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# Effect of Railroad Deregulation on Export - Grain Transportation Rate Structures

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# Effect of Railroad Deregulation on Export-Grain Transportation Rate Structures

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## Introduction

The trend toward federal deregulation of the nation's transportation sector has been viewed with concern by many in the agricultural community. Of great interest is the recent deregulation of the railroad industry (Staggers Rail Act) and its effect on the competitiveness of the transportation environment for bulk agricultural commodities.

The Staggers Rail Act of 1980 represents one of the most dramatic changes in federal policy toward railroads since the Interstate Commerce Act of 1887, the act responsible for creating the Interstate Commerce Commission (ICC). The Staggers Act is based on the premise that while the railroad industry once constituted a monopoly, requiring ICC regulation, this is no longer true (Keeler). It is held that competition is generally adequate to constrain any potential abuses by railroads. The act assumes that less regulation and more reliance on the marketplace will give rise to a more efficient, financially viable rail system.

Although the Staggers Act includes many provisions, some of its most extensive regulatory changes and controversial features relate to rates. The legislation allows carriers considerable flexibility in determining rates. Current regulation is designed to prevent rates from rising to monopoly levels for commodities of captive shippers and to limit rates from falling below variable costs. Maximum rates are identified through specified revenue to variable cost ratios but apply only if the railroad is earning an "adequate" return on investment (Keeler). In addition, independent railroad pricing has been encouraged by provisions that reduce the time required for a particular railroad's proposed rate adjustment to become effective and by requiring one objecting to a railroad's proposed rate to offer proof of its inappropriateness. Further, Section 208 of the Staggers Act permits carriers and shippers to enter into private contracts. Contracts generally commit the grain shipper to some minimum shipment size and volume while the railroad provides service at below tariff rates. Contracting allows railroads to offer shippers incentives to adopt practices and schedules that subsequently enhance railroad efficiency and, in so doing, permits the railroad to offer reduced rates to a particular shipper without fear of violating the historical statutes regarding personal price discrimination. An equally important feature of the new act reduces the freedom of carriers to collaborate on rates through rate bureaus. Rate bureaus are gov-

ernment-sanctioned associations that historically permitted carriers to collaborate on rates. With passage of the Staggers Act, only carriers involved in providing service on interline hauls may jointly set rates for that haul. Thus, the role of rate bureaus has been dramatically reduced.

Some agricultural interests question the workability of the competitive transportation environment, even with the precautionary provisions of the Staggers Act. They argue that some surplus-grain producing regions are served by few rail carriers and, in some cases, have limited alternatives to ship via competing modes. The Plains is often cited as an example; this region is served by a small number of competing rail firms, there is ineffective barge competition because of few navigable rivers, and since many of the Plains' grain markets are at extended distances, the motor vehicle's cost structure limits its effectiveness as a competitor (Fruin, Koo). Further, shippers in the South and Central Plains may be vulnerable because of their heavy dependence on a single market, the export market, and the one major transportation corridor (Plains-Gulf port corridor) that links the region to this market. More effective transportation competition would exist if the region depended on spatially separated markets that were linked to the supply region by several carriers. The Corn Belt, in contrast to the Plains, seems to be in a more competitive transportation market. Much of the region is close to effective barge competition, and there are many market outlets and competing transportation corridors over which grain may move. Therefore, the effect of deregulation may be quite different in the Corn Belt and the Plains regions.

Predicting the outcome of deregulation is complicated by conflicting notions regarding the regulator's behavior during the pre-Staggers era. Historically, it was thought that the ICC tended to follow the value-of-service pricing theory, (i.e., rates for low-valued bulky commodities like grain were set at low levels while higher-valued manufactured goods bore relatively high rates) (Posner; Meyer, Peck, Stenason, and Zwick). There is an alternative notion that over time the ICC abandoned the value-of-service pricing scheme because of increasing competition from motor carriers in the high-valued products transportation markets. A study by Sorenson, Anderson, and Nelson in the early 1970s refuted the view that ICC policy favored agriculture. In fact, much of the rail grain rate structure seemed to be put in place by a discriminating monopolist—Corn Belt rates exhibited relatively low revenue-to-variable cost ratios while wheat rates in the Plains were characterized by large ratios. This finding and others seem to question the notion that value-of-service pricing was the basis for grain rate structures during the period preceding deregulation (Friedlaender and Spady; Fuller, Makus, and Taylor; Spann and Erickson).

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If ICC policy did subsidize agriculture through low rail rates, then the Staggers Act may cause rail rates to rise sharply in those regions where intermodal competition is limited and deregulation does not facilitate interrailroad competition. However, if the ICC allowed railroads to act as a cartel, the pre-Staggers rail rates may be near the maximum allowed by intermodal competition. And, if the Staggers Act failed to generate interrailroad competition, then deregulation may not substantially alter rates. Conversely, if the Staggers Act succeeds in promoting inter-rail competition, rates may decline.

Economists have contributed to an extensive body of literature that identifies the considerable inefficiencies and costs generated by ICC regulation, but limited efforts have been made to extrapolate the likely consequences of deregulation. Most noteworthy among efforts that attempt to evaluate the likely effect of deregulation are those by Friedlaender and Levin. Friedlaender notes that the effect of deregulation with regard to bulk agricultural commodities is difficult to predict but speculates that effective rate competition among railroads is remote, even in the absence of rate bureaus. Furthermore, Friedlaender observes that under pre-Staggers regulation, railroads were able to exploit a considerable amount of their monopoly power on bulk agricultural commodities. In view of the ineffective rate competition expected by Friedlaender in the deregulated environment, and because of the railroads' ability to generate maximum rates on noncompetitive traffic before deregulation, Friedlaender concludes that railroads have little untapped monopoly power on noncompetitive agricultural traffic. Thus, rate deregulation most likely would not lead to substantial or general rate increases in noncompetitive transportation environments.

Levin simulated the deregulation outcome under various assumptions concerning elasticity of rail demand, degree of interrailroad competition, magnitude of rail cost reduction attainable with enhanced commercial freedom, and various levels of truck competition. Levin shows the social desirability of the deregulation outcome is closely related to the degree of interrailroad competition. Railroads' rate of return and welfare losses vary only moderately with reductions in rail and truck costs, but a modest degree of interrailroad competition has a profound effect. Levin indicates grain transportation markets are probably most accurately represented by an intermediate degree of railroad competition; therefore, grain rates are unlikely to increase much in a deregulated environment.

The theoretical expectations regarding the effect of deregulation are uncertain, but empirical evidence is increasing. Unfortunately, there are several problems associated with measuring the effect of deregulation on rate levels. Because much of the rail-transported grain moves under confidential contracts, the published tariffs provide incomplete information, (i.e., accurate rate information is not accessible). Further, coincident events make it difficult to segregate the effect of deregulation from other happenings. As an example, grain exports have declined nearly 50 percent from the peak years in 1980-1981, and presumably this has led to declines in the demand for transportation and a downward pressure on rates. Clearly,

a method that controls for these effects is necessary to accurately measure the impact of deregulation.

Despite problems associated with the empirical analysis of deregulation, useful evidence has been collected. Several Kansas studies attempted to measure and contrast rate trends during the pre- and post-Staggers era (Babcock et al.; Klindworth et al; and Sorenson). They report that published rail rates between 14 Kansas elevator sites and Gulf ports increased an average of 38.9 cents per bushel in the 4 years preceding the Staggers Act and declined 37 cents between 1981 and 1984. Price spreads were found to closely follow rail rates during the 8-year study period. Adam and Anderson investigated corn and soybean price spreads for a sample of Nebraska elevators from September 1978 through August 1984. They conclude price spreads declined in the post-Staggers period by large and statistically significant amounts. The Kansas and Nebraska studies imply similar impacts attributable to deregulation.

This study attempts to measure the impact of rail deregulation on export rates that link Plains and Corn Belt regions with their respective port areas in order to learn more about the effect of the deregulated environment on railroad price structures. An effort is made to evaluate the effect of deregulation on rates by analyzing the price spread between port and selected hinterland regions from 1976 through 1985. The decision to focus on geographic price spreads was prompted by knowledge that many export-grain rail rates in the post-Staggers era are determined through private negotiations and are not public information. In this case, direct measurement of rates to identify the effect of deregulation would be difficult or impossible. By controlling for changes in export demand, local supply, and costs of transportation, storage, and marketing services, an attempt is made to isolate the effect of deregulation on rates. It is assumed that the grain-handling industry is sufficiently competitive for geographic price spreads to reflect changes in transportation rates that may result from railroad deregulation.

This report includes five additional sections. First, attention is given to describing the selected study regions and their historic grain transportation patterns. This is followed by a section outlining the conceptual model that directs the analysis and a statistical model designed to isolate the effect of deregulation on rates. The results section focuses on that portion of the statistical model that analyzes the effect of deregulation and elaborates on secondary issues associated with deregulation. The study findings are subsequently discussed in view of the pre-Staggers notions about deregulation and the ICC's apparent regulatory philosophy. Finally, conclusions and recommendations are offered.

