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# Determinants of Wheat Transportation Rates for Pacific Northwest Shippers

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## INTRODUCTION

The Staggers Act of 1980 greatly increased rate flexibility for railroads. The ability to negotiate contracts with individual shippers was perhaps the greatest departure from previous policy. By 1989 the Association of American Railroads (AAR) estimated that more than half of all rail traffic was being shipped under contract rates (Winston et al, 1990).

Rail contracts for grain shipments increased in popularity from 1980 through 1986 when it was estimated that approximately 63% of all rail grain shipments moved under contract (Fuller, Ruppel, and Bessler, 1990). In January 1987, the ICC's rule on contract disclosure were implemented. Although contract rates were not made public, most of the terms of agricultural contracts became readily available after this date. Several railroads stopped making contracts due to the increased information made available to the public under the disclosure rules. By 1988, only 40 % of railroad-transported grain moved under a contract (Fuller, Ruppel, and Bessler, 1990).

While early evidence suggested that contract rates were lower than tariff rates (ICC, 1984), it is no longer clear whether contracts have a significant effect on rates. Evidence from experimental studies (Ruppel, Fuller, and McKnight, 1990) suggest increased efficiency from increased disclosure, but no discernible effect on rates. Fuller, Ruppel, and Bessler (1990) find an upward trend in rail grain rates after 1987 that they attribute to the disclosure policy.

The purpose of this paper is to identify significant determinants of transport rates for wheat shippers in the Pacific Northwest. In doing so, this paper examines whether the existence of rail grain contracts after 1987 have had a significant impact on transportation rates.

Past studies have used the ICC's public access Waybill sample as the source for rail rates. Although the Waybill sample does indicate whether a shipment was made under a contract, the reported revenue is not necessarily the actual contract revenue collected by the railroad. Indeed, to preserve confidentiality, railroads are only required to report a "reasonable" approximation to what the rate on such a shipment would be (Wolfe, 1986). Thus, the Waybill data are not reliable indicator of contract rates.[1]

Another drawback to the ICC Public Use Waybill sample is that it does not allow identification of either the shipper or the railroad. In the Pacific Northwest, there are only two railroads that offer grain transport services: the Burlington Northern (BN) and the Union Pacific (UP). The Burlington Northern is the larger of the two railroads in terms of grain volumes shipped and this study attempts to determine whether BN's dominant position is reflected in transport rates.

As an alternative to the Waybill sample, price spreads are used as a proxy for transportation rate. Due to the cost of acquiring primary data, this study is limited to a sample of elevators which ship export wheat from the Pacific Northwest (PNW). The PNW is defined here to include the states of Oregon, Washington, and Idaho.

A model is developed to estimate the impact of rail contract rates on transport costs paid by PNW wheat shippers. Care is taken to control for other factors that may influence rates such as distance to port, the size of the shipper, and the presence of intermodal and interrail competition. Recent studies (MacDonald, 1987,1989; Wilson, Wilson, and Koo, 1988) indicate an important role for intermodal competition in the determinations of post-Staggers grain transport rates.

The paper is organized as follows. Section 1 provides a brief history of rail contracts following the Staggers Act. Section 2 discusses the use of price spreads and their limitations. The data and methodology used in this study are presented in Section 3, followed by a presentation of empirical results. The final section summarizes the major findings of this study.

## BACKGROUND ON RAIL CONTRACTS

Prior to 1980, motor carriers were exempt from regulation when engaging in the transport of agricultural commodities such as grain. Thus, the Motor Carrier Act of 1980

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did not alter competitive options to trucking firms. Railroads, however, had been prevented from engaging in rate competition and had been unable to negotiate contracts with individual shippers. Section 208 of the Rail Staggers Act of 1980 gave railroads the power to engage in contracts with individual shippers, thus making railroads more competitive with exempt motor carriers.

