HOLBROOK WORKING

PRICE EFFECTS OF FUTURES TRADING

INTRODUCTION

For some 30 years there has been, it seems to me, a growing tendency among economists to question whether organized trading in commodities and in securities tends to diminish price fluctuations or to increase them. Personal impressions of the prevalence of such opinions are unreliable, but it is at least clear that economists' opinions on the subject are divided, and that the growing body of information concerning organized trading on commodity exchanges, compiled by the Commodity Exchange Authority (CEA), has contributed toward belief that such trading tends to result in more price fluctuation than would otherwise occur.

In 1958 the United States Congress enacted a law prohibiting futures trading in onions (Public Law 85-839). Recurring attacks on futures trading in commodities had led earlier to the placing of some restrictions on such organized trading. Thirty-six years earlier, futures trading in certain commodities had been placed under federal regulation;[1] but this was the first time that futures trading in any commodity had been made illegal in the United States.[2] The 1958 Onion Futures Act was passed after extensive congressional hearings that had demonstrated the existence of a conflict of competent evidence and opinion regarding the price effects of futures trading. The congressional decision hinged primarily on choice of which of two conflicting lines of evidence concerning the price effects of futures trading was the more deserving of credence.

The economic usefulness of *hedging* in onion futures received congressional consideration also, but only from the standpoint of whether the benefits from hedging were sufficiently great to offset the ill effects of the "severe and unwarranted fluctuations in the price of cash onions" that were attributed to futures trading in the commodity.[3]

[1] The Futures Trading Act of 1921, to regulate futures trading in grains, was declared unconstitutional by the U.S. Supreme Court in an opinion written by Chief Justice Taft, which clearly implied that the decision might have been different if the act had relied on the commerce clause of the Constitution instead of on the congressional taxing power (*13*, p. 68). Congress promptly re-enacted substantially the same legislation as before, under the name of the Grain Futures Act (1922), including in it the assertion that ". . . such fluctuations in prices are an obstruction to and a burden upon interstate commerce . . ." (*15*, Sec. 3). This act was upheld by the Supreme Court in a decision written again by Chief Justice Taft (*14*). The Commodity Exchange Act of 1936, in the form of an amendment to the Grain Futures Act, changed the name of the regulatory body and extended its authority to cover a number of additional commodities. Subsequent amendments to the act have further extended the list of regulated commodities. The only commodities thus regulated have been products of agriculture, or their derivatives, produced in substantial volume in the United States.

[2] Effective, in practice, on November 10, 1959, when a U.S. District Court held the act constitutional and dissolved an injunction that had restrained prior enforcement of the act. This decision was not appealed.

[3] The quoted phrase is from the report of the Senate Committee on Agriculture and Forestry recommending enactment of the legislation (*12*, p. 1).

Economic knowledge is in an unsatisfactory state when the Congress, in considering proposed legislation, finds it necessary to go beyond its inherently appropriate function of weighing advantages against disadvantages, and must instead decide the relative credibility of conflicting evidence, presented by competent authorities, concerning economic facts. If the conflict of evidence in this instance had concerned only one relatively unimportant commodity, the conflict might not seem of great importance. But this conflict of evidence arose from a source that affects the interpretation of evidence concerning the usefulness of futures trading in any commodity. It affects also, to some extent, the interpretation of evidence on the usefulness of organized markets for securities. The conflict became especially clear in this instance because stocks of onions cannot be carried over from one cropyear to the next. Onion prices must change sharply near the end of a storage season whenever prices during earlier months have left a disproportionately large or small stock of onions for use in the final weeks of the storage season. In the onion market, therefore, the frequency of occurrence and the size of price readjustments near the end of the storage season are peculiarly sensitive indicators of tendencies toward price maladjustment earlier in the season.

The present paper deals with direct statistical evidence concerning the effects of futures trading on the behavior of onion prices.[4] A later article will show why other evidence was so misinterpreted that it was thought to contradict the direct statistical evidence that had been presented in congressional hearings prior to enactment of the legislation.

EXTENT OF POSSIBLE INFLUENCE OF FUTURES ON CASH PRICES

It is usual to designate prices that are not futures prices as "cash" prices, or prices "of the cash commodity." Cash prices, in that sense, include prices specified in contracts that, though they call for delivery in the future, are not technically futures contracts. Dehydrators, for example, commonly purchase most or all of their onion supplies under contracts made, at a designated price, in advance of planting of the onions.[5] During the years when there was futures trading in onions it became fairly common for dealers also to contract the purchase of onions from growers, either in advance of planting or at any subsequent date before harvest when the grower wished to enter into a sales contract.

The "cash" prices with which we shall be mainly concerned in the present study are those applying on sales for immediate delivery. To avoid ambiguity, I shall designate them as *spot* prices.

The distinction between forward contracts that are not technically futures contracts and those that are, may be made roughly on the ground that futures contracts are rarely used for merchandising purposes, whereas other forward contracts are ordinarily so used. But this is not a reliable distinction, inasmuch as futures contracts serve as merchandising contracts whenever delivery is made on them; and other forward contracts are sometimes settled otherwise than by

[4] The statistical data used here were compiled for a study made in 1959 at the request of the Chicago Mercantile Exchange. I am indebted to the Exchange for permission to use the data here.

[5] This, I am told, is the general practice of dehydrators in California, the only area concerning which I am informed on the prevalence of such buying.

delivery, in which case they fail to serve a direct merchandising function. The reliable criteria of distinction are the requirements that a futures contract must meet the requirements of an organized commodity exchange with regard to: (1) quantity, kind, and quality of the commodity, and time and place of delivery; (2) time and place of execution (within designated business hours and at a designated place on the exchange floor); and (3) manner of execution (by "open outcry"). The requirements concerning time, place, and manner of execution constitute the most important technical distinction between futures contracts and other forward contracts: futures contracts must be made publicly, with maximum opportunity for competitive bidding and offering, whereas other forward contracts are usually made privately and often with only limited opportunity for competitive bidding or offering.[6]

When a "cash" price, for either immediate or deferred delivery, is arrived at through bargaining between buyer and seller, the presence of futures trading in the commodity must exert its influence, if any, on the cash price through affecting either what the buyer is willing to pay, or what the seller is willing to accept. Suppose that the buyer is a dealer and the seller an onion grower in Western Michigan, and that the time is in October of a year when there was futures trading in onions. Both the buyer and the seller might be influenced by his own personal judgment of what onions ought to be worth in view of the estimated size of the recently harvested crop. The grower would typically be influenced by his knowledge of recently prevailing prices at that and neighboring shipping points, and perhaps by a price offered to him that morning by another dealer. He would probably not know the latest futures quotations, and almost certainly would be little influenced by them, if at all. The dealer would be influenced by his knowledge of prices that other dealers in the area had been offering, and his knowledge of prices currently being offered by firms to which he was accustomed to sell. He would probably be little influenced by quotations in the futures market, unless he intended to hedge such supplies of onions as he might buy. If he intended to hedge by selling onion futures, the price at which he could sell futures would substantially influence his judgment of what he could afford to pay for cash onions.

Because buyer and seller in most transactions, even in an unorganized market, are influenced by some knowledge of prices that other buyers are willing to pay, or other sellers willing to take, and because they always know something about prices paid on other recent transactions, the price arrived at in each individual sale of onions is affected indirectly by the price opinions of many people. If a substantial number of these people are using the futures market for hedging, and therefore make decisions concerning "spot" transactions partly on the basis of futures prices, the futures prices have a substantial influence on spot prices. If there is little hedging in futures, then the futures prices have relatively little influence on the spot prices.

For some purposes it is more instructive to take an over-all view of the process of price formation than to look at it in intimate detail, as we have above. In an

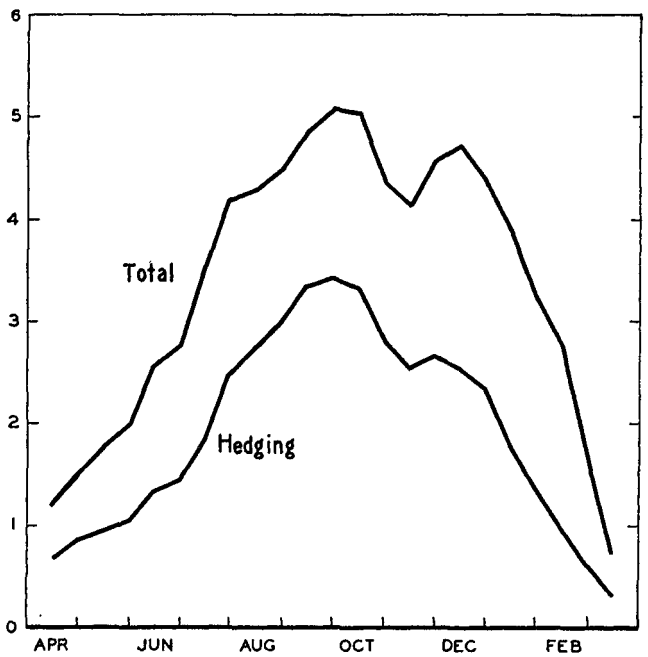
[6] Many writers have sought to distinguish futures contracts on the basis of standardization of only those terms of the contract comprised under (1) of the previous sentence, and thus have tended to overlook the important aspect of open competition in futures contracts, covered by (2) and (3) above.

over-all view, the price of onions in October may be regarded as an outcome of the price expectations of many actual and potential holders of onion stocks, in the presence of an existing supply of onions that must be held by some group of potential holders. In the absence of futures trading the potential holders of stocks are, in the main, only growers and dealers who have storage facilities. In the presence of futures trading, a dealer with stocks in storage may hedge them, and when he does so, the buyer of the hedging contracts becomes, from the standpoint of price effect, the holder of those onion stocks. Hedging thus causes holders of futures contracts to exert influence on the spot price. This view of the way in which futures trading influences spot prices makes it evident, as the previous one did not, that the influence of futures trading on spot prices must depend roughly on the *proportion* of total stocks that is hedged rather than on the absolute amount of such hedging.

The amount of "reported" hedging in onion futures at the middle and end of each month from April 15, 1956 to March 15, 1957, is shown in Chart 1. This

CHART 1.—Total Open Contracts and "Reported" Hedging Contracts in Onion Futures, April 15, 1956 to March 15, 1957*

(Thousand carlots of 30,000 pounds each)



* Data from U.S. Dept. Agr., *Commodity Futures Statistics,* Stat. Bulls. No. 196, p. 62, and No. 221, p. 63. "Reported" hedging contracts include only those reported by individuals or firms holding contracts for 25 or more carlots in any one future.

is the earliest April–March cropyear for which hedging statistics are available,[7] and it appears to be a year in which the amount of hedging was fairly representa-

[7] No holders of futures contracts in onions were required to report to the CEA prior to Sept 24, 1955, when onions became a regulated commodity under the Commodity Exchange Act.

tive of the average for those years in which there was a substantial amount of futures trading in onions. The hedging statistics shown in the chart cover holdings of hedging contracts reported to the CEA by hedgers holding contracts for 25 carlots or more in any one future. The figures, therefore, cover only fairly large-scale hedging. According to the data in Table 1, based on more detailed information collected for one date near the time when hedging was at its maximum for that cropyear, large-scale short hedging accounted then for about 92 per cent of all short hedging.

