ANALYSIS OF GRAIN SHIPPER/RAILROAD CONTRACT DISCLOSURE: AN EXPERIMENTAL APPROACH

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ABSTRACT

The Staggers Rail Act (1980) permitted confidential railroad contracts. Later legislation required disclosure of certain contract terms to allay small shipper claims of injury. This study uses experimental economics to analyze the effects of information disclosure. An oligopolistic market structure was designed to simulate the market for rail services in the south/central Great Plains. Contract information was disclosed to market participants under three scenarios: no disclosure, partial disclosure, and full disclosure. The analysis revealed favorable impacts on efficiency but no discernable effect on negotiated prices. An unexpected outcome was profit enhancement by some participants under the partial disclosure format.

Key words: experimental economics, transportation, grain transportation.

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The Staggers Rail Act of 1980 represented one of the most dramatic changes in federal policy toward railroads since the Interstate Commerce Act of 1887 (Keeler). One of the most controversial provisions of the Act (section 208) permitted railroads and grain shippers to enter into confidential contracts. These contracts typically committed grain shippers to minimum shipment sizes and volumes, with the railroads providing transportation services at below-tariff rates.

The contracting provision of the Staggers Act generated concern among some agricultural shipper groups (e.g., the National Grain and Feed Association) who argued that small shippers were disadvantaged by the high volume contract rates offered to large shippers. That is, they felt that contracting had facilitated shipper discrimination, a destructive competitive practice. In view of this concern, Congress enacted Public Law 99-509 in October, 1986. Section 4051 of this law required increased disclosure of essential contract terms. Presumably the expanded disclosure requirement would reduce any shipper discrimination which may have existed. In December, 1986, the Interstate Commerce Commission (ICC) issued interim rules (Ex Parte 387) implementing the provisions of Section 4051. The new interim rules required additional and more specific disclosure of contract terms in general, and allowed for complete disclosure when an affected shipper filed a petition for discovery of additional contract terms (Federal Register). Apparently the ICC was attempting to balance the conflicting requirements of contract confidentiality on the one hand with disclosure of essential terms to potential complainants on the other.

The requirement that increased contract information be disclosed has generated concern among some shippers. They argue that the price confidentiality feature of rail contracts has enhanced interrailroad competition since railroads are prevented from knowing precisely what prices they must compete against in order to acquire traffic (Milling and Baking News). Accordingly the shippers are urging the ICC to exercise caution in formulating rules to publicize the contents of railroad contracts. Recent studies (threatens Association of American Railroads (1985), Klindworth, et al., Fuller, et al, MacDonald) have shown that deregulation under the Staggers Act did in fact lead to dramatic rate reductions, particularly in the Plains states. Some shippers believe that these rate reductions were, in large part, created by confidentiality of rail contract price information and that the current trend towards fuller disclosure of contract terms threatens the apparent interrail competition which has developed since deregulation.

More probably, the outcome of increased contract disclosure is uncertain. Depending upon one's interpretation of prior history and embracement of certain economic assumptions, a number of theoretical outcomes are possible. The intent of this paper is to examine the effect of selective contract information disclosure on prices (rates) and profits of grain shippers and railroads in the Great Plains. No primary or secondary data are available to directly analyze the issue; thus laboratory experiments are used to explore possible consequences.

Similar issues have been analyzed using laboratory experiments. Hong and Plott employed a laboratory setting to explore the consequences of a proposed rate publication policy for the U.S. barge industry. The proposed policy required a carrier to file a rate change with the ICC at least

fifteen days before the rate change was to become effective. In laboratory markets Hong and Plott contrasted the proposed posted rate policy with negotiated rates and found that posting caused higher prices, lower volume and reduced efficiency. Claims that rate filing policies would improve market operations were not supported by the experimental results.

Additional research by Grether and Plott examined the possible relation between posted prices and certain industrial practices by an oligopoly of lead-based gasoline additive manufacturers. The Federal Trade Commission had charged that an existing price posting policy was anti-competitive, while the manufacturers maintained that the pricing outcomes were simply the result of the highly concentrated market structure. Grether and Plott used laboratory experiments to refute the oligopolists' claim that concentration alone, unaided by certain practices, did not necessarily foster collusion-like prices. Further studies which are somewhat related to the proposed analysis include those by Plott and Smith, and Williams.