Section 208 requires contract terms as well as rates to be filed with the Interstate Commerce Commission (ICC). However, the ICC's rules for filing and disclosure of contract provisions were formulated with the intent of maintaining confidentiality for the parties involved. The protection of contract confidentiality has made it difficult, if not impossible, for shippers or ports to challenge contracts since so little information is publicly disclosed.

The confidentiality of rail contract rates has been a controversial issue amongst grain shippers. In a survey of grain elevators in North Dakota and Minnesota, Griffin and Zink (1987) found that large shippers using contract rates advocated confidentiality whereas smaller shippers did not. This same general result is supported by the results of Casavant and Dickrell's (1987) survey of Washington and Oregon grain shippers. In an Interstate Commerce Commission (ICC) study of contract confidentiality (ICC, 1984), some shippers and ports expressed the opinion that such contracts had a negative impact on small shippers.

The argument implicit in objections to rail contracts is that large shippers have more bargaining power and thus are able to get more favorable contract terms than smaller shippers. Critics of this view argue that small wheat shippers pay higher transport rates not because of contract rates, but because they are unable to take advantage of multiple carload rates offered by railroads to anyone who can provide the volume necessary to utilize multiple carload rates.

The ICC's interim contract discovery/ disclosure rules went into effect in January 1987, being finally decided on February 2, 1988 (ICC Ex Parte No.387). The extent of the disclosure varies between commodity groups. Paper and forest products have a fairly high level of contract term disclosure. The terms of agricultural contracts (grain included) are more readily available but contract rates are not disclosed. Coal contract provisions remain relatively confidential with little disclosure required.

Although the ICC began to grant contract rates prior to the passage of the Staggers Act, only six contracts were in effect as of December 1980 (Keeler, 1983). After 1980, rail contracts rapidly gained popularity with 8,285 new contracts being filed in 1983, resulting in a total of 12,301 contracts on file with the ICC as of January 1, 1984. Of these contracts, almost 60% were with shippers of forest products, chemicals, minerals, grain and grain products (ICC, 1984).

Grain contracts increased through 1986 when 2,932 new contracts were placed on file with the ICC. New grain contracts filed fell to 2,147 in 1987 and 1,695 in 1988, a decline of 45 percent. Total non-grain rail contracts rose 12.5 percent from 12,306 in 1986 to 13,845 in 1988 (ICC, 1989). Two events took place in 1987 that contributed to the decline in rail grain contracts. First, the January 1987 implementation of the ICC's Interim rules on disclosure caused railroads such as the Burlington Northern (BN), to withdraw from contract negotiations. Second, a grain rail car shortage developed in the late 1980's making rail carriers less willing to commit to long term capacity and rate guarantees.

Contract terms vary widely and, in addition to specifying rates, may include guarantees of volume to a railroad, limitations on load time allowed without penalty, and rail service guarantees. Some contracts include provisions for maintenance of stable rates and for the use of private hopper cars and special demurrage arrangements. The ICC (1984) found that most grain contracts negotiated as of January 1984 provided for reduced rates when a shipper met volume commitments or commitments from the shipper or receiver for a certain percentage of the business on a route. Since 1987, however, there is some evidence that contracts may call for rate premiums in return for rail car guarantees (ICC, 1989). This switch in terms reflects a change from the early 1980's when there was excess capacity of rail cars, to the rail car shortage that persists to this date.

## USE OF PRICE SPREADS

The price spread (PSPREAD) is defined here as the difference between the port (export) price of wheat (PEXPORT) and the bid price paid by the elevator to the farmer (BID):

$$PSPREAD = PEXPORT - BID$$

Defined in this way, the price spread includes handling and marketing costs as well as the cost of transportation. Klindworth et al (1985) find that 84-91% of the price spread can be attributed to the transportation cost.

The use of price spreads in a time series analysis can present several problems. First, the price spread can fluctuate due to changes in demand conditions that affect the export price and thus the price spread. Similarly, supply conditions may influence the bid price offered to farmers as farm production may vary over time. Fuller et al (1987) are careful to control for factors other than transportation costs that may vary over time. A cross-sectional analysis, using data from only one point in time eliminates the need to deal with fluctuations in export demand: all shippers face the same export price.

