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AN EXAMINATION OF ILLINOIS RIVER GRAIN BARGE RATES

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ABSTRACT

On August 1, 1978, the Merchants Exchange of St. Louis initiated a daily barge freight call session in which contracts for immediate or future delivery of barge services are established. An analysis of the Illinois River barge rates, established at the Merchants Exchange, indicates that barge rates respond to market conditions in both the transportation and grain industries. In particular, excess barge equipment, resulting from a significant expansion in barges during the late 1970's, accompanied by a diminished rate of export demand and transport equipment utilization have contributed to a decline in barge rates since 1979. Of importance to Illinois grain producers is that 70% of grain exports originating in Illinois traverse the inland waterways.

INTRODUCTION

In 1982 the value of Illinois feed grains and soybeans entering export channels totaled over $2.8 billion. This figure, representing about 18 percent of the value of U.S. exports in these commodities, confers upon Illinois the status of being the leading feed grain and soybean exporting state (Ill. Agr. Stat. 1983). Illinois producers are aware of the benefits arising from this unique position. In 1982 Illinois reported an average annual price received for corn of $2.70 per bushel, compared to $2.65 in Iowa and $2.55 in Indiana, Minnesota and Ohio (USDA, Agricultural Prices). A similar differential existed in the soybean market. Illinois soybean prices averaged 15 cents per bushel over soybean prices received in other midwestern states. This advantage, if it is to be maintained, depends upon the strength of export demand and developments in the transportation sector. Of particular importance to Illinois producers are developments in the barge industry. Over 75 percent of grain and soybean exports originating in Illinois traverse the inland waterways. This study considers the factors contributing to the variability and decline of barge rates established for grain shipments originating on the Illinois River.

MATERIALS AND METHODS

On August 1, 1978, the Merchant's Exchange of St. Louis initiated a daily barge freight call session (St. Louis Market Record) in which contracts for the immediate or future delivery of barge services are established. The call session was conceived as a means to create a competitive element in the movement of export grain to New Orleans (Amer. Shipper). Contracts are established for the Illinois; Upper, Middle, and Lower Mississippi; and Ohio Rivers.

Barge rates established during the daily call sessions have been monitored since the sessions were initiated. As illustrated in Figure 1, there is sufficient variability in Illinois River barge rates to warrant this investigation. For example, during the March, 1979 to February, 1984 period, barge rates established for Illinois River shipment ranged from 107 percent (May, 1983) to 291 percent (November, 1980) of the benchmark tariff for Illinois River origins.[1]. At Peoria, Illinois this range represented a swing of about $8.85 per ton shipped. In addition, during a navigation season, defined as March to February, barge rates vary according to a fairly well-defined seasonal pattern. For the years depicted in Figure 1, rates gradually decline from the level established at the opening of the navigation season, but sharply increase at harvest. Also note the downward trend in the level of rates since 1980.

This variation suggests that barge rates respond to market conditions in both the transportation and grain industries. Intuitively, if the demand for export grain is high or there exists an excess demand for transportation equipment, barge rates would increase to ration the available supply of barge equipment. On the other hand, if export demand is low or there exists an excess supply of transportation equipment, barge rates would decline to encourage greater use of barge services. The minimum level to which barge rates would decline is the variable cost of providing barge services. This and other relationships may be expressed for descriptive purposes as follows:

(1) $BR_t = f(X_t, BF_t, EQU_t, SF_t, RCP_t, GOV_t)$

where BR_t is a weighted average of barge rates established by trade for shipments originating on the Illinois River in month t, X_t indicates current grain export volume, BF_t is the current size of the covered hopper barge fleet, EQU_t is an indicator of grain transportation equipment utilization, SF_t represents supply factors in the grain originating region, RCP_t represents competitive export rail rates, and GOV_t represents any U.S. governmental policy that may impact grain flows. Table 1 presents the types, sources and coding of the data available to quantify the relationship implied by equation 1. The first five navigation seasons (March, 1979-February, 1984) in which the St. Louis Merchants Exchange barge freight call session operated serve as the time period for analysis.

RESULTS AND DISCUSSION

Table 2 presents the estimated simple correlation coefficients for the variables considered in this study. The magnitude and sign of these coefficients indicate the strength and direction of the relationship between the independent variables and Illinois River barge rates and between the independent variables with each other.

[1]Barge rates are quoted at a premium or discount to a standardized tariff. Bargeload Bulk Grain Tariff #7, cancelled in 1976, has remained the benchmark for barge rates. Rates in this tariff are termed equal to 100 percent of tariff. At Peoria, 100 percent of tariff equals $4.81 per ton.

