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ABSTRACT

The theory of dominant firm price leadership is used to explain price and output behavior and equilibrium in rail and truck grain transportation. A very important factor explaining intermodal competition is the slope of the supply function of the competitive fringe, the truck mode. An econometric model was specified and estimated in the case of eastbound wheat shipments from North Dakota.

I. Introduction

The general thrust of recent legislation affecting transportation has been toward increased rate flexibility. As a result, demand and price analysis have come into vogue in transportation research, particularly in the case of grain transport. Most studies have used some type of spatial equilibrium model to analyze various impacts. However, little empirical research has been published on intermodal competition and the behavior of transport prices. Exceptions include studies by Binkley and Harrer and by Beilock and Shoukwiler, both of which analyze prices of a single mode in the absence of competition. The purpose of this paper is to analyze inter-modal (truck/rail) competition in the case of wheat transportation from North Dakota to Minneapolis/St. Paul and Duluth/Superior. Specific objectives are to: 1) develop a theory of modal pricing and output determination using the dominant firm price leadership model; and 2) estimate parameters of the model in the case of eastbound wheat transport from North Dakota.

II. Modal Market Share

Only two modes, truck and rail, are available to move grain and oilseed produced in North Dakota to first market, or some transsshipment point. The market share that each mode captures depends on a number of factors including service, price, buyers and sellers preference, type of market (domestic or export), proportional rates, backhaul opportunities, etc. The split between truck and rail for hard red spring wheat and durum wheat vary from year to year between commodities and between destinations as a result of these factors.

Trucks have captured a significant share of the hard red spring wheat movement to Minneapolis since 1972-73 when they accounted for only 24 percent of the movement (Table 1). Since then they have moved as much as 56 percent of the spring wheat, 1978-79, and continue to account for forty-some percent of the movement. The increase in percent of market share by trucks has not necessarily resulted in an increased absolute volume. Trucks typically have hauled an average of 14.7 million bushels varying from a low of 10 million to a high of 21.5 million in the last eleven years. Railroads, on the other hand, have suffered some significant absolute reductions during certain years, such as 1978-79, during the middle of the "transportation capacity shortage" and 1980-81 when they handled 12.7 and 15.9 million bushels respectively.

TABLE 1. HARD RED SPRING WHEAT RAIL AND TRUCK MARKET SHARES FOR MOVEMENT FROM NORTH DAKOTA TO MINNEAPOLIS/ST. PAUL AND DULUTH/SUPERIOR.

Year	Minneapolis/St. Paul			Duluth/Superior		
	Total (000 bushels)	Percent Rail (%)	Percent Truck (%)	Total (000 bushels)	Percent Rail (%)	Percent Truck (%)
1972-73	60,963	76	24	95,959	84	16
1973-74	42,962	65	35	80,462	72	28
1974-75	35,485	72	28	54,419	81	19
1975-76	32,855	66	34	74,467	73	27
1976-77	38,230	58	42	53,419	70	30
1977-78	28,199	57	43	65,832	70	30
1978-79	28,846	44	56	108,717	59	41
1979-80	44,031	51	49	76,887	67	33
1980-81	27,981	57	43	62,608	71	29
1981-82	31,584	57	43	77,113	74	26
1982-83*	45,654	55	45	75,915	74	26
Average	37,886	61	39	75,072	72	28

Source: North Dakota Grain and Oilseed Transportation Statistics, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, selected issues.

*Preliminary.

The absolute volume of movement of hard red spring wheat to Duluth is much greater than that to Minneapolis and rails have dominated this movement both in terms of absolute volume and market share with the exception of a couple of years. The rails have accounted for seventy to eighty-four percent of the movement the past eleven years except for 1978-79 and 1979-80 when trucks captured forty-one and thirty-three percent of the market respectively. This occurred during the period of time when there was a significant transportation and throughput capacity shortage in the United States.