Study Region Background

The focus of this study is the rail transportation market for grain in the south and central Plains, a region including Kansas, Oklahoma, Texas, eastern Colorado and a portion of southern Nebraska. The area is a major producer of hard red winter wheat. Since the region is landlocked and must ship extended distances to reach its principle markets, railroad carriage dominates. It is estimated that over half of the wheat production in the region goes to the export market with about 90 percent exiting via Texas ports. A 1985 survey of grain export firms operating on the Texas Gulf shoved that 93 percent of their wheat receipts from this region were rail-

transported (North Central Regional Committee - 137).

The study region's grain handling and assembly system is unique as compared to that of other surplus grain-producing regions in the U.S. As is the case in all regions, country elevators assemble grain from producers. But, in contrast to other regions, the grain is then assembled to secondary holders which operate at transshipment locations. There are about 15 major transshipment locations in the region which store and condition grain until its final shipment to port or to a domestic demand location. Based on the 1984 waybill data (ICC), it is estimated that about 82 percent of rail-transported wheat receipts at Texas ports moved via these transshipment locations (454 million bu.), or conversely, that only about 18 percent moved directly to port from country elevators.

The secondary holding facilities at these transshipment locations are operated by the major international traders (Cargill, Continental, Bunge, Dreyfus and Elders), a regional cooperative (Union Equity), line elevator companies, and firms which specialize in secondary holding. Based on data published in various state trade directories (e.g., Kansas Official Directory, Kansas Grain and Feed Dealers Association), it was estimated that ten firms operate approximately two-thirds of the 85 transshipment facilities in the region. Furthermore, the major international traders and the regional cooperative operate all export facilities at Texas ports except those managed by two port authorities. Although market share information is not readily available for the grain shippers, Union Equity is clearly the dominant shipper from transshipment locations in the south/central Plains with something less than half the total market. The remainder of the market is divided between Cargill and Continental, with a

small share going to Bunge (North Central Regional Committee - 137).

There are ten Class I railroads operating in the region. Six of these railroads link the region with Texas ports: the Santa Fe (ATSF), Burlington Northern (BN), Union Pacific (UP), MKT-OKKT (Katy), Kansas City Southern (KCS), and the Southern Pacific (SP). The KCS links Kansas City with the Port of Beaumont and has only a limited gathering system. Likewise, the SP extends between San Francisco and New Orleans and operates little trackage in the study region. Likewise, the Katy is also a relatively small carrier because of a modest gathering system. Based on the 1984 railroad waybill data, the other three carriers (ATSF, BN and UP) assemble nearly 90 percent of all export grain to Texas ports.

A collaborative project between the U.S. Department of Agriculture and the ICC provided important information on the provisions and role of contracts between study region shippers and railroads (Klindworth, et al.). The project, which studied all contracts written between grain shippers and rail carriers in Kansas from 1980 through 1983, reported that contracts typically included only the largest grain shippers (the international traders, the regional companies and large regional cooperatives) who were offered rate reduction incentives by the carriers based on shipment size and volume. Almost no contracts were consummated between country elevators and rail carriers. Furthermore, most contracts involved movement between the region's transshipment centers and port facilities. It was estimated that 75 percent of the grain transported on this export corridor moved via contract rates rather than by tariff schedules.

It was concluded that contracting between grain shippers and railroads in the study region is characterized by an oligopolistic market structure

with only a few large grain firms contracting with the region's several railroads. Accordingly, laboratory experiments were constructed to represent this market structure.

Methods

The experiment was designed to test the impact of selective information disclosure on trading prices and on buyer (grain shipper) and seller (rail carrier) profits. An experimental economic environment was created to reflect the market for central/south Plains rail services. Because the focus of the study was the market impact of contract disclosure, only the essential ingredients from the real world were brought into the laboratory setting. Twelve 2-hour experimental sessions were held. For each session, six student volunteers were randomly assigned buyer or seller status. In order to reflect the existing market structure (Union Equity, Cargill, Continental, Burlington Northern, Santa Fe and Union Pacific), there was one large buyer (LB) and one large seller (LS), each of whom controlled one-half of their respective markets, and two smaller buyers and sellers (SB1, SB2, SS1 and SS2), each with one-quarter market shares.

