Do Lettuce Buyers Exert Oligopsony Power?

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FOR MANY YEARS complaints have been heard that retail food marketing is becoming increasingly concentrated in the hands of large food chains which are shifting more and more to direct buying of fresh produce from the shipping point markets. Some farmers claim that direct buying has reduced the number of competing buyers in the shipping point markets and, because of the volume handled, the large chainstores use oligopsony power to depress prices and thus adversely affect growers' incomes.

This paper presents an analysis of the buying practices of three major food chains, hereafter called principal buyers, operating in Salinas, Calif., a primary shipping point market for lettuce. Lettuce was selected for a case study for several reasons. First, the Salinas Valley is a major producing area of summer lettuce in California. During the 1963 shipping season, it supplied about 85 percent of summer lettuce produced in California and about 70 percent of the U.S. total. Second, the market operated without institutional constraints--the California Summer Lettuce Marketing Order was terminated in 1962. Third, lettuce is sold in the fresh market only, which simplifies the analysis.

Fourth, the three largest national food chains operate buying offices in the Salinas-Watsonville area. In the opinions of lettuce shippers, each of these firms was purchasing significant percentages of the total market supply of lettuce. Furthermore, the quantity purchased by the next largest buyer was believed to be considerably lower than that purchased by the smallest buyer of the three chains. Therefore, a priori, the Salinas-Watsonville lettuce market could be characterized as an oligopsony market. The purpose of this study was to explore the validity of this assumption.

The procedure involved (1) an investigation of changes in the number of buyers and sellers in the market, (2) an estimate of the relative volumes bought by the principal chains, and (3) an investigation of the purchasing patterns of principal buyers to learn whether the patterns resemble those which could be expected in an oligopsony market.

Nature and Sources of Data

The three largest national food chains were asked to supply data on their daily purchases of lettuce and prices paid during the main 1963 shipping season. They agreed to supply these data on condition that the three buyers would be treated as a group in the statistical analysis and that the data for individual buyers would not be disclosed. The beginning and ending weeks of the shipping season were excluded, leaving a period from May 13 through September 20. This afforded 19 weekly, and, excluding 3 holidays, 92 daily observations.

A sample of invoices was obtained from the shippers in order to check the reliability of the price data supplied by the three chains. These invoice prices were compared with the daily average prices reported by each chain. In each case, a single observation was compared to a daily average; therefore, the significance of the differences could not be verified statistically without some additional knowledge of the distribution of daily prices. However, the differences were found to be small. For the total sample, the average deviation of invoice prices from the reported average daily price was only $0.0078 per carton. Thus, the food chains' data were considered reliable.

The reported quantities of lettuce purchased by the principal buyers were estimated from data derived from a stratified random sample of shippers' records. The following sampling plan was utilized: The 1963 directory of the Grower-Shipper Association listed 43 firms selling lettuce. The 1962 market order assessment records listed an additional 5 firms. Six of the 43 firms merged their selling activities and were considered one entity in the sampling. Market order assessment records indicated that four firms made no shipments in 1962. Nine

firms were excluded from the sample because each shipped less than 100,000 cartons in 1962. The remaining 30 firms were stratified according to the 1962 market order assessments to give the following distribution:

Size of firm (cartons shipped)	Number of firms	Percent of total volume	Sampling rate (percent)
Over 1,000,000.......	6	51.8	100
500,000 - 1,000,000..	8	25.8	75
100,000 - 500,000..	16	22.3	50

Each contacted shipper was requested to give the number of cartons of lettuce sold to each of the three main buyers during the five randomly selected weeks of the 1963 shipping season.

The chains' data were supplemented by data collected by the Federal-State Market News Service. Two modifications were made in the latter: (1) Reported daily shipments of lettuce were converted from cars and carlot equivalents to number of cartons, using a conversion factor of 640 cartons; (2) the reported "mostly" price, the average of "mostly" price range, or the average of the quoted range, whichever was lowest, was used as an approximation to the average market price. According to the Federal-State Market News Service staff in Salinas, this approximation is closer to the average market price than any available alternative.[1] All prices were for cartons containing two dozen heads of lettuce and exclude the cooling charge.