## Marketing of Grain in Study Regions

The study area was made up of subregions comprising the entire states of Kansas, Iowa, and Indiana as well as the Texas Panhandle and portions of Illinois. Kansas and the Texas Panhandle subregions constitute one study area. These Plains subregions are surplus producers of hard red winter wheat, a wheat class that has historically comprised about half of the United States' annual wheat



production. Principal hard red winter wheat producers are Kansas, Oklahoma, Texas, Colorado, Nebraska and several northern Plains states.

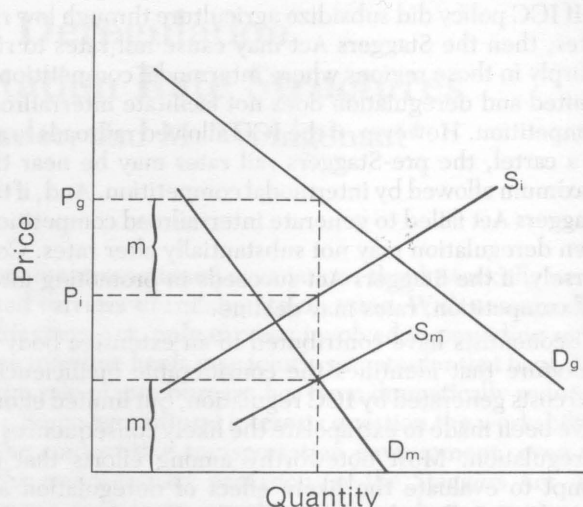
USDA data show about 60 percent of the United States' hard red winter wheat production is typically exported. A 1977 study by Leath, Hill, and Fuller showed the Texas regions exported from 60 percent to 81 percent of their wheat shipments while Kansas regions exported slightly more than half of their shipments. Gulf ports receive more than 99 percent of the Kansas and Texas regions' export shipments with the Houston-Galveston-Beaumont complex being the principal export location. All study regions rely heavily on rail transportation—about 90 percent of the western Kansas wheat outflow was carried by rail, whereas, northeast Kansas and the Texas Panhandle shipped about 75 percent by rail, the lowest share shipped by any region.

The corn study region includes areas of Iowa, Illinois, and Indiana. These states have historically produced nearly 50 percent of the United States' annual corn production with Illinois and Iowa each typically producing 1.0 billion to 1.7 billion bu., while Indiana's annual production ranges between 0.4 and 0.7 billion bu. About 30 percent of the United States' annual corn production typically moves to export markets. A 1977 study shows the Corn Belt study regions ship to alternative export locations (Hill, Leath, and Fuller). All study region states shipped export grain to at least three of the four export coastal areas (Great Lakes, Atlantic, Gulf, Pacific); however, for Illinois and Iowa, the majority of export shipments (88 percent-90 percent) were to Gulf ports, principally Mississippi River ports. In contrast, Indiana shipped about 75 percent of its corn exports to Atlantic ports. In 1977, Iowa and Illinois shipped up to 90 percent of their Gulf shipments by barge while all of Indiana's corn movement to Atlantic ports were transported by rail.

### Conceptual and Statistical Model

The following conceptual model is used to direct the analyses. Price relationships in major transportation corridors are assumed to be determined under the derived demand framework depicted in Figure 1. In this analytical framework, the grain price spread between a U.S. port and some hinterland producing region is determined by the interaction of the export grain demand curve at the port ( $D_g$ ), the farm-level supply function ( $S_i$ ), the demand for export marketing services derived from these two schedules ( $D_m$ ), and the supply of marketing services on the corridor that links the hinterland and the port ( $S_m$ ). The price spread ( $m$ ) is the price difference,  $P_g - P_i$ , where  $P_g$  is the grain price at a port (e.g., a Gulf port, and  $P_i$  is the price at an interior location, such as an Illinois producing region. Other things being equal, an increase in export demand ( $D_g$ ), and farm-level supply ( $S_i$ ) or a decline in the supply of marketing services ( $D_m$ ) will tend to widen the price spread.

Two regression models are estimated to measure the effect of deregulation; one model attempts to capture the effect of deregulation on price spreads ( $m$ ) and rates in the Plains region (surplus wheat-producing regions) while the second model focuses on the Corn Belt. The Plains or



**Figure 1. Model of grain transportation corridor's price spread.**

wheat model includes, as the dependent variable, the monthly time series data on price spreads (1976-1985) between 12 hinterland regions in Texas and Kansas and Texas Gulf ports, while the corn model includes monthly price spreads between 18 hinterland regions in Iowa, Illinois, and Indiana and Gulf and/or Atlantic coast ports.

In general, the adopted procedure involves estimating regression equations with price spreads as the dependent variable. The independent variables include: (1) controls for shifts in the above-noted demand and supply schedules (Figure 1), (2) region and time dummies, and (3) a dummy and an interaction term to isolate changes in price spreads that may have resulted from the 1980 deregulation.

Monthly price spread observations are generated for each hinterland region over a multiyear period, thus pooling both cross-section and time-series data. It seemed unreasonable to assume that the ordinary least-squares estimates of the intercept and slope would be constant for all hinterland regions across all time periods. Thus, dummy variables that allow the intercept term to vary over time and over regions were introduced. The region dummies attempt to control for cross-region price spread determinants not formally incorporated in the model.

The study focuses on isolating the effect of deregulation through analysis of price spreads. To accomplish this, a deregulation dummy was introduced. This binary variable estimates the adjustment in the regression equation's intercept that is associated with deregulation. The deregulation dummy is also used interactively with the time trend variable to generate an additional variable whose estimated coefficient relates changes in the slope of the time trend variable that may have occurred because of deregulation.

The general model estimated to determine the effect of deregulation on geographic price spreads is as follows:

$$(1) P_{it} = \alpha + \beta_1 D_{it} + \beta_2 S_{it} + \beta_3 MS_{it} + \text{region dummies} + \text{time dummies} + \text{deregulation dummy} + \text{deregulation dummy} \times \text{trend time} + U_{it}$$

where,  $P_{it}$  is the monthly average price spread between hinterland regions and ports in dollars/bushel;  $D_{it}$  repre-

sents export demand shifters;  $S_{it}$  represents farm-level supply shifters;  $MS_{it}$  represents marketing service supply shifters; and  $U_{it}$  are the unexplained residuals. Subscripts  $i$  and  $t$  refer to regions and time periods, respectively.

The dependent variable is the monthly price spread (dollars/bushels) between each hinterland study region and its associated port area for the 120-month period (1976-1985). Figure 2 shows this time-series profile for the west-central Kansas study region. In general, all of the wheat regions' price spreads tend to widen through 1980 and then begin to narrow.

Several types of variables were identified as potential shifters of export demand, farm-level grain supply, and marketing services supply. National export levels and international grain prices were considered as potential measures of export demand. However, because of the lag between the grain sale and its subsequent outflow, the quantity exported per month was predetermined with respect to the current month's price. Thus, quantity, rather than price, was assumed to be the outside factor. Furthermore, including the international grain price (e.g., Rotterdam price) as a demand shifter may have created a spurious re-

gression problem (i.e., the error term may not have been independent of the explanatory variable). For these reasons, monthly national exports was selected as the appropriate proxy for export demand (Figure 3) (USDA, 1976-1985a). It was assumed that port area demand was closely related to the national export level.

Several variables were tentatively selected as a proxy for the farm-level supply function. An effort was made to collect annual grain supply for each hinterland study region, but for several states, the production and price data were not available for similar geographic units. It was assumed that the quantity of produced grain was predetermined, so, as an alternative, state-level and national grain supply data were the selected variables (USDA, 1976-1985b; USDA, 1976-1985c).

During the study period, there were substantial changes in factor prices, and these changes may have affected spreads between hinterland farm-level prices and port area export prices. For purposes of this analysis, real costs of holding grain are represented by the difference between the nominal interest rate (Figure 4) and the percent change in the wholesale price index (International Mone-