The students were first instructed as to the task at hand and were then placed in separate offices on one floor in the department of XXX at YYY, with two phone lines available to each trader. Following two ten-minute training periods, six ten-minute trading periods were run. In the trading periods, the students were allowed to negotiate up to three trades, one with each participant on the other side of the market. The sellers had positively-sloped supply schedules reflecting production costs. The buyers had negatively-sloped demand schedules reflecting resale values. Three sets of demand and supply schedules (reflecting low, moderate, and high

demand/supply conditions) generated nine possible equilibrium points as shown in Figure 1. The demand/supply conditions varied by period. Training periods 1 and 2, were high demand - high supply (HDHS) and low demand - low supply (LDLS), respectively. Periods 3 and 6 were transition periods with moderate demand and moderate supply (MDMS). Periods 1, 2, 3 and 6 had equilibrium prices of $0.80 throughout, and equilibrium quantities of 140, 60, 100 and 100, respectively. At the end of each session the subjects were paid pre-ordained fixed percentages of their trader profits for the evening, with the percentages set such that the expected payout was identical for each market participant.

The periods of interest for hypothesis testing and further data analysis were periods 4, 5, 7 and 8. Periods 4 and 7 were baseline periods, and were either high demand / low supply (HDLS) or low demand / high supply (LDHS). If period 4 was HDLS, then period 7 was LDHS, and vice versa. Periods 5 and 8 were disclosure periods, and had the same equilibria as their preceding period. The four data periods had equilibrium prices of $1.00 and $0.60 for HDLS and LDHS, respectively, and equilibrium quantities of 100 throughout.

The twelve sessions were equally divided along a 2x3 treatment design as shown in Figure 2, reflecting a high or low price in periods 4 and 5, and one of three information disclosure treatments: none (NO), partial (PT), and full (FL). Under the NO treatment, there was no information on previous period quantities or prices made available to the traders. Under FL, all participants received a listing of all trades contracted during the previous trading period. Under PT, traders were allowed to request information on two trades from the previous period by specifying (1) a