In a cross-section, however, it is still possible to get variation in price spreads across firms even if transportation rates are identical. This may occur if the elevator industry itself is competitive in some regions but there is market power concentration in others. If an elevator has a regional monopoly, it does not have to compete for farmers' grain and thus may be abler to pay farmers a lower BID price than if there had been inter-elevator competition. A lower BID will, ceteris paribus, increase the price spread even though transportation rates are identical. In this case the price spread includes not only the transportation, marketing and handling costs, but also monopoly profits accruing to the elevator.

If there is not a monopoly, competing elevators will bid up the BID price in an attempt to attract grain, lowering the price spread. In a perfectly competitive situation, all monopoly profit will be eliminated and the resulting price spread will reflect only the transportation, marketing and handling costs. Thus, care must be taken to control for the competitiveness in the elevator industry when using price spread as a proxy for transportation cost.

Data for calculating the price spread were obtained by calling the Port of Portland and obtaining the export price for wheat (PEXPORT). Data for the bid price (BID) were obtained by calling each elevator. All data were collected for a single date in February, 1989.

## DATA AND METHODOLOGY

This study attempts to examine the determinants of actual transport cost to wheat shippers. Shippers in the model are assumed to select the mode that minimizes transportation costs. Since we are dealing with a cross sectional study, the export price is constant. Thus, the price spread depends solely on the transportation and handling costs, and the bid price.

The transportation rates available to the shipper are modelled as:

$$P_{ij} = f(MC_{ij}, E_{ij}; I_{ij})$$

$$E_{ij} = g(C_j, M)$$

where $P_{ij}$ is the transportation price charged by the ith transport firm at the jth location. $MC_{ij}$ is the marginal cost of the ith firm providing transportation at the jth location. $E_{ij}$ is the elasticity of demand faced by the ith firm at the jth location which depends on $C_j$, the amount of inter- or intramodal competition at the jth location and M, the market elasticity of demand for wheat. $I_{ij}$ represents the institutional factors affecting the rate offered by the ith firm at the jth location such as the existence of a rail contract.

Wheat shippers in the PNW region are connected to export ports via a complex transportation system that includes rail, highway, and water transport carriers. The Burlington Northern (BN) and the Union Pacific (UP) are the two railroads linking export ports to PNW wheat shippers. Commercial navigation takes place on the Snake-Columbia River system where a network of locks and dams allow barge transportation as far east as Lewiston, Idaho. There are also several major highways in the area, providing a system for truck transportation.

Finally, in addition to modelling the transportation rates paid, use of the price spread requires an examination of the competitiveness of the elevator industry. As mentioned in the previous section, if monopoly elevators are able to pay lower bid prices to farmers, this will have an impact on price spreads that is independent of transportation rates.

The empirical model to be estimated is:

$$RTM = a_0 + a_1 DISTANCE + a_2 VOLUME + a_3 NUMBRR + a_4 MIWATER + a_5 CONTR + a_6 MCLF + a_7 ELEV + a_8 WASH + a_9 IDAHO + a_{10} BN + u$$

Where:

RTM is revenue per ton-mile. The price spread is converted into rate per ton mile to make this analysis comparable to other studies. This is done by converting the price spread into a per ton price and dividing by miles to the port.[2]

DISTANCE is the distance, in miles, from the elevator to the nearest export port (Seattle or Portland),

VOLUME is the annual volume in tons of wheat originating at that elevator,

MIWATER is equal to one plus the number of miles from the elevator to the nearest river terminal where barge service is available.

CONTR is a dummy variable = 1 if a rail contract is on file with the ICC for that elevator, = 0 otherwise.

MCLF is a dummy variable =1 if the elevator has multiple carloading facilities, = 0 otherwise,

ELEV is the number of grain elevators located within a 50 mile radius of the sample point.

NUMBRR represents the number of railroads serving a particular location.[3]

WASH is a dummy variable = 1 if the elevator is located in the state of Washington, = 0 otherwise.