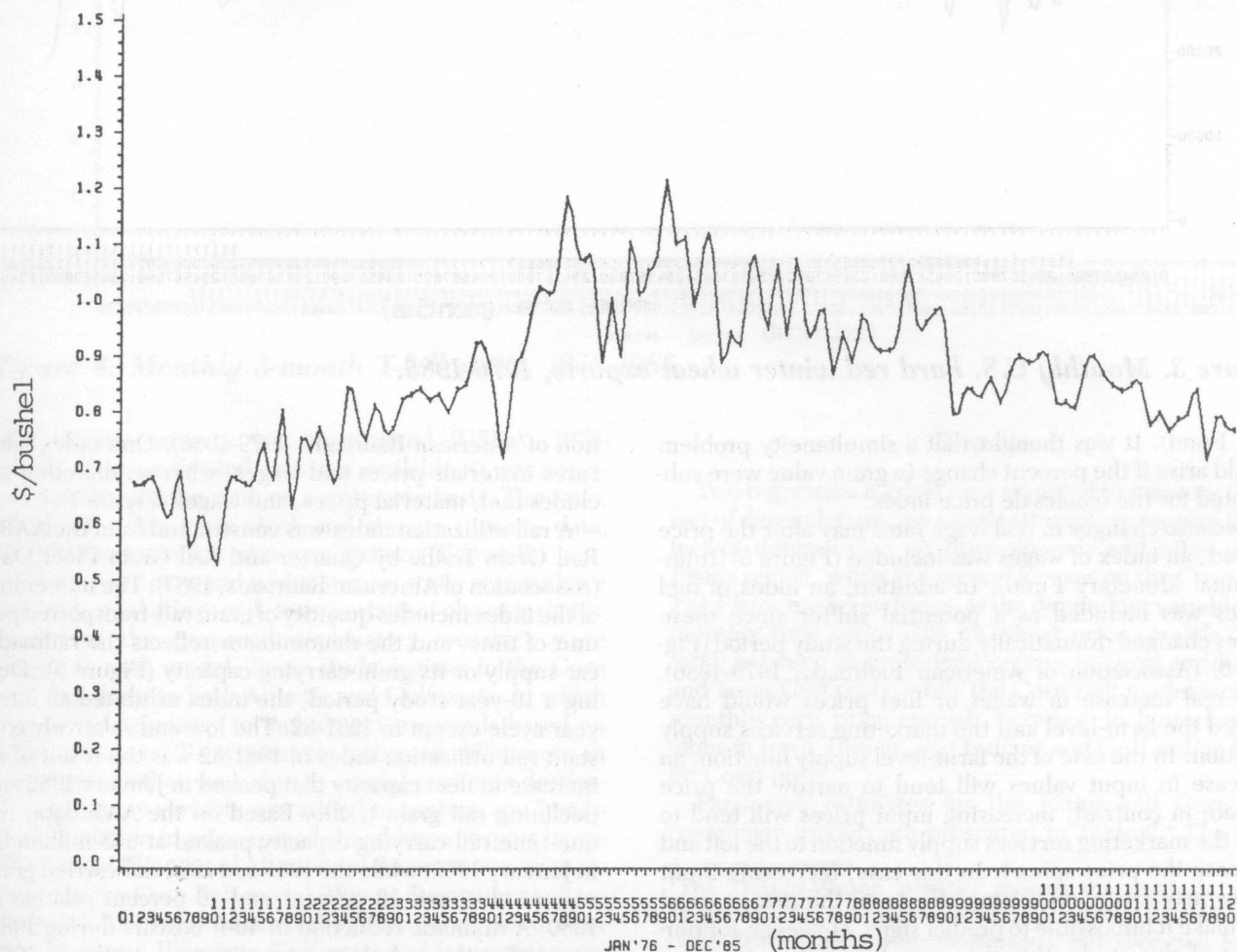
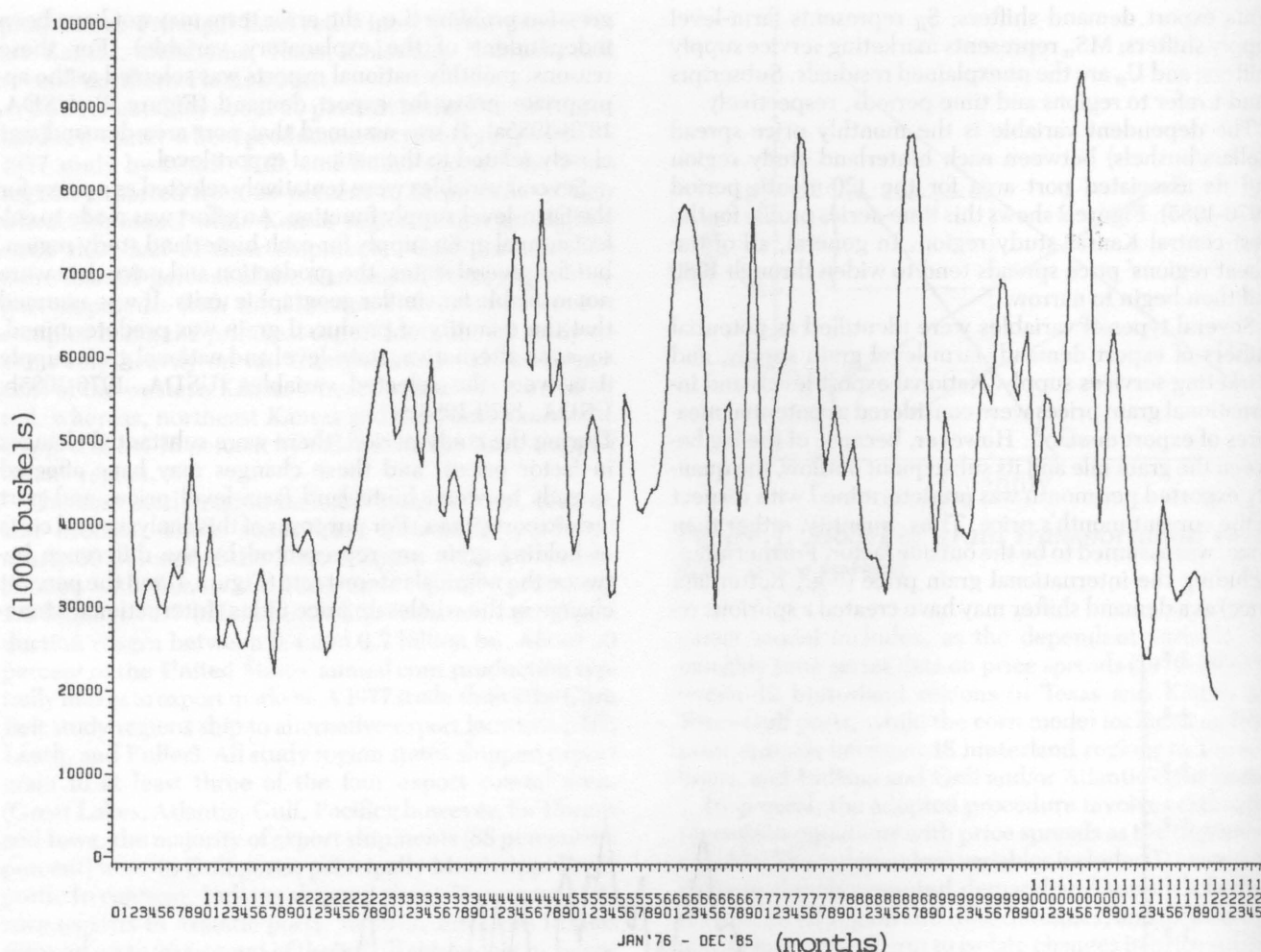


Figure 2. Monthly west-central Kansas wheat price spread, 1976-1985.<sup>1</sup>

<sup>1</sup>Price spread is estimated by subtracting the monthly average west-central Kansas farm-level wheat price from the monthly average Houston export wheat price.



**Figure 3. Monthly U.S. hard red winter wheat exports, 1976-1985.**

tary Fund). It was thought that a simultaneity problem would arise if the percent change in grain value were substituted for the wholesale price index.

Because changes in real wage rates may alter the price spread, an index of wages was included (Figure 5) (International Monetary Fund). In addition, an index of fuel prices was included as a potential shifter since these prices changed dramatically during the study period (Figure 6) (Association of American Railroads, 1979-1986). Any real increase in wages or fuel prices would have shifted the farm-level and the marketing services supply function. In the case of the farm-level supply function, an increase in input values will tend to narrow the price spread; in contrast, increasing input prices will tend to shift the marketing services supply function to the left and increase the price spread. In this case, increasing input prices may create off-setting effects on the price spread and make it impossible to predict signs. However, for purposes of this study, this outcome does not represent a problem since interest is only in controlling for such effects. To measure the potential effect of changing rail costs on rates and the subsequent impact on price spreads, two rail cost indices were selected. Both indices were generated by the Association of American Railroads (Associa-

tion of American Railroads, 1979-1986). One index measures materials prices and wages, whereas the other includes fuel, material prices, and wages (Figure 7).

A rail utilization index was constructed from the AAR's Rail Grain Traffic by Quarter and Rail Grain Fleet Data (Association of American Railroads, 1987). The numerator of the index includes quantity of grain rail-transported per unit of time, and the denominator reflects the railroad's car supply or its grain-carrying capacity (Figure 8). During a 10-year study period, the index exhibited an intra-year cycle except in 1981-82. The low and relatively constant rail utilization index in 1981-82 was the result of an increase in fleet capacity that peaked in January 1982 and declining rail grain traffic. Based on the AAR data, the one-time rail carrying capacity peaked at 845 million bu in January 1982, while the 1981 and 1982 rail-carried grain volume declined 12 percent and 16 percent relative to 1980. A dramatic reduction in 40-ft boxcars during 1982, coupled with modest increases in grain traffic in 1983, reestablished the historical movement in the rail car utilization index.