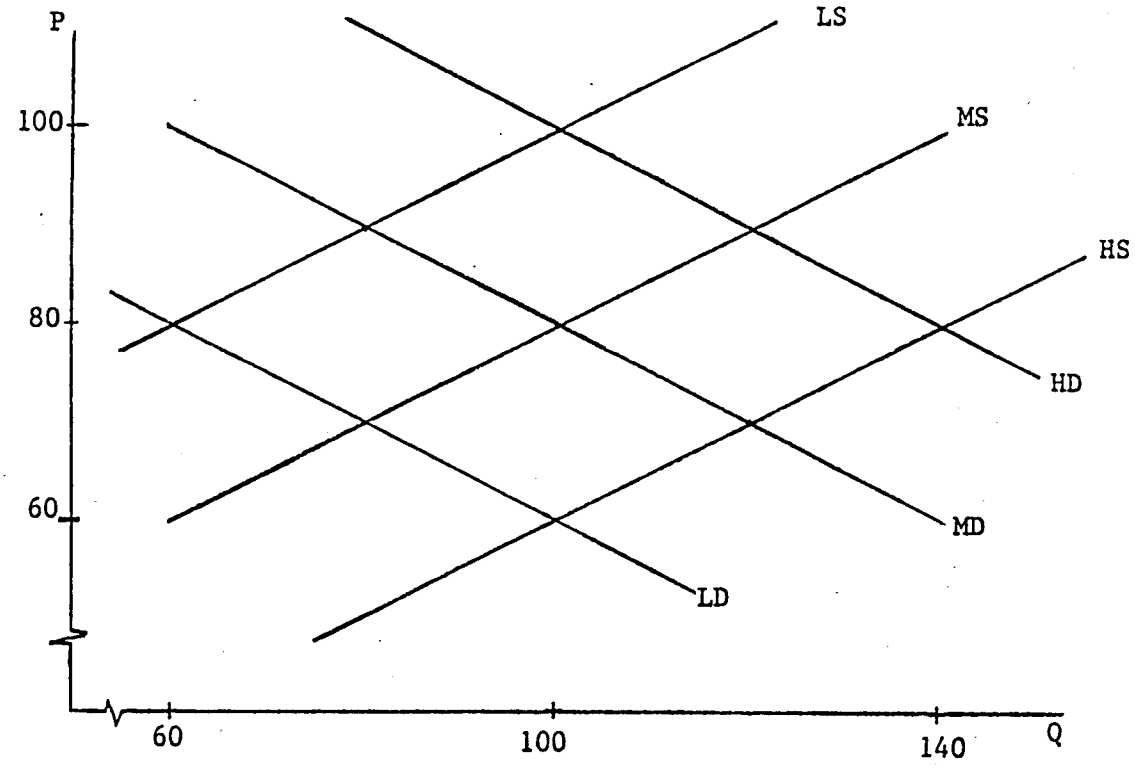

Figure 1. Supply and demand possibilities

Price	Disclosure: NO	PT	FL
HDLS	3,11	2,12	5,10
LDHS	4,7	1,8	6,9

Figure 2. Sessions by treatment

particular buyer or seller involved in a trade and (2) either the first trade, the last trade, the largest quantity traded, the smallest quantity traded, the highest contract price, or the lowest contract price associated with the trader specified in (1). There were two experimental sessions for each cell of Figure 2.

Results

The experiment was conducted over a 1-month period during the Fall 1988 semester. Major findings on profits and prices are presented. Following Plott and Smith, a perfectly efficient market standard was established in order to measure overall trader efficiency. This standard assigned period-specific equilibrium prices to all trades and optimal quantities to all traders. Given the inframarginal nature of the last unit, this perfectly efficient solution (PES) was 97 units traded per session (24 units for each of the smaller traders and 49 units for the larger traders). The mean of the actual units traded over all 12 sessions was 90.1 units per period, which amounted to 92.9 percent of the efficient solution. Overall profits were somewhat higher, at 94.2 percent of the standard. Efficient trading of 90 units per session would have resulted in 99 percent of PES profits. Actual profits were diminished to the extent that traders either failed to trade their allocation or exceeded this number, both individually and as a group. There were only four periods where individual traders recorded either zero or negative profits.

1. Profits

Buyer and seller profits were approximately equal, at 95.2 percent and 93.2 percent of the perfectly efficient standard, respectively. The small

traders each earned more than the PES, on average receiving 3.2 percent "excessive" profits. The small buyers (SB) were at 100.3 percent and 102.4 percent, with the small sellers (SS) at 102.6 and 107.4 percent. The large traders were well below the PES, at 89.2 and 81.6 percent for the buyer and seller, respectively.

Trades at equilibrium prices would have generated profits for both buyers and sellers up to their "allocations". Zero-sum games were in effect for non-equilibrium prices and for excessive quantities. That is, contract prices above or below the equilibrium price generated rents to the seller or buyer respectively. Likewise, a buyer or seller contracting a profitable trade beyond his/her "allocation" did so at the expense of the competition. That is, if a SB contracted to purchase (profitably) more than 25 units in a given period, one or more of the other buyers was doomed to less-than-optimal quantities and/or profits and at least one of the sellers was doomed to sub-optimal profits for that period. The latter half of this statement is true because a profitable trade beyond 25 units for a SB would have necessitated a purchase price below the equilibrium price. Over all 72 periods, the 90.1 average number of trades per period amounted to 40.8 and 49.3 for LB and the SBs, and 39.6 and 50.5 for LS and the SSs, each respectively. The mean prices per trade also favored the smaller traders. On average, LB paid 81.7 cents per unit while the SBs paid only 78.7 cents per unit, and LS received only 76.2 cents per unit compared to 81.8 cents per unit for the SSs. Thus in terms of both non-equilibrium prices and excessive quantities, the smaller traders extracted rents from the larger traders.

A number of pairwise means comparisons and analysis of variance

(ANOVA) tests were conducted on whether profits over the 72 trading periods were statistically different for the six traders. Table 1 presents pairwise means comparisons over (a) all trading periods, (b) the non-transition periods only, and (c) the disclosure periods only. Results over all periods indicate that none of the profits means for the small traders were significantly different from each other (all statistical tests are with respect to a five percent significance level unless otherwise specified). Period profits for LB, on the other hand, were significantly smaller than SB1 and both of the SS, and profits for LS were significantly smaller than all four of the small traders. Dropping the transition periods (3 and 6) from the analysis left LB significantly smaller than SB and one SS, and LS significantly smaller than both SBs and one SS. Including only the disclosure periods (5 and 8) across all treatments showed LS to be significantly smaller than every other market participant, including LB. Further bivariate means comparisons by trader and type of disclosure were conducted over all trading periods. However, no significant differences in mean profits were obtained.