Changes in Number of Buyers and Sellers

There are no data on the number of buyers in the shipping point market. The only available data pertaining to California middlemen dealing in agricultural commodities are for the entire State. The State licenses five categories of middlemen: (1) agents, (2) brokers, (3) cash buyers, (4) commission merchants, and (5) dealers.[2] In the last 10 years, there was a slight decrease in the total number of licenses issued, as well as some decrease in three of the five categories of licensed middlemen (table 1).

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[1] For the period under investigation the use of "whichever lowest" prices resulted in a difference of less than 1 cent per carton.

[2] For definitions see Agricultural Code of California, Chapter 6, Section 1261.

Table 1.--Number of produce dealer licenses issued by the State of California, 1953 and 1963

Type of license	1953	1963
Agent......................	3,944	4,477
Broker.....................	1,413	1,302
Cash buyer.................	795	630
Commission merchant.........	1,033	1,130
Dealer.....................	4,080	3,631
Total..................	11,265	11,170

Source: Bureau of Market Enforcement, California State Department of Agriculture.

Another indication of a decrease in the number of buyers is the Salinas-Watsonville F.O.B. Buyers' Association, which in 1964 had 39 members, 9 less than in 1953.

Shipping point buyers compete with buyers located outside of the Salinas market. The available evidence shows that the number of the latter buyers had declined. For example, the Census reports show that the number of produce wholesalers with paid employees in the United States increased from 6,775 in 1948 to 7,389 in 1954 but decreased to 7,259 in 1958. The number of wholesale firms in the wholesale produce market also decreased from 6,492 in 1939 to 5,627 in 1948 and 5,375 in 1958.[3]

The data about the changes in the number of sellers are slightly better. Records of the California Summer Lettuce Marketing Order show that the number of handlers (sellers) of summer lettuce decreased between 1958 and 1961 (table 2). The percentage of total volume handled by the 4 largest and 10 largest handlers also increased slightly.

The trend in other California lettuce producing areas is similar. Records of the California Winter Lettuce Marketing Order indicate a similar decrease in number of handlers (table 3).

A longer time span is covered by data from the Dry-Pack Lettuce Marketing Order, which show a decrease from 84 shippers in 1950 to 27 in 1959 (table 4).[4] The shippers remaining in business are more nearly equal in size. This is indicated by the shift of Lorenz curves over time toward a 45° line (fig. 1).

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[3] A. C. Manchester, "The structure of wholesale produce markets," U.S. Dept. Agr., Agr. Econ. Rpt. 45, 1964, p. 102 and 105.

[4] The California Marketing Order for Dry-Pack Lettuce applies to Santa Barbara and San Luis Obispo Counties only.

Table 2.--Summer head lettuce: Frequency distribution of handlers, by size and percentage of total volume handled, California, 1958 and 1961

Size (1,000 crates handled)	1958				1961			
	Number of handlers	Percent of all handlers	Volume handled (thousand crates)	Percent of total volume	Number of handlers	Percent of all handlers	Volume handled (thousand crates)	Percent of total volume
Less than 1........	4	3	--	--	8	5	--	--
1- 9............	31	19	137	1	39	27	143	1
10- 49............	40	24	986	4	29	20	647	2
50- 99............	22	13	1,647	6	14	10	956	3
100-199............	25	15	3,640	13	10	7	1,496	5
200-299............	13	8	3,166	12	15	10	3,828	13
300-399............	7	4	2,307	8	6	4	2,096	7
400-499............	7	4	3,032	11	4	3	1,747	6
500-749............	8	5	4,874	18	9	6	5,317	19
750-999............	3	2	2,570	9	9	6	7,801	28
1,000 and over.....	4	3	4,883	18	3	2	4,692	16
Total.........	164	100	27,242	100	146	100	28,912	100
Four largest.......	--	--	4,883	18	--	--	5,664	20
Ten largest........	--	--	9,532	35	--	--	10,912	38

Source: Compiled from voting records on amendments to the California Marketing Order for Summer Head Lettuce.

