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T. Randall Fortenbery, Hector O. Zapata,

and Eugene L. Kunda

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Impacts of Elevator Concentration on Local Basis

T. Randall Fortenbery, Hector O. Zapata, and Eugene L. Kunda[1]

The Staggers Act of 1980 substantially increased the flexibility of railroads to set rail rates, and to negotiate shipper specific freight rates. One result of rail rate deregulation has been a dramatic increase in the use of unit trains by the grain shipping industry. The use of unit trains allows shippers to capture economies of scale in grain shipping costs by providing a large volume of grain movement over a short period of time. Utilizing unit train rates, however, requires shippers to be able to load trains quickly. Facilities incapable of meeting the turn around requirements of railroads cannot take advantage of unit train rates, and must purchase transportation services through the more expensive single rail car market or use alternate modes of transportation.

Empirical research through the 1980's has documented that per unit freight rates have been reduced for grain shipments through the use of unit trains (Hutchinson). However, all elevators have not been impacted equally. Elevators incapable of handling unit train loading have often been placed at a transportation disadvantage. As a result, there have been substantial changes in the elevator industry in an attempt to capture economies of scale in grain transport. Changes include facility attrition, changes in ownership, and facility expansion. A question which has not been thoroughly addressed is the impact these changes have had on the farming community in terms of local grain price impacts.[2] For example, have there been changes in elevator market concentration which have allowed elevator firms to internalize most of the transportation savings, or have changes in the elevator industry resulted in a more efficient grain handling system with producers and elevators sharing in the gains from cheaper transportation? While it is clear that transport costs for grain have decreased, it is less clear how the rate savings have been distributed between farmers and shippers.

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[1] The authors are Assistant Professor, University of Wisconsin-Madison, Associate Professor, Louisiana State University, and Advisory Economist, Chicago Board of Trade.

[2] As discussed below, Hanson et al. did evaluate the impact of rail contracts on local price, but did not explicitly examine the relationship between elevator market share and price. In addition, their analysis focused on a smaller geographical cross section than is considered here.

The purpose of this paper is to objectively measure the impact of changes in the elevator industry on local price behavior. To the extent that changes have occurred to take advantage of economies of scale with respect to transportation services, we might expect local prices to be positively impacted. Conversely, however, increased concentration of elevator firms may have resulted in an exercise of increased market power, and a general weakening of farm prices.

Related Research

A series of studies in the late 1970s and early 1980s examined the impact of industry market share on prices. The industries studied were largely drawn from the retail food sector, and the variable of interest was retail price. Marion et al. found the net profits and grocery prices of large food merchandising chains to be positively related to market concentration and individual firms' market shares. They argued that higher profits by dominant firms were not due to efficiency gains and lower costs, but rather market power.

Parker and Connor attempted to measure welfare losses in the food manufacturing industry resulting from monopoly power. They concluded that high concentration ratios in the food manufacturing sector resulted in substantial consumer losses in 1975. Their conclusions were partially based on regression models that explained the price cost margin of the food firms as a function of the four firm concentration ratio, the square of the four firm concentration ratio, as well as other industry specific variables.

Gisser examined the productive efficiency of the food manufacturing industry as a function of concentration. He concluded that increased concentration has resulted from increases in total input productivity. A net social benefit was derived because estimated total factor productivity was sufficient to offset the entire loss to consumers. In each of these studies market performance was explained as a function of concentration in the industry considered.

Several studies in the 1980s evaluated various aspects of the Staggers Act on the grain industry. In 1984, Wilson examined the impact of Staggers on North Dakota grain shipments by mode. He found modal shares to be generally inelastic with respect to relative transport rates. In addition, changes in total grain shipments were found to have a positive effect on rail shares.

Hauser et al. examined changes in elevator structure in response to the increase in unit train rate arrangements in the early 1980s. They found that Iowa was over invested in unit car facilities, while Nebraska faced large incentives for facility expansion.

Hanson et al. evaluated the impact of rail contracts on grain bids to farmers. They found that destination contracts (defined as a contract between a railroad and any buyer other than the elevator who initially purchased the grain from the farmer) had a significant and positive impact on price bids for corn and soybeans, and origin contracts (defined as contracts between railroads and elevators purchasing directly from farmers) had a significant impact on wheat bids. The inference from their work is that farmers have benefited from Staggers deregulation.

The analysis presented here adds to the previous literature by explicitly relating local grain price performance to changes in elevator concentration. It addresses the question of whether the gains identified by Hanson et al. were transitory as elevators adjusted to the post Staggers environment, and whether the elevator industry has managed to capture transportation rents through increases in industry concentration.

Data and Methodology

As elevators have continued to respond to a less regulated transportation environment, one might wonder whether the level of concentration in the industry has allowed elevators to capture transportation savings at the expense of farmers. To investigate this question, we employ a data set which covers the period 1980 (the year prior to Staggers) through 1992.[3] We measure elevator concentration as the ratio of total storage bin space each elevator firm owns relative to the total bin space available on a state by state basis. The states considered are those for which the USDA regularly publishes farm level corn prices.[4] The result is a data set which spans 13 years, with 16 cross-sectional observations at each time series.

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[3] The Staggers Act was passed in late 1980. By 1981, the ICC had begun to aggressively implement the provisions of the act (MacDonald).

[4] The specific states are Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Carolina, Ohio, Pennsylvania, South Dakota, Texas, and Wisconsin.

Similar to research on the food manufacturing industry, we employ a four firm concentration ratio as an explanatory variable (Parker and Connor, Gisser). The four firm concentration ratio is calculated by state, and represents the total bin space controlled by the four largest firms (size being defined by storage capacity) divided by the total bin space available in each state.