Comparison of the two curves in Chart 1 shows that total open contracts in onion futures moved in fairly close correspondence with the volume of reported short hedging. Such a tendency has been observed in all futures markets for which similar data are available, and the tendency holds for changes from year to year as well as from month to month within a year.[8] The data in Table 1 show,

TABLE 1.—COMPOSITION OF OPEN-CONTRACT HOLDINGS IN ONIONS, CHICAGO MERCANTILE EXCHANGE, OCTOBER 31, 1956*

Class of Contract	Carlots		Per cent	
	Short	Long	Short	Long
Large-scale hedging	2,790[a]	124[a]	64.8	2.9
Smaller-scale hedging	232[b]	215[b]	5.4	5.0
Industry-connected speculation	415[c]	1,762[c]	9.6	40.9
Other speculative	344[c]	1,680[c]	8.0	39.0
Spreading (large-scale only)	524[a]	524[a]	12.2	12.2
Total	4,305	4,305	100.0	100.0

* Data from U.S. Dept. Agr., *Onion Futures: Survey of Open Contracts on the Chicago Mercantile Exchange, October 31, 1956*, except as otherwise noted.

[a] Contract holdings of 25 carlots or more by one individual or firm in any one future, from U.S. Dept. Agr., *Commodity Futures Statistics*, Stat. Bull. No. 221, p. 63.

[b] Total hedging contracts reported in the *Survey*, p. 3, less large-scale hedging contracts as shown in Stat. Bull. No. 221, p. 64.

[c] Contracts (including spreading contracts) so classified in the *Survey*, p. 12, less one-half of the spreading contracts shown in Stat. Bull. No. 221, p. 64.

further, that a substantial part of the difference between the amount of short hedging contracts and the total volume of open contracts is accounted for by "spreading" contracts. Spreading, which is one form of arbitrage, involves holding long contracts in one future against short contracts in another future. It serves to offset any tendency, such as commonly occurs, for hedgers to distribute their net short contract holdings among the various delivery months differently than speculators distribute their net long contract holdings.

It would be a mistake to infer from the hedging data in Chart 1 that futures trading during the spring and summer of 1956 exerted a substantial influence on *spot* prices of onions during April–August of that year. The "cash" prices that were influenced by futures trading prior to August, at the earliest, were only prices paid to growers on contracts calling for delivery after harvest at the end of the summer. There is virtually no hedging of stocks of harvested onions during

[8] See, for example, *2*, pp. 33–39; *3*, pp. 279–95.

April–August, for two reasons: first, stocks are always small during those months, because onions then move quickly from the field to the consumer; and second, hedging of such small stocks as there are would serve no useful purpose prior to about August at the earliest, owing to the fact that spot prices during earlier months move under different influences than those that affect the course of the futures prices. The earliest delivery month for onion futures was November, and the latest in each crop year, March. Prices of onion futures during the spring and summer therefore reflected expected supply and demand for onions grown for harvest at the end of the summer, and then mostly stored for gradual use during subsequent months. Spot prices during April–July, on the other hand, depend on the changes week by week in relative shortage or abundance of onions produced on acreage intended for harvest at about that particular time of year (or sometimes, in early April, on the amount of onions remaining in storage from the previous year's crop).

The exchanges made no attempt to conduct futures trading in onions for delivery during any spring or summer month because it was obvious that the small stocks of onions during those months would not give rise to enough hedging to support futures trading for delivery in any of those months.

The first new-crop onions of each year come from the lower Rio Grande Valley of Texas. They reach consuming markets in substantial volume about the third week of March, in an average year, but the time of their arrival varies through a range of 5 or 6 weeks, as may be seen from Table 2. The three years covered

TABLE 2.—ILLUSTRATION OF RANGE IN TIMING OF SOUTH TEXAS ONION SHIPMENTS

Year	Dates of completion of stated fractions of total shipments[a]		Length of interval between dates
	First one-fourth	First one-half	
1957.....	March 15	March 23	8 days
1958.....	March 31	April 11	11 days
1959.....	April 22	May 1	9 days

[a] Based on daily shipments by both rail and truck as reported by U.S. Dept. Agr., Market News Service, Weslaco, Texas, in annual summaries for the season.

by the table happen to include about the earliest harvest on record, and also the latest one among years since the introduction of the early-maturing varieties of onions that are now grown there. During the weeks when South Texas normally supplies most of the onions consumed in the United States, imports tend to be substantial if the price is high.

During the latter part of May and all of June, the nation's onions come mainly from California and Arizona. Georgia formerly harvested a fairly large crop at that time, but now grows relatively few onions. The timing of harvests in these states varies little from year to year. In July the harvest of "early summer" onions begins in a number of states from New Jersey to California, including the more northerly producing areas in Texas. The prices received tend to be considerably lower than for earlier-harvested onions, yet higher than prices will be after har-

vest in those northern areas of the United States that produce on the average some 70 per cent of each year's crop. Lowest spot prices tended before World War II to be reached in October, but tend now to come in September.

Though stocks of harvested onions tend to remain small through most of August, the spot price in August could sometimes have come under substantial influence from futures trading because some growers of onions could choose between harvesting in August or delaying the harvest until later. In a year of low prices in August, owing to heavy production in areas where onions were planted for August harvest, growers might find dealers willing to offer a better price in August on contracts for delivery of onions in September or October than for onions to be delivered immediately. The price offered by the dealer for deferred delivery of the onions, in such an instance, would ordinarily have been based on the price in the futures market, and the resulting deferral of harvesting by some growers, tending to prevent further depression of the spot price in August, would thus have been an effect transmitted from the futures market. It would commonly have been associated with hedging by dealers against their purchase contracts made with growers.

At the end of summer, not far from September 1, the character of the onion market changes drastically. Then the onions grown on a large acreage in northern states come to maturity. These are onions intended for consumption during the succeeding seven months or so, grown in northern areas because there cold weather follows quickly on the heels of the harvest and onions will keep well in economical "common" storage.[9] Thus at the end of summer onions change, economically, from a perishable commodity to a storable commodity. During the previous five months onion marketing has been virtually hand-to-mouth, and onion pricing has involved matching immediate demand to immediate supply. During the next seven months, approximately, onions will be supplied from stock, and onion pricing must seek to match total demand for the storage season to the supply available for that season. Prices tend to fall to a minimum at the beginning of the storage season, and thereafter to advance until its end.

The storage season for onions is of variable duration, owing to the variability in timing of harvest of the crop of early Texas onions that is illustrated in Table 2, above, and the time when it will end is not reliably predictable early in the season. Onions must be priced during the storage season with the objective that old-crop supplies in storage shall be exhausted coincidentally with arrival on the market, in large volume, of new-crop Texas onions, else there will occur either an interval in which virtually no onions are to be had, or a part of the storage stocks will be lost because they are not salable in competition with onions from the new crop.

Though statistics on the hedging of onions are available only from September 1955, relative amounts of hedging in onion futures may be inferred satisfactorily from statistics of open contracts in onion futures, which are available for earlier years. One of the potential influences of futures trading in onions that obviously

[9] The most southerly areas where large quantities of onions are produced for storage are in Colorado, where high elevation gives temperature conditions similar to those in more northerly producing areas, and in parts of California, where proximity to the ocean moderates summer temperatures. In the California areas, however, autumn temperatures are not low enough to favor storage of onions beyond early winter.

deserves consideration is that exerted at the time of year when hedging of onion stocks tended, in the presence of futures trading, to reach a maximum. This appears to have been about the middle of October—sometimes a week or two earlier, and sometimes a week or two later. Table 3 shows how open contracts in onion futures on October 15 varied during the years subsequent to World War II, both in absolute amount and as a percentage of estimated stocks of onions in the nation on that date. The latter figures are shown graphically in Chart 2.

Because the amount of futures contracts held as hedges on stocks of onions at any time must be appreciably less than the total amount of futures contracts, total hedged stocks of onions on October 15 of the four years 1946–48 and 1958 must have been less than 3 per cent of estimated total stocks in 1948, and less than 2 per cent in the other three years. (The last year was one of little hedging because the futures market was then operating only by virtue of a court order that

TABLE 3.—OPEN CONTRACTS IN ONION FUTURES IN RELATION TO ESTIMATED STOCKS OF ONIONS, OCTOBER 15, 1946 TO 1958*
(Carlots of 30,000 pounds)

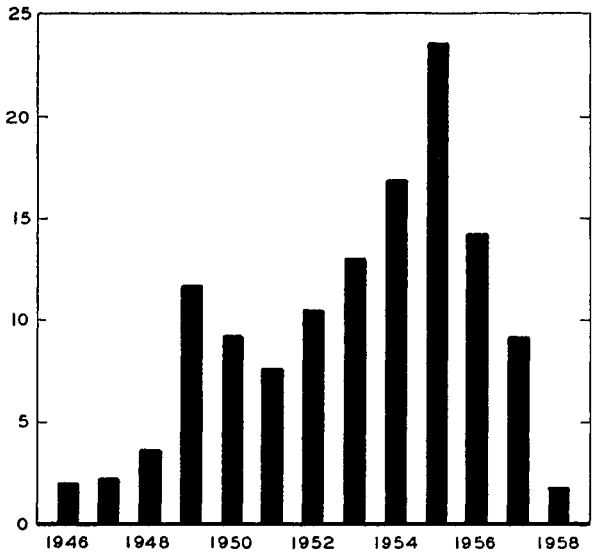
Year	Open Contracts	Estimated Stocks	Per cent
1946	797	39,000	2.0
1947	571	26,000	2.2
1948	1,145	32,000	3.6
1949	3,514	30,000	11.7
1950	3,254	35,000	9.3
1951	2,365	31,000	7.6
1952	3,156	30,000	10.5
1953	4,813	37,000	13.0
1954	5,739	34,000	16.9
1955	7,564	32,000	23.6
1956	4,955	35,000	14.2
1957	3,126	34,000	9.2
1958	606	33,000	1.8

* Open contracts on Chicago Mercantile Exchange, from Chicago edition of *Wall Street Journal* and from annual *Yearbooks* of Chicago Mercantile Exchange; stocks on October 15 estimated at 60 per cent of "late summer" crop and rounded to thousand carlots.

enjoined enforcement of the Onion Futures Act, and possible early termination of futures trading in onions cast doubt on the usefulness of hedges in futures.) Such small amounts of hedging could not have had much influence on spot prices, whereas the much larger amounts of hedging in the nine intervening years, 1949 to 1957, might possibly have had an appreciable influence on spot prices of onions. In the comparisons that follow, we distinguish between three groups of years, namely: (a) eleven years prior to World War II, when there could be no hedging in futures owing to absence of futures trading; (b) four years of little hedging, subsequent to World War II, the last of those years being the final year in which there was futures trading in onions after early October; and (c) nine years with what I call a "substantial" amount of hedging, probably averaging about as much as during 1956/57 (Chart 1).