To reflect a widening price spread that may be attributable to shortages in hinterland storage capacity, a ratio variable that measures unused storage capacity relative to



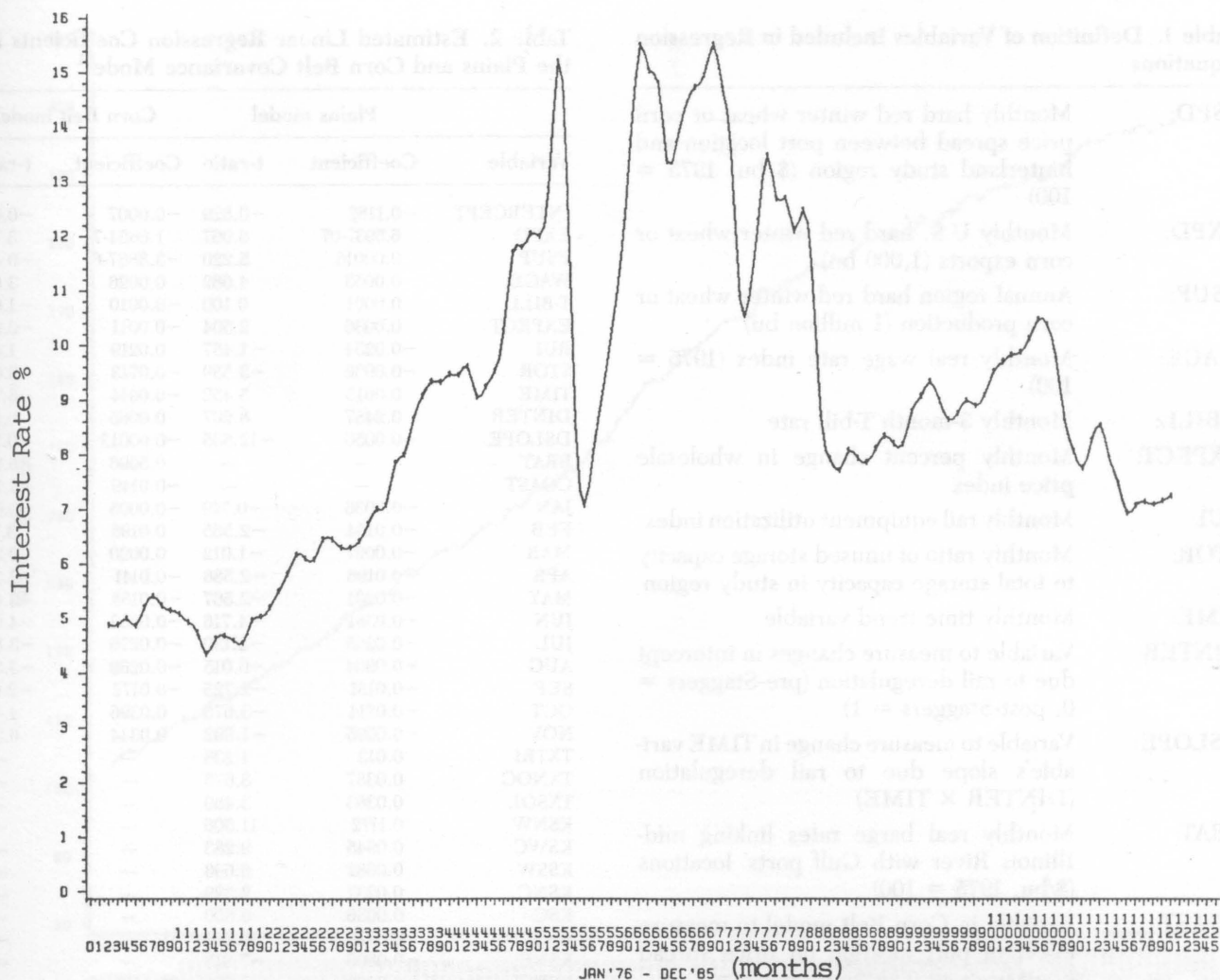


Figure 4. Monthly 3-month T-bill rates, 1976-1985.

total storage capacity was constructed (USDA, 1976-1985d). Because limited data was available, it was necessary to estimate the ratio on a statewide basis. The ratio, calculated using grain stock and storage capacity data, exhibits the expected intra-year pattern (Figure 9).

Because the corn and wheat surplus study regions have different marketing and transportation characteristics, several of the proposed explanatory variables were unique to each model. Some study regions in the Corn Belt ship grain to both Atlantic and Gulf ports, in which case it was necessary to include price spreads based on both port areas. To account for potential differences in price spreads that were due to coastal port area destination, a dummy variable was added to capture any "cross-coast" variation in price spread. In addition, export barge rates on the Illinois and Mississippi River system were included in the Corn Belt model (Illinois Department of Agriculture). The barge mode is the principal carrier of corn from Iowa and Illinois to Gulf ports and is a major competitor of the railroad industry (Figure 10). See Table 1 for definition of variables included in the analysis (Appendix A).

## Results

Two regression models are estimated to measure the effect of deregulation; one model attempts to capture the effect of deregulation on price spreads and rates in the Plains region, while the second focuses on the Corn Belt. The Plains model includes, as the dependent variable, the monthly time series data on wheat price spreads (1976-1985) between 12 hinterland regions in Texas and Kansas and Texas Gulf ports, while the Corn Belt model includes monthly corn price spreads between 18 hinterland regions in Iowa, Illinois, and Indiana and Gulf and/or Atlantic Coast ports.

Parameter estimates for the Plains and Corn Belt covariance models are presented in Table 2.<sup>1</sup> The signs

<sup>1</sup>The Durbin-Watson statistics showed the residuals of the Plains and Corn Belt models to be serially correlated; therefore, both models were reestimated and corrected for autocorrelation. The first-order serial correlation coefficient for the Plains model had an estimated value of 0.466 with a standard error of 0.023. The Corn Belt model's serial correlation coefficient had a value of 0.356 with a standard error of 0.019. The adjusted R-squared for the Plains and Corn Belt models were .60 and .66, respectively.



**Table 1. Definition of Variables Included in Regression Equations**

PSPD:	Monthly hard red winter wheat or corn price spread between port location and hinterland study region (\$ bu, 1975 = 100)
EXPD:	Monthly U.S. hard red winter wheat or corn exports (1,000 bu)
FSUP:	Annual region hard red winter wheat or corn production (1 million bu)
WAGE:	Monthly real wage rate index (1975 = 100)
T-BILL:	Monthly 3-month T-bill rate
EXPECT:	Monthly percent change in wholesale price index
RUI:	Monthly rail equipment utilization index
STOR:	Monthly ratio of unused storage capacity to total storage capacity in study region
TIME:	Monthly time trend variable
DINTER:	Variable to measure changes in intercept due to rail deregulation (pre-Staggers = 0, post-Staggers = 1)
DSLOPE:	Variable to measure change in TIME variable's slope due to rail deregulation (DINTER $\times$ TIME)
BRAT:	Monthly real barge rates linking mid-Illinois River with Gulf ports' locations (\$/bu, 1975 = 100)
COAST:	Variable in Corn Belt model to measure effect of port location on price spread (Gulf ports = 0, Atlantic ports = 1)
JAN-NOV:	Month dummies
TXTRI:	Region dummy for Texas Triangle region
TXNOC:	Region dummy for Texas Canadian River region
TXSOL:	Region dummy for Texas Muleshoe-Plain-view region
KSNW-KSSE:	Region dummies for Kansas regions. Last two letters identify geographic location of region in state.
IDNW-IDSE:	Region dummies for Indiana regions. Last two letters identify geographic location in state.
IANW-IASE:	Region dummies for Iowa regions. Last two letters identify geographic location in state.
ILW-ILNC:	Region dummies for Illinois regions. Last two letters identify geographic location in state.

**Table 2. Estimated Linear Regression Coefficients for the Plains and Corn Belt Covariance Model<sup>1</sup>**

Variable	Plains model		Corn Belt model	
	Coefficient	t-ratio	Coefficient	t-ratio
INTERCEPT	-0.1182	-0.829	-0.0007	-0.009
EXPD	6.5937-07	6.067	1.6624-7	3.730
FSUP	0.00016	5.220	-3.8867-6	-0.46
WAGE	0.0053	4.662	0.0026	3.622
T-BILL	0.0001	0.100	-0.0010	-1.048
EXPECT	0.0036	2.504	-0.0011	-0.922
RUI	-0.0254	-1.457	0.0219	1.462
STOR	-0.0936	-3.559	-0.0743	-3.040
TIME	0.0015	5.452	-0.0014	-6.780
DINTER	0.2487	8.207	0.0065	0.271
DSLOPE	-0.0056	-12.535	-0.00013	-0.361
BRAT	—	—	0.5096	16.833
COAST	—	—	-0.0149	-2.732
JAN	-0.0036	-0.749	-0.0005	-0.089
FEB	-0.0154	-2.565	0.0198	3.740
MAR	-0.0067	-1.012	0.0020	0.382
APR	-0.0196	-2.586	-0.0141	-2.368
MAY	-0.0201	-2.567	-0.0188	-3.443
JUN	-0.0381	-4.716	-0.0253	-4.023
JUL	-0.0265	-3.130	-0.0276	-3.807
AUG	-0.0004	-0.015	-0.0269	-3.395
SEP	-0.0181	-2.725	-0.0172	-2.018
OCT	-0.0214	-3.675	0.0396	4.486
NOV	-0.0095	-1.992	0.0344	6.376
TXTRI	0.013	1.238	—	—
TXNOC	0.0387	3.675	—	—
TXSOL	0.0363	3.450	—	—
KSNW	0.1172	11.506	—	—
KSWC	0.0945	9.283	—	—
KSSW	0.0682	6.693	—	—
KSNC	0.0237	2.329	—	—
KSC	0.0086	0.850	—	—
KSSC	-0.0026	-0.254	—	—
KSNE	-0.0806	-7.918	—	—
KSEC	-0.0264	-2.606	—	—
IDNW	—	—	0.0051	0.519
IDNC	—	—	0.0047	0.486
IDNE	—	—	-0.0627	-6.415
IDWC	—	—	0.0250	2.560
IDC	—	—	0.0073	0.745
IDEC	—	—	-0.0058	-0.591
IDSW	—	—	0.0420	4.305
IDSC	—	—	0.0417	4.272
IDSE	—	—	-0.0040	-0.405
IANW	—	—	0.1248	14.399
IANC	—	—	0.1064	12.258
IANE	—	—	0.0870	10.015
IASW	—	—	0.1101	12.684
IASC	—	—	0.0902	10.391
IASE	—	—	0.0357	4.110
ILW	—	—	0.0206	3.093
ILNC	—	—	-0.0023	-0.353
Adjusted R-squared	0.6017		0.6557	
N	1440		2520	

<sup>1</sup>Estimated equations corrected for serial correlation.