Durum movements to both Minneapolis and Duluth have been dominated by the rail mode. Rails have maintained between 79 and 95 percent of the market share into both markets during the past eleven years (Table 2). This is probably a result of buyer preference. The reason for this conclusion is that hard red spring wheat and durum have identical rates, rail and truck transportation characteristics, production locations and market destinations. However, even though the transportation factors are exactly the same, the truck/rail market shares are significantly different for the two classes of wheat.

III. Rail Pricing Practices

Railroads have adjusted their rates on wheat from as early as 1960. Prior to 1960 the rates on all grain to Minneapolis and Duluth, except flaxseed which was slightly higher, were exactly the same. The rate adjustments which were made between 1960 and 1984 were directed at the hard red spring wheat movement, although durum took the same rate as hard red spring. Thus, durum essentially had a free ride and experienced rate reductions even though the railroads dominated the movement to Minneapolis and Duluth (Table 2). One possible reason for this is that both hard red spring and durum and other wheats are all designated under one STCC code. The railroads have never differentiated rates by type of wheat.

TABLE 2. DURUM WHEAT TRUCK AND RAIL MARKET SHARES FOR MOVEMENTS FROM NORTH DAKOTA TO MINNEAPOLIS/ST. PAUL AND DULUTH/SUPERIOR.

Year	Minneapolis/St. Paul			Duluth/Superior		
	Percent Rail (%)	Percent Truck (%)	Total Movement (000 bu.)	Percent Rail (%)	Percent Truck (%)	Total Movement (000 bu.)
1972-73	94	6	17,472	86	14	58,343
1973-74	91	9	14,145	89	11	37,686
1974-75	95	5	19,455	88	12	40,728
1975-76	86	14	14,905	83	17	51,553
1976-77	86	14	17,024	84	16	35,537
1977-78	88	12	16,478	85	15	61,990
1978-79	85	15	18,797	79	21	60,973
1979-80	81	19	26,712	84	16	57,379
1980-81	90	10	15,046	88	12	38,502
1981-82	86	14	19,768	89	11	49,242
1982-83*	89	11	19,936	86	14	41,059

Source: North Dakota Grain and Oilseed Transportation Statistics, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, North Dakota, selected issues.

*Preliminary

Truck competition, particularly small firms primarily devoted to hauling exempt commodities, provided the impetus for railroads to adjust their rates downward on wheat to Minneapolis and Duluth. Diversion of traffic started to take place as early as the mid-fifties when the exempt carrier moved 3.5 percent of the wheat. Since that time railroads have been cognizant of this competitive factor and have made rate adjustments to meet it.

Rate adjustments were made equally for the Minneapolis and Duluth markets even though there were and are differences in the truck competition into the two markets. Both Minneapolis and Duluth were equalized in 1936 and the rates on wheat, with the exception of a small portion of the state, have been equal to the two destinations.

The Minneapolis market has been subjected to more intense truck competition on a market share basis than has Duluth. During the last eleven years, trucks averaged 39 percent of the market to Minneapolis and 28 percent of the Duluth market (Table 1). One of the reasons for the larger truck market share into Minneapolis is the greater potential for backhaul opportunities. The greater the percentage of backhaul the more difficult it becomes for railroads to price competitively with trucks.

Early general pricing adjustments in rail wheat rates to the east took place in 1960, 1963 and 1971. These reductions were a direct result of motor carrier competition which had captured 15, 17.3 and 39.3 percent of the market in 1958, 1963 and 1971 respectively. The truck market share declined after the 1971 reduction to 34 percent in 1971-72 and 19 percent in 1972-73. However, truck share began to increase again in 1973-74. Trucks continued to increase their market share, with the exception of one year, 1974-75, until they had 56 percent and 41 percent of the market in 1978-79 for Minneapolis and Duluth respectively. The railroads reduced rates in the eastern part of the state in 1977 to counter the developing truck competition but took no further rate action until 1981 when they introduced multiple car rates eastbound.

