent them from happening.

But just one other thought on this big May wheat deal back in, well, early spring. I happened to see some of the market letters that were written by the customers' man, of a firm which was very prominent on the long side. And I read these letters way back in early January when the market actually at that time was low relative to its high and low.

In other words, there was no excitement, there was no enthusiasm, there was nobody looking over anybody's shoulder, there was no threatened squeeze. Well, so help me, they were the most provocative, most enticing, most alluring letters that you can ever imagine. At that time, some of us dis-
cussed the letters over lunch. There were many people that felt the guy was absolutely right and they were wholeheartedly on that side. And there were many who took a different view.

What I am trying to say is that the result of small group’s opinion, strong opinion, that such and such a market action was going to take place and a lot of advertising of that fact drew innocent people into a situation which I don’t think was manipulated to an extent that was claimed.

GOLD: Well, the investigations and law suits that have come up in Kansas City are going to determine that.

But wasn’t it true that, not the general market letter writers but the actions of one man dominating a group which controlled perhaps twenty million bushels — which I assume was far above the limits that were supposedly set — might be one of the things that could come out of this present thing.

WITHROW: I’m not trying to defend or castigate in any way in this case.

GOLD: Why did the exchange let it go that far?

WITHROW: It is a free country. And as I say, the previous year the speculator who didn’t know anything about wheat who read a similar letter like that would have made a lot of money, and nobody’s fingers burned much.

This time we saw the other side of the coin and some speculators were hurt and so they complained, etc. Now, that is as far as I know about the situation. Whether they, the investigators, proved that there was fraud, etc. I don’t know; and I don’t think you do at this time.

As I have said there is a police force that is working all the time to prevent this thing, and I think doing a fine job.

FLOOR: I would just like to suggest that if you use Mr.
Gold's thinking on the market we would probably close them much faster.

FLOOR: On the contrary.

FLOOR: Just a moment. Who would be the judge and jury to draw the line, where it is and so on? I think we have enough restrictions on these particular futures as they exist.

FLOOR: We were talking about price variation; now, isn't price variation attractive to speculators and where do you draw the line as to what is not?

MILNER: Several have talked on that. Whom did you want to address it to?

FLOOR: It doesn't make any difference. Maybe someone else could put me straight on this.

BLACK: We condemn certain people in the government and so on for inserting instability in the market, but almost in the same breath we don't want too much instability or variation.

HIERONYMUS: I think that we would need to take 10 or 15 minutes to straighten this out but to put it briefly: I think the objective, the price objective, is to get the maximum possible stability in the market. Now, this doesn't mean there is not variability; but what a speculative market tries to do is to foresee everything that will influence price and discount all of those influences into the current price so that you come out with precise stability. This is the objective.

BLACK: If you do that, you will still have quite a lot of variability because of outside circumstances.

HIERONYMUS: That's right. We don't expect a perfect job out of it, with a perfect discounting market, with perfect foresight; if there were, then there would be perfect stability. This is beyond any reasonable hope of accomplishment. But insofar as the market is able to foresee forthcom-
ing events and discount the influence of those events into current prices, then it has a stabilizing influence.

That is, yesterday, the market was discounting the influence of such change as there would be in the government crop estimates into yesterday's price. And insofar as it was doing two things accurately: one, accurately estimating what those estimates would be; and secondly, accurately estimating what the influence of those estimates on price, would be, it was stabilizing the price between yesterday and today. And in the one estimate, there was rather substantial change. In the other estimate, the one that the most concern was about, there was not much change.

And the price variation of both of them a while ago, at 10:30, was not great; so it had been pretty well discounted.

Now, the market did a very bad job of discounting the August 1st crop estimates; and, as Dick pointed out, all hell broke loose the next day. The average of the estimates of the August 1st soybean estimate on this floor was 511 million bushels. They missed it and the price adjustment the next day was large.

Futures trading has a stabilizing influence and this is a desirable thing; I think it is.

BLACK: You are using this term stabilization in two different senses; or at least, we are here.

If you have a very jumpy year because of the weather and business conditions, you are going to have an unstable market. If you will have a very normal sort of year, you will have a more stable market.

Now, that is one thing, but to get a good fit all the time, every day, to what the market conditions are, you call that producing stability. Well, now, that is two different ways of using the word "stability," isn't it?

I wonder if we don't need some other kind of word to
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describe this perfect fit.

HIERONYMUS: I think we are falling into trouble because we are hedging. I think the first criterion is to have a price that fluctuates freely in response to changes in economic forces; the fluctuation necessary to accomplish the adjustments necessary to changing conditions; this amount of price variation you must have. More price variation than that is undesirable price variation.

BLACK: I think we are going to have to invent some word to prevent that confusion. You talk about monthly prices being more stable than between months. Well, aren't you going to expect that; you come out with your crop reports once a month. Now, that is a change. As they change from month to month you are going to expect them to keep within a certain range within that month.

HIERONYMUS: No. No, because the crop report is only one of the things that goes on. Estimates of the next crop estimate are continually made. In some months you will expect more variation than others because there will be more variation in natural factors.

DAHL: I just want to make one point in connection with that question. I think it is very apparent that the loan program associated with some commodities like wheat and corn has acted as a detriment to speculation because of its effect on price.

On the other hand, most of the comments in this paper were devoted to onions. Now, here we have a commodity that has typically violent price fluctuations; and futures trading has been accused of increasing these rather violent price fluctuations. And I believe the point that has not been made clear here is that we have attempted to do some research to see what the influence of futures' trading has been on price.
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BROOKS: Along these lines, what is attractive to a speculator? Is it a market that has considerable fluctuation or little fluctuation? What makes a market attractive to a speculator?

WITHROW: We do a considerable business being a commission house, with speculators, and I can tell you that they want a market that has a fluctuation but they don't want just wild, willy-nilly fluctuations.

Speculation, as I recall, is a Greek word which means to foresee. They want to have the opportunity to foresee, to forecast something that is reasonable. Not just a flip of a coin, but something they can use some judgement on.

And they do want a good amplitude of variation; I think that is true.

Just one other point: I think nothing is wrong with variation, if it is in response to economically important factors. And, here is a good example: The cost of housing in this country has gone up, what, two or three times in the last 20 years.

Now, there is a very violent up-fluctuation; and yet we have recognized our housing shortage because the price has been allowed to go to the point where contractors with profit motive have built homes and we have solved our problem.

And I think there are other countries where they have rent controls and restrictions. France is one of them; where they are 10 or 15 years behind us because they didn't have a price fluctuation that gave this motivation to building and licked a real economic problem.

GRAY: May I make a comment on Brooks' question? It will be short.

The question of the extent to which prices fluctuate isn't
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the only matter concerning the speculators. If you look across from commodity to commodity you will find the exchanges have done not too bad on the level of spreads.

In a sense it is fair to say that among commodities, from the viewpoint of a speculator who is trading on margins, all prices have about the same amount of margin. More work needs to be done in this regard, especially between the spreads and trade by itself.

MILNER: I wish we could continue this. I know you are deeply interested and wish to go ahead for a while, as you have been in the two previous sessions; but out of fairness to the session this afternoon, we must quit now.