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NEW EVIDENCE ON COMPETITION IN THE GRAIN TRADE†

Competition in the grain trade has posed a conundrum for onlookers. Events in the volatile grain markets occasionally convince grain growers and policy makers that the grain trade functions noncompetitively or otherwise against their interests. But a suspicion is not an operational question, and therefore receives no answer. Economists have paid only modest attention to the industry. Our research tools and concepts, forged to deal with commodity-producing industries, can cope with a trading or arbitrage activity only after careful adaptation. Hypotheses generated by applying concepts of industrial organization to explain the organization and competitive patterns of the grain trade (Caves, 1978) could be tested only on casual data. This paper uses new data that shed light on key structural features of the sector and permit tests of additional hypotheses.

CONCENTRATION IN GRAIN EXPORTS

The presence of large companies is explained by a conjunction of economies of utilization in the information systems required to support large-scale international transactions, the risk-pooling advantages of large size, and of lesser importance, scale economies, particularly in storage and transportation facilities (Caves, 1978). The model predicts that the scale of transactions and the concentration of traders will decline as one examines increasingly localized transactions. Concentration should therefore be substantially higher in export

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transactions than in wholesale grain sales within the United States, a hypothesis consistent with the available data (Conklin, 1981, pp. 32–33).

Accurate measurement of concentration in grain exporting is needed not only to assess this hypothesis but also to respond to questions of public policy. On the one hand, farm producers fear that commercial exporters may wield monopsony power and thereby capture some net revenue from foreign sales that could otherwise flow to agricultural producers. On the other hand, some economists have wondered whether the grain merchants exploit any monopoly power that the United States may possess on world grain markets—a source of potential gain to national income (Schmitz et al., 1981). For some time only guesses were available about the concentration of grain exporters. Unofficial estimates circulated in the trade had indicated that the four largest companies accounted for 80 percent of exports. Thompson and Dahl (1979) quoted 85 percent and McCalla and Schmitz (1979) 90 percent for the five-firm concentration ratio. More accurate data have now become available, both in official documents and in information made available to us by members of the North American Export Grain Association (NAEGA).

An accurate measure of the concentration of direct export sales was reported by Wright and Krause (1976, Table 6), drawing upon data collected by the United States Department of Agriculture (USDA) on export sales during the 1974/75 marketing year. The four largest exporters accounted for 61.0 percent of export sales for wheat, 42.0 percent for corn, 40.5 percent for soybeans, and 47.3 percent for sorghum. These figures are substantially lower than the guesses quoted above.

Recent studies provide several other findings about trends in export concentration and the composition of rival firms. Although official data on export concentration are available only for 1974/75, other information is available about changes between that benchmark and 1980/81. Over that period the share of the five largest firms in total grain sales for export fell 5.3 percent while that of Japanese-owned or affiliated companies rose 4.7 percent, that of agricultural cooperatives rose 1.1 percent, and all other exporters lost 0.5 percent (USGAO, 1982, p. 16). Furthermore, entry into the grain export industry was substantial during the 1970s. One-fifth of the firms active in the industry in the mid-1970s had entered during the preceding five years (Conklin, 1981, Table 3.7). Between 1974/75 and 1980/81, the number of firms reporting export sales increased by 32 percent for wheat, 38 percent for corn, and 15 percent for soybeans (USGAO, 1982, p. 18). In 1980/81 approximately 100 firms were reporting export grain sales.

Wright and Krause (1976) document the active and expanding role of foreign investors in the industry: 26 foreign-affiliated firms, by their count, made 45.9 percent of export grain sales in the 1974/75 marketing year. The assets of the foreign-controlled firms grew 43 percent in that year, so they were evidently expanding rapidly and acquiring substantial facilities in the United States (USGAO, 1982, p. 18). Foreign firms are also significant resellers of American commodities in the domestic market (Conklin, 1981, pp. 47–51). The presence of firms of diverse national origins is important for assessing

seller concentration because heterogeneous origins and objectives of rival firms in manufacturing industries significantly complicate the process of recognizing their oligopolistic interdependence (Newman, 1978).[1]

The grain trade also shows some traits of a "contestable" market, in which actual sellers are few but exposed to displacement by entrants. Scale economies in the industry rest on fixed facilities (such as terminal elevators) that can be easily transferred between firms, and on administrative networks for organizing and using information that represent little durable, fixed investment. The "contestability" of the market is evident not only in the extent of entry, but also in such events as the rise and fall of Cook Industries, the largest exporter in fiscal 1976 but departed from the industry two years later.