It was anticipated that both FL and PT disclosure would result in enhanced market efficiency in the sense that excessive trader profits would be expected to decrease and below-average profits to increase. Furthermore, it was expected that markets would increase in efficiency in ascending order from NO disclosure through PT disclosure to FL disclosure. To analyze this outcome, coefficients of variation (CV) across trader profits were calculated for each of the 72 trading periods. These results are shown in table 2. The average CV across all trading periods was 39.7, dropping slightly to 38.7 when only the non-transition periods were considered. The

Table 1. Results of Pairwise Profits Comparisons Between All Traders

Name	N	Mean Profit	BuyerA	BuyerB	BuyerC	SellerX	SellerY	SellerZ
(a) Over all periods			F(1,142)					
BuyerA	72	5.35	--					
BuyerB	72	6.14	5.48*	--				
BuyerC	72	6.02	2.86	0.08	--			
SellerX	72	6.15	4.37*	0.00	0.08	--		
SellerY	72	6.45	11.78*	0.65	1.00	0.50	--	
SellerZ	72	4.89	2.54	13.13*	7.89*	10.46*	22.75*	--
(b) Periods 4, 5, 7 and 8			F(1,94)					
BuyerA	48	5.43	--					
BuyerB	48	6.16	3.43	--				
BuyerC	48	6.41	4.74*	0.24	--			
SellerX	48	5.68	0.35	1.10	2.04	--		
SellerY	48	6.25	4.51*	0.42	0.10	1.59	--	
SellerZ	48	4.90	2.28	9.59*	10.77*	3.30	11.45*	--
(c) Periods 5 and 8			F(1,46)					
BuyerA	24	5.66	--					
BuyerB	24	6.35	1.46	--				
BuyerC	24	6.31	1.27	0.03	--			
SellerX	24	6.03	0.69	0.31	0.23	--		
SellerY	24	6.13	0.83	0.13	0.09	0.03	--	
SellerZ	24	4.55	6.11*	9.89*	9.23*	10.86*	9.38*	--

NOTE: F-statistic tests equality of means; * indicates significant at the five percent level.

Table 2. Means, Standard Deviations and Coefficients of Variation Across All Traders by Period and Treatment

Sn	Pd	Mean Profit	St.Dev.	C.V.	Change	Sn	Pd	Mean Profit	St.Dev.	C.V.	Change
					(No Disclosure)						
3	3	5.841	2.189	37.5		7	3	5.893	0.915	15.5	
3	4	5.987	1.017	17.0		7	4	5.909	1.531	25.9	
3	5	6.022	0.872	14.5	- 2.5	7	5	6.270	2.700	43.1	17.2
3	6	6.107	2.499	40.9		7	6	6.413	2.294	35.8	
3	7	5.912	2.988	50.5		7	7	5.577	1.571	28.2	
3	8	5.879	1.750	29.8	-20.7	7	8	5.686	2.450	43.1	14.9
4	3	5.812	1.279	22.0		11	3	5.680	2.251	39.6	
4	4	5.807	3.863	66.5		11	4	5.622	1.320	23.5	
4	5	5.749	2.543	44.2	-22.3	11	5	5.994	2.601	43.4	19.9
4	6	6.089	3.161	51.9		11	6	6.003	1.739	29.0	
4	7	6.277	1.736	27.7		11	7	6.017	2.544	42.3	
4	8	5.591	1.299	23.2	- 4.5	11	8	6.083	1.675	27.5	-14.8
					(Partial Disclosure)						
1	3	5.787	3.443	59.5		8	3	5.982	0.400	6.7	
1	4	5.902	3.339	56.6		8	4	6.197	2.425	39.1	
1	5	5.533	0.915	16.5	-40.1	8	5	6.437	2.612	40.6	1.5
1	6	5.765	1.267	22.0		8	6	5.951	2.190	36.8	
1	7	4.794	3.661	76.4		8	7	5.763	1.853	32.1	
1	8	5.905	1.257	21.3	-55.1	8	8	6.187	2.155	34.8	2.7
2	3	5.587	8.323	149.0		12	3	6.053	1.411	23.3	
2	4	4.597	2.659	57.9		12	4	5.789	2.702	46.7	
2	5	4.140	2.513	60.7	2.8	12	5	6.176	2.558	41.4	- 5.3
2	6	5.521	1.828	33.1		12	6	6.132	1.390	22.7	
2	7	4.748	1.759	37.0		12	7	6.010	1.579	26.3	
2	8	4.982	2.543	51.0	14.0	12	8	6.142	1.235	20.1	- 6.2
					(Full Disclosure)						
5	3	5.667	2.669	47.1		9	3	6.086	3.020	49.6	
5	4	5.851	1.769	30.2		9	4	6.358	3.597	56.6	
5	5	5.907	2.148	36.4	6.2	9	5	5.372	2.357	43.9	-12.7
5	6	5.678	2.139	37.7		9	6	5.569	5.184	93.1	
5	7	6.290	3.273	52.0		9	7	5.294	3.230	61.0	
5	8	6.232	2.484	39.9	-12.1	9	8	6.042	1.470	24.3	-36.7
6	3	6.073	2.511	41.3		10	3	5.856	1.707	29.1	
6	4	5.970	3.726	62.4		10	4	5.998	2.351	39.2	
6	5	5.840	1.993	34.1	-28.3	10	5	5.735	1.092	19.0	-20.2
6	6	6.249	3.301	52.8		10	6	5.674	1.653	29.1	
6	7	5.985	1.372	22.9		10	7	5.795	2.610	45.0	
6	8	6.550	2.556	39.0	16.1	10	8	5.710	2.338	40.9	- 4.1