CHART 2.—Open Contracts in Chicago Onion Futures on October 15 as Per Cent of Estimated Total Onion Stocks 1946 to 1958*

(Per cent)



* Data from Table 3.

AVERAGE SEASONAL VARIATION IN SPOT PRICES OF ONIONS

As a first step in examining evidence of price effects from futures trading in onions, we may well consider the average seasonal variation of "cash" prices of onions. I use two different price series, chosen on the basis of two different criteria of representativeness of the series. Both are series of spot prices, that is, prices for immediate delivery.

One of these series consists of the official estimates of "U.S. average" prices to growers, which is intended to be representative in the sense that multiplication of the average price in any month by the quantity of onions sold by all commercial growers in the United States during that month should yield a good approximation to the amount of money received by all commercial onion growers on their sales in that month. The average is intended to retain that characteristic, month by month, even though onion prices change differently in different parts of the country.

The other series used, prices to onion growers in Western Michigan, is representative in a sense determined by the position of Michigan onions in the national market. That state supplies about one-seventh of the late summer onions produced in the United States, and they are sold in markets where they compete directly with onions from Idaho and Colorado, to the west, and New York to the east, and compete directly or indirectly with late summer onions from all the states between. This is the area in which Chicago onion futures were most reasonably used for hedging, and in which virtually all the hedgers of onions were found in the several surveys of holders of onion futures contracts that have been made by the CEA; consequently, any influences on spot prices of onions that were

exerted by the futures market would have borne more strongly on prices in the market area supplied from Michigan than on prices in Pacific Coast states.[10]

Data on average seasonal variation of the two series of spot onion prices are shown in the left half of Table 4 as simple averages of the prices, in constant

TABLE 4.—AVERAGE SEASONAL VARIATION OF ONION PRICES DURING SEPTEMBER–MARCH OF THREE CLASSES OF YEARS*

Month	Cents per 50-pound sack[a]			Index of seasonal variation[b]		
	No hedging[c]	Little hedging[d]	Substantial hedging[e]	No hedging[c]	Little hedging[d]	Substantial hedging[e]
	A. U.S. Average Farm Prices					
Sept.	96.2	101.1	92.5	77.0	63.1	80.3
Oct.	94.2	112.4	99.8	75.4	70.1	86.6
Nov.	99.3	132.0	112.0	79.5	82.3	97.2
Dec.	120.3	144.7	115.4	96.3	90.3	100.2
Jan.	136.2	170.0	122.1	109.0	106.1	106.0
Feb.	153.5	205.6	125.5	122.9	128.3	108.9
Mar.	174.7	256.0	139.0	139.9	159.7	120.7
	B. Western Michigan Price to Growers					
Sept.	138.5[f]	135.4	127.2[g]	79.7	68.3	87.0
Oct.	136.5	146.5	138.3	78.5	74.0	94.6
Nov.	143.2	173.6	149.8	82.4	87.6	102.5
Dec.	168.6	178.0	143.5	97.0	89.9	98.2
Jan.	182.3	200.3	151.4	104.9	101.1	103.6
Feb.	202.3	231.8	154.8	116.4	117.0	105.9
Mar.	245.2	321.2	158.7	141.1	162.1	108.5

* Data from Tables III and IV.
[a] At 1947–49 price level.
[b] September–March average = 100.
[c] Average for 1930/31–1940/41.
[d] Average for 1946/47–1948/49, and 1958/59.
[e] Average for 1949/50–1957/58.
[f] Estimated by subtracting average Sept.–Oct. change in U.S. farm price from Michigan average for October.
[g] Using estimate for September 1949 derived by subtracting Sept.–Oct. change in U.S. average price from Michigan price in October.

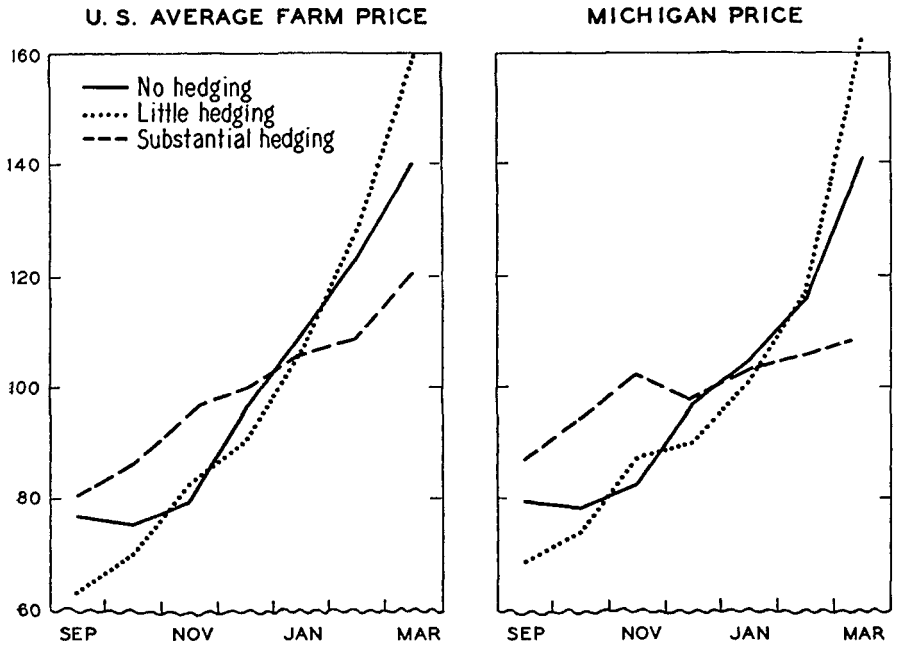
[10] The situation was similar to that in the wheat market: prices of wheat on the Pacific Coast can move rather independently of Chicago wheat prices, hence hedging of wheat is less prevalent on the Pacific Coast than east of the Rocky Mountains; and because hedging of wheat is less prevalent in the Pacific Coast states, spot prices of wheat there are under less direct influence from Chicago wheat futures than are wheat prices in Nebraska, Illinois, or Ohio.

We will subsequently observe some differences in movement between the two price series used that will invite explanation. They could occur most obviously as a result of prices in the Pacific Coast states moving differently from prices farther east. Prices in those far western states are weighted fairly heavily in the national average, and during September–March can move somewhat independently of onion prices east of the Rocky Mountains. Another possibility of divergence of movement arises from the fact that late summer onions grown south of Oregon, Wisconsin, Michigan, and New York State, tend to be moved into consumption early because the climate in those more southerly areas is not so favorable to long storage of onions as it is farther north. This circumstance tends, on the one hand, to produce stronger seasonal variation of price in the more southerly states, and on the other, to call logically for variation from month to month in the weights applied to prices from different areas in calculating the national average price. Published information on the details of calculation of the national average price of onions does not permit determining how the average has been affected by this technical situation, and it is sufficient for present purposes to note simply the existence of this possible source of disparity between movements in the two price series that we use. Some (ordinarily small) differences between the two series arise from the fact that the U.S. averages are based on prices for only two dates each month (7, p. 1), whereas the Michigan prices are averages of weekly high and low prices.

dollars, for each month from September to March. At the right, the data are expressed as index numbers with the September–March average taken as 100.

The indexes of seasonal price variation, shown graphically in Chart 3, reveal a strikingly smaller average price advance from either September or October to March during the years with a substantial amount of hedging in onion futures than in either of the other two groups of years, and close similarity in average seasonal variation between the years without hedging and the years with little hedging in onion futures. The seasonal variation in years with little hedging shows the closer resemblance to that in years with substantial hedging only as regards the average price movement from September to October. Before World

CHART 3.—Average Seasonal Variation in Onion Prices to Growers, September–March, According to Amount of Hedging in Onion Futures*
(Sept.–Mar. average price = 100)



* Data from Table 4. Years with no hedging, 1930/31 to 1940/41; years with little hedging, 1946/47 to 1948/49 and 1958/59; years with substantial amount of hedging, 1949/50 to 1957/58.

War II the seasonal low in onion prices tended to be reached in October, whereas since the war it has tended to be reached in September, regardless of whether there was substantial or little hedging in futures.

Comparison between the Michigan price and the U.S. average price to growers shows close similarity between their seasonal movements in the years without hedging and also in the years with little hedging. For years with a substantial amount of hedging, on the other hand, the Michigan price shows considerably less average seasonal variation than does the U.S. average price.

Statistical comparisons such as are made in Table 4 and Chart 3 deserve always to be checked against other information to determine whether differences

observed may reasonably be ascribed to the characteristics used as a basis of differentiation or ought to be attributed to something else. Are the differences noted here properly attributable to the amount of hedging done, and therefore basically to the presence or absence of futures trading in onions?

It has long been held, both on logical grounds and on observational evidence, that futures trading tends to result in reduction in the seasonal variation of spot prices. And the amount of any such effect, as we have seen, must depend on the amount of hedging that is done. On these grounds, it appears reasonable to suppose that futures trading in onions, and the accompanying hedging, was indeed the cause of reduced seasonal variation of onion prices in the years with a substantial amount of hedging. The greater apparent effect on Michigan prices than on the U.S. average farm price tends to confirm this causal inference.

If we look for some other possible cause of the differences observed, we may readily find one such cause for the change in price tendency between September and October. The great increase in use of highway transport for onions between the prewar and the postwar years, by speeding movement to market, has had an effect similar to that of growing earlier-maturing onions, and would tend to move the date of average seasonal minimum price forward. The inference that it was such a change, rather than hedging in futures, that moved the seasonal low from October to September tends to be confirmed by the absence of any difference in timing of the low between the years with little hedging and years with a substantial amount of hedging. The other major differences observed find no logical explanation in any changes that have occurred, to my knowledge, except those associated with futures trading in onions.

INTRASEASONAL VARIABILITY OF ONION PRICES

Criticisms of futures trading have usually, if not always, consisted primarily of allegations that the existence of futures trading leads to greater variability of prices than would otherwise occur. Economists have usually held the opposite view. When the Senate Committee on Agriculture and Forestry of the 85th Congress recommended to the U.S. Senate that it pass H.R. 376 to prohibit futures trading in onions, the sole purpose stated by the committee was expressed in the sentence: "It now appears that speculative activity in the futures markets causes such severe and unwarranted fluctuations in the price of cash onions as to require complete prohibition of onion futures trading in order to assure the orderly flow of onions in interstate commerce" (*12*, p. 1).

One might suppose from this statement that a comparison of the variations in onion prices during years when there was futures trading in onions with the variations that occurred in years without futures trading, would show either that prices varied much more widely or that large price variations occurred much more frequently in the years with futures trading than in the prior years; or perhaps that futures trading increased the amount of price variation according to both of these criteria. The detailed price record in Chart 4 gives no confirmation of any of these inferences. The records for individual years in the chart are grouped, first, according to total price range during September–March, with years of small price variation at the top, years of large price variation at the bottom, and years

with an intermediate amount of price variation in between.[11] Within each of these groupings, years are subgrouped according to whether they were years with no futures trading, and therefore no hedging in futures, years with little hedging, or years with a substantial amount of hedging. As we noted earlier, it is only in the years with a substantial amount of hedging that it is reasonable to suppose that futures trading could have had much influence on cash prices of onions.