Although trucks were increasing their market share in the latter part of the 1970's, there was really no reason for the railroads to reduce rates because of the extreme shortage of transportation capacity which lasted from October of 1977 until January of 1980. During this period railroads operating in North Dakota were doing so at maximum capacity. All of the grain hauling equipment and motive power were being fully utilized. Thus, a rate reduction at this time would not have resulted in increased market share but only reduced revenue.

As soon as the capacity shortage eased the railroads introduced temporary reductions in the spring of 1980 in an effort to utilize idled equipment and capacity. This was done prior to the passage of the Staggers Act. Both railroads operating in North Dakota, the Burlington Northern and Soo Line, offered special reduced rates on wheat known as the spring shoppers special. These rates were temporary in nature and were eventually canceled.

In July of 1981, the railroads introduced multiple car rates on wheat to Duluth and Minneapolis which were significantly lower than the existing single car rates. There were at least two reasons for introducing multiple car rates, one was to gain operating efficiencies, the other was the continued truck competition. After the multiple car rates were introduced, the single car rates were reduced and multiple car rates were also reduced in what appeared to be price competition between railroads. However, the resulting lowered rates were developed primarily to meet continued truck competition. The reduced rates have been effective in diverting traffic away from the truck mode. Railroads have increased their market share to 74 percent to Duluth and 55-57 percent into Minneapolis.

IV. Theoretical Model[1]

The theory of the firm under dominant firm price leadership is used in this study to explain factors affecting modal demands, prices (or rates),

[1]Many of the recent studies in transportation demand analysis have used functional specifications based on the theory of derived demand and duality. Examples include studies by Friedlander and Spady (1980), Oum (1978 and 1979), and Wilson (1980). See Wilson (1980) for a review of these and other approaches to demand analysis in transportation.

and output. The structure of the transportation industry for many movements and commodities is characteristic of the assumptions underlying the dominant firm price leadership model. Scherer (1980) and Worcester describe a complete specification of the theory. The model provides a deterministic solution, at least in the short-run, to price and output in an industry with a dominant firm and many small competitors, referred to as the competitive fringe.

The dominant firm price leadership model is adapted in this study to explain modal pricing and output determination, i.e., as opposed to explaining firm behavior, the model is used to explain modal behavior. In North Dakota there are two major railroads shipping grain to the principal markets of Minneapolis and Duluth and in most cases their combined market share exceeds 50 percent. Consequently, the railroads are viewed as the dominant mode. Pricing decisions by the two railroads are conditioned by an implicit objective of joint profit maximization. Historically, rate changes have been facilitated through their rate bureau. Recent legislation has severely restricted the activity of rate bureaus and has prevented the railroads from explicitly colluding on price decisions. Nevertheless, from an intermodal competition perspective, the railroads operating under the assumption of implicit joint profit maximization can be treated as the price leader.

Modal rates are viewed as endogenous in this model as opposed to being determined by the regulatory process. Rail rates have always had a certain degree of flexibility and have responded to fundamental market conditions (e.g., changes in demand, equipment shortages, etc.). Railroads have always had the regulatory flexibility to reduce rates. Increases in rail rates have been less flexible because of the regulatory mechanism. As discussed above, during the time period of this study there were many rate changes, both increases and decreases, but rarely were rate increases not approved. Thus, the regulatory mechanism prior to the Staggers Act could be treated as a facilitator of rate changes, resulting in "sticky" rates, rather than a rate-setting agent.

The competitive fringe is comprised of from 600 to 1,000 exempt motor carrier firms, most of which operate with less than five tractors (Wilson, Griffin, and Casavant). Each of these is individually too small relative to the railroads to exert a perceptible influence on price through their output decisions. Consequently, firms in the competitive fringe take the railroad price as given.[2] A slight price differential between truck and rail may exist because the services provided by each mode is slightly differentiated. Nevertheless, the rate level is determined by the railroads and truckers acting individually. Take this rate as given.