average CVs for the baseline periods (4 and 7) and the disclosure periods (5 and 8) over all treatments were 42.6 and 34.7, respectively. There was only a slight drop between these two sets of periods under the NO treatment, from 35.2 to 33.6, presumably reflecting learning on the part of the market participants. However, the mean CVs decreased from 46.5 to 35.8 and from 46.2 to 34.7, for the PT and FL treatments, respectively. This result is our first indication of enhanced market efficiency associated with information disclosure. While mean CVs between the baseline and disclosure periods decreased in five (of eight) NO sessions and in six FL sessions, they decreased in only four PT sessions.

Further evidence of enhanced market efficiency with information disclosure was obtained by looking at specific trader behavior. Deviations from the mean profit level for each trader for each of the non-transition periods were calculated. The direction and magnitude of the changes in these deviations between the baseline and disclosure periods are reported in table 3. An efficient market would presumably result in both negative and positive deviations in the baseline period moving toward (and possibly beyond) zero in the disclosure period. A positive sign in table 3 thus represents an efficient market movement, while a negative sign reflects a movement in the "wrong" direction. Of the 48 sets of comparisons over all traders for the NO treatment, there were only 11 inefficient movements, reflecting (qualitatively) an efficient market. For the FL treatment, the 12 negative values represent a slight increase in the number of inefficient movements while for the PT treatment the number of inefficient movements was 16. The magnitudes of the changes reveal a different outcome. The average value over all sessions of the 105 efficient moves was 2.09, while

Table 3. Efficiency of Profits Movements From Baseline to Disclosure Periods by Trader

Sn	Pd	BuyerA	BuyerB	BuyerC	SellerX	SellerY	SellerZ
				(No Disclosure)			
3	4/5	1.31	0.17	0.78	1.40	1.13	-0.61
3	7/8	1.06	2.03	0.23	1.89	0.22	1.23
4	4/5	0.35	2.55	-0.26	3.54	1.32	2.23
4	7/8	1.49	0.55	4.15	-1.55	0.82	-0.24
7	4/5	-0.36	0.57	5.50	-2.22	3.91	4.01
7	7/8	1.42	-2.23	4.42	1.11	5.03	1.31
11	4/5	-1.24	1.16	-3.23	3.21	5.03	2.60
11	7/8	2.26	-0.27	0.73	-1.59	3.17	1.69
				(Partial Disclosure)			
1	4/5	1.56	1.20	4.27	3.83	3.52	-0.32
1	7/8	4.25	-0.92	0.80	6.29	3.12	0.64
2	4/5	3.83	6.99	1.44	2.36	1.90	-0.36
2	7/8	0.26	-1.98	0.45	-2.03	1.39	1.51
8	4/5	-0.31	2.00	-0.61	0.46	1.08	-1.68
8	7/8	1.33	0.33	-1.21	-0.07	0.86	-0.99
12	4/5	1.55	-2.74	1.70	-0.59	1.65	-0.56
12	7/8	-0.69	-0.86	1.13	2.10	0.46	1.26
				(Full Disclosure)			
5	4/5	2.93	1.10	-1.34	1.44	-1.17	2.77
5	7/8	-0.05	-0.08	2.18	1.93	0.14	-0.02
6	4/5	-1.04	0.25	4.99	-0.09	1.65	2.65
6	7/8	0.83	4.21	-0.73	1.01	1.89	5.21
9	4/5	4.27	3.70	4.91	3.70	-0.43	0.23
9	7/8	3.64	0.57	1.31	5.42	0.98	1.07
10	4/5	2.05	4.37	0.41	1.09	-1.02	0.61
10	7/8	1.55	0.82	-0.93	0.25	-0.53	1.71