Data acquired from members of NAEGA were used in this study to calculate the concentration of American grain export sales. These data have certain deficiencies, including the fact that not all exporters are members of NAEGA, although the membership apparently includes the largest exporters.[2] Furthermore, data could not be secured for the exited Cook Industries, although the firm was an important exporter (and NAEGA member) during the years to which our data pertain.[3] Thus, we expect our concentration ratios to differ somewhat from those based on complete data submitted to the Department of Agriculture, and they do. Our figures for four-firm concentration in wheat exports are 62.5 percent for 1974 and 65.2 percent for 1975 versus 61.0 percent for 1974/75 from USDA data quoted by Wright and Krause (1976); for corn our figures are 42.9 and 49.1 percent versus 42.0 percent; and for soybeans 53.1 and 46.0 percent versus 40.5 percent.

The chief use of concentration data from NAEGA lies less in confirming the calculations based on USDA data than in supplemental calculations that can be derived from them. The data cover not only the "direct" export sales used to

[1] Another such strategic heterogeneity was revealed in the data from NAEGA members, discussed below. Responses to the survey indicate that several of the largest grain-exporting firms also trade substantial volumes in the United States domestic market, while other leaders do almost no domestic trading. The smaller grain-exporting firms exhibit similar variations in the extent of their domestic trading.

[2] Another problem is the diverse fiscal years for which sales records are maintained by the exporters, which precluded securing data from them on any mutually consistent calendar definition. Each company's sales were calculated in its own fiscal year, as a fraction of total export shipments during that same year, by using data on total export shipments reported monthly in the *Statistical Annual* of the Chicago Board of Trade. Companies' shares for fiscal years ending in a given calendar year were combined to derive estimates of export concentration. Several sources of measurement error are unavoidable, including (1) the problem of timing, in that the shipment of grain follows its sale to a foreign buyer with a varying delay, and (2) the possibility that sales contracts are altered or cancelled before shipment occurs.

[3] Some indication of the magnitude of this bias can be obtained by examining the concentration of NAEGA member exports (not total United States exports) for all grains, using data in Goldberg and McGinity (1979, p. 186). For fiscal 1975 (corresponding approximately to the 1974/75 crop year) the four largest NAEGA members (including Cook) accounted for 65.8 percent of NAEGA exports by volume; the four largest excluding Cook accounted for 57.3 percent. Thus, the omission of Cook does impart a downward bias, but other sources of measurement error and noncomparability with the ratios calculated with USDA data are also present.

calculate the concentration ratios just quoted but also "indirect" export sales—grain sold to other American merchants and subsequently exported by them. The model leads us to expect that scale economies in international information networks, in risk bearing, and in the coordination of bulk ocean transportation will slant the business of direct export sales toward the largest firms. As a result, their ratios of direct to indirect exports should exceed those for the smaller firms that do some direct exporting. Table 1 organizes these data to expose this contrast without disclosing data for individual firms. It presents average ratios of direct export sales to indirect export sales from 1974 to 1978 for four of the six large grain-exporting firms in our sample and for three of the smaller ones.[4] The average figure for the large firms exceeds unity for each grain, and the average for the smaller firms falls short,[5] confirming that the smaller firms do rely more heavily on indirect export sales.

TABLE 1.—AVERAGE RATIO OF "TRUE EXPORT SALES" TO INDIRECT EXPORT SALES, 1974 TO 1978, BY CROP AND SIZE CLASS OF FIRM

	Crop		
Size class	Wheat	Corn	Soybeans
Four of the six largest grain-exporting firms	3.70	7.82	6.58
Three smaller grain-exporting firms	0.25[a]	0.47	0.43

Source: Confidential replies to a survey of NAEGA members.
[a]Includes a fourth small firm.

In summary, recent evidence on seller concentration in grain exports suggests a level that is only marginally into the range that we associate with oligopoly in manufacturing industries, and significantly below the guesses that have been put forth previously.[6] It is, however, still higher than concentration in the domestic grain trade—in accord with the factors that seem to account for large-scale enterprises in grain exporting. No data are available on long-run trends in concentration in grain exports, but recent evidence suggests a significant number of new entrants and probably some reduction in the average shares of the leading firms.

[4] Other NAEGA members responding to the questionnaire did not supply enough information to be included in this analysis.