The dominant firm price leadership model provides a deterministic solution for modal prices and output. Equilibrium results are shown in Figure 1. Railroads choose profit maximizing levels of output by incorporating the supply function of the competitive fringe in their decision framework. More specifically, the effective demand curve for the railroads, ABD_A is the difference between the aggregate demand curve for transportation, D_A, and the supply function of the competitive fringe S_{TR}. The marginal revenue function for the railroads is MR_R. Profit maximizing price and output, P* and Q_{RR} for the railroads is found by equating their marginal revenue and marginal cost, MC_R, functions. Firms in the competitive fringe take the dominant mode price as given and adjust output to where price equals their short-run marginal cost. In equilibrium, without heterogeneous services, prices charged by the two modes are the same, though being set by the railroads; the demand function for the trucks is perfectly elastic at P* and their output is determined by their supply function; the rail demand function

[2]Cosgriff provides evidence on the price-taking behavior of trucking firms.

determines the output provided by the railroads; and aggregate demand is the summation of individual modal demands.

Figure 1

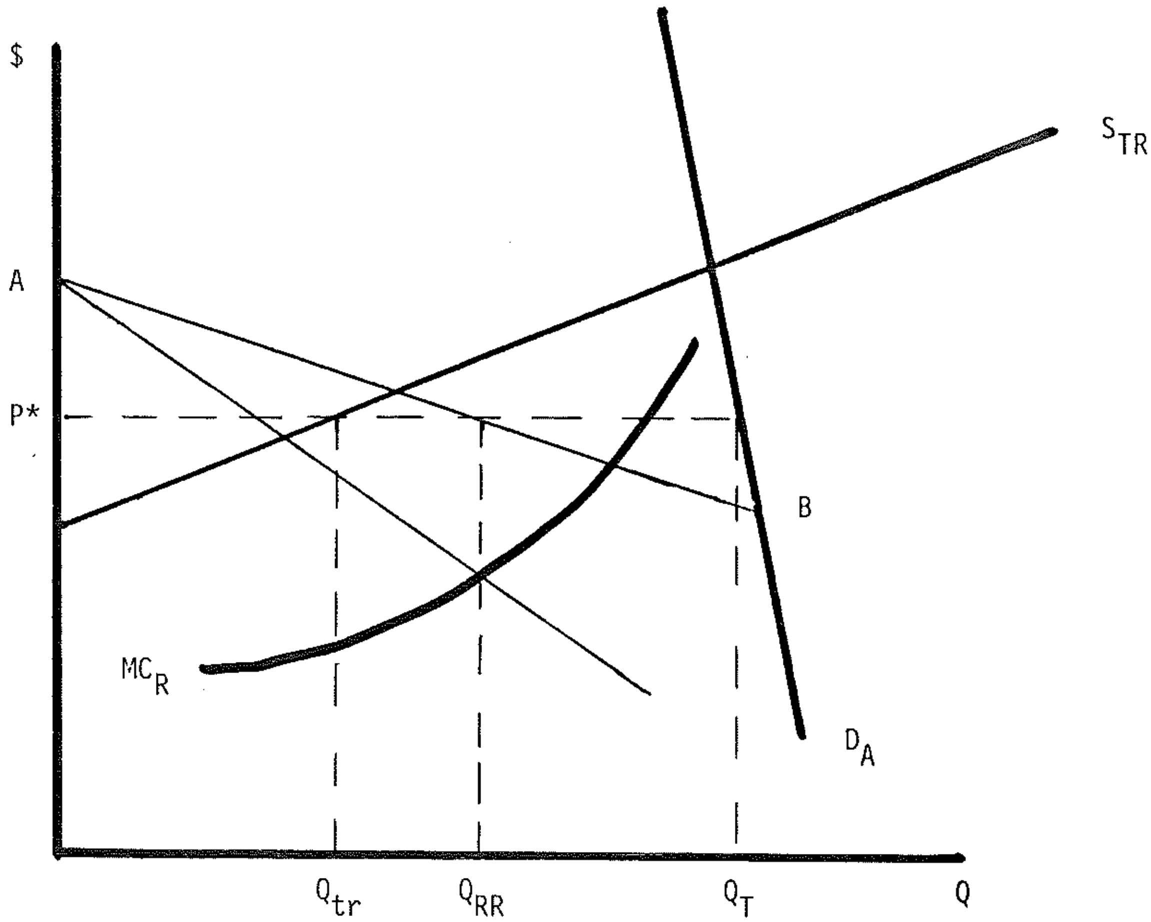

Figure 1. Price and Output Determination Under Dominant Firm Price Leadership

A very important factor affecting intermodal competition is the slope of the supply function for the competitive fringe. A very elastic (inelastic) supply function for motor carriers results in a relatively elastic (inelastic) effective demand function for the rail mode. Thus, the dominant firm's market power is limited by the slope of the supply function of the competitive fringe, and therefore, the technology of the competitive fringe. In other words, market dominance, or the ability to set prices, is dependent on the slope of the trucker's supply function.

Many interesting comparative static results can be derived from the above model, some of which are described below. Changes in aggregate demand result in changes in the effective demand for the rail mode; pressure for changes in rail rates; and corresponding changes in truck rates and equilibrium modal outputs. The supply function of the competitive fringe shifts with changes in input prices and technology and results in changes in the effective demand function for the rail mode; changes in modal rates; and changes in equilibrium modal outputs. The availability of rail cars can be treated as service quality variables and acts as a shifter of the rail demand function.[3] A rail car shortage, for example, would result in a leftward shift in the rail demand function, and an increase in the demand function for the competitive fringe, with corresponding changes in equilibrium modal rates and output. If the car shortage is severe enough truck rates would have a premium relative to rail rates.[4]

V. Empirical Model