The small coefficient between total barge shipments of grain (TB) and Illinois River barge rates (BR) is unexpected. Barge companies have traditionally operated on more than one river segment and barge equipment (with the exception of the higher horsepower towboats) may service origins on any river segment. Therefore, it would be expected that the increased usage of barge equipment upon the entire Mississippi River System — from 1.5 billion bushels in 1979 to about 2.2 billion bushels in 1983 — would impact Illinois River barge rates to a greater degree. One explanation for the minor relationship between barge rates and the change in barge shipments is the offsetting and depressing impact on barge rates of current barge capacity (BF). The much stronger relationship between barge rates and the capacity of the barge fleet ($r = -0.59$) suggests that barge capacity is a definite cause of the general decline in the level of barge rates. In retrospect, the response of the barge industry to the dramatic growth in grain exports during the 1970's was to overinvest in grain barge equipment. In the 1980's export growth slowed considerably. Excess barge capacity has results. The depressing impact of this excess capacity is especially evident during the fourth navigation season (March 1982-February 1983). During this period grain barge shipments totaled 2.2 billion bushels — representing an 18 percent increase over the previous season — yet the average barge rate declined by 15 percent from the previous season.

The positive correlation exhibited between barge rates and grain equipment utilization (XRU, RL) and grain exports (X) suggests that Illinois barge rates respond in a positive manner to the variation in transport service requirements of grain producers and handlers. Furthermore, the positive correlation between these factors and barge rates tends to reinforce the conclusion drawn concerning barge fleet size, that is, given a barge capacity more in line with the barge service needs of grain handlers, barge rates would be more responsive to changes in those needs.

The Gulf basis (BAS) is an indicator of corn export demand (Baumel) or alternatively, the availability of corn at Gulf ports in relation to demand. The Gulf basis, usually positive, widens given increased export demand or decreased availability of corn at the Gulf ports. The negative relationship between the Gulf basis and barge rates is confusing if the basis reflects export demand. A positive sign would be expected. However, if the Gulf basis reflects grain availability at Gulf ports, a wider basis during the summer months when inland stocks are drawn down, and hence the demand for transportation is diminished, would explain the negative relationship.

The small relationship implied between competitive rail rates (RCP) and barge rates should be interpreted cautiously. During the period studied, the average navigation season barge rates declined from 230% to 107%, rail rates, however, were subject to legislated increases until 1980. Since 1982, both barge rates and the rail rates utilized in this study have declined significantly. Between 1982 and 1984 the rail rates declined by about 34 percent and the average barge rates by 46 percent. Secondly, the rates as included in this study do not include rail or barge shipper margins. The changes in total rate — rail or barge rate plus margin — may better reflect competition between the two modes.

The relationship implied between barge rates and Illinois corn production (PROD) is both smaller than expected and of the wrong sign. An increase in production should cause an increase in demand for barge transportation, hence an increase in rates. The correlation coefficient between PROD and BR in Table 2 implies the

opposite. One key factor to consider, however, is that changes in production may impact barge rates to a more significant degree during harvest. This hypothesis is considered in the multiple regression analysis which follows.

Table 3 presents three separate multiple regression equations which measure the impact of market factors on barge rates. With the exception of PRH_t, all independent variables have been defined. PRH_t is a combination of the production data and a dummy variable configuration equal to one in October and November and zero otherwise. The purpose if PRH_t is to capture the influence of the peak harvest demands on barge transportation services. JAN80 and PIK are also dummy variables equal to one during January, 1980 (corresponds to the announcement of the USSR grain embargo) and October 1983 through February 1984, respectively.

In all three equations the signs of the beta coefficients correspond to the signs implied in the matrix of simple correlation coefficients. The following conclusions may be drawn based upon the three equations:

- Excess capacity in the barge industry is a definite cause of the decline in barge rates. The negative coefficient attached to BF_t is significant in all three equations.
- The relationship between the Gulf basis and barge rates is similarly significant and negative. This suggests that as the Gulf basis widens barge rates decline. Indeed, this is the case, a simple average of the Gulf basis, by month, over the five year period indicates that the Gulf basis equals 11 cents per bushel in November and gradually increases to 18 cents by June. A wide basis during the summer months when inland stocks are drawn down, and hence the demand for transportation is diminished, is consistent with lower barge rates.
- The announcement of the USSR grain embargo had an immediate, significant and short-term impact upon the level of barge rates. In fact, barge rates declined from 273% of tariff in December, 1979 to 163% in January 1980. January 1981 barge rates were 253% of tariff.
- The impact of the PIK program upon the level of barge rates is inconclusive. In equation (1) the coefficient attached to the PIK variable is significant at the 90% confidence level. However, the negative sign of the corn production variable and the low DW statistic suggest that the structure of the equation is questionable. In equation (2), PRH_t — harvest demands for transportation services — is substituted for $PROD_t$. The sign of PRH_t is positive, as expected. However, the relationship between PIK and barge rates is no longer significant, that is, PIK, unlike the grain embargo, had no significant impact upon the level of barge rates. The decline in barge rates that is noticeable during the PIK period is fully explained by the other variables included in equation (2).
- Equation (3), which includes export rail-car unloading instead of total rail-car loadings and export volume, performs best in estimating the level of barge rates. Serial correlation is diminished when compared to the specifications (1) and (2). The R^2 statistic is also improved.

SUMMARY

Between 1979 and 1984, barge rates for grain shipments originating on the Illinois River have declined from 230% to 107% of tariff. The major factor contributing to this decline is the excess capacity of barge equipment resulting from overexpansion of the barge industry in the 1970's. Although barge rates are posi-

tively related to the level of exports and grain equipment uilization, increases in these market factors will be insufficient to offset the depressing impact of excess barge capacity upon barge rates. At least in the short-term, Illinois grain producers and handlers will continue to benefit from depressed barge rates.

LITERATURE CITED

Baumel, C. Phillip. "Impact of Alternative User Fees on Agricultural Commodities Transported on the Inland Waterway System." Testimony to United States Senate Committee on Environment and Public Works. August 23, 1983.

Commodity Research Bureau, Inc. *Commodity Year Book*. New York, NY: Commodity Research Bureau Inc. 1979-1984.

Illinois Cooperative Crop Reporting Service. *Illinois Agricultural Statistics: Annual Summary, 1983*. Illinois Department of Agriculture. 1984.

"St. Louis Grain Merchants Create Bid Competition on Barge Delivery of Export Grain to New Orleans." *American Shipper*, September, 1978.

"St. Louis Market Record." *Barge Freight Rate Call Session*. St. Louis: Merchants Exchange of St. Louis, 1979-1984.

U.S. Department of Agriculture. Agricultural Marketing Service. Grain Division. *Grain and Feed Market News*. Independence, MO: Government Printing Office, various issues.

_____. Statistical Reporting Service. Crop Reporting Board. *Agricultural Prices*. Washington, D.C.: Government Printing Office, various issues.

Table 1. Market Factors Upon Which the Level of Barge Rates Is Dependent and the Available Data to Quantify Market Factors

Market Factor	Available Data	Coding
Export Demand	Gulf basis[a, b, c]	(Bas)
	Grain exports[b]	(X)
Transportation Equipment Utilization and Capacity	Barge fleet size[d]	(FB)
	Grain barge shipments[b]	(TB)
	Export rail-car unloadings[e]	(XRU)
	Grain rail-car loadings[e]	(RL)
Rail Competition	115-car export rail rate from Central Illinois	(RCP)
Supply Factor	Illinois corn production[f]	(PROD)
Government Intervention	Embargo	(JAN80)
	PIK	(PIK)

[a]BAS = FOB New Orleans corn price minus nearby Chicago Board of Trade futures (Thursday observations averaged over month)
[b]Source: Grain and Feed Market News
[c]Source: Commodity Yearbook
[d]Source: Barge Industry Executives — typical life of barge equipment is 22 to 24 years, covers are removed at 17 years
[e]Source: American Association of Railroads
[f]Source: Illinois Agricultural Statistics

Table 2: Simple Correlation Statistics (r) Between Barge Rate Related Variables

	BR	BF	TB	X	BAS	XRU	RL	RR	PROD
BR	1.00								
BF	-0.59	1.00							
TB	-0.19	0.24	1.00						
X	0.59	-0.18	0.01	1.00					
BAS	-0.51	-0.02	0.14	-0.43	1.00				
XRU	0.60	-0.29	-0.43	0.60	-0.39	1.00			
RL	0.55	-0.53	0.18	0.26	-0.15	0.38	1.00		
RCP	-0.05	0.50	0.30	0.08	-0.44	-0.17	-0.20	1.00	
PROD	-0.13	-0.06	0.20	-0.04	0.10	-0.24	-0.14	0.21	1.00

Table 3. Multiple Regression Equations Explaining the Variation in Illinois River Barge Rates