[5] This statement is also true for the individual firms in each of the two groups for each of the three grains.

[6] For a recent consideration of the "critical" concentration ratio, see Bradburd and Over (1982).

STABILITY OF MARKET SHARES

The data supplied by NAEGA members also indicate the variability of the grain merchants' shares of exports over the period 1974 to 1978. Market-share instability holds interest because, other things equal, it reduces the likelihood of viable understandings among rivals that can restrict competition. It can also be regarded as a consequence of other elements of market structure and behavior. Stability of shares requires either that short-run marginal cost curves be steeply sloped in the neighborhood of equilibrium or that sellers be insulated from close rivalry with one another by natural (product differentiation) or artificial (collusive agreements) methods. Absence of these conditions from the grain trade, postulated earlier, should make market share highly variable (Caves, 1978).

To evaluate the stability of shares of grain exports, we calculated for each of five large companies the ratio, to its mean share, of the average absolute deviation of its annual share from that mean, for the period 1974 to 1978.[7] The median values for these proportional deviations (and their ranges) were, in percent:

Wheat	17	(11–27)
Corn	19	(6–29)
Soybeans	13	(10–20)

These data appear to reveal substantial variation in shares, but unfortunately we lack a clear standard for evaluating their magnitudes. The variability of the grain exporters' shares might be compared to that of leading firms' shares in manufacturing industries, but no annual data exist. Tabulations of changes in four-firm concentration ratios over the five-year intervals at which they are published strongly suggest less variability than in shares of grain exports.[8]

This variability can be explored further by shifting attention from companies' shares of exports to their levels of sales. We can then compare the variability of total United States exports of each crop to the variability of each company's annual shipments. The proportional deviation of total export shipments was 13 percent for wheat in this period, 16 percent for corn, and 14 percent for soybeans. That market shares themselves vary is close to sufficient evidence that individual companies' sales typically were more variable still. In fact, the proportional deviations of export sales for the five leading companies ranged from 11 to 32 percent for wheat, 17 to 30 percent for corn, and 11 to 27 percent for soybeans. While several firms show exports no more variable than total exports, the proportional deviation of export sales for the median

[7] The sixth large firm changed its fiscal year during the period 1974 to 1978 and thus could not be included in the analysis of market-share stability.

[8] See Caves (1980, pp. 515–520). Ogur (1976) provides a survey of the research literature on market-share stability.

company is about half again as large as for total exports, for each grain.[9] Any conclusions must be judgmental, but the data do seem to confirm the absence of a structural basis for stable shares.[10]

PHYSICAL FACILITIES AND STRATEGIC DIFFERENCES

The survey that underlies this paper collected information about elevators and other physical facilities recently acquired or constructed in order to analyze their economies of scale and economies in their coordinated use. The number of comparable facilities recently built or acquired proved too small to provide more than general confirmation of existing evidence of scale economies in grain elevator capacity. Combined with other sources, however, the data illuminate another aspect of the industry—the extent of strategic differences among the leading firms in the ownership and control of storage and transportation equipment. The earlier analysis suggested an incidental role for physical facilities in explaining advantages of scale in the grain trade (Caves, 1978). Therefore diverse strategies were expected among the leading companies.

The survey revealed that three of the six large companies own or lease (mainly lease) covered hopper cars (average 1,266 per company). Of the six smaller companies sampled, again three own or lease (mainly lease) covered hopper cars (average 286 per company). Companies' reports on utilization of these cars in 1976 show that they were almost never idle when they could have been in use. Captive equipment, a fixed cost to the grain merchant, will normally be used before rolling stock is hired from the railroads (given the stickiness of railroad pricing). Some leases are short term; long-term leases from one to ten years presumably provide flexibility through staggered expiration.

The situation is similar for barges used on inland waterways. Three of the six large companies control barge fleets (predominantly owned), as do three of the smaller six companies (evenly split between owned and leased). Utilization

[9] It is conceivable that market shares or total sales could be variable only because of shifts in demand among importing countries, with the individual exporting firm's shares stable for each destination. Therefore, variability was examined in several prominent importing markets—West Germany, Japan, Italy, and Spain. For all grains and destinations except wheat exports to Japan and West Germany, no more than one company reports sales less variable than total American exports to that country. The only case in which the variability of most companies' exports is less than the variability of total exports is exports of wheat to Japan; a one-year bulge in total exports had no counterpart in the sales of the companies surveyed. The variability of export sales to individual countries is examined further below.