Two price series are shown in Chart 4. One, represented by a vertical bar for each month, shows the price range for the most representative quality of yellow globe onions at Western Michigan shipping points, as recorded in daily quotations reported by the Market News Service of the U.S. and the Michigan Departments of Agriculture, in cooperation. The other series, represented by dots connected by a light solid line, shows the average U.S. farm price for each month, as estimated by the U.S. Department of Agriculture.

For reasons noted in the previous section, the Michigan price series tends to be representative of onion price movements in that portion of the country where futures trading could have some direct influence on spot prices of onions, through the hedging of onion stocks. The Michigan prices, being available daily, have also the great merit that they reveal price variations within months as well as from month to month. The ranges between the highest and lowest price quoted each month for a representative quality of onions, as shown by the vertical bars in Chart 4, obviously give significant information on the amount of price variation during each month. The usefulness of this particular measure of intramonth price variation will be discussed presently.

As was indicated in previous comments on the two price series shown in Chart 4, divergencies of movement between them probably arise mainly from the influence on the national average of prices in Pacific Coast states, which can often move rather differently from prices to the east of the wide area of thinly populated country between the Pacific Coast states and the Mississippi Valley. It is noteworthy, in these circumstances, that the two price series have moved in such generally close conformity as is observable in Chart 4.

To provide comparability of the prices, and particularly of the price ranges, for different years within a span during which large changes occurred in the general wholesale price level, all prices have been expressed in terms of dollars of constant purchasing power, at the 1947–49 level.

The largest amounts of variation in onion prices during the course of a season, it may readily be noted, have occurred in connection with price advances that were nearly continuous from September or October to March. Examples from the three different categories of amounts of hedging occurred in 1931–32, 1947–48, and 1951–52. There is only one example of large price variation that involved a price decline that was continuous through several months, that of 1949–50. In years with little or no hedging, onion prices tended to be so low at the beginning

[11] Study of an array of the ranges (which may readily be constructed from the data in Table II, below) shows groupings that indicate logical definitions for "small" and "large" ranges. The upper limit of "small" might have been lowered to 75 cents, with loss of only one year (1946–47) from the category, or raised to $1.20, with addition of only one year (1935–36). The lower limit of "large" might have been dropped to $1.75 with addition of one year (1957–58), while raising it to $2.00 would have removed only one year (1940–41) from the category. Raising the upper limit to $2.10 would have removed 1936–37 and 1952–53 from the category of years of large price variation.

of the storage season (Chart 3 and Table 4) that there was little risk of substantial price decline from those levels. In years when there was a substantial amount of hedging, on the other hand, onion prices were so well supported in September and October that subsequent discovery that the crop had been seriously underestimated, as happened in 1949, could result in a large and prolonged price decline.

Large price variation during the course of a season has several times resulted mainly or wholly from large price movements during only February–March, as in 1936–37, or during March alone, as in 1940–41.

The substantial amount of price variation that is classed in Chart 4 as moderate ($1.05 to $1.79) occurred most often in the form of a price advance that culminated in January or February, and that was followed by a price decline (1933–34, 1935–36, 1937–38, and 1950–51). There were also cases of substantial price advance near the end of the storage season (1932–33 and 1957–58) and one example of progressive price decline after November (1955–56). The latter is another illustration of the fact that when onion prices in September and October are supported at a level that seems appropriate to the estimated size of the crop, they must subsequently decline if the crop has been underestimated.[12] When prices in September and October are "conservative," on the other hand, they do not decline appreciably from that level unless the crop proves to have been much larger than was estimated shortly after harvest.

The evidence in Chart 4, instead of showing much larger price variations, or more frequent large price variations, in the years with a substantial amount of hedging in onion futures than in prior years, shows the opposite. The greatest amount of variation in Michigan shipping-point prices during September–March of any year with a substantial amount of hedging was $3.13 for 50-pound sack (in prices adjusted to the 1947–49 price level), from a low of $1.19 in September 1951 to a high of $4.32 in March 1952. In 1931–32, without futures trading and hedging, the price range during October–March was $7.34 per 50-pound sack, from $2.08 to $9.32. The nine years with a substantial amount of hedging included two years with little price variation (57 and 73 cents, respectively) and only three years with a price range of $1.80 or more. The eleven immediate prewar years, without futures trading, included only one (1930–31) in which the price range was less than $1.05, and five years with large price variation.

The foregoing observations may be summarized in tabular form as follows:

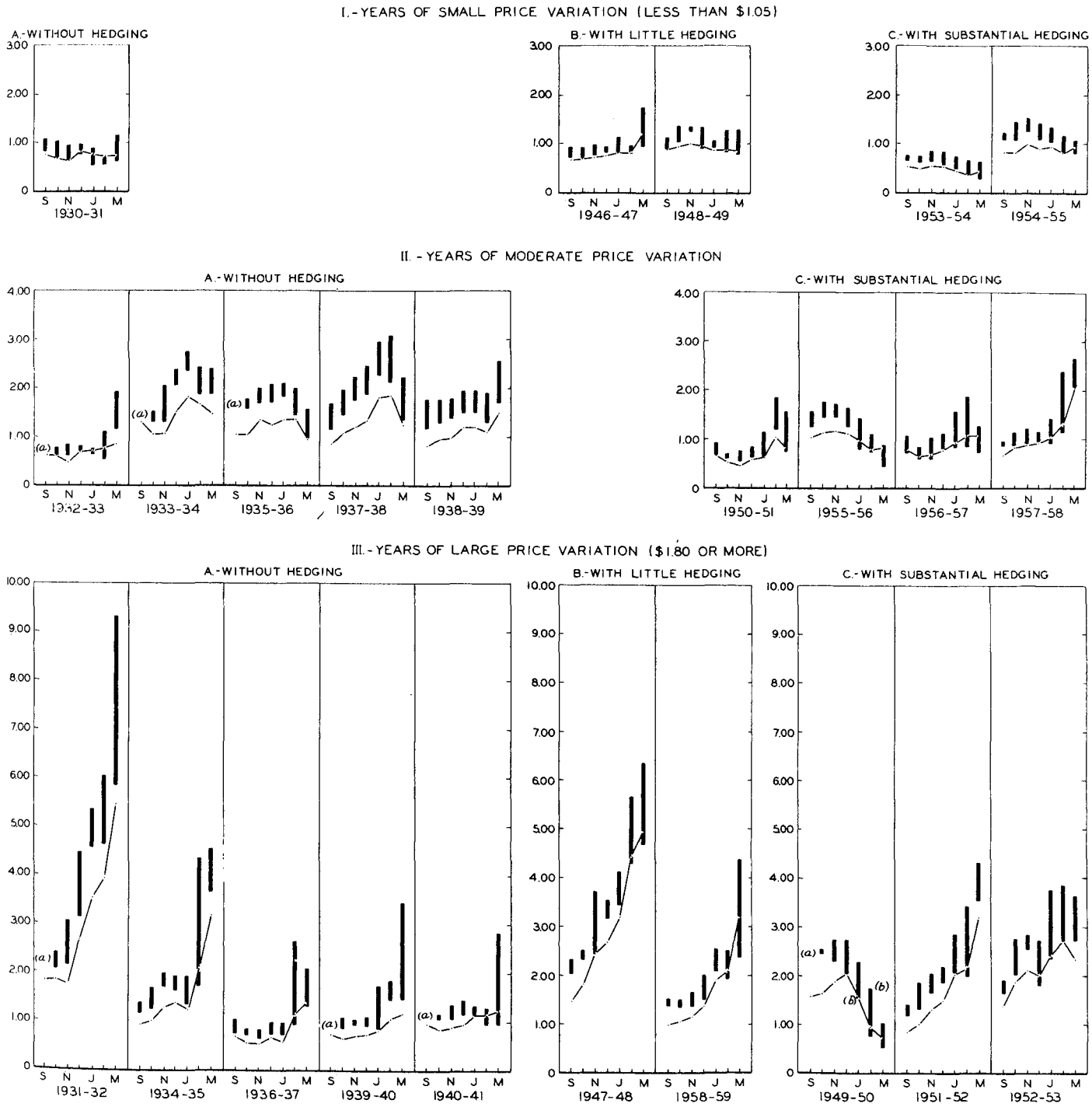
Amount of hedging	Largest price variation	Proportion of years with large variation	Proportion of years with small variation
None	$7.24	45%	9%
Substantial	$3.13	33%	22%

It is noteworthy also that the four postwar years in which there was little hedging show a tendency toward severe price variability, like that of the prewar years without hedging rather than like the more moderate variability observed in years with a substantial amount of hedging. In two of the four years with little

[12] After the end of the storage season the official estimates of the 1949 and 1955 crops of late summer onions were raised by 6.7 and 7.1 per cent, respectively.

CHART 4. — Monthly High and Low Prices of Onions to Michigan Growers, and Monthly National Average Prices to Growers, September–March, 1930/31 to 1940/41 and 1946/47 to 1958/59*

(Dollars per 50-pound sack at 1947–49 price level)



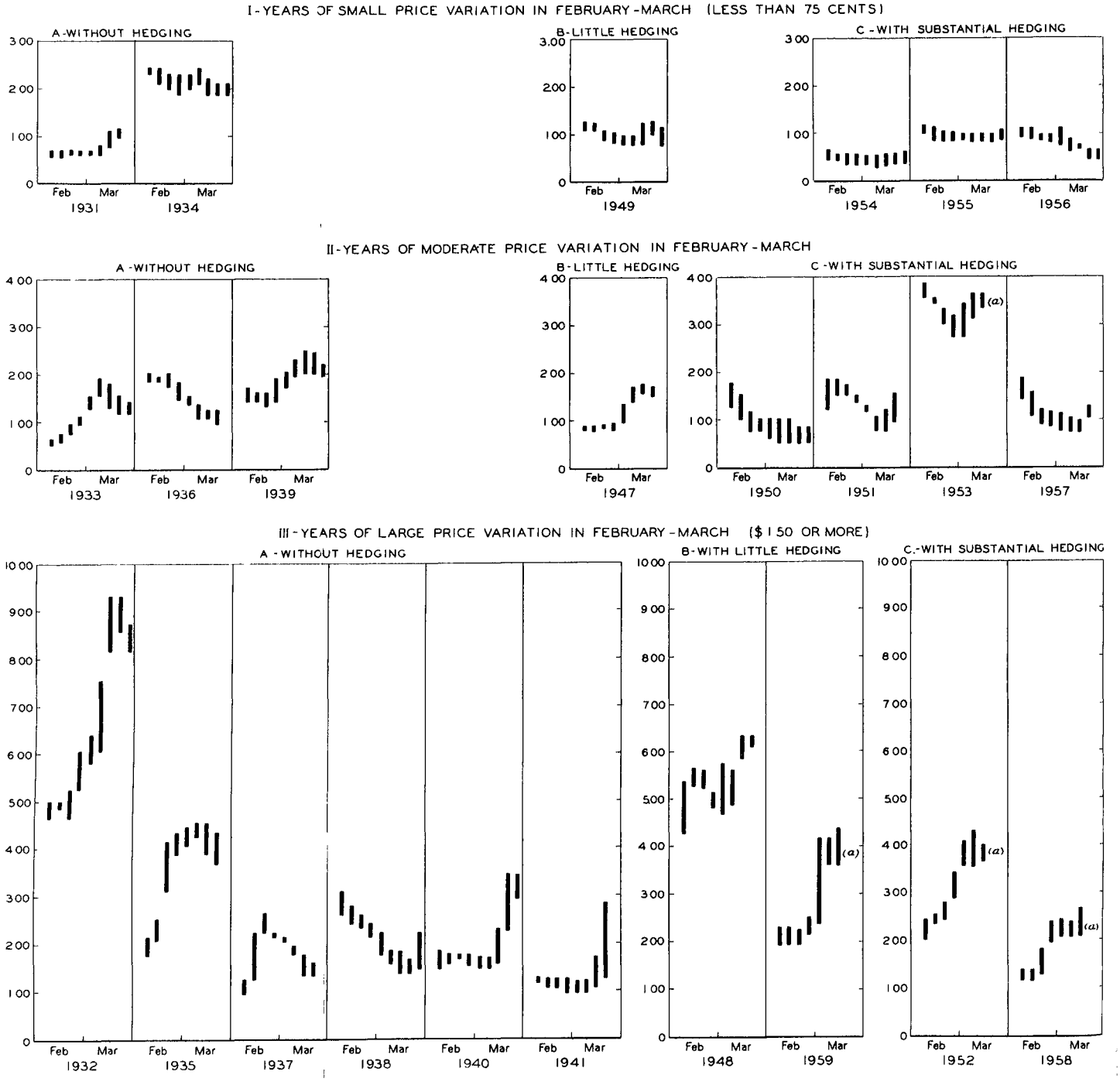
* Data from Tables II and IV. Michigan price range shown by vertical bars.