A dynamic econometric model of dominant mode price leadership was specified and estimated in the case of eastbound wheat shipments from North Dakota. Monthly time series data were used and are described in greater detail below. The general model included three behavioral equations and one equilibrium condition. Functions were specified for truck supply, rail demand, and heterogeneity in modal rates. The availability of rail cars is included on the model both as a shifter in the rail demand function and as a hedonic variable explaining price variability.

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[3]As an alternative, a shortage of rail cars could be treated as the perfectly inelastic portion of MC_R.

[4]Alternatively, rail car shortages could be interpreted as an increasing inelastic portion of the railroads' marginal cost function. The comparative static results are similar to those discussed here, and are developed fully in Wilson (July 1984).

Following is the model specification:

Truck Supply:	$Q_{T_t} = f(P_{T_t}, P_{T_{t-2}}, F_t, I_t, T_t) + e_{t1}$	(1)
Rail Demand:	$Q_{r_t} = f(P_{r_t}, C_t, Q_t) + e_{t2}$	(2)
Price Heterogeneity:	$P_{T_2} = f(P_{r_t}, Q_t, P_{w_t}, C_t, U) + e_{t3}$	(3)
Equilibrium:	$Q = Q_r + Q_T$	

where:

Q_r and Q_t are shipments by rail and truck, respectively;

P_r and P_t are rates for rail and truck, respectively;

Q is aggregate shipments;

F is an index of fuel costs;

I is an index of motor carrier costs;

T is a trend variable representing technology;

C is an index of rail car availability;

P_w is the wheat price at the terminal market;

U is a binary variable equal to one during the period in which multiple-car rail rates were used; and

e_{ti} are error terms.

The truck supply response function was specified as a finite distributed lag model with instantaneous adjustment. An alternative would be to specify a partial adjustment model but because of ease of entry and exit in the industry, as well as between movements, the adjustment process was assumed instantaneous. F and I represent prices of major inputs and T is a proxy for technological change throughout the period of study. In this case, increases in fuel efficiency in the truck industry were observed. The rail demand function is the difference between aggregate demand and the truck supply function as specified in the dominant firm price leadership model. As such, the rail demand function is static and C and Q are shifters. The price heterogeneity equation was included to explain the relationship between prices of the two modes. Q and P_W are proxy variables reflecting the potential inherent advantage of trucks in turnaround time. High grain prices and/or large aggregate movements would result in a premium for truck service over rail due to the advantage of faster turnaround. Rail car availability, C, is a service quality variable for the rail mode, and affects truck demand and the premium or discount for trucks over rails. U reflects the fundamental change in pricing due to the introduction of multiple-car rail rates. The effect of U was also included as a shifter in the rail demand function but was insignificant in all cases.[5]

Minneapolis and Duluth are two eastern destinations for wheat shipped from North Dakota. Rather than aggregate across these movements, they were treated separately, but simultaneously, to preserve any anomalies which may exist. Separate equations for each destination were specified resulting in six behavioral equations and two equilibrium conditions.