Independent Variable	equation (1)	(2)	(3)
BF_t	-23.461	-26.291	-26.477
	(-5.6)[a]	(-6.6)	(-9.4)
BAS_t	-1.3107	-1.8458	-1.7489
	(-3.3)	(-5.9)	(-7.3)
XRU_t			1.11844
			(5.7)
RL_t	0.23404	0.20565	
	(1.9)	(1.8)	
X_t	0.33372	0.20144	
	(3.8)	(2.4)	
$PROD_t$	-0.585		
	(-2.3)		
PRH_t		0.02425	0.31591
		(3.5)	(5.8)
JAN80	-63.081	-77.126	-109.12
	(-2.3)	(-3.1)	(-5.2)
PIK	-47.153	-0.7626	
	(-1.9)	(-0.07)	
Intercept	334.108	340.151	398.556
	(4.8)	(5.3)	(12.5)
	R^2 = 0.79	R^2 = 0.81	R^2 = 0.86
	DW = 1.23	DW = 1.45	DW = 1.74

[a]The estimated significance of the beta coefficients, the student's t-ratio is in parenthesis. For 60 observations the critical t-values are 2.00 for 95% confidence and 1.67 at the 99% confidence level.

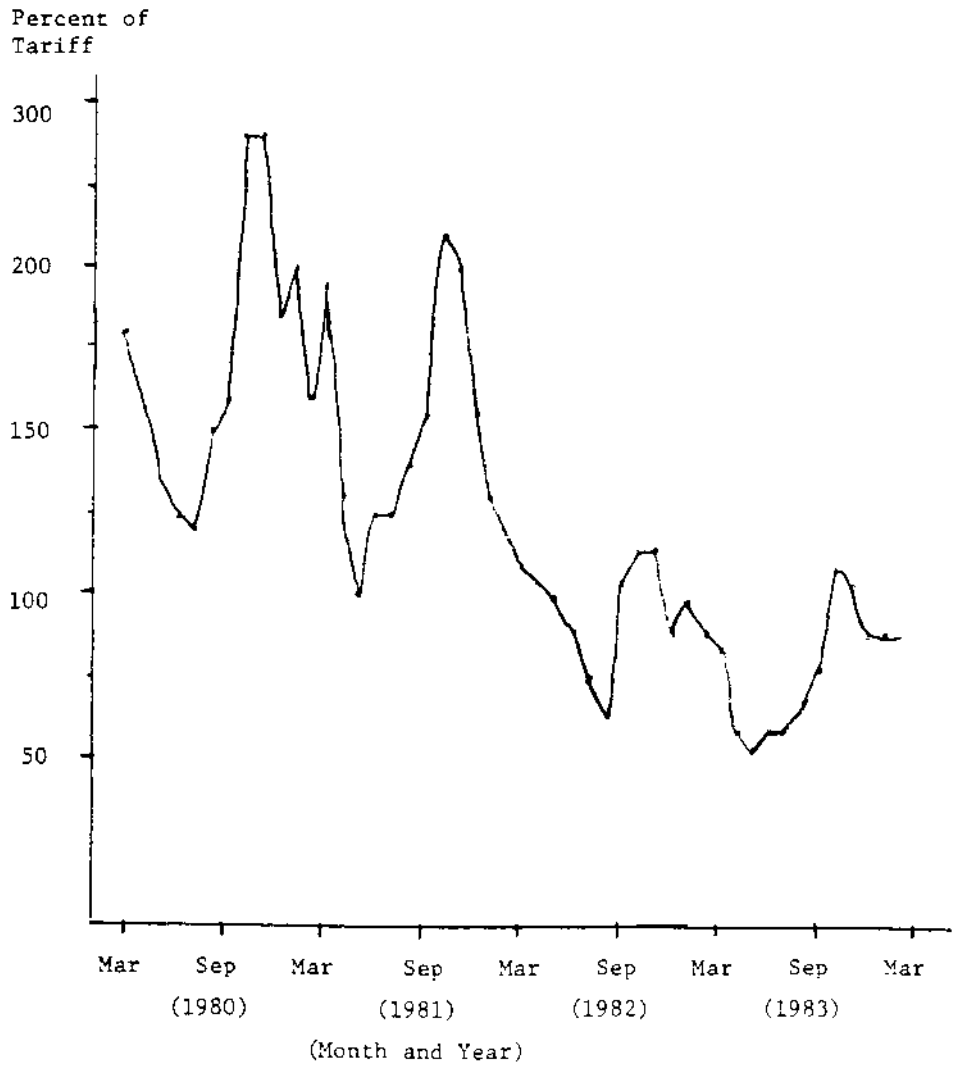

Fig. 1. Illinois River Grain Barge Rates as a Percent of Tariff, 1980-1983