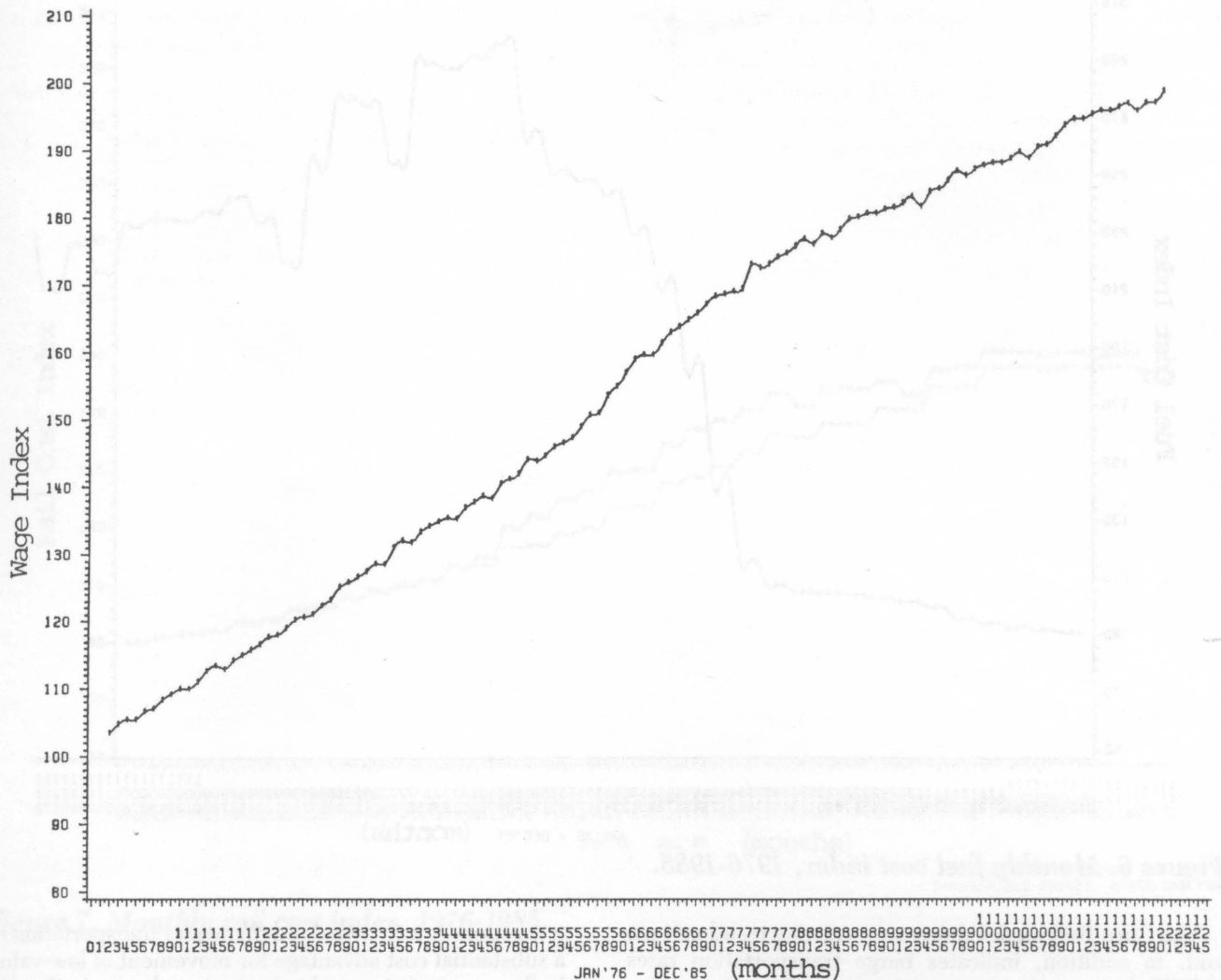


Figure 5. Monthly U.S. wage index, 1976-1985.

and magnitudes of the estimated parameters appear plausible given the outlined theoretical framework.<sup>2</sup> See Appendix A for the mean, minimum, and maximum values of variables that appear in regressions and the simple correlation among variables.

The effect of rail deregulation on rates is measured with the deregulation dummy (DINTER) and the interaction term (DSLOPE) that was created by interacting the time trend variable with DINTER. Both variables are highly significant in the Plains model but not significant at usual levels in the Corn Belt model. The outcome suggests that deregulation generated rate declines in the Plains but not in the Corn Belt. The Plains model rate trend during the

pre-Staggers months (1-60) is calculated with the INTERCEPT coefficient (\$-.1182) and the TIME coefficient (\$.0015), which is multiplied by month. The post-Staggers trend (months 61- 120) is estimated by aggregating the DINTER coefficient (\$.2488) with the INTERCEPT coefficient and the DSLOPE coefficient (\$-.0056) with the TIME coefficient. The estimated coefficients on the TIME, DINTER, and DSLOPE variables in the Plains model were generally unaffected by adding variables to the model or deleting them, suggesting the robust nature of the estimated coefficients.

Figure 11 identifies the estimated rail rate trend in the Plains study region during the pre- and post-Staggers era. Real rates increased during the five-year period preceding deregulation (\$.0015) and then commenced a dramatic decline. Deregulation appears to have reduced the rail rate trend an average of \$.0041 per bushel (\$.0056 + .0015) for each additional month into the deregulated period. During the analyzed post-Staggers period (five years), the rate trend declined an average of about 33 cents per bushel. This result closely parallels Sorenson's observations regarding the impact of deregulation at selected Kansas locations.

<sup>2</sup>Various models that included non-linear forms and lagged variables were estimated. In general, the linear form proved best and lagged variables were not often significant. The exception was the wheat model where one-month lag in demand (EXPD), rail utilization index (RUI), and storage (STOR) were significant. However, it was judged that the modest improvement did not warrant inclusion in the final model.