Each of the equations in the system is overidentified. In addition, it is recognized that equations 1 through 3 are correlated with one another for several reasons: first, shipments to both destinations compete for the same transportation capacity, and second, shipments diverted from one mode or destination would go to the other. Consequently, three-stage least squares (3SLS) is the appropriate estimation technique. However, because of autocorrelated residuals in and/or across equations, 3SLS estimates is not efficient. To correct this, the following estimation procedure is used: 1) use two-stage least squares (2SLS) to estimate the autocorrelation

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[5]Aggregate demand, Q, is treated as exogenous and perfectly inelastic to transport prices in the above model. The model was also estimated where Q was endogenous but the results were not significantly different than those presented.

coefficient for residuals in each equation, 2) transform data with the estimated autocorrelation coefficient using general differencing method, and 3) the resulting equations are estimated using generalized least squares. This estimation procedure is similar to autoregressive three-stage least squares used by Wang and Fuller and provides asymptotically consistent and efficient estimates.

VI. Data Sources

The time period of the study was from July 1973 to December 1982. Data necessary for the analysis included shipments and price (or rate), as well as other data, for each mode. Shipment data were those collected by the North Dakota Public Service Commission and represent grain shipments from all licensed warehouses, and are reported in bushels by month, origin, mode, type of grain, and destination. Rail rates were taken from the Minneapolis Grain Exchange Rate Book. A central point was chosen for each of the nine crop reporting districts in North Dakota and monthly rates were collected for each of the grains to each of the destinations. The rate from each origin was weighted by the proportion of total movements shipped from that origin relative to the state. In July 1981, rates were published for 26-car multiple origin, 26-car single origin, and 52-car trains. After discussions with trade representatives, it was concluded that the 26-car single origin rate was most appropriate and was used throughout the remainder of the time period. Nine elevators were identified in North Dakota which have maintained records on rates paid for truck transportation for the duration of the study period. These points were scattered throughout eastern and central portions of the state. Monthly rates from each shipping point to each destination were collected. An average rate was calculated across these origins and used to represent the time series of truck rates in North Dakota.

The fuel price index is for Refined Petroleum Products. The motor carrier cost index is that for motor carrier transportation equipment. Both are taken from the Survey of Current Business. The index of rail car availability was derived from monthly surplus/shortage figures provided by one of the two railroads operating in the state. The grain price used in the price heterogeneity equation is for hard red spring wheat, 14 percent protein, at Duluth. All cost indexes and prices were deflated by the wholesale price index.

VII. Empirical Results

The six equation system was estimated simultaneously and the results are shown in Table 3. Separate equations are shown for each destination. Values of the coefficients and significance levels vary across destinations but the signs are the same and as expected in all cases.

The value of the coefficient for P_{T_t} is the slope of the supply function for the trucking industry and is significant in each case. The negative coefficient for $P_{T_{t-2}}$ indicates the dynamic nature of supply response in the trucking industry. The effect of changes in price indexes of major inputs each have a negative effect on supply. The trend variable is a proxy for increases in fuel efficiency throughout the time period of the study, but is only significant in the case of Minneapolis shipments. Rail demand is inversely related to its own price and is only significant for shipments to Minneapolis. The index of rail car availability, C, reflects service quality and the positive and significant value of its estimated coefficients indicates it has the effect of shifting the rail demand function in the same direction as changes in C. Shifts in the aggregate demand function for transportation are represented by Q in the rail demand function. Signs of the coefficients in the truck price heterogeneity equation have the expected signs and all are significant with the exception of those for grain prices, P_w. The coefficients indicate that truck rates increase relative to rail rates with either increases in the level of aggregate demand, and/or decrease in the availability of rail cars. The value of the coefficient for the binary variable for multiple-car rates accounts for the price spread which has developed between the modes since the introduction of 26-car multiple origin rates.