[10] Another way to investigate stability is in terms of changes in ranks from year to year. If one point is assigned to a change of one position in a firm's sales rank, two points to a change of two positions, and so on, the maximum churning of market shares of the six leading firms would correspond to an index value of 18 points. Total changes in ranks for each grain in the four pairs of consecutive years from 1974 to 1978 were divided by the index value corresponding to the maximum possible changes. The actual turnover was 25 percent of the maximum for corn and soybeans, 28 percent for wheat.

rates for these barges were rather lower in 1976 than for hopper cars and varied considerably from company to company. For both barges and covered hopper cars, the share of a company's transportation requirements accounted for by controlled equipment varied widely among the companies with equipment under control. The range in 1976 was from less than 10 percent to 100 percent. Thus, the diverse patterns of use of controlled transportation equipment affirm two points about the competitive structure of the grain trade. Transportation equipment is not a necessary asset for the firm and thus not a cause of barriers to entry. And the different strategic choices made by the leading firms point to heterogeneity in their cost structures, because important costs that are fixed for some remain variable for others.

Data on grain elevators owned by the leading grain merchants, presented by Thompson and Dahl (1979), supplement our findings about transportation equipment. Their data show that in 1977 the share of export elevator capacity owned by four large exporters, excluding Cook, was 52.7 percent.[11] Regional variations are considerable: These four control 46.3 percent of capacity on the Gulf coast, which accounts for more than half of grain exports; 50.2 percent on the Great Lakes; 49.4 percent on the Pacific coast; and a much higher 86.5 percent on the Atlantic coast. Cooperatives and smaller grain merchants are represented in most areas, and public elevators account for 25 percent of capacity on the Gulf of Mexico. The leading exporters' combined share of export elevator capacity roughly equals their share of grain exports. Once again, however, strategic differences among the major firms are apparent; for instance, one of the six largest grain exporters owns no export elevators. An exporter needing elevator space can rent from a competitor or a public elevator. A grain exporter indeed may act only as a broker or pure trader, arranging shipments through other firms rather than acquiring physical possession of the grain.

The greater concentration of export than of domestic grain transactions implies that the leading firms will hold smaller shares of inland terminal elevators than of export elevators. According to Thompson and Dahl (1979), the four large exporters owned 18.0 percent of inland terminal capacity (versus 52.7 percent of export elevator capacity). The leading firms' share of country elevator capacity is not known exactly, but is surely much smaller than their share of terminal elevator capacity.[12] The differences in the leading firms' ownership of various types of elevator capacity also indicate that grain-exporting firms are not vertically integrated in the conventional sense: Their operations do not require that grain pass in sequence from controlled country elevators to or through their terminal or export facilities (Caves, 1978). As with transportation equipment, it is no surprise that the larger firms follow different strategies of elevator ownership.

[11] According to the USGAO (1982, p. 17), the share of elevator storage capacity at ports controlled by "major exporters" fell from 56 percent in 1968 to 50 percent in 1981, while farmer-owned cooperatives increased their share from 10 to 21 percent.

[12] Juillerat and Farris (1971) report this conclusion for the North Central states.

SCALE AND UTILIZATION IN INFORMATION NETWORKS

Grain trading is essentially arbitrage between low-price and high-price locations. The grain-trading firm must coordinate information from numerous sources and execute transactions based on this information. A company's success depends crucially on the information it has about prices and market conditions in various locations and its ability to anticipate or predict impending changes in these prices. Also required is accurate information about legal and institutional details pertaining to the destination country and the status of transportation services available between the origin and destination. To secure, update, and analyze this information requires a staff of specialized personnel as well as outlays on the information itself. Significant economies of scale in the acquisition, processing, and use of this information can arise because information can be reused, and the value of obsolescing information depends on a continuous trading presence.[13] Also, a specific scale economy arises because information on the nth trading point reveals the potential profitability of another $n-1$ pairs of origin-destination trading points.