Price performance is measured by local basis, as opposed to flat farm price. This provides three advantages. First, it allows for measures of relative performance. By measuring each local market relative to the national market (assumed to be represented by the futures market) we are less likely to spuriously associate price changes resulting from changes in international demand, year specific crop conditions, or other events to changes in elevator structure. The second advantage of measuring price performance as a function of basis is that it eliminates the need to deflate prices, allowing for analysis and discussion of the effects in nominal terms. A third advantage is that we can make direct regional comparisons. Given the research of Hauser et al., it is reasonable to assume changes in elevator structure resulting from changes in transportation services are not likely to be symmetric across regions.

For our purposes, basis is measured as cash minus futures price. The specific basis of interest is the harvest basis. We therefore calculate basis as the USDA reported October cash price in each state each year minus the average October quote for December corn futures.

The elevator data includes elevators that have been approved by ASCS to store grain, rice, and dry edible beans or seed. ASCS keeps historical information on these facilities in their Grain Inventory Management Data Base in Kansas City. The specific data selected for this analysis includes warehouses approved to store CCC corn. As such, the analysis overstates concentration in each state. Non-approved warehouses are not included, and on farm storage is not accounted for.

The owners of each individual facility listed are identified by a unique ownership code. Storage capacities in each state are aggregated by ownership code. These aggregate storage numbers are then used to calculate concentration ratios.

The methodology used to estimate the concentration models was first introduced by Fuller and Battese. The basic assumption is that the model's random errors can be decomposed into:

$$U_{ij}=V_i+e_j+\varepsilon_{ij},\ i=1,2,...N;\ j=1,2,...T$$

where i indicates cross-sectional observations and j time series observations. The estimation assumes V_i, e_j, and ε_{ij} are independently distributed with zero means and variances $\sigma_{v2} \geq 0$, $\sigma_{e2} \geq 0$, and $\sigma_{\varepsilon 2} > 0$. The covariance matrix for the vector of random errors is estimated following Searle, and then used to derive generalized least squares estimates of the model coefficients. Using Monte Carlo data, Drummond and Gallant have shown the resulting parameter estimates to be unbiased. In addition, they found the Fuller-Battese procedure to be more robust than alternate estimation techniques.

Model and Estimation Results

The specific model estimated takes the form:

$$BASIS=CR4+CR4^2+LAG(BASIS)$$

where basis is the harvest basis in each state each year, CR4 is the percent of total storage space controlled by the four largest firms in each state, $CR4^2$ is the square of the industry concentration, and the last term is the previous year's basis. The square of the concentration is included to allow for a non-linear response in basis to changes in elevator concentration. The lag of basis is included because previous research has shown that current basis levels are largely influenced by previous basis levels.

The results derived from estimating the above model are presented in table 1. Note that all three variables are significant at the 1 percent level. The results indicate that basis levels have increased about 1 cent per bushel with each 1 percent increase in elevator concentration. The negative sign on the squared concentration term implies that the change in basis resulting from increased concentration diminishes as concentration levels increase.

Previous work in the food manufacturing industry argued that market power becomes significant when industry concentration exceeds 40 percent for the top four firms. In order to determine whether there is a differential impact of increased concentration in those states with relatively high levels of concentration, we also estimate the above model including only those states

which consistently had concentration ratios over 40 percent during the sample period.[5] The results of this analysis are in table 2. Note that in this case, none of the coefficients are significantly different from 0. The conclusion is that basis in these areas has not been positively impacted by further increases in elevator concentration. However, local basis has also not been adversely impacted by changes in elevator concentration. Given a lack of basis response, it would appear that most transportation benefits resulting from deregulation are accruing to market participants beyond the farm level.

Table 1. Effect of changes in elevator concentration on basis levels, 17 states, 1980-1992.

Variable	Parameter Estimate	Standard Error	T-Ratio
Intercept	-0.2814	0.0821	-3.4237
CR4	0.0096	0.0032	3.0041
$CR4^2$	-0.0001	0.00003	-2.5914
Lag(basis)	0.2182	0.0688	3.1716

[5] It should be noted that the 40 percent figure is ad hoc, and previous literature has not provided a sound theoretical or empirical foundation for this figure. Nonetheless, it has been widely used as a critical value. Six states from our sample fall into this category. They are Georgia, Kentucky, Michigan, North Carolina, Pennsylvania, and Wisconsin.

Table 2. Impact of elevator concentration on basis when concentration exceeds 40 percent, 6 states, 1980-1992.

Variable	Parameter Estimate	Standard Error	T-Ratio
Intercept	-0.3823	0.2558	-1.4979
CR4	0.0116	0.0075	1.559
$CR4^2$	-0.0001	0.00005	-1.4029
Lag(basis)	0.252	0.1192	1.2745

Conclusions

The purpose of this paper is to estimate the impact of changes in elevator concentration on producer prices as the elevator industry adjusts to a deregulated transportation environment. Results indicate that on average producers have experienced a positive change in local prices relative to national prices as the elevator industry has become more concentrated. The inference is that producers are sharing in the transportation cost savings previously documented to have occurred as a result of deregulation. However, these benefits do not appear to be shared by producers in states which have had historically high elevator concentration levels initially. While we do not detect any adverse price movement resulting from increased concentration levels in these states, it does not appear that producers are benefiting from decreased transport rates.

The research presented here supports the conclusions of Hanson et al. that producers in the corn belt have benefitted from transportation deregulation. However, we also show that these benefits have not occurred across the entire corn producing region. This has implications for the future of transportation policy. The aggregate results presented here suggest that the corn producing industry does not stand to gain from a return to rail regulation if it distorts the economies of scale associated with unit train movement and pricing. However, implications are less clear for states which have in excess of 40 percent of commercial storage controlled by the largest four firms. Even in these states, however, adverse price movement is not found to be associated with increased levels of elevator concentration.

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