Table 3.--Winter head lettuce: Frequency distribution of handlers, by size and percentage of total volume handled, California, 1958 and 1961

Size (1,000 crates handled)	1958				1961			
	Number of handlers	Percent of all handlers	Volume handled (thousand crates)	Percent of total volume	Number of handlers	Percent of all handlers	Volume handled (thousand crates)	Percent of total volume
Less than 1........	2	3	--	--	1	2	--	--
1- 9............	1	1	3	1	1	2	3	--
10- 49............	7	10	199	2	3	5	81	1
50- 99............	8	11	544	3	7	13	565	3
100-199............	16	23	2,256	14	14	25	2,112	16
200-299............	18	26	4,478	28	12	21	3,009	23
300-399............	8	11	2,804	17	8	15	2,754	21
400-499............	6	9	2,810	17	6	11	2,547	19
500-999............	3	5	1,958	12	2	4	1,191	9
1,000 and over.....	1	1	1,034	6	1	2	1,028	8
Total.........	70	100	16,086	100	55	100	13,287	100
Four largest.......	--	--	2,992	19	--	--	2,683	20
Ten largest........	--	--	5,802	36	--	--	5,144	39

Source: Compiled from voting records on amendments to the California Marketing Order for Winter Head Lettuce.

Table 4.--Number of lettuce shippers and percentage of total volume handled by largest shippers, Santa Barbara and San Luis Obispo counties, Calif., 1950-59

Year	Number of shippers	Percent of total volume handled	
		By the 4 largest shippers	By the 10 largest shippers
1950.........	84	43	78
1951.........	56	43	73
1952.........	64	39	68
1953.........	57	41	71
1954.........	50	39	75
1955.........	47	38	76
1956.........	43	42	83
1957.........	39	40	80
1958.........	35	44	81
1959.........	27	46	84

Source: Annual Report, Marketing Order for Dry-Pack Lettuce, issued by Dry Pack Advisory Board, Santa Maria, Calif.

DISTRIBUTION OF LETTUCE SHIPPERS BY PERCENTAGE OF TOTAL VOLUME HANDLED

Santa Barbara and San Luis Obispo Counties, Calif., 1950, 1954, 1959

DATA COMPILED FROM ANNUAL REPORTS, "MARKETING ORDER FOR DRY-PACK LETTUCE," ISSUED BY DRY PACK ADVISORY BOARD, SANTA MARIA, CALIF.

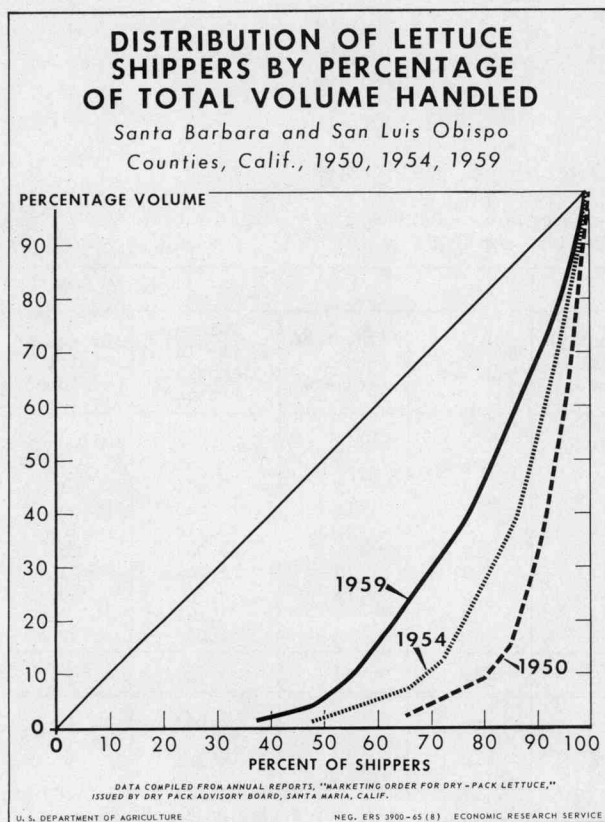U.S. DEPARTMENT OF AGRICULTURE   NEG. ERS 3900-65 (8)   ECONOMIC RESEARCH SERVICE

Figure 1

Admittedly, the evidence on changes in buyer concentration is rather unsatisfactory. Nevertheless, from the above data it may be concluded that there has been some decrease in the numbers of both buyers and sellers of lettuce.