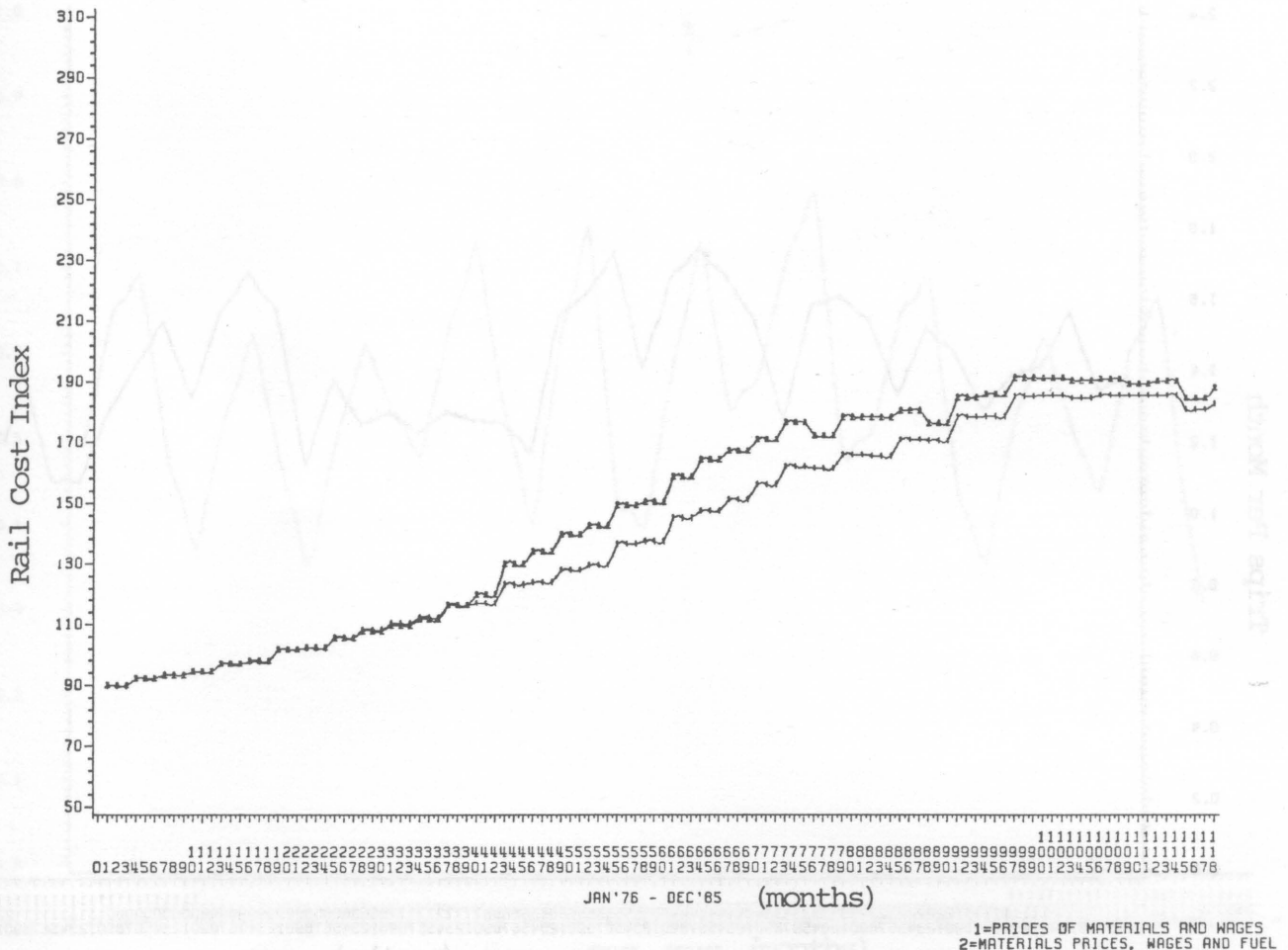


Figure 7. Monthly rail cost index, 1976-1985.

the proxy for the expected change in grain price (EXPECT) was significant in the Plains model. The measure for energy prices was highly correlated (.80) with T-BILL and accordingly was not included in the final model. Seasonality appeared to be a factor in explaining price spreads in the Plains and Corn Belt transportation corridors as did the region dummies. The region dummies account for cross-region variability that is unaccounted for by included variables. The notion of no difference between Gulf and East Coast corn price spreads is rejected because of the significance of the COAST variable — the estimated coefficient ( $-\$.0149$ ) shows corn price spreads to be slightly less when based on East Coast prices.

#### Additional Plains Study Region Results

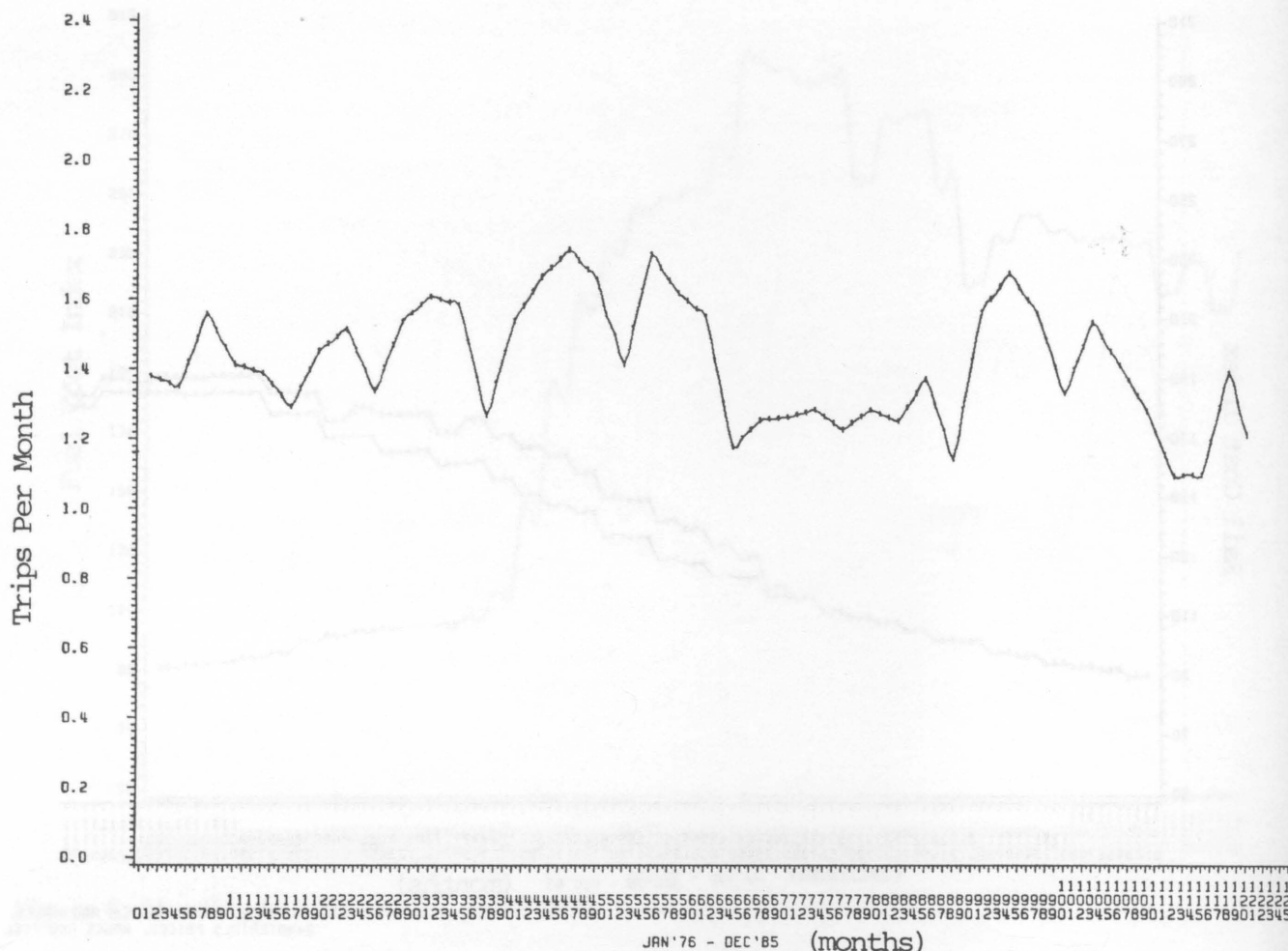
There was interest in learning whether the Staggers Rail Act had a similar effect across all Plains study regions and whether the effects of deregulation were uniform over time.<sup>4</sup> The deregulation dummy (DINTER) and the

interaction term (DSLOPE) measure the average effect of deregulation on the study region's price spreads. Because there is interest in knowing whether the effect of deregulation was similar across all hinterland regions, two additional types of interaction terms were added. These terms measure the differential effect of deregulation on each region by allowing each region's slope and intercept values to shift relative to the average for all regions. The intercept shifters are generated by multiplying the region and the deregulation dummy variables, while the slope shifters are created by multiplying the region dummy with the deregulation dummy and the time trend variable. If these estimated coefficients are significant, the notion that deregulation had a differential impact on the various regions will be supported. The analysis showed deregulation to have an unequal effect among regions. In particular, the price spread in northwest Kansas (KSNW) and the three Texas regions (TXTRI, TXNOC, TXSOL) showed an additional narrowing as a result of deregulation. This implies deregulation led to above-average rate declines in these regions.

The notion that deregulation may have had an unequal effect over time was tested by augmenting the model (Table 2) with several variables. The DSLOPE and DINTER variables measuring the average effect of deregulation over the 1981-85 period, but by adding year slope

<sup>4</sup>The estimated models were not motivated by a desire to develop structural equations; accordingly, the estimated parameters should be viewed as concomitants rather than structural (Pratt and Schlafer). The included variables are designed to purge the data of their effects so that the impact of deregulation could be measured more appropriately.