TABLE 3. SYSTEM PARAMETER ESTIMATE FOR MODAL COMPETITION IN EASTBOUND GRAIN TRANSPORT FROM NORTH DAKOTA (ASYMPTOTIC T-RATIOS IN PARENTHESES).

I. Truck Supply Response

	Int.	P_{T_t}	$P_{T_{t-2}}$	F	I	T	p[1]
Duluth	-3449 (1.18)	416* (3.77)	-81* (1.83)	-13* (2.15)	-27.6 (1.24)	7.6 (0.76)	.5606
Minneapolis	10.44 (0.01)	152* (2.61)	-48 (1.61)	-4.15 (1.27)	-18.5* (1.77)	9.06* (2.0)	.3444

II. Rail Demand

	Int.	P_r	Q	C	p
Duluth	-1390 (1.46)	-30 (1.01)	0.91* (70.97)	0.09* (1.86)	.5819
Minneapolis	69.7 (0.15)	-24* (1.68)	0.82* (46.91)	0.002 (0.09)	.5153

III. Price Heterogeneity

	Int.	P_r	Q	P_w	C	U	p
Duluth	13.86* (3.88)	0.48* (5.52)	0.00008* (4.22)	0.009 (0.92)	-0.0003* (2.83)	2.97* (2.83)	.7553
Minneapolis	9.85* (3.05)	0.52* (6.89)	0.0002* (4.86)	0.001 (1.23)	-0.0001 (1.32)	1.89* (2.15)	.6861

*Indicates asymptotically efficient at the 10 percent level.

[1]p is the value of the first order autocorrelation used for adjusting the data using the general differencing technique.

Elasticities of the major variables are calculated at their mean levels and are shown in Table 4. In the dominant firm price leadership model of intermodal competition, the slope of the supply function of the competitive fringe is a very critical factor explaining pricing and competitive behavior. The price elasticities of supply for the trucking industry are 4.93 and 3.01, respectively, for Duluth and Minneapolis shipments. Major variables which shift the truck supply function are prices of major inputs, fuel, and transportation equipment. Increases in either result in leftward shifts in the supply function. Values of the elasticities indicate that supply response is relatively more elastic with respect to truck rates and fuel in the case of Duluth versus Minneapolis shipments. This characteristic behavior of the supply response function is likely conditioned by the relatively fewer backhaul opportunities in the case of Duluth versus Minneapolis. As a result, truck shipments to Minneapolis are relatively less responsive to these variables.

TABLE 4. ELASTICITY ESTIMATES* OF MODAL COMPETITION IN EASTBOUND GRAIN TRANSPORTATION FROM NORTH DAKOTA.

I. Truck Supply Response

	Truck Rate	Motor Carrier Cost Index	Fuel
Duluth	4.93	-0.89	-0.83
Minneapolis	3.01	-1.02	0.26

II. Rail Demand

	Rail Rate	Rail Car Availability	Aggregate Demand
Duluth	-0.12	0.12	1.20
Minneapolis	-0.25	0.01	1.20

III. Price Heterogeneity

	Rail Rate	Rail Car Availability	Aggregate Demand	Grain Price
Duluth	0.52	-0.11	0.03	0.06
Minneapolis	0.58	-0.04	0.03	0.06

*Calculated at mean values of the variables.

The rail rate elasticity of demand is inelastic for shipments to both destinations. In the dominant firm price leadership model the slope of the rail demand function is determined by the difference in slopes of the aggregate demand and competitive fringe supply functions. The elasticity is determined by the slope of the function and the rate level. The relatively low rail rate elasticities in this study can be explained by two factors. First, the aggregate transportation demand function is assumed perfectly inelastic to transport rates and experimentation to endogenize this effect yielded illogical results. Consequently, the rail demand elasticity is low despite the relatively elastic supply functions for the competitive fringe. Second, rail rates must be at a low level relative to the fundamentals of the market to be operating in the inelastic portion of their demand function.