Especially in the export market, these scale factors should help to explain the existence of large firms. The companies' cost data cannot be disentangled to reveal these scale effects directly, but an indirect test proved feasible. The number of origin-destination pairs that represent potentially profitable trades for a company increases as the company's information network becomes more extensive. Thus, larger firms should export to a greater number of foreign destinations if they have established more extensive information networks. This proposition was tested using data from five of the largest grain exporters on the number of countries to which they sold a shipment of 500,000 bushels or more of wheat, corn, and soybeans[14] in each of four years. Twenty observations were available for each grain. The logarithm of total shipments (LSHIP) was then regressed on the logarithm of the number of destination countries (LNC), a dummy variable (DUM) to control for the inclusion of indirect export sales in the data of one company, and a constant term. The regression equations are as follows:

$$\begin{aligned}
\text{Wheat LSHIP} &= \underset{(0.62)}{6.58} + \underset{(0.20)}{1.61}\ \text{LNC} - \underset{(0.20)}{0.46}\ \text{DUM} \quad (R^2 = 0.79)\\
\text{Corn LSHIP} &= \underset{(0.58)}{9.84} + \underset{(0.20)}{0.75}\ \text{LNC} - \underset{(0.20)}{0.55}\ \text{DUM} \quad (R^2 = 0.53)\\
\text{Soybeans LSHIP} &= \underset{(0.46)}{8.57} + \underset{(0.19)}{0.99}\ \text{LNC} - \underset{(0.19)}{0.24}\ \text{DUM} \quad (R^2 = 0.70)
\end{aligned}$$

where the standard errors of the estimated coefficients are shown in parentheses.

The coefficient of the number of destination countries is statistically significant for each grain. The values of these coefficients differ significantly from

[13] This argument is developed further in Caves (1978).

[14] The capacity of one moderate-size freighter.

unity only for wheat, indicating that for the other grains a larger total volume of export transactions means only more destination countries and not larger sales to the typical destination country. The coefficient of the indirect-exports dummy is negative, as expected if indirect sales permit a company to participate in sales to countries on which its own informational resources have not focused, so as to bring about a transaction. This analysis could be improved if data could be secured on individual export transactions rather than destination countries, but with that caveat it seems to offer appreciable support to the hypothesis of informational scale economies.

RISK POOLING AND SCALE OF OPERATION

Size of operation may bring advantages in international transactions stemming from the reduction of risk as well as lower unit costs. The individual international transaction tends to be large relative to transactions in the domestic grain trade, and the variance of returns to the trader on individual transactions probably increases more than proportionally due to the longer duration of ocean shipments and increased possibilities of government intervention. The risk-spreading advantages of size arise from the self-insurance process implicit in executing a larger number of transactions whose returns are imperfectly correlated. If we assume that firms themselves are risk averse as entrepreneurial decision units, it becomes likely that the risk-spreading advantages of size are significant.[15]

The ideal test of the extent of risk pooling attained by the large grain merchants requires data on gross margins attained in individual transactions and in export operations as a whole. These are not available.[16] Some inference can be made, however, if we posit that the risks attached to shipments to different countries are imperfectly correlated. Then the extent of risk pooling should increase with the number of countries to which exports are sold. This imperfect correlation, which cannot be observed for gross margins, can be analyzed for export volumes themselves. For each of five large companies supplying the necessary data, the average absolute deviation of total shipments from the mean was calculated for 1974 through 1977 and expressed as a fraction of the mean—the proportional deviation. The same was done for shipments to each of four major importing countries—West Germany, Japan, Italy, and Spain.[17]

[15] Economists hold diverse views about the reasonableness of assuming a risk-averse utility function within the firm. The closely held ownership of the commercial grain merchants makes it more reasonable for them than for firms with widely held equity to assume that risk-averse utility functions for their owners translate into risk-averse preference functions governing the firms' own decisions.

[16] In principle, because a company's grain purchases are commingled, it is generally impossible after the event to identify the cost of the grain sold in a particular transaction.

[17] Spain is not included in the calculations for wheat because it imports relatively little United States wheat. Furthermore, a country is omitted from the analysis for a firm if the firm did not ship to that country in at least two of the four years. These four countries were chosen because they are major destination countries for American grain exports. Our conclusions would be essentially unchanged if additional countries were included in the analysis.

Table 2 shows for each (anonymous) company and grain the proportional deviation for its total export shipments and the mean of these proportional deviation measures for the individual countries. Some reduction in variability is generally apparent. In the median case, the variability of shipments to the average country is 127 percent greater than the variability of overall shipments.