**Figure 8. Monthly trips per Grain Rail Car, 1976-1985.**

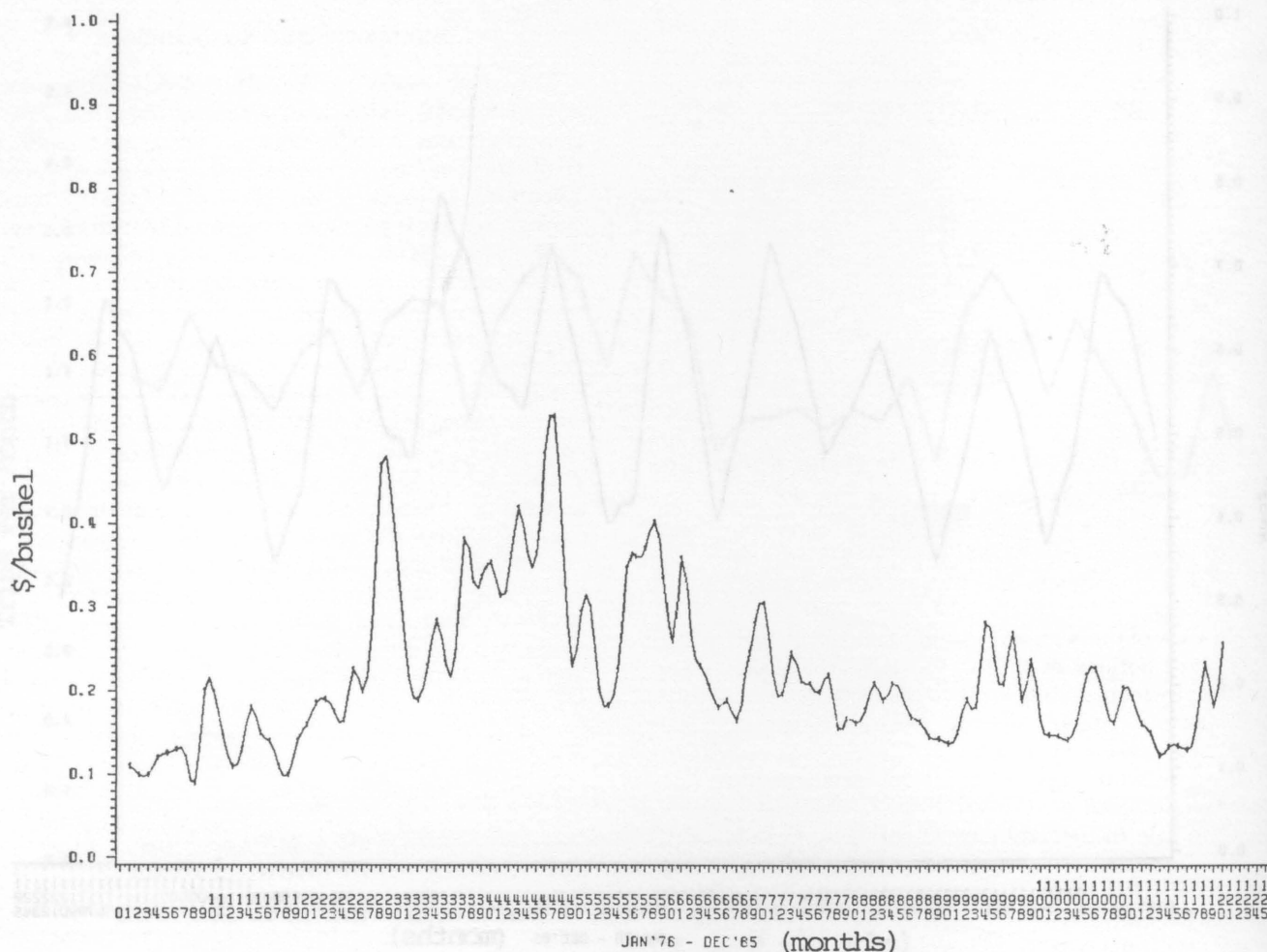
and intercept shifters, the hypotheses that deregulation had a differential effect over time may be tested. Introduction of year dummy variables (1981-85) facilitates measuring of yearly changes in intercept values while introduced interaction terms (DSLOPE  $\times$  year dummy variables) measure changes in slope. The results show deregulation did not have a uniform effect over time. In particular, in 1982, and to a lesser extent in 1983, there were increased narrowings in the geographic price spread. Supporting evidence regarding the temporal effects of deregulation was revealed by removing the DSLOPE and DINTER variables from the augmented model but allowing the year intercept and slope variables to remain. This model measures the effect of deregulation in each year during the 1981-85 period. The analysis shows most year variables to be significant at the 1 percent level with the greatest narrowing in price spread to have been in 1982 and 1983, with lesser impacts in 1984, 1981, and 1985.

Conceptually, some variables may have had a differing effect on rail rates and price spreads during the pre- and post-Staggers era, and through further analysis of these variables additional insight regarding the effects of deregulation may be gained. As an example, railroads may have an opportunity to adjust labor input because of deregulation, in which case labor may have affected the price

spread differently during the pre- and post-Staggers period. In addition, there may be interest in knowing whether railroad rates have become increasingly sensitive to demand as a result of deregulation. To test notions regarding the differential impact of selected variables on pre- and post-deregulation price spreads, interaction terms were created and added to the model.

The deregulated time period (1981-present) has been characterized by weak export demand, and it has been argued that a resurgence in this demand will lead to substantial increases in rail rates. To test the notion that railroad rates have become increasingly sensitive to demand during the post-Staggers era, attention was focused on the monthly export level variable (EXPD) and an interaction term (EXPD  $\times$  DINTER). Both variables were included in a reestimated model and found to be statistically significant. Based on these variables' estimated coefficients, elasticities that measure the responsiveness of price spread to monthly export levels were calculated. Results indicate an equally insensitive relationship between price spreads and export levels during the pre- and post-Staggers periods. The estimated pre-Staggers elasticity coefficient was .07 while the post-Staggers coefficient was estimated to be .06. This outcome offers no support to the notion that increasing export levels or demand would lead to dra-





**Figure 10. Monthly Illinois River barge rates to Gulf, 1976-1985.**

The results provide strong evidence that the Staggers Rail Act of 1980 led to a restructuring of export grain rates. There appears to have been a substantial decline in export rail rates linking Central and South Plains wheat-producing regions with Gulf ports whereas deregulation seems to have had little or no effect on the Corn Belt's export rates. Furthermore, the declining rates do not seem in large part attributable to the diminished foreign demand for U.S. grain or shifts in the farm-level or marketing services supply functions.

### Plausibility and Implications of Results

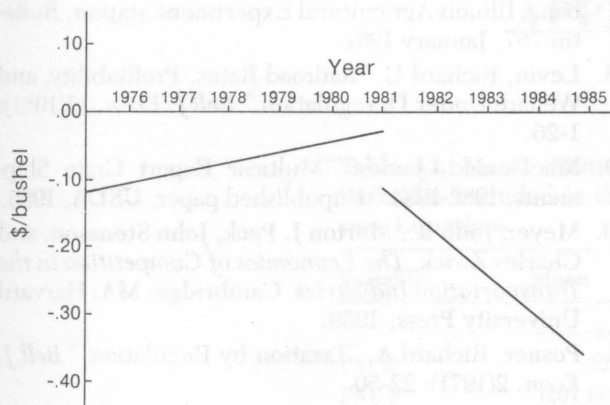
To some extent, these findings are at variance with earlier predictions. It was generally held that the transportation environment in the Corn Belt would promote competition and lower rates, whereas most Plains transportation corridors are dominated by a few rail carriers, hence an oligopolistic market structure that would dampen price (rate) competition.

Although the results of this study were somewhat unexpected, there is supporting evidence. The findings of Sorenson, et al. in Kansas and Adam, et al. in Nebraska support the Plains model results that deregulation led to a substantial decline in rates. Hauser collected published

rail rates on various export-corn transportation corridors over the 1978-83 period and found rates to modestly increase (\$.02) and decrease (\$.02-\$.08) in relatively small increments after deregulation. Furthermore, collected tariff rates on both Plains and Corn Belt transportation corridors generally support the models' findings (Appendix B).

Several provisions of the Staggers Act were designed to create a competitive railroad pricing behavior. First, the Staggers Act ended rate bureaus' anti-trust immunity and subsequently removed the railroads' ability to jointly set rates. Some argue that rate bureaus permitted railroads to act as a cartel when setting rates. If rate bureaus did serve as cartels in the pre-Staggers era and the ICC did not adhere to the value-of-service pricing theory, rates in those grain surplus regions with little intermodal competition (Plains) would tend to be relatively high, whereas areas with strong intermodal competition (Corn Belt) would have comparatively low rail rates. Second, the Staggers Act attempted to further enhance the competitive transportation environment through provisions that facilitated the widespread use of contracting. Because of the confidential nature of contracts, rate information does not become public. As a result, competing railroads are denied essential information for tacit price-setting, a form of price-making that may evolve in lieu of





**Figure 11. Estimated rail rate trend during the Pre- and Post-Staggers Period.**

formal arrangements historically offered through rate bureaus.

In view of the regulatory modifications offered by Staggers and notions regarding the ICC's pre-Staggers behavior, the explanation for the observed results come into perspective. Apparently, rate bureaus were allowed to function as a cartel, and the ICC permitted railroads to offer rates whose upper bound was determined by competitive forces (i.e., the value-of-service pricing theory had no role in the pre-Staggers export-grain rate structure). In this case, the lack of intermodal competition in the Plains led to high rates, whereas the strong intermodal competition in the Corn Belt created relatively low rates. With the passage of Staggers, interrailroad competition was apparently facilitated. And in the Plains region, which had little intermodal competition and the highest pre-Staggers rates, there was a substantial opportunity for rates to decline because of competitive pricing behavior. Accordingly, rates declined precipitously in the Plains compared with the Corn Belt, where rates declined modestly or not at all. Strong water competition in the Corn Belt had kept pre-Staggers rail rates low, limiting the opportunity for rate reductions. Thus, deregulation had an uneven effect on the Plains and Corn Belt regions' export-grain rate structures.

Several implications of the results seem important. First, there is strong evidence that ICC rail regulation was not aimed at protecting agricultural shippers. Rather, evidence supports the notion that rail regulation served to allow cartel pricing (Hilton). Rates have fallen in the Plains region where a cartel would have been effective, but in the Corn Belt, where intermodal competition would have made for a less effective cartel, rates have declined little or not at all. Second, this study's findings seem to support Levin's earlier work. Levin showed the social desirability of deregulation to be closely related to the existence of interrailroad competition. It seems that removing the immunity of rate bureaus and contracting have generated interrailroad and possibly geographic competition in those regions of the United States where railroads have historically enjoyed monopolistic power and relatively high rates.