Volume of Purchases by Three Principal Buyers

Although no data are available to show a redistribution of volume which may have occurred among the buyers, figures collected from the buyers were used to estimate the percentage of total supply of lettuce purchased by them. The estimates reveal that the three largest buyers accounted for a considerably smaller percentage of total daily shipments than most lettuce shippers had believed. During the period under investigation, the three principal buyers never purchased more than 20 percent of total volume. On only 4 days these buyers accounted for more than 15 percent; the average for the 92 days was approximately 10 percent of the total daily shipments (table 5).

Table 5.--Distribution of percentage of total daily lettuce volume purchased by the three principal buyers, Salinas, Calif., 1963

Percent of daily volume	Number of days
0 - 2.4............................	0
2.5 - 4.9............................	6
5 - 7.4............................	9
7.5 - 9.9............................	26
10 - 12.4............................	32
12.5 - 14.9............................	15
15 - 17.4............................	3
17.5 - 19.9............................	1
Average 9.945...........................	92

Source: Data supplied by buyers and "Marketing lettuce from Salinas-Watsonville and other central California districts, 1963," Sacramento, Federal-State Market News Service, 1964, p. 15.

Because of the discrepancy between a priori expectation and these estimates, their reliability was checked with an independent estimate based on data from shippers' records. The new estimate was made for 5 randomly selected weeks during the 1963 shipping season. During these 25 days the estimated purchases of the three principal buyers never exceeded 20 percent of the market supply. On 11 days the three buyers accounted for less than 10 percent; the average

for the 25 days was 11.5 percent of the total daily shipments, compared to the estimated average of 10.4 percent based on data reported for the same days by the principal buyers. The discrepancy between the two estimates can be ascribed to sampling variation; therefore, the estimated percentages of the total supply purchased by the three principal buyers are considered to be valid.[5]

Purchasing Patterns of Principal Buyers

Although oligopoly theory and its counterpart, oligopsony theory, have not reached a stage of development to suggest a single empirical test for oligopsony in a market, the three hypotheses tested below are consistent with the premise that large buyers can affect the market price by varying their purchases.

Hypothesis 1: The three principal buyers pay lower prices for lettuce than other (smaller) buyers. The ability of principal buyers to discriminate may be attributed to the following: (1) Since these buyers account for a significant percentage of the total volume sold, they may induce a shipper to give them price concessions under the threat of withdrawal from the market; and (2) the nature of lettuce production is such that when harvest is completed the production costs are sunk costs, hence the seller, rather than lose a sale completely, may take a price below his long-run marginal costs.

Ideally we would like to compare the prices paid by principal buyers with prices paid by other buyers. Because of the lack of data we have substituted average market price for the prices paid by "other" buyers. To test the above

hypothesis the reported average daily market price calculated from Market News reports was compared to the average daily price paid by the three principal buyers. If the average daily market prices were equal to the average daily prices paid by principal buyers, the distribution of differences between the two daily prices would have a mean of zero. Thus, the evidence would be consistent with the above hypothesis if a significant difference from zero is found, i.e., if the t value is found to be outside the confidence interval of ± 1.980 at the 95 percent confidence level. The t value was found to be -5.455 and so we accept the hypothesis that the principal buyers paid prices that were different from the average market price.

However, the average price paid by the principal buyers for the whole period exceeded the average reported market price. Therefore, we tested a statistical hypothesis that the average price paid by principal buyers exceeded the average market price by $0.025 per carton.[6] Again, judging the significance at the 95 percent confidence level the hypothesis would be accepted if the t value did not fall below $+1.658$. The t value was found to be $+1.964$; therefore, the hypothesis that the principal buyer paid a higher average price than the reported average market price was accepted.

Two problems associated with the above statistical analysis have to be noted. First is a data problem. The average reported market price includes the prices paid by principal buyers. The prices paid by other buyers derived from the average market price, therefore, are biased in favor of the principal buyers if actual prices paid by those buyers are lower than the market average and biased against those buyers if the prices paid are higher.