the average of the 39 inefficient moves was 0.95, 55 percent less. The inefficient moves were (on average) 61 percent of the value of the efficient moves for the NO treatment (1.25 to 2.05), but were 49 percent for the PT treatment (1.00 to 2.05) and only 29 percent for the FL treatment (0.92 to 2.16). That is, with disclosure, market participants encouraged movements in the "correct" direction, and reacted negatively to increased profits or losses.

2. Prices

Contract prices were analyzed across all trades negotiated during the 72 periods. The 570 contracts amounted to slightly less than 8 trades per period, one less than the maximum potential number of trades per period. The LB and LS engaged in 201 and 212 trades, respectively, out of a possible 216 across all sessions and periods. The smaller traders, on the other hand, negotiated fewer trades, with 180, 189, 178 and 180 contracts for the SBs and SSs, respectively, in spite of (oftentimes) exceeding their PES allocations. The dependent variable for much of the following analysis of prices is the trading price less the equilibrium price (TPLEP). The mean of TPLEP over all trades was -0.4 cents, indicating some price advantage to the buyers in the aggregate.

Price analysis was done using ANOVA techniques over one-dimensional, two-dimensional and three-dimensional classification schemes. One-dimensional schemes included (a) three types of disclosure; (b) baseline periods vs. disclosure periods; (c) high prices in periods 4/5 and low prices in periods 7/8 (HDLS/LDHS) vs. low prices in periods 4/5 and high prices in periods 7/8 (LDHS/HDLS); and (d) various combinations of large

and small buyers and sellers, with the small traders on each side of the market considered together as SS and SB.

When prices were analyzed one-dimensionally, TPLEP was found to be significantly different between NO and PT disclosure and between NO and FL disclosure; between HDLS/LDHS and LDHS/HDLS; between LB and SB; between LS and SS; and between LB and LS. The significant difference between the high price / low price equilibria is intriguing. Under both schemes, the traders were moving from an equilibrium price of 80 cents in periods 3 and 6 to an equilibrium price of $1.00 and 60 cents in periods 4/5 and 7/8, and vice versa. The TPLEP means were 4.66 cents below the HDLS/LDHS equilibria and 2.77 cents above the LDHS/HDLS equilibria. These differences point to the difficulties facing the traders as they consistently underestimated the higher prices and overestimated the lower prices.

There was one major surprise in these one-dimensional results, that there was no significant difference between the baseline periods and the disclosure periods. Two-dimensional analyses shed further light on this outcome. The two-dimensional scheme was type of disclosure treatment (NO, PT, FL) by disclosure period (baseline/disclosure). These results are reported in table 4. The expectation was that the mean TPLEP would move toward zero between the baseline and disclosure periods for all three treatments, and that both PT and FL disclosure would enhance this movement. Under NO disclosure the mean TPLEPs between the baseline and disclosure periods were significantly different at a ten percent level and moved toward zero as expected. While no significant differences were detected between the mean TPLEPs for either PT or FL disclosure, the TPLEP means moved toward zero with FL disclosure, but diverged from zero with PT

Table 4. Pairwise Means Comparisons of TPLEP by Treatment Between Baseline and Disclosure Periods

Type of Disclosure	Period	N	Mean Price	St. Dev.	"t" Value[1]	d.f.
None	Baseline (4,7)	64	4.28	9.98	1.68	129
	Disclosure (5,8)	67	1.15	11.32		
Partial	Baseline (4,7)	63	-1.62	12.55	0.56	121
	Disclosure (5,8)	60	-2.82	11.20		
Full	Baseline (4,7)	66	-4.14	13.31	0.60	130
	Disclosure (5,8)	66	-2.80	12.12		

[1] t-statistic for comparison of means

disclosure. Recall that in the earlier profits analysis, PT disclosure had shown the greatest number of inefficient movements between the baseline and disclosure periods. Here we have a second bit of evidence of enhanced profiteering under PT disclosure.