IDAHO is a dummy variable = 1 if the elevator is located in Idaho, =0 otherwise.

BN is a dummy variable =1 if Burlington Northern Railroad serves the sample point, =0 otherwise.

u is a random error term.

All variables are expressed in natural logs so that coefficients may be interpreted as elasticities.

DISTANCE is included in this specification to see whether transport rates per ton-miles (RTM) reflect the cost-distance taper. The expected result is a negative coefficient on DISTANCE, showing that per unit transport costs fall with distance.

VOLUME, the annual volume shipped, is included to capture any size related differences in transportation costs. If higher volume shippers are able to negotiate lower rates from railroads or other transport firms, a negative sign would be expected on the VOLUME coefficient.

MIWATER and NUMBRR are variables designed to capture the effects of intermodal and interrail competition on transport rates. Since all variables are expressed in natural logs, a one has been added to MIWATER because port locations have zero miles to port and the log of zero is not defined. A positive coefficient on MIWATER would mean that elevators located farther from alternative barge transport are charged higher rates. If interrail competition lowers transport rates, NUMBRR will be negative.

The CONTR dummy is included to see whether elevators that have rail contracts on file with the ICC pay less for transportation than those who do not. A negative coefficient on CONTR would support the hypothesis that rail contracts lower transport costs for those shippers who are able to negotiate such contracts with the railroads.

The MCLF dummy is an attempt to test whether rate differences are due to shippers taking advantage of discounted multiple carload rates. The use of multiple carload rates, although available prior to 1980, were not used extensively until post-1980. Rate discounts offered by railroads for multiple carload shipments are, at least partially, cost based. The problem here is that a shipper must have access to multiple carloading facilities (MCLF's) to be able to take advantage of these discount rates. Not only is the initial investment in MCLF's large, such facilities require large shipment volumes. Both of these factors contribute to the inability of some small shippers to take advantage of the lower rates. If a MCLF is present and used efficiently, a negative coefficient would be expected, indicating a lower transport rate.

ELEV is a variable included to capture the possible influence of elevator market competition for grain on the price spread. ELEV measures the number of elevators within a fifty mile radius of the sample point; elevators farther than fifty miles from the sample are not considered to be viable competitors for a farmer's grain due to the increased transportation cost involved in delivering the grain to the elevator. If increased elevator competition causes the bid price paid farmers to increase, there should be a decrease in the price spread. A negative estimated coefficient for ELEV would be observed in this situation.

Dummy variables were included for WASH and IDAHO to capture any state specific differences in wheat transport rates. Note that the dummy coefficient for the state of Oregon is implicit in the constant term. Thus, the coefficients for IDAHO and WASH indicate whether transport rates paid in Washington and Idaho differ significantly from those experienced in Oregon (Maddala, 1977). MacDonald (1987) found a statistically significant coefficient for his Washington state dummy variable, a result he interpreted as reflecting differences between state and Federal regulations.

Finally, the BN dummy is included to determine whether service by Burlington Northern, the dominant grain railroad in the region, has any significant (positive or negative) impact on transport rates.

There were 60 elevators included in this study; 19 in Washington, 19 in Oregon, and 22 in Idaho. Elevator locations were determined from the PNW Grain and Feed Association's 1989 Directory. The data here represent a sample selected by including the first elevator from each town listed in the 1989 Directory; elevator listings were alphabetical. The elevator sample was then checked to ensure inclusion of at least one elevator from each wheat producing county in the state. Finally, the ICC's list of contracts filed was used to identify elevators that had contracts for export wheat. Any elevators on the ICC's list but not already included in the study, were added. This was done to guarantee inclusion of shippers that used contracts.