VIII. Conclusions

The dominant firm price leadership model is appropriate for analyzing intermodal competition in transportation for many agricultural commodities. The model assumes one mode dominates and sets prices subject to the supply function of the competitive fringe and aggregate demand. In particular, the effective demand for the dominant mode is the difference between the aggregate demand and supply function of the competitive fringe. The competitive fringe takes the rate as established by the dominant mode and produces where prices and short run marginal costs are equal. A critical factor in the intermodal competitive behavior is the slope of the supply function for the competitive fringe. A more elastic supply function results in a more elastic rail demand function, and vice versa. This is offset by the slope of the aggregate demand function. In this context the model could be used to explain the concept of market dominance which is currently an important regulatory issue in search of an economic interpretation. The results, however, are dependent on the fundamentals of the market which are potentially unique for particular movements.

An econometric model of dominant mode price leadership was specified and estimated in the case of eastbound wheat shipments from North Dakota. Results indicated that the competitive fringe supply functions were relatively elastic and input costs such as fuel and equipment are important factors. The railroads are pricing in the inelastic portion of their effective demand functions. This is due to the rates which are low relative to market conditions, and the aggregate demand function which is perfectly inelastic with respect to transport rates. Intermodal price differentials evolve in response to the level of aggregate demand, the availability of rail cars, and the recent introduction of multiple car rail rates.

References

Beilock, R. and J. S. Shoukwiler. "Modeling Weekly Truck Rates for Perishables." Southern Journal of Agricultural Economics, (July 1983): 83-87.

Binkley, J. and B. Harrar. "Major Determinants of Ocean Freight Rates for Grain: An Economic Analysis." American Journal of Agricultural Economics, 63 (1982): 47-57.

Cosgriff, J. The Cost and Operation of Exempt Motor Carriers in North Dakota. Upper Great Plains Transportation Institute, Rpt. No. 33. Fargo: North Dakota State University, 1978.

Friedlander, A. F. and R. H. Spady. "A Derived Demand Function for Freight Transportation." Review of Economics and Statistics, 62, August (1980): 432-441.

Miklius, W., K. Casavant, and P. Garrod. "Estimation of Demand for Transportation of Agricultural Commodities." American Journal of Agricultural Economics, 58 (1976): 217-23.

Oum, T. H. "A Cross Sectional Study of Freight Transport Demand and Rail Truck Competition in Canada." Bell Journal of Economics, 10, Autumn (1979): 463-82.

Oum, T. H. "Derived Demand for Freight Transport and Intra-Modal Competition in Canada." Journal of Transport Economics and Policy, 12, January (1978): 149-68.

Scherer, F. M. Industrial Market Structure and Economic Performance. Chicago: Rand McNally, 1980.

Wang, G. and W. A. Fuller. "Estimates for a Simultaneous Equation Model With Lagged Endogenous Variables and Autocorrelated Errors." Communications in Statistics, 11 (1982).

Wilson, William. Estimation of Demand Elasticities for Transportation Modes in Grain Transportation. Agricultural Economics Report No. 159. Fargo: North Dakota State University, Department of Agricultural Economics, 1982.

Wilson, W., G. Griffin, and K. Casavant. Costs and Characteristics of Operating Interstate Motor Carriers of Grain in North Dakota. Upper Great Plains Transportation Institute, Rpt. No. 46, Fargo: North Dakota State University, September 1982.

Wilson, William. "Modal Shares, Car Shortages, and Multiple-Car Rates in Grain Transportation." North Central Journal of Agricultural Economics, 6 (July 1984): Forthcoming.

Worcester, D. A. "Why Dominant Firms Decline." Journal of Political Economy, 65 (1957): 338-47.