[a] Quotations lacking or insufficient to establish price range for the month.

[b] Missing high or low Michigan price quotation estimated on the basis of Chicago spot quotations.

CHART 5.—Weekly High and Low Prices of Onions to Michigan Growers, February and March, 1931 to 1941 and 1947 to 1959*

(Dollars per 50-pound sack at 1947–49 price level)



* Data described in note to Table III.

[a] No quotations.

hedging, Michigan shipping-point prices moved during September–March through price ranges of $4.31 and $3.06 respectively.

The range of onion prices during the final two months of the storage season, February–March, has usually exceeded the price range during all of the five previous months of the season. It was late-season price movements, beginning in one instance as early as mid-January, that were cited in the congressional hearings as the principal examples of price movements that were said to have been ". . . both more rapid and of greater extent because of activity in the futures market."[13] Chart 5 concentrates attention on the variations of onion prices during those two months in which the variations have tended historically to be largest, and shows the course followed by the price variation during each month.

The most striking feature of the comparisons afforded by Chart 5 is that, whereas six of the eleven years without futures trading and hedging had a February–March price range of $1.50 or more per 50-pound sack (in 1947–49 dollars), only two of the nine years with a substantial amount of hedging had so large a February–March price range. The following tabulation shows the maximum February–March price range in each group of years, the proportion of years with large February–March price range, and the proportion with a small February–March price range.

Amount of hedging	Largest price variation	Proportion of years with large variation	Proportion of years with small variation
None	$4.68	55%	22%
Substantial	$2.32	22%	33%

Closer study of Chart 5, with attention to the course of prices in prior months (Chart 4), reveals further differences in characteristics of February–March price changes between the years with a substantial amount of hedging and those without futures trading and hedging. The February–March price movement was sometimes a continuation of a movement begun earlier. This was the case in only one year without hedging, but in three of the years with a substantial amount of hedging. The years are listed in a tabulation on the next page. In two of them, 1950 and 1956, the progressive price change during the last four months of the storage season was clearly a necessary readjustment occasioned by an error in estimation of the size of the previous onion harvest, as we have noted earlier.

In three of the years without hedging, and in two years with a substantial amount of hedging (roughly the same proportions of years in the two categories), the February–March price movement reversed the direction of a strong price movement that had occurred during previous weeks. The greatest contrast as regards character rather than size of price movements between the two classes of years compared in the tabulation above, appears in the relative frequency of occurrence of price movements that were progressive during February–March, but were neither continuations of movements that had been in progress during several prior weeks nor reversals of a prior movement. Such movements, re-

[13] The quoted words are from the testimony of Rodger R. Kauffman, Administrator of the CEA (*8*, p. 3). Though the statement is comparative, the evidence cited in connection with it included no comparison with price movements in the absence of futures trading in onions.

flecting belated price readjustment to the demand and supply situation, occurred in four of the years without futures trading and hedging, and in only one year with a substantial amount of hedging.

Kind of price movement during February–March	Years with indicated kind of price movement during February–March	
	without hedging	with substantial hedging
Continuation of direction of movement of previous months	1932	1950, 1952, 1956
Reversal of prior direction of movement	1934, 1938, 1939	1951, 1957
Progressive, but unrelated to prior movement	1935, 1936, 1940,[a] 1941	1958
Oscillation	1933,[b] 1937	1953

[a] The price movement in February–March of this year involved a price advance of about $1.70 after early March that followed an advance of about 60 cents in late January. Though the movement thus does not exactly fit any of the categories used for this tabulation, it most nearly fits this category.

[b] Because the price decline after early March of 1933 was only about one-third as large as the price advance that preceded it, the price movement during February–March of this year might perhaps be classed as "progressive, but unrelated to prior movement."

The final category in the foregoing tabulation comprises years in which the February–March price movement was not closely related to prior price movement, and consisted of price advance (or decline) in February, followed by a decline (or advance) in March. The relative infrequency of such occurrences is a noteworthy characteristic of the evidence in Chart 5.

In summary, the amount of short-time variation in cash prices of onions, as judged by the price range during the entire storage season each year (Chart 4), was clearly not greater with futures trading than it had been without it, but appears instead to have been reduced by the existence of futures trading. And when we consider the variation in cash prices of onions during the two months in which, historically, the amount of variation has been greatest, namely February-March, we find again no evidence of an increase in price variation, but instead, still more striking evidence that futures trading reduced the variability of cash prices of onions.

Some further significant characteristics of onion price variation, as it was affected by futures trading in onions, can be brought to light clearly only through comparison of averages of the monthly price ranges, and of measures of the variability of those ranges.[14] These are shown below in Table 5.

[14] Price range during a month is not only a simple and satisfactory measure of the variation of onion prices during a month, as may be seen from a study of Chart 5, but is a peculiarly good measure of comparative amounts of variation in different months. The special advantage of the range as a measure of short-time price variation arises from the character of the variation that is to be measured. Each daily price is closely related to the price on the previous day, and each weekly price, to the price of the previous week. What is required for measurement of price variation during a month is not a measure of the *dispersion* among a set of more or less independent price quotations recorded during the month, but a measure of the *amount of price change* during the month. Moreover, the sense in which we want to measure the amount of price change is one that requires taking account of the extent to which there is an accumulation of changes in one direction. A series of price changes of one cent per day on each of 25 successive days, within a total price range of only one or two cents, represents much less total price change during the month than does a series of 25 one-cent price changes that cover a price range of 20 or 25 cents.

For a price range to measure an amount of price change accurately in an absolute sense, it is necessary that the price quotations apply to a single, exactly specified, quality of the commodity, and

TABLE 5.—AVERAGE PRICE RANGE, BY MONTHS, AND VARIANCE OF PRICE RANGE, WITH DIFFERING AMOUNTS OF HEDGING*
(Cents per 50-pound sack at 1947–49 price level)

Month	Average price range with			Variance of range with		
	No hedging	Little hedging	Substantial hedging	No hedging	Little hedging	Substantial hedging
Sept.	38[a]	21	22[b]	300[a]	59	105[b]
Oct.	29	22	32	221	91	512
Nov.	39	44	32	580	3,213	78
Dec.	41	26	41	1,122	218	572
Jan.	46	36	66	626	495	414
Feb.	89	58	84	5,457	2,855	1,792
Mar.	119	100	57	8,324	2,459	445

* Computed from data in Table II; classification of years as for Chart 4.
[a] Based on data for September of five years only.
[b] Based on data for September of eight years only.

During the eleven prewar years without futures trading, prices of standard quality yellow globe onions at Western Michigan shipping points showed their least variation (smallest average price range) during the month of October (Chart 6). Each month thereafter had a greater average price range than the preceding month, but the increases from month to month were small prior to February and March. Those last two months, however, had average price ranges that were roughly two and three times as great, respectively, as the average price range in the month of December.

The postwar years with little hedging, being only four in number, show considerable irregularity in the monthly averages. Their general level is lower than that of the averages for corresponding prewar years, but not by a statistically significant amount. Their pattern of change is the same as for the prewar years, namely, one of gradual increase through January, then sharp increase in February and March. Their average February and March ranges are roughly two and nearly four times as great, respectively, as the average range in December of those years.

The nine years with a substantial amount of hedging, on the other hand,

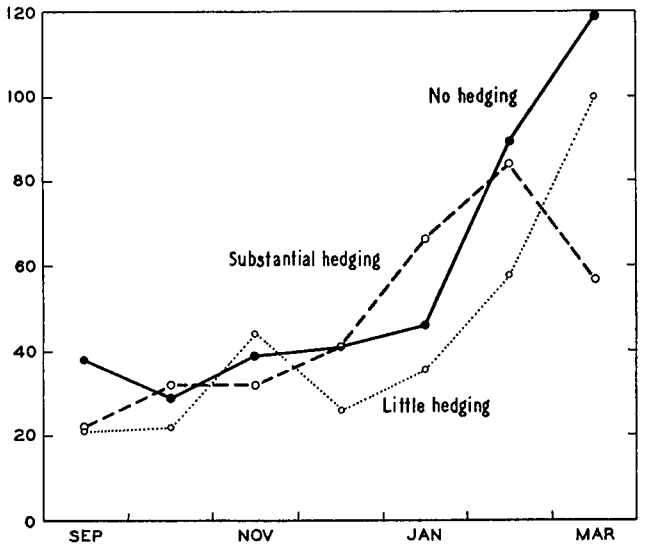
yet be frequent enough to record the full amount of price movement that occurs. No quotations on spot onion prices meet both of these requirements. But for satisfactorily accurate measurement of *differences* in amount of price variation, it is sufficient that the quality range covered by the quotations be narrow, and the quotations frequent.

Among the available quotations on spot prices of onions, those covering carlot sales are wholly unsatisfactory for measurement of price variation because they both cover a wide range of qualities, and are relatively infrequent. As between prices on Chicago "street sales" and Michigan shipping-point prices, the latter appear to be the better quotations for prewar years at least, and it is an advantage that they are prices to growers. They reflect a narrow range of qualities, as may be seen from the very small price ranges that appear in Chart 4 for a few months, or in Chart 5 for a few weeks, when there happened to be little price movement.