The second problem refers to the test of the statistical hypotheses. In testing the two statistical hypotheses it was assumed that the populations of average daily market prices and daily average prices paid by the principal buyers have normal distributions. To test this assumption, cumulative frequency distributions were constructed and plotted on probability paper. The considerable deviations of both curves from the straight line indicated that neither population is normal.

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[5] One possible explanation of the fact that only a small share of the market is controlled by principal buyers is their shifting of purchases among various primary shipping point and terminal markets. This, however, seems to indicate that the potential gains from exercise of oligopsony power in one market are smaller than the gains from arbitrage.

It may also be argued that oligopsony power would be negligible with the control of such a small share of the market. On the other hand, economic theory does not provide an indicator as to what percentage of the market has to be controlled for the exercise of some oligopsony power. Primarily for the second reason the analysis of data was continued.

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[6] $0.025 establishes a limit to the confidence interval.

Because of the obvious nonnormality of the two populations, the sign test, which does not depend on the assumption of normality, was used to test again the statistical hypothesis that the average daily market prices are equal to the average daily prices paid by the principal buyers. Judging at $\alpha = 0.008$ level of significance we would reject the hypothesis if 33 or fewer plus signs, or 33 or fewer minus signs, were observed. Seventy-two minus signs and 20 plus signs were observed; therefore, we rejected the hypothesis of equality between average market prices and prices paid by the three principal buyers.

Modification of a sign test was used to test the statistical hypothesis that the prices paid by dominant buyers exceeded the average market price. Varying amounts were added to the average market prices and then the sign test was used to determine the critical region within which the resulting distribution of signs was not significantly different from 50:50. Such a critical region was found to be between $0.03 and $0.05 per carton above the market price.

A further investigation of individual buyer data disclosed that the results are affected primarily by one of the three buyers who consistently pays a premium above market price. The average prices paid by the two remaining buyers were not significantly different from the average market price. [7]

Hypothesis 2: The purchasing patterns of the three principal buyers are interdependent. One strategy possible in an oligopsony market is for two buyers to reduce their purchases to avoid bidding up the market price when one buyer purchases heavily.

Three types of combinations in purchases may occur when one buyer increases his purchases: The remaining buyers may both increase, both decrease, or one increase and the other decrease their purchases. Similarly, the same three types of combinations may occur when one buyer decreases his purchases. For the chi-square test the days were counted when different combinations of purchases were observed. The increases and decreases in purchases for each buyer were calculated from his average for the period. If the purchasing patterns of the buyers were interdependent, the number of observations in each category would differ significantly from the expected frequencies. The hypothesis would be accepted if X^2 exceeded 7.38. The contingency table for the chi-square test is presented in table 6. The X^2 value was found to be 2.1272, so the hypothesis that purchases of the buyers are interdependent was rejected. [8] The X^2 tests for each individual buyer gave the same results as for all three buyers combined.

Table 6.--Contingency table of expected and observed frequencies

(Independence in purchases by the three principal buyers)

Purchases by one buyer	Purchases by other buyers			Row totals
	Both above average	Both below average	One below and one above average	
Above average...	35 (30)	37 (38)	58 (62)	130
Below average...	(28) (33)	44 (43)	74 (70)	146
Column totals...	63	81	132	276

Hypothesis 3: The purchases of principal buyers depend on price changes. Some lettuce shippers claim that these buyers reduce the quantity of lettuce purchased when the market price begins to fall. This action causes the price to fall further. When the price is sufficiently depressed, the buyers increase their purchases.

The evidence would be consistent with the hypothesis if we observed that the principal buyers reduced their purchases when the price had decreased from the preceding day, i.e., if the quantity of lettuce purchased on these days was significantly lower than on days when the price either increased or remained the same.

An analysis of variance was applied to the daily purchases by the principal buyers. These purchases were classified into three categories depending on the direction of the price change from the preceding day. The hypothesis would not be accepted if differences among the means

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[7] A large buyer may discriminate in terms of quality rather than price, i.e., for the same price he may be able to purchase higher quality lettuce than other buyers. Other terms of trade may also differ. Because of the difficulties in quantifying the quality variable this aspect was not analyzed.