TABLE 2.—VARIATION OF EXPORT SHIPMENTS OF FIVE LARGE GRAIN EXPORTERS, 1974 TO 1977
(*Absolute deviation as percent of mean*)

Grain	Measure	Company				
		A	B	C	D	E
Wheat	Overall	.19	.13	.38	.21	.22
	3 countries[a]	.23	.87	.53	.78	.38
Corn	Overall	.17	.24	.27	.14	.25
	4 countries[b]	.46	.61	.60	.38	.33
Soybeans	Overall	.17	.12	.22	.04	.27
	4 countries[b]	.28	.58	.50	.36	.23

Source: Confidential replies to a survey of NAEGA members.
[a]West Germany, Japan, and Italy.
[b]West Germany, Japan, Italy, and Spain.

FUTURES MARKETS AND PRICE COORDINATION

A final hypothesis about the grain trade subject to test from our data holds that the pricing process takes a form that will very likely make direct price coordination between rival companies impossible. Noncompetitive behavior among sellers in a market ultimately depends on the recognition of a mutual interest in maintaining prices above a competitive level governed by the rivals' marginal costs. In a conventional commodity-producing industry with moderate or higher concentration of sellers, various leadership and signaling mechanisms are available that—on the statistical evidence—allow some elevation of prices relative to costs once seller concentration reaches about the level observed in the export grain trade.

It has been argued that the structure of this trading industry denies the firms access to the information that would be necessary to effect coordination of short-run pricing and activity decisions (Caves, 1978). Each firm's trading interest is affected by many firm-specific and fast-changing data that are generally unobservable between competing firms. Even if unlimited communication were possible among them, grain traders act as both buyers and sellers,

and often at the same time, so that their short-run interests diverge. Finally, the existence of futures markets that are generally regarded as fully competitive inhibits coordinated action;[18] so does the practice of tying current purchase and sale agreements to this moving target (Helmuth, 1977).

The data from the grain exporters were used to test one key component of this argument, namely the hypothesis that leading firms hold divergent positions in the futures market. The hypothesis is that on average there should be no correlation between changes in the net positions of various pairs of companies. It is these changes that require market transactions, may create pressure for a market-price change, and would demand coordination if the companies were to sustain any effective short-run mutual understanding.

Data were secured from the six large companies on their net open futures positions as of the close of trading on Wednesday of each week in 1975 for futures contracts traded on the Chicago exchange—wheat and corn contracts for delivery in September and December 1975 and soybean contracts for delivery in September and November 1975.[19] For each contract and for each company, the change in its net open position was computed as the simple difference of the position between Wednesday closing and Wednesday closing the previous week. The initial week utilized in the analysis was the first one in which all six companies report nonzero net open positions. The final week was chosen with the consideration that each trader must move toward a zero open position in the last weeks of trading in a contract. To avert the statistical bias that this closure would impart to the correlation analysis, we terminated the observations for each contract the week after the number of total outstanding contracts reached a peak (according to the Chicago Board of Trade *Statistical Annual*). The combined restrictions left at least 22 weeks covered for each contract except September soybeans; it was dropped from the sample because data were available for only one week.[20]

Zero-order correlation coefficients were calculated, yielding for each contract a matrix of correlation coefficients indicating the relationship between changes in open positions for all fifteen possible pairs of the six companies. These matrices were analyzed in two ways. First, the distribution of correlation coefficients for each contract was examined for evidence of prevailing substantial positive values. The resulting distributions of values for the five contracts, reported in Table 3, indicate substantial dispersions, but with median values close to zero and clearly no disposition toward significant positive values. Some significant coefficients do turn up, but the negatives outnumber

[18] Conklin's research (see USGAO, 1982, pp. 29–36) showed that the announcement of export sales is regularly reflected in movements of prices on grain futures markets, and that the adjustment of futures prices occurs quite rapidly. Also, the volume of trading on United States futures markets has greatly increased as foreign as well as American traders have come to use them (p. 20).

[19] The data refer in most cases to the positions established by the American grain-trading division of the firm; several companies have other divisions that may also hold futures contracts.

[20] For the other contracts the weeks covered are September wheat, 2/26/75 through 7/23/75; September corn, 1/8/75 through 7/23/75; November soybeans, 1/8/75 through 10/8/75; December wheat, 3/5/75 through 9/24/75; and December corn, 1/8/75 through 10/15/75.

the positives 10 to 8. Second, the correlations across the contracts for each pair of companies were examined for persistent positive values that would indicate parallel action. No such pattern was found. It seems reasonable to accept the null hypothesis of no relationship among the changes in futures positions of these companies.