Between January 22, 1987 and March 31, 1989, there were 104 contracts filed involving wheat shipments originating in Oregon, Washington, or Idaho. Of those 104 contracts, 48 specify a destination at a PNW port (ICC, 1989)

Each elevator was contacted by telephone to collect data on elevator bid price, annual volume shipped, and the availability of multiple carloading facilities (MCLF's). The elevator bid prices were all collected for a single date in February, 1989. The number of railroads serving wheat shippers at each location was determined by direct contact with the railroads. A railroad was counted as serving a point if it had a tariff on file for that location.

## RESULTS AND DISCUSSION

The regression model was run using observations for all sixty elevators in the sample. Except where noted, statistical significance refers to tests using a 95 percent significance level.

The estimated coefficients presented in Table 1 show the expected strong and significantly negative influence of DISTANCE on the transport rate. This indicates that rates follow the cost taper that occurs with distance.

The small and statistically insignificant coefficient on VOLUME indicates that large shippers do not enjoy any rate advantages over smaller ones. Note that this result contradicts MacDonald's (1987,1989) finding that shippers with larger annual volumes command lower rail rates. This may be because the price spread calculated here is not necessarily a rail rate, but the transportation cost of the mode the shipper actually used. While annual volume may influence rates charged by railroads, the results here suggest that smaller shippers may pay transport rates comparable to those of large volume shippers by using alternative available modes such as barge and/or truck.

The positive and highly significant coefficient on MIWATER confirms the importance of barge competition in the determination of wheat transport rates.

The coefficient on CONTR is positive although not statistically significant. This result suggests that contracts do not influence the transportation rates shippers pay in the post-1987 (post-disclosure) era. Although earlier evidence suggested that contracts lowered grain transportation rates, this does not appear to be the case in the PNW in 1989. The positive coefficient implies a rate premium on contract movements, a result that is consistent with the hypothesis that contracts are used to assure car availability in a tight market for rail grain cars.

The coefficient on MCLF is neither statistically significant nor of the expected sign. This suggests that access to MCLF's does not make a big difference in transport paid by PNW wheat shippers. A possible reason for this is that some of the MCLF's are not being used because elevators are unable to generate the necessary volume. Indeed, one Oregon elevator representative blamed crop reserve programs for reducing their volume and rendering the MCLF's unprofitable. Also, it appears that barge is a viable low-cost, high volume alternative for grain shippers in this region.

The estimated ELEV coefficient is negative, but not statistically significant. This result indicates the appropriateness of using the price spread as a proxy for the transportation rate. Differences in competition between elevators do not seem to influence the price spread. This is consistent with the textbook view that the farm level price for wheat is set at the export price less transport cost (Tomek and Robinson, 1981). The fact that elevators tend to pass along transportation rate changes directly to the farmer is one reason farmers are so concerned with changes in the regulatory structure of the transportation industries.

Neither state dummy coefficient is statistically significant. Note this result is inconsistent with MacDonald's (1987,1989) assertion that state regulation in Washington might have a significant impact on rail rates. Discussions with Washington state regulators indicated that there is, de facto, no state regulation of wheat rail rates. Almost all wheat produced in the state is destined for export and export wheat is considered to be part of interstate commerce, thus subject to Federal regulatory oversight. Further, the majority of Washington wheat destined for export actually crosses state lines as it shipped from the port of Portland. In any case, Washington state regulators did not think that there were any significant differences between intra and interstate wheat rail rates in Washington.

An alternative explanation for MacDonald's earlier finding of a significant Washington state dummy is that state of Washington is served primarily by the Burlington Northern (BN) railroad whereas Oregon and Idaho have more rail service provided by the Union Pacific. Since MacDonald used the ICC Waybill sample as his data source, he was unable to identify individual railroads. The negative coefficient on the BN variable is statistically significant using a 93% confidence interval.