The sizes of the onions for which the Michigan quotations have been taken have varied somewhat from year to year. Large onions are preferred by some buyers for some purposes, small onions by other buyers for other purposes. In consequence, large onions may be priced either above or below small onions, depending on relative abundance of the different sizes. In these circumstances it is not necessarily desirable that onion price quotations over a period of years should apply to the same sizes of onions in all years, and for the purpose of measuring price variation it is preferable that the quotations be taken in each year for onions of whatever size is most abundant in that year.

CHART 6.—Average Monthly Price Range (Variation), September to March, According to Amount of Hedging in Onion Futures*

(Cents per 50-pound sack at 1947–49 price level)



* Data from Table 5. Years with no hedging, 1930/31 to 1940/41; years with little hedging, 1946/47 to 1948/49 and 1958/59; years with substantial amount of hedging, 1949/50 to 1957/58.

show a notably different pattern of change in variability from month to month than occurred without futures trading and hedging. The fact that in these years onion prices varied least in September, rather than least in October, presumably reflects only the fact that after World War II September became the month of lowest average level of onion prices, as we noted earlier. In subsequent months there was a gradual increase in average monthly range through December; but in January the average range was 60 per cent greater than in December, instead of only about 10 per cent greater as it had been before the introduction of futures trading in onions. The average range in February was slightly less than in the years without futures trading; and the average range in March was considerably less than in February instead of considerably greater. The average price range of 57 cents in March of years with a substantial amount of hedging was less than half of the average price range of 119 cents in March of years that lacked futures trading and hedging.

Apart from the reduction in average September price range between years without hedging and years with a substantial amount of hedging (which seems attributable to a shift in timing of the seasonal low of prices rather than to futures trading), none of the differences between columns in the left half of Table 5 approaches statistical significance for months prior to January. The difference for March, between years with no hedging and years with substantial hedging, is statistically significant at the 5 per cent level, and that for January, nearly so.[15]

The data in the right half of Table 5 show significantly reduced variance of the

[15] The t-values are 2.0 for January and 2.18 for March.

price ranges for both November and March in years with substantial hedging as compared with years with no hedging, and also as compared with years with little hedging. The reduction for November, though statistically highly significant,[16] appeared to me inconsistent with other evidence in the table until I studied the distribution of price ranges by individual years (Table II). Then it became apparent that, partly because the range measures variation in the sense of movement, the variance of the ranges measures a notably different characteristic of prices than does the mean range. Large variance of the price range can arise either from the occurrence of exceptionally large price ranges in an occasional year, or from the occasional occurrence of an exceptionally small price range. It has often happened in the early part of a storage season that the spot price of onions has remained virtually unchanged throughout a month, in which case the price range for the month, as reflected in Table II, represents chiefly or wholly a quality difference. Such extreme price stability, tending to produce a large variance of price range for the month, has occurred in months as late as December, in years with either no hedging or little hedging, but never after October in years with a substantial amount of hedging. In short, the presence of a substantial amount of futures trading and hedging appears to have produced a low variance of the price range in November by tending to induce some price variation during that month in all years, as well as by tending to avoid exceptionally large price variation during that month in any year.[17]

The reduction of variance of price range in March associated with a substantial amount of hedging is more striking and more highly significant statistically[18] than is the reduction in average price range, and for a different reason than that explaining the low variance in November. The great reduction in variance in March was wholly a consequence of eliminating extremely large price ranges, not partially a result of preventing occurrence of very small price ranges. Indeed, the nine years with a substantial amount of hedging include three in which the price range during March was smaller than in any of the 15 years with little or no hedging, and included one (1954/55) in which the price range during March was only slightly more than half as large as the smallest price range (1933/34) during March of any year without futures trading and hedging.

The implications of the above evidence will become clearer if we pick out its main features and consider them together. We have observed that futures trading in onions appears to have had effects on the variability of cash prices of onions as follows: (1) substantially reduced the variability of onion prices during the storage season as a whole; (2) produced no appreciable change in the variability (average monthly range) of onion prices in the months from September to December, inclusive; (3) increased the average amount of price change occurring in January; and (4) greatly reduced the variability of onion prices in March, the final month of the storage season.

The first two of the foregoing observations, taken together, indicate that

[16] $P < 0.01$ in the comparison with years with no hedging, and <0.001 in the comparison with years with little hedging.

[17] Chance has of course played a part in producing such an extremely low variance as we find for November of years with a substantial amount of hedging; the test of statistical significance indicates only that chance does not wholly account for the extremely low variance observed for November.

[18] $P < 0.001$ in the comparison with years with no hedging, and <0.05 in the comparison with years with little hedging.

futures trading influenced the variability of cash prices of onions chiefly through reducing the amount of price readjustment that proved to be necessary late in the storage season. If our study of the statistical evidence had not gone beyond turning up these first two observations, we might have concluded that futures trading reduced the variability of cash prices of onions solely in one way: by tending toward the establishment early in each storage season of a level of prices appropriate to the existing supply of onions and the potential consumption demand for them, and thus tending to avoid the need for large price readjustments near the end of the storage season.

The third and fourth observations are in no way inconsistent with the first two, but they indicate that however much futures trading may have helped toward obtaining good adjustment of the early-season price level to known supply and demand conditions, its reduction of intraseasonal price variation has been produced partly in another way. It has caused necessary late-season price readjustments to occur earlier in the season than they commonly did in the absence of futures trading, and has in that way also reduced the size of the readjustments needed. When the price has been too low early in the season (Chart 4 indicates that in 11 years just before the introduction of futures trading, onion prices often had to be adjusted upwards from the early-season level, but only once ended the season lower than at the beginning), supplies of storage onions threaten to be exhausted before the newcrop onions become available. Suppose that supplies promise to run out a week too soon. If prices are raised four weeks before the new crop will arrive, and thus only three weeks before stocks would otherwise be used up, the price rise needed is one that will reduce the rate of consumption by one-third. But if, under the same conditions, prices are raised eight weeks before the new crop will arrive, the price rise needed is one that will reduce the rate of consumption by only one-seventh.

Need for late-season readjustment of onion prices occurs often through no fault of the market. Bad weather in South Texas during the winter and the first weeks of early spring may delay the onion harvest there until two or three weeks after the average date,[19] requiring that the supply of storage onions be made to last that much beyond the time when a reasonable early-season appraisal should have counted on the last storage onions being moved into consumption. Or fine weather in South Texas during the winter may bring the new crop to market two or three weeks before the average date. The market effect in that case depends on the size of the Texas crop. If the Texas crop happens to be unusually small as well as early, the demand for storage onions to supplement the short Texas crop may more than offset the price-depressing effect of early arrival of the Texas crop. But if the Texas crop promises to be large as well as early, then the consumption of storage onions must be speeded up, else part of the storage stocks prove salable only at a price that will not pay the costs of shipment and handling.

It is obviously desirable that any readjustment of onion prices needed to compensate for unusual timing and size of the Texas crop should be made as early in the season as possible, in order to minimize the amount of price change

[19] See the shipment data on page 8.

required to effect that compensation. Useful predictions of the timing of the South Texas harvest can often be made about the first of January. If it appears then that the Texas harvest is likely to be late and small, it is desirable that the price of storage onions should reflect that prospect promptly, even though it still remains possible that fine weather may succeed bad weather in Texas, with the result that a price rise based on the poor crop prospects in Texas may have to be followed by a return to the previous level of prices for storage onions.

SUMMARY AND CONCLUSIONS

The evidence in foregoing pages clearly indicates that futures trading in onions substantially reduced the amount of variation in spot prices of onions. But that indication cannot be taken as the basis for a firm conclusion without considering also the evidence that led investigating committees of the two houses of the Congress to reach a contrary conclusion. Presumably the Congress also, in acting according to the recommendations of these committees, expressed the concurrence of a majority of its members in the conclusions of its committees. The congressional committees had before them much less evidence of reduction in the variation of onion prices, associated with futures trading, than is given above. In consequence, they had much less reason than we now have to look critically for possible weaknesses in the evidence purporting to show that futures trading had increased the fluctuations in cash prices of onions. I therefore summarize first the features of the statistical evidence that require especially critical examination of the contrary evidence on which the Congress acted.

The statistical evidence of reduced price variability that was heard by the congressional committees[20] dealt only with the monthly national average prices, shown in Chart 4 above by the points connected by light lines. It considered the seasonal range of these monthly averages, and the average price change from month to month between them, but not their average seasonal variation. And the comparisons made did not discriminate between years with a substantial amount of hedging and years with little hedging, but only between prewar and postwar years. Consequently, the only fairly impressive direct evidence on comparative price variability that was before the committees was evidence that month-to-month changes in onion prices had been somewhat smaller since the war than previously. This was evidence that could rather reasonably be treated lightly, as possibly a consequence of some change in conditions other than the introduction of futures trading. It could the more reasonably be brushed aside thus because month-to-month changes between price averages might conceivably have failed to reflect well the increase in short-time price variability that was said to have resulted from futures trading in onions.

We have now the highly persuasive evidence of reduced average seasonal variation in onion prices (Chart 3). This evidence seems not explainable on any ground other than as an effect of futures trading in onions. How else can one account for the fact that the observed effect was confined to only those postwar years in which there was a substantial amount of hedging in onion futures?

We have here dealt with intramonth price variation, as well as with intra-

[20] Given in full in *10*, pp. 50–56, and discussed briefly in *8*, pp. 51–54, and *11*, pp. 450–55, also.

seasonal variation, measuring the former in terms of monthly price ranges. Consequently, any short-time price variation that would not show in month-to-month price changes must be reflected in our data. Moreover, the prices we use are prices to growers in an area close to Chicago, where any increased price variability attributable to futures trading in onions should show especially clearly. We nevertheless find no increase in variability of spot prices of onions associated with futures trading, but instead, find a reduction in both intraseasonal and intramonth variability. And this evidence of reduced variability appears clearly only in those postwar years in which there was a substantial amount of hedging in onion futures (Chart 4). It thus appears to be related specifically to the hedging in onion futures.

By considering short-time price variability month by month through the storage season, we have learned that the reduction in price variability associated with futures trading in onions has consisted primarily of reduction in the size of price changes during February–March and especially of price changes during March (Charts 5 and 6 and Table 5). One reason that these late-season price changes have been smaller with a substantial amount of hedging than with little or no hedging, we find, is that they have tended to occur a month or so earlier in the years with a substantial amount of hedging than in the other years. Price changes in these final months of the storage season, moreover, were reduced substantially only in those postwar years in which there was a substantial amount of hedging in onion futures, not in the postwar years (including 1958/59) in which there was little hedging. In partial explanation of the reduction in size of these late-season price changes we find that they have been moved forward in time. Necessary readjustments near the end of a storage season can be smaller if they are made fairly early than if made late. The earlier timing, like all of the other noteworthy alterations in observed behavior of onion prices, was clearly evident only in the years with a substantial amount of hedging, not in those postwar years in which there was little hedging in onion futures.

Reduction in size of price readjustments found necessary near the end of a storage season is precisely the sort of reduction in price variability that should logically be expected as a result of futures trading in a commodity; and promptness of price response to new market information is peculiarly likely to be induced by futures trading. What we have observed in these last respects, therefore, appears especially likely to have been an effect of futures trading in onions, and seems not explainable in any other way.