The two-dimensional scheme was extended to a set of three-dimensional designs by adding variations on trader size and side of the market, with the same relevant comparison between the baseline periods and the disclosure periods. Again there were no discernible disclosure impacts. This is not to say that there were no significant differences between the means in the cells of either the two-dimensional or three-dimensional schemes. In fact, the null hypotheses of equal cell means in the two-dimensional design and in each of the three-dimensional schemes was rejected at the five percent significance level.

The Value of Information

From the reported results on profits and prices, we can conclude that disclosure for the most part had a positive impact on market efficiency, but that the effect of disclosure on market prices was inconclusive. A logical question to ask is whether disclosure <u>in fact</u> had no impact on market prices, or whether the market structure imposed by the experimental design overwhelmed any potential impact which could be ascribed to disclosure. The latter is more than likely the explanation. By looking at the requests for information which were submitted by the traders under the PT disclosure treatment, we can clearly see an "excess capacity" problem facing the sellers.

The information the traders could have selected breaks down along five parameters: side of the market, size of the trader, order of the trade,

trading price, and trading quantity. The first two of these parameters had to do with a trader's request for information on another trader. As shown in table 5, for the most part, both buyers and sellers requested information on traders from the opposite side of the market. Only 6 buyer requests and 7 seller requests (out of 48 possible requests) were for the same side of the market. Information requests on size was likewise fairly equally distributed on each side of the market, with buyers requesting information on a large trader 18 times and sellers requesting large trader information 17 times (again out of a possible 48).

The latter three items above had to do with the type of information requested. There were 9 buyer requests and 7 seller requests for the largest quantity traded by a given buyer or seller. As would be expected, no trader requested information on the smallest trade which another trader had made. Again, these requests do not seem to be largely different between buyers and sellers. However, dramatic differences appeared in prices requests and order of trade requests. Buyers requested low price information 31 times and high price information 3 times, as opposed to 16 seller requests for the high price and 3 for the low price. On the other hand, sellers on 14 occasions wanted to know the first trade which another trader had made, and on 8 occasions requested information on the last trade. Buyers requested order of trade information only 5 times <u>total</u>. The large seller was especially concerned with order, with 9 requests for first trade and 2 requests for last trade. Apparently the experimental design encouraged (or even forced!) market participants to lock in their trades early. This outcome may have contributed to the overall poor showing on the part of the large traders, especially the large seller, and

Table 5. Summary of Information Requested Under Partial Disclosure

INFORMATION REQUESTED ON TRADER:

	A	B	C	X	Y	Z
By Buyers	2	2	2	15	11	16
By Sellers	17	13	11	5	2	0
Total	19	15	13	20	13	16

INFORMATION REQUESTED ON TRADE:

	First Trade	Last Trade	Large Quant	Small Quant	High Price	Low Price
By Buyers	2	3	9	0	3	31
By Sellers	14	8	7	0	16	3
Total	16	11	16	0	19	34

may have been responsible for the overall downward pressure on prices. Certainly, the large traders seldom exhibited the market power which the experimental design had offered them.

Conclusions

Straightforward extension of these results to the potential impact of information disclosure on rail rates between grain shippers and railroads in the central/south Plains is difficult. Certainly rail services have been in excess supply during some periods and in some locations since the early 1980s when overseas grain markets softened. To the extent that the experimental design fostered a feeling of an excess of supply among the market participants, the current study may be relevant.

The impact of partial information disclosure is intriguing. While some results showed contributions to market efficiency with partial disclosure, other results indicated that skilled traders may have been able to enhance their profits by insightful utilization of selective information and/or that unskilled traders were further defeated by their lack of ability to either select or utilize pertinent information. To the extent that this experimental outcome can generalize to a real world setting, selective contract disclosure may harm those market participants who are already being hurt and may offer further advantage to already profitable market participants. At a minimum the unexpected (but inconclusive) evidence presented above that points to enhanced profiteering with partial information disclosure merits further research.

Preliminary evidence based on an analysis of geographic price spreads shows real rail rates over the study region's major transportation

corridors to have edged upward since contract disclosure. Furthermore, rate disclosure may be responsible for the reduced use of grain transport contracts. In 1986, an estimated 63 percent of rail grain moved under contract, whereas by 1988 the share had dropped to 40 percent (Association of American Railroads, 1989). If increased contracting was in fact responsible for lower rates during the early Staggers years (implying more efficient markets), the fear of partial information disclosure requirements may directly or inadvertantly be linked to the decreased number of contracts, thereby contributing to enhanced market inefficiency.

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