The negative coefficient on BN means that shippers face lower rates at points served by

**TABLE 1**

**Regression Results for Full Sample**
**(n=60)**

Dependent variable: Revenues per ton-mile

| Variable | Coefficient | t-Statistic |
|---|---|---|
| Constant | 1.879 | 3.861 |
| DISTANCE | -.893 | -9.004 |
| VOLUME | -.013 | -.591 |
| MIWATER | .165 | 4.299 |
| NUMBRR | -.114 | -.720 |
| CONTR | .086 | 1.056 |
| MCLF | -.040 | -.479 |
| ELEVATOR | -.046 | -.813 |
| IDAHO | -.101 | -.577 |
| WASH | -.042 | -.261 |
| BN | -.212 | -1.840 |

All variables are expressed in natural logarithms. See text for variables definitions.

R-squared = .855

Adjusted R-squared = .826

the Burlington Northern. Thus, rather than raising transport rates due to its dominant position in the region, it appears that the Burlington Northern may actually be passing cost savings on to its customers. This is consistent with conventional wisdom in the industry which suggests that BN is very competitive and has been able to increase the efficiency of its grain operations.

The negative but statistically insignificant coefficient on NUMBRR suggests that interrail competition is not as crucial in the PNW as in the Midwest where there are often three or four railroads serving a single point. Rather than the number of railroads at a particular point, it appears that rates depend on whether the point is served by Burlington Northern.

Another factor which may influence interrail competition is the presence of potential entry. The Southern Pacific railroad does serve points in Oregon although it does not currently have grain railcars to serve this region. If, however, wheat rail rates got high enough, it might encourage the SP to enter the wheat transport business. This hypothesis was tested by including a dummy variable in the regression to indicate whether a point was located on or near a Southern Pacific line. The coefficient on the Southern Pacific dummy was not statistically different from zero. This result supports the finding that interrail competition does not affect wheat transportation rates; neither actual nor potential competitors influence transportation rates.

## CONCLUSION

The results of this study suggest that rail contract rates do not have a discernible effect on wheat transport rates in the PNW. This finding lends tentative support for the view that the 1987 imposition of ICC disclosure requirements significantly reduced contract making and eliminated discounts previously associated with rail grain contracts.

The insignificance of multiple carload facilities in influencing wheat transportation rates is an unexpected finding. It may be that crop reserve programs enacted after the facilities were built have lowered the potential for transportation rate saving.

Larger volume shippers do not appear to pay systematically lower transport rates as reflected in the small and insignificant coefficient estimated for VOLUME. While this means that smaller grain elevators are not at a disadvantage with respect to price when competing for farmer's grain, it says nothing regarding the transport service quality offered small or more remote locations. Since shippers make their transportation choice based on the full cost of transport that includes service quality differentials as well as the transport rate paid, the use of contracts to insure service quality may lower the full cost of transportation to shippers who have such contracts. This remains a topic for future study.

The importance of intermodal competition in the determination of wheat transport rates is confirmed by the results found here. The presence of an extensive water transport system in the PNW provides shippers with a viable, low cost alternative to rail transportation.

Interrail competition, either existing or potential, is not as important in the PNW as in the Midwest and findings show that shippers served by one railroad, the BN, get lower transport rates. It is hypothesized here that the BN is a cost efficient railroad that passes cost savings on to its customers. Past studies have not identified individual carriers but have relied upon a concentration measure to assess interrail competition. This is probably due to their reliance on the public access ICC waybill sample which does not identify carriers. The importance of individual carrier efficiency in the determination of transport rates is a topic for future research.

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## ENDNOTES

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1. MacDonald (1987) compared tariff and Waybill rates to see if the Waybill sample included contract rates. Since the Waybill rates were below the tariff rates, he concluded that the Waybill sample included contract rates. This view seems to be accepted by Fuller, Ruppel, and Bessler (1990) in their analysis.

   The deviation between Waybill and tariff rates may be explained by individual carrier's deviations from tariff rates that are not set in contracts.

2. The price spread per bushel of wheat is multiplied by 35.7 (the number of bushels of wheat in a ton of wheat) to get the price spread per ton. Revenue per ton-miles is obtained by dividing the price spread per ton by DISTANCE.

3. MacDonald (1987,1989) uses a Herfindahl Index as the measure of concentration. Data for such a calculation were not available here where there was a maximum of two rail carriers serving a point.