[8] Contingency coefficient = 0.087.

of the three categories were not statistically significant. An analysis of variance for these data is presented in table 7. Using the F-test, the value of the F-ratio with 2 and 70 degrees of freedom is 0.77, indicating no significant differences among the categories. To be significant, the value of the F-ratio at the 95 percent confidence level must exceed 3.15.

Table 7.--Analysis of variance of means of quantities of lettuce purchased

Item	Sum of squares	df	Mean square	F-ratio
Category means	44,117,596	2	22,058,798	$F = \frac{22,058,798}{28,715,887} = 0.77$
Within........	2,010,112,094	70	28,715,887	$F_{.95}(2, 70) = 3.86$
Total.....	2,054,229,690	72	--	--

QUANTITIES OF LETTUCE PURCHASED BY THREE PRINCIPAL BUYERS DURING DECLINING PRICE PERIODS, SALINAS, CALIF., 1963

Figure 2

For the F-test, it was assumed that the population of quantities purchased by principal buyers was a normal population. This assumption was tested and it was found that the population was approximately normal.

The foregoing evidence may be questioned because the day-to-day price changes may not be large enough to influence the strategy of buyers. An examination of the price changes during the period under investigation revealed several periods during which the price declined for 3 or more days.[9] The end of some periods of declining prices was marked by increased purchasing by the principal buyers (fig. 2). It was necessary to determine whether there is a significant difference between the average increase in the quantity purchased during periods of price declines and the average increase in the quantity purchased during other periods. A significant difference would be indicated if the t value exceeded + 1.714 at a 95 percent confidence level. The t value was 0.248, therefore we rejected the hypothesis that the increases in quantity purchased during the declining-price period are significantly different from increases in purchases during the periods of increasing or stable prices. The test of normalcy again indicated that the population of increases in quantity of lettuce purchased by principal buyers was approximately normal.

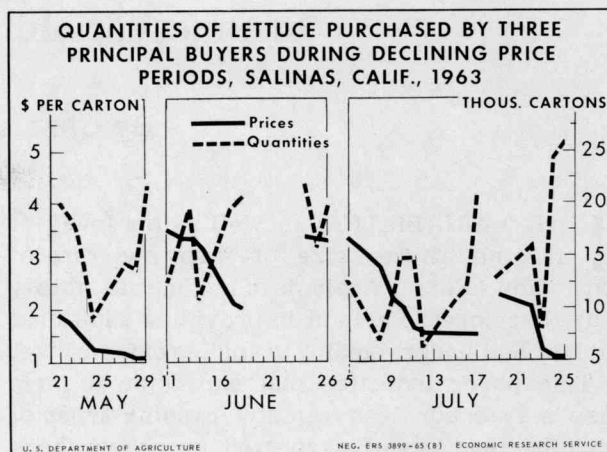An attempt also was made to test the price leadership hypothesis. The test of this hypothesis, however, proved to be rather complicated and required data that were not readily available.

Conclusions

The results of the analysis are inconsistent with the hypothesis that large buyers exercise oligopsony power in the primary shipping point market for lettuce at Salinas. Although the number of lettuce buyers probably declined during the last decade, the change was neither drastic nor abrupt. It was also offset to some extent by a decrease in the number of shippers.

The three principal buyers account for a relatively small share of the market. During the 92 days of the 1963 shipping season investigated they accounted for approximately 10 percent of the daily market supply of lettuce.

Furthermore, the analysis indicated that the principal buyers paid either the average market price or a higher price. Their purchasing patterns did not show interdependence in the variation of quantities purchased. Nor did the results disclose that the buyers followed a strategy of withdrawing from the market during periods of declining prices.

Although the results are significant, only one commodity market was studied. Other markets should be investigated before any policy implications could be claimed.

The analysis, of course, is subject to the usual difficulties connected with operational definition of theoretical concepts, limitations of data, and available statistical techniques.

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[9] Saturdays, Sundays, and holidays for which no data are available were disregarded.