Though the congressional committees heard some evidence indicating that futures trading had reduced the variability of onion prices, the Senate Committee on Agriculture and Forestry nevertheless concluded ". . . that speculative activity in the futures markets causes such severe and unwarranted fluctuations in the price of cash onions as to require complete prohibition of onion futures trading in order to assure the orderly flow of onions in interstate commerce" (*12*, p. 1). The House Committee on Agriculture apparently reached essentially the same conclusion, expressed somewhat differently (*9*, pp. 3–4). On what grounds did they so decide?

The extensive congressional hearings on futures trading in onions produced

no evidence that conflicts directly either with our findings above on comparative price variability, or with our ascription of observed reductions in price variation to futures trading in onions. Partly for that reason many people connected with the exchanges believe that the Congress acted in this instance mainly in response to organized political pressure from onion growers and other agricultural groups and from onion dealers—pressure that was stimulated and organized primarily by onion dealers. The sharply diminished average seasonal variation in onion prices that we noticed earlier had curtailed profits from onion storage, and futures trading in onions had sharpened competition for dealers in other respects. But while evidences of political pressure on a number of members of Congress were clearly apparent, study of the hearings leads me to believe that the congressional decision turned on what the investigating committees regarded as competent economic evidence of unwarranted price fluctuations attributable to futures trading. I can do no more here than state that opinion and sketch briefly the nature of what seems to me to have been the persuasive evidence.

The members of the investigating committees were undoubtedly familiar in advance with the economic reasoning commonly used to support the conclusion that futures trading tends to stabilize prices. In the hearings they were shown tabulations prepared by the CEA that classified all holders of onion futures, on certain representative dates, according to occupation. The occupations of the people thus shown to have been speculating in onion futures did not suggest that these speculators would be particularly competent judges of supply and demand conditions for onions.

The committees were given evidence that a great deal of the speculation in onion futures was in-and-out trading, involving the holding of a speculative position for not more than two weeks. They were told[21] by the administrator of the CEA that such trading ". . . necessitates guessing on . . . immediate and so-called technical conditions" (*10*, p. 32). He had begun his testimony on this occasion by citing the most recent example of a price movement that he held to have been ". . . both more rapid and of greater extent because of activity in the futures market," and followed by saying: "this sort of price movement in onion futures has occurred on many occasions prior to this most recent episode. . . . Price movements of this sort cannot be attributed to supply and demand, and force the conclusion that speculation, and in some instances manipulation, has been a dominant factor" (*10*, p. 28). Shortly afterward he remarked that, "Wide and rapid price swings attract speculation which at times further widens these swings, thus attracting more speculation. This speculative fever continues until the individual speculators have either lost their money or made enough to satisfy them for the time being" (*10*, p. 30).

Evidence broadly similar to that cited above has led a good many economists to question whether futures trading does not tend in general to increase the amount of short-time variation in commodity prices rather than to stabilize prices. The congressional committees investigating futures trading in onions were told

[21] In what follows I quote often, instead of paraphrasing, to guard against inadvertent misrepresentation of what was said. Though a single source is cited for each quotation, identical or similar statements are to be found in the hearings of committees of both the House and the Senate.

by the administrator of the CEA that onions were *peculiarly* subject to speculative excesses of price movement, because the economic characteristics of onions lead naturally to larger and more rapid price changes than occur in the price of any other commodity that has been the subject of futures trading, and "The frequency of wide price movements [in onions] attracts a type of speculator who is looking for quick action and who is likely to get into and out of the market in a short time" (*10*, p. 30). The committees were told also that the hedging done in onion futures differed in character from the hedging of such commodities as wheat, corn, and cotton: "There is a tendency on the part of onion hedgers to hedge only partially and to place and remove their hedges sporadically, with changing appraisals of current market conditions" (*8*, p. 6).

The evidence and opinions presented by the CEA and summarized above have direct bearing only on price tendencies in the presence of futures trading in onions. The investigating committees heard no evidence regarding the probable extent of unwarranted fluctuations in cash prices of onions in the absence of futures trading. The apparent inference of the committees that unwarranted fluctuations of cash prices in the presence of futures trading had tended to be much larger than in its absence could be mistaken, then, for either of two reasons: (1) If the committees were correct in inferring that severe and unwarranted fluctuations of cash onion prices did occur often as a result of speculation in onion futures, these fluctuations may still have been smaller than the unwarranted variations in cash prices of onions that tended to occur in the absence of futures trading. (2) Alternatively, it is possible that the committees were mistaken in supposing that the fairly severe fluctuations shown to have occurred in futures prices of onions were generally unwarranted fluctuations. The specific evidence regarding them was that they were in some sense "speculative." But the assumption that, being speculative, they were also unwarranted, rested mainly on two other assumptions: (a) that people whose listed occupations do not involve physical handling of onions must be generally ignorant of national conditions of supply and demand for onions; and (b) that in-and-out speculation cannot be mainly concerned with seeking profits by taking advantage of new information regarding supply and demand, thereby promoting desirably prompt adjustment of prices to the new information.

In view of the existence of these clear possibilities of error in the main inference drawn by the congressional committees, or accepted by them, the next step needed seems to be a more careful consideration of what inferences can properly be drawn from such evidence on futures trading as was presented to the congressional committees by the CEA. A subsequent article will undertake such a consideration from the broad standpoint of the effects of futures trading in general. One result will be to show that accumulation of information and economic research during the past 40 years, much of it done by the CEA, has produced a great amount of evidence concerning futures trading and its effects that has not yet been assimilated into generally accepted economic thought. In consequence, the new knowledge has been a source of confusion. When it is properly assembled and interpreted, the apparent conflict in existing evidence will disappear.

CITATIONS

1 Chicago Mercantile Exchange, *Yearbooks.*

2 G. W. Hoffman and J. W. T. Duvel, *Grain Prices and the Futures Market* (U.S. Dept., Agr., Tech. Bull. No. 747, 1941).

3 J. S. Schonberg, *The Grain Trade* (New York, 1956).

4 U.S. Dept. Agr., *Commodity Futures Statistics,* Stat. Bulls. Nos. 196, 221 (1956, 1957).

5 ——— *Marketing Texas Onions, Lower Rio Grande Valley of Texas* (1957, 1958, 1959; mimeo).

6 ——— *Onion Futures: Survey of Open Contracts on the Chicago Mercantile Exchange,* Oct. 31, 1956 (mimeo).

7 ——— *Agricultural Prices, Supp. No. 1,* February 1959.

8 U.S. 85th Cong., 1st sess., House, *Hearings before the Committee on Agriculture,* May 1–3, 1957.

9 ——— 1st sess., House, Rept. No. 1036, Aug. 8, 1957.

10 ——— 1st sess., Senate, *Hearings before a Subcommittee of the Committee on Agriculture and Forestry,* Aug. 12, 1957.

11 ——— 2d sess., Senate, *Hearings before the Committee on Agriculture and Forestry,* Mar. 22–26, 1958.

12 ——— 2d sess., Senate, Rept. No. 1631, May 6, 1958.

13 U.S. Supreme Court, *Hill v. Wallace,* 259 U.S. 44, May 15, 1922.

14 ——— *Board of Trade v. Olsen,* 262 U.S. 1, Apr. 16, 1923.

15 U.S. Statutes, 42 Stat. 998.

16 *Wall Street Journal, Chicago Edition.*

TABLE I.—MONTHLY HIGH AND LOW PRICES OF ONIONS TO GROWERS, MICHIGAN, SEPTEMBER–MARCH 1930/31 TO 1958/59*

(Cents per 50-pound sack at current prices)

Year	H or L	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1930/31	H	60	55	50	50	45	35	57½
	L	45	37½	32½	40	27½	27½	30
1931/32	H	[a]	110	140	200	235	260	400
	L	[a]	95	98	140	200	200	250
1932/33	H	[a]	32½	35	33	30	42½	75
	L	[a]	25	25	27½	25	20	45
1933/34	H	[a]	70	95	110	130	115	115
	L	[a]	60	60	95	110	90	80
1934/35	H	70	85	100	98	100	225	235
	L	60	62½	85	82½	70	90	190
1935/36	H	[a]	93	105	110	110	105	80
	L	[a]	82½	88½	90	95	75	50
1936/37	H	55	45	45	55	55	150	120
	L	40	37½	35	40	40	53	75
1937/38	H	95	110	120	130	155	160	115
	L	65	80	95	100	120	110	70
1938/39	H	90	90	90	98	98	95	125
	L	60	65	70	75	75	65	85
1939/40	H	[b]	57	55	57	90	95	175
	L	[b]	45	48	47	44	75	75
1940/41	H	[b]	60	70	75	70	67	150
	L	[b]	55	55	60	60	50	50
1941/42	H	[b]	145	165	160	225	220	285
	L	[b]	100	125	145	160	200	215
1942/43	H	130	135	140	165	172	182 }	192
	L	95	90	117	125	160	180 }	
1943/44	H	[a]	[a]	[b] }	179	{ 204 }	204	{ [a]
	L	[a]	[a]	[b] }		{ 189 }		{ [a]
1944/45	H	130	120	145	150	155	165	130
	L	110	110	115	130	125	125	62
1945/46	H	179	204 }	204	{ 219 }	219	234	{ [a]
	L	150	170 }		{ 204 }			{
1946/47	H	75	80	90	85	103	90	165
	L	60	60	70	75	75	75	90
1947/48	H	230	250	375	365	430	580	650
	L	200	230	245	325	360	440	480
1948/49	H	120	145	140	135	110	130	130
	L	95	110	130	95	95	85	80
1949/50	H	[a]	250	270	270	225	175[c]	100
	L	[a]	240	225	200	150[c]	75	50
1950/51	H	100	75	85	95	130	215	180
	L	70	65	60	70	70	140	90
1951/52	H	160	215	235	250	325	385	485
	L	135	150	190	215	235	225	400
1952/53	H	215	310	315	300	415	425	400
	L	185	225	285	200	260	300	300
1953/54	H	85	85	95	95	85	75	70
	L	75	70	70	65	55	40	32½
1954/55	H	135	160	170	155	150	130	120
	L	120	120	140	120	115	90	90
1955/56	H	175	195	190	180	160	125	100
	L	140	160	160	140	90	85	50
1956/57	H	125	100	120	130	185	220	150
	L	85	70	70	95	100	100	85
1957/58	H	115	135	145	140	170	285	320
	L	105	105	110	110	110	135	250
1958/59	H	180	180	200	240	305	300	525
	L	165	160	165	180	250	230	285

* See Table III for footnotes.