TABLE 3.—CORRELATION OF WEEKLY CHANGES IN NET OPEN FUTURES POSITIONS OF SIX COMPANIES AND OF WEEKLY CHANGES OF ALL CONTRACTS WITH FUTURES PRICES, SELECTED FUTURES CONTRACTS, 1975

Value of correlation coefficient	Company pairs, by contract					Net positions and price, all contracts
	Sept. wheat	Sept. corn	Nov. soybeans	Dec. wheat	Dec. corn	
0.7 to 1.0	1	0	0	0	0	0
0.5 to 0.69	2	1	0	0	0	1
0.3 to 0.49	1	1	0	2	1	0
0.1 to 0.29	0	2	4	1	5	6
−0.1 to 0.09	2	7	5	4	5	7
−0.3 to −0.11	4	1	5	4	1	11
−0.5 to −0.31	3	1	1	4	3	2
−0.7 to −0.51	2	2	0	0	0	3
−1.0 to −0.71	0	0	0	0	0	0
Median correlation coefficient	−.15	.03	−.04	−.13	.05	−.11

Sources: Confidential replies to a survey of NAEGA members, and Chicago Board of Trade, *Statistical Annual*, 1975.

Correlations were also calculated between the weekly changes in the net open position of each company and the weekly changes in the futures price. If each company acts as a price taker on the futures markets, changes in price should be insignificantly correlated with changes in position. Nonetheless, negative correlations are consistent with the stabilizing practice of buying in a falling market and selling in a rising one, while positive correlations might be indicative of destabilizing speculation. The last column of Table 3 gives the distribution of these correlations for the six companies in the five contracts. The correlation coefficients tend to be small and negative. Only one positive coefficient is statistically significant, whereas five negative ones are. These correlations support only very limited conclusions, but they clearly are not inconsistent with price-taking or stabilizing behavior.

Thus, the analysis of companies' open positions in a small sample of futures contracts supplies no evidence of noncompetitive behavior or action premised on influencing a futures-market price. It is also consistent with the hypothesis

about the grain trade's structural disabilities for giving effect to companies' mutual interest, even if that interest is recognized.[21]

CONCLUSIONS

This paper uses new data supplied by members of the North American Export Grain Association to test propositions about market structure and competition in the grain trade set forth in an earlier article (Caves, 1978). These data support the following conclusions:

1. Levels of concentration are consistent with more comprehensive concentration ratios derived from export sales reported to the USDA (Wright and Krause, 1976). Indirect export sales (grain sold to other merchants for export) are relatively more important for smaller exporting firms.

2. Annual variations in the market shares of larger firms seem greater than those typical in manufacturing industries, although a clean comparison to manufacturing industries is not possible. The absence of product differentiation or fixed physical capacities to constrain market shares predicts that finding.

3. Several forms of strategic diversity occur among the leading grain merchants: in the control of grain elevators and transportation equipment, in the extent of reliance on export relative to domestic transactions, and in the national origins of multinational participants. Studies of manufacturing industries have found strategic heterogeneity to be a procompetitive factor, other things equal.

4. Scale economies in information networks are used by grain exporters. These economies are revealed indirectly in that larger exporters sell to more country destinations and (generally) do not sell more grain per period to the typical destination country. The ability of larger firms to exploit scale economies in information networks should generate more market information at a lower cost per bit of information, thus contributing to the efficiency of the world grain market.

5. The typical leading company's annual exports to an individual country vary considerably more than its total exports, which indicates that risk spreading is common practice.

6. Companies with differing open positions and expectations about trends in market prices lack a common short-run interest in grain-price levels. Changes in open futures positions of larger companies are on average uncorrelated, and the changes are related to weekly changes in futures prices in ways consistent with the companies' behaving as price takers.

[21] Thompson and Dahl (1979) conclude that pricing in the grain-export industry is consistent with pure competition: They find that grain prices along the export marketing channel tend to differ only by the normal costs of moving the grain through the channels. Short-run deviations quickly result in arbitrage that reestablishes the normal price difference. Their analysis covers the prices of United States #2 yellow corn from 1975 to 1977 at a country elevator in Minnesota, the inland terminal market in Chicago, ports on the Gulf of Mexico and in Baltimore, and the market in Rotterdam.

Thus, the data support (at a number of points) a theoretical analysis that reconciles an appearance in the grain trade of competitive market behavior among large leading firms by confirming the bases of scale economies and the absence of focal points for parallel noncompetitive behavior.

CITATIONS

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