TABLE II.—DEFLATED MONTHLY HIGH AND LOW PRICES OF ONIONS TO GROWERS, MICHIGAN, SEPTEMBER–MARCH 1930/31 TO 1958/59*

(Cents per 50-pound sack at 1947–49 price level)

Year	H or L	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1930/31	H	109.3	102.0	94.7	96.7	88.6	70.1	116.4
	L	82.0	69.6	61.6	77.4	54.1	55.1	60.7
1931/32	H	[a]	240.7	307.0	448.4	536.5	603.2	932.4
	L	[a]	207.9	214.9	313.9	456.6	464.0	582.8
1932/33	H	[a]	77.6	84.3	81.1	75.8	109.5	191.8
	L	[a]	59.7	60.2	67.6	63.1	51.5	115.1
1933/34	H	[a]	151.2	205.6	239.1	277.2	240.6	240.1
	L	[a]	129.6	129.9	206.5	234.5	188.3	187.9
1934/35	H	138.9	171.0	200.8	196.0	195.3	435.2	455.4
	L	119.0	125.8	170.7	165.0	136.7	174.1	368.2
1935/36	H	[a]	177.8	200.4	209.1	209.9	200.4	154.7
	L	[a]	157.7	168.9	171.1	181.3	143.1	96.7
1936/37	H	103.8	84.9	84.0	100.5	98.6	267.4	210.5
	L	75.5	70.8	65.3	73.1	71.7	94.5	131.6
1937/38	H	167.2	198.2	221.8	244.8	294.7	308.3	222.0
	L	114.4	144.1	175.6	188.3	228.1	211.9	135.1
1938/39	H	176.8	178.2	178.9	195.6	196.0	190.0	250.5
	L	117.9	128.7	139.2	149.7	150.0	130.0	170.3
1939/40	H	[b]	110.5	107.0	110.7	174.4	185.5	343.8
	L	[b]	87.2	93.4	91.3	85.3	146.5	147.3
1940/41	H	[b]	117.2	135.4	144.2	133.3	127.9	283.0
	L	[b]	107.4	106.4	115.4	114.3	95.4	94.3
1941/42	H	[b]	241.3	274.5	262.7	360.6	350.3	449.5
	L	[b]	166.4	208.0	238.1	256.4	318.5	339.1
1942/43	H	200.6	207.7	214.7	251.5	259.8	273.3	285.7
	L	146.6	138.5	179.5	190.5	241.7	270.3	
1943/44	H	[a]	[a]	[b]	266.8	304.0	303.1	[a]
	L	[a]	[a]	[b]		281.7		[a]
1944/45	H	192.3	177.3	213.9	220.6	227.3	241.6	190.1
	L	162.7	162.5	169.6	191.2	183.3	183.0	90.6
1945/46	H	261.7	296.5	293.9	314.7	314.7	334.3	[a]
	L	219.3	247.1		293.1			[a]
1946/47	H	93.0	91.7	99.1	92.8	111.6	96.7	173.0
	L	74.4	68.8	77.1	81.9	81.2	80.6	94.3
1947/48	H	233.7	251.0	372.4	355.8	411.5	565.8	634.1
	L	203.2	230.9	243.3	316.8	344.5	429.3	468.3
1948/49	H	113.1	138.1	133.7	129.8	107.0	128.4	128.8
	L	89.5	104.8	124.2	91.3	92.4	84.0	79.3
1949/50	H	[a]	255.4	276.1	276.4	230.3	178.0[c]	101.5
	L	[a]	245.1	230.1	204.7	153.5[c]	76.3	50.8
1950/51	H	93.4	69.6	77.8	84.7	113.0	184.5	154.5
	L	65.4	60.4	54.9	62.4	60.9	120.2	77.2
1951/52	H	141.1	189.1	206.9	220.3	287.6	342.2	431.9
	L	119.0	131.9	167.2	189.4	208.0	200.0	356.2
1952/53	H	192.3	279.0	284.6	273.7	377.6	387.8	363.6
	L	165.5	202.5	257.4	182.5	236.6	273.7	272.7
1953/54	H	76.6	77.1	86.5	86.3	76.6	67.9	63.3
	L	67.6	63.5	63.8	59.0	49.6	36.2	29.4
1954/55	H	122.7	145.8	154.5	141.6	136.2	117.8	109.1
	L	109.1	109.4	127.3	109.6	104.4	81.5	81.8
1955/56	H	156.7	174.7	170.9	161.7	143.0	111.2	88.6
	L	125.3	143.4	143.9	125.8	80.4	75.6	44.3
1956/57	H	108.2	86.5	103.5	111.8	158.2	188.0	128.3
	L	73.6	60.6	60.4	81.7	85.5	85.5	72.7
1957/58	H	97.4	114.6	122.8	118.1	143.0	239.5	267.3
	L	89.0	89.1	93.1	92.8	92.5	113.4	208.8
1958/59	H	151.1	151.3	167.8	201.3	255.2	251.0	439.0
	L	138.5	134.4	138.4	151.0	209.2	192.5	238.3

* See Table III for footnotes.

TABLE III.—DEFLATED MONTHLY AVERAGE PRICES OF ONIONS TO GROWERS, MICHIGAN, SEPTEMBER–MARCH 1930/31 TO 1958/59*

(Cents per 50-pound sack at 1947–49 price level)

Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1930/31	94.1	85.7	72.7	90.1	72.8	63.9	84.2
1931/32	[a]	251.2	251.7	399.1	493.6	507.6	781.5
1932/33	[a]	81.3	72.0	71.9	65.9	78.8	145.7
1933/34	[a]	139.0	155.8	224.1	251.8	220.9	207.7
1934/35	130.5	144.0	189.1	182.8	166.2	299.0	422.6
1935/36	[a]	167.4	184.5	188.4	193.7	181.2	123.4
1936/37	85.6	76.0	72.3	86.2	82.2	186.8	172.1
1937/38	143.8	171.1	198.7	212.8	265.0	254.1	171.8
1938/39	118.3	170.6	160.8	171.2	169.8	153.6	211.2
1939/40	[b]	101.1	99.8	100.7	120.3	164.8	239.4
1940/41	[b]	113.8	118.3	127.6	124.0	114.8	137.9
1941/42	[b]	198.3	237.1	251.4	317.3	335.4	401.3
1942/43	165.9	176.6	190.2	224.1	255.0	272.5	285.7
1943/44	[a]	[a]	[b]	266.8	287.2	303.1	[a]
1944/45	174.9	170.8	189.5	205.9	202.6	212.9	135.5
1945/46	254.7	261.5	293.9	298.6	314.7	334.3	[a]
1946/47	80.4	82.8	88.8	87.3	93.4	87.5	146.1
1947/48	215.3	239.4	321.5	328.5	373.2	517.1	569.6
1948/49	99.9	120.8	128.9	114.8	97.8	106.8	197.2
1949/50	[a]	251.9	252.5	241.1	218.8[c]	116.3[c]	74.0
1950/51	75.8	66.1	65.4	73.0	91.7	156.1	109.4
1951/52	130.5	148.4	189.2	201.5	250.8	261.1	386.6
1952/53	180.5	248.8	271.0	240.4	282.0	333.5	330.2
1953/54	73.7	72.0	75.6	69.7	64.8	50.8	46.1
1954/55	114.3	122.5	140.9	123.2	123.1	98.5	92.7
1955/56	142.7	158.5	156.9	141.5	116.1	95.1	64.2
1956/57	88.7	72.2	83.6	94.5	103.5	125.5	95.7
1957/58	92.2	103.9	113.2	106.4	112.2	156.4	229.0
1958/59	146.1	142.9	155.2	181.2	236.8	215.9	372.1

NOTES FOR TABLES I–III

* High (H) and low (L) prices to growers, f.o.b. Western Michigan shipping points, of the most representative quality of yellow globe onions. Prices from Market News Service, U.S. and Michigan Departments of Agriculture, *Marketing Michigan Onions, Summary,* annual 1930/31–1958/59. Monthly averages (Table III) are based on high and low prices for each of the 4 or 5 weeks falling wholly or mainly within the month. Deflation (Tables II and III) by BLS index of wholesale prices of all commodities, base 1947–49 = 100, as officially released by the U.S. Dept. Labor, Bur. Labor Stat.

[a] No quotations.

[b] Quotations for less than 3 weeks.

[c] Missing quotations supplied on the basis of Chicago price quotations.

TABLE IV.—UNITED STATES MONTHLY AVERAGE DEFLATED FARM PRICES OF ONIONS, SEPTEMBER–MARCH 1930/31 TO 1958/59*

(Cents per 50-pound sack at 1947–49 price level)

Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1930/31.....	78.3	68.6	62.5	83.1	76.7	72.1	72.8
1931/32.....	183.5	185.9	175.4	269.0	353.8	394.4	547.7
1932/33.....	61.1	59.6	48.1	68.7	70.7	77.3	84.3
1933/34.....	130.4	103.6	108.2	152.1	181.2	167.3	146.1
1934/35.....	93.2	100.6	130.5	140.0	126.9	212.7	319.7
1935/36.....	104.9	105.1	133.5	123.5	133.5	133.5	94.7
1936/37.....	69.8	58.4	55.9	67.6	59.1	115.8	140.3
1937/38.....	86.2	108.1	120.1	131.8	180.6	183.0	125.4
1938/39.....	82.5	97.0	99.4	119.7	120.0	110.0	150.3
1939/40.....	71.9	65.8	70.0	71.8	81.3	107.4	117.8
1940/41.....	96.6	83.9	88.9	96.1	114.2	114.5	122.6
1941/42.....	108.8	124.7	158.0	188.8	264.4	294.5	331.2
1942/43.....	123.4	138.4	153.3	167.6	196.3	225.2	267.8
1943/44.....	194.0	201.4	231.6	260.8	298.0	312.0	459.2
1944/45.....	140.5	125.5	125.3	147.0	175.9	190.3	146.1
1945/46.....	197.3	203.4	237.7	251.4	301.7	364.2	374.2
1946/47.....	68.2	68.8	71.5	76.4	81.2	80.5	120.5
1947/48.....	147.3	180.7	243.2	268.0	320.5	443.9	497.5
1948/49.....	90.4	95.2	100.2	96.1	87.5	88.9	84.2
1949/50.....	157.6	163.4	189.1	204.7	158.6	96.6	71.0
1950/51.....	65.3	51.0	45.7	57.9	60.8	103.0	81.5
1951/52.....	83.7	101.1	132.0	149.7	203.5	217.7	320.5
1952/53.....	138.6	189.0	212.2	200.7	241.1	273.7	236.3
1953/54.....	54.0	49.9	54.6	54.4	45.0	37.1	44.3
1954/55.....	81.8	82.0	100.0	91.3	95.3	81.5	95.4
1955/56.....	102.9	112.0	116.9	112.3	98.3	80.0	84.2
1956/57.....	79.6	64.8	69.0	79.1	94.0	109.4	109.4
1957/58.....	69.4	84.8	88.9	92.8	102.6	130.2	208.8
1958/59.....	99.1	105.0	113.3	138.4	190.8	209.2	321.9

* Prices from U.S. Dept. Agr., Agr. Marketing Serv., *Commercial Vegetables and Strawberries: Monthly Prices for Fresh Market, 1924–56* (*Agricultural Prices,* Supp. 1, Feb. 1957) p. 14; and *Agricultural Prices,* Feb. 1958, p. 26, and Feb. 1959, p. 26. Deflation as for Tables II and III.