## Summary and Conclusions

This study evaluates the effect of deregulation on export grain rates. Because of deregulation, much of the export grain moves under contract rather than published tariff rates, making direct rate measurement impossible. Therefore, to evaluate the effect of deregulation, price spreads between port and associated hinterland regions were analyzed. This involved estimating covariance models that include price spreads as the dependent variable, independent variables that control for shifts in demand and supply functions, region and time dummies, and a dummy and interaction term to isolate the effect of deregulation.

Study results show deregulation led to a substantial decline in wheat export rates but had no or little impact on corn export rates. During the pre-Staggers era, rate bureaus facilitated the operation of rate-fixing cartels and, as a result, Plains region rates were generally high because of limited intermodal competition. Apparently, passage of the Staggers Rail Act removed rate bureaus' cartel-like features, and, in spite of the few operating rail companies on most wheat transportation corridors, interrailroad competition developed. As a result of the historically high rates in the Plains region, and with the advent of interrailroad competition, rail rates declined. In contrast, there has been little decline in corn export rates because the region's railroads have historically experienced strong intermodal competition from low-cost water transportation. Accordingly, there has been little opportunity for railroads to reduce Corn Belt rates, even though intra-modal competition has been made to exist.

Because of the rather short post-Staggers' period of observation, it is difficult to know whether railroads will behave in the long run as they have in the short run. Regardless, it is essential that agriculture carefully evaluate proposed modifications to Staggers, especially those that deal with contracting and rate bureaus. Also of great importance is the policy that the ICC adopts toward rail and rail-barge mergers. The large number of merger applications will undoubtedly produce a major restructuring of the U.S. railroad network. It is important that Congress and the ICC play a constructive role in preserving the observed interrailroad competition.

## Acknowledgments

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# APPENDIX A

**Table A1. Mean, Minimum, and Maximum Values of Variables Included in the Plains and Corn Belt Regression Equations**

Variable	Mean	Minimum	Maximum
----- Plains Model -----			
PSPD	.51	.19	.95
FSUP	1101.96	829.90	1243.60
EXPD	48180.34	19129.00	113266.00
T-BILL	8.91	4.35	16.3
EXPECT	.44	-3.28	6.02
WAGE <sup>1</sup>	103.39	96.55	113.06
RUI	1.42	1.10	1.74
STOR	.57	.32	.88
----- Corn Belt -----			
PSPD <sup>1</sup>	.28	-.06	.65
EXPD	162934.00	73776.00	256844.00
FSUP	1007.91	340.91	1731.25
STOR	.56	.23	.88
BRAT <sup>1</sup>	.15	.07	.40

<sup>1</sup>Values deflated with wholesale price index (1975 = 100).

**Table A2. Simple Correlation Coefficients for Variables Included in Plains Model**

	PSPD	EXPD	FSUP	WAGE	T-BILL	EXPECT	RUI	STOR
PSPD	1.00	.091 (.0005)	-.422 (.0001)	-.440 (.0001)	.099 (.0002)	.264 (.0001)	.365 (.0001)	-.158 (.0001)
EXPD		1.00	.212 (.0001)	.059 (.0246)	.492 (.0001)	-.038 (.1430)	.193 (.0001)	.025 (.3526)
FSUP			1.00	.166 (.0001)	.306 (.0001)	-.239 (.0001)	-.287 (.0001)	-.043 (.8018)
WAGE				1.00	-.335 (.0001)	-.303 (.0001)	-.247 (.0142)	-.078 (.0001)
T-BILL					1.00	.092 (.0206)	-.012 (.0001)	-.040 (.1279)
EXPECT						1.00	.258 (.0001)	-.033 (.2726)
RUI							1.00	.202 (.1900)
STOR								1.00

Values in parenthesis represent probability that simple correlation coefficient is zero.

Table A3. Simple Correlation Coefficients for Variables Included in Corn Belt Model

	PSPD	EXPD	FSUP	WAGE	T-BILL	EXPECT	RUI	STOR	BRAT
PSPD	1.00	.223 (.0001)	.267 (.0001)	-.242 (.0001)	-.154 (.0001)	.250 (.0001)	.378 (.0001)	-.257 (.0001)	.581 (.0001)
EXPD		1.00	.071 (.0004)	-.241 (.0001)	.443 (.0001)	.168 (.0001)	.320 (.0001)	-.071 (.0003)	.439 (.0001)
FSUP			1.00	-.063 (.0014)	.051 (.0105)	.045 (.0244)	-.077 (.0001)	-.285 (.0001)	-.031 (.0724)
WAGE				1.00	-.335 (.0001)	-.303 (.0001)	-.248 (.0001)	.196 (.0001)	-.172 (.0001)
T-BILL					1.00	.092 (.0001)	-.012 (.5528)	-.023 (.0001)	.127 (.0001)
EXPECT						1.00	.258 (.0001)	-.153 (.0014)	.376 (.0001)
RUI							1.00	.125 (.0001)	.589 (.0001)
STOR								1.00	.003 (.0001)
BRAT									1.00

Values in parenthesis represent probability that simple correlation coefficient is zero.

## APPENDIX B

Table B1. Export Rate Linking Topeka, KS, with Houston, TX, 1976-1983

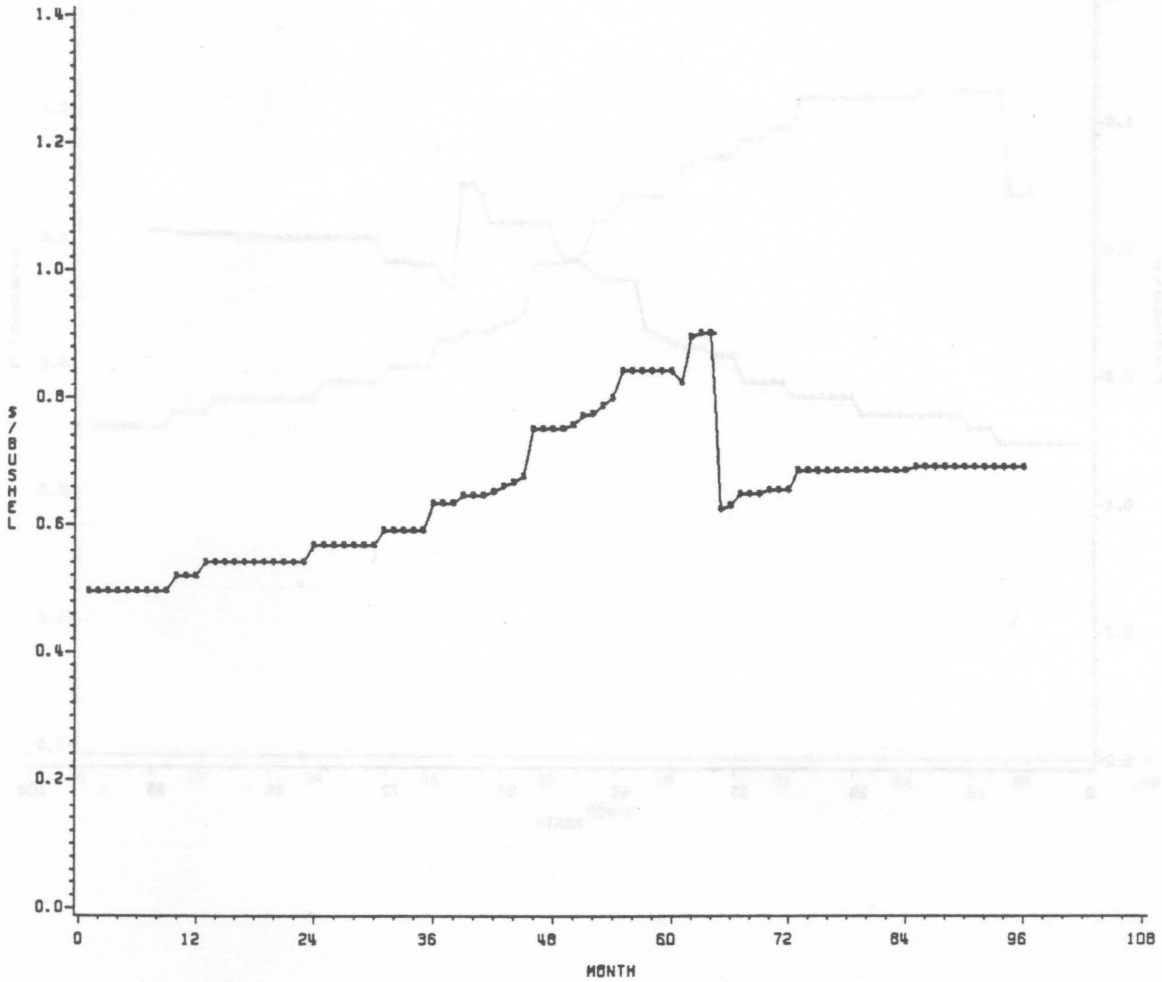




Table B2. Export Rate Linking Hutchinson, KS, with Houston, TX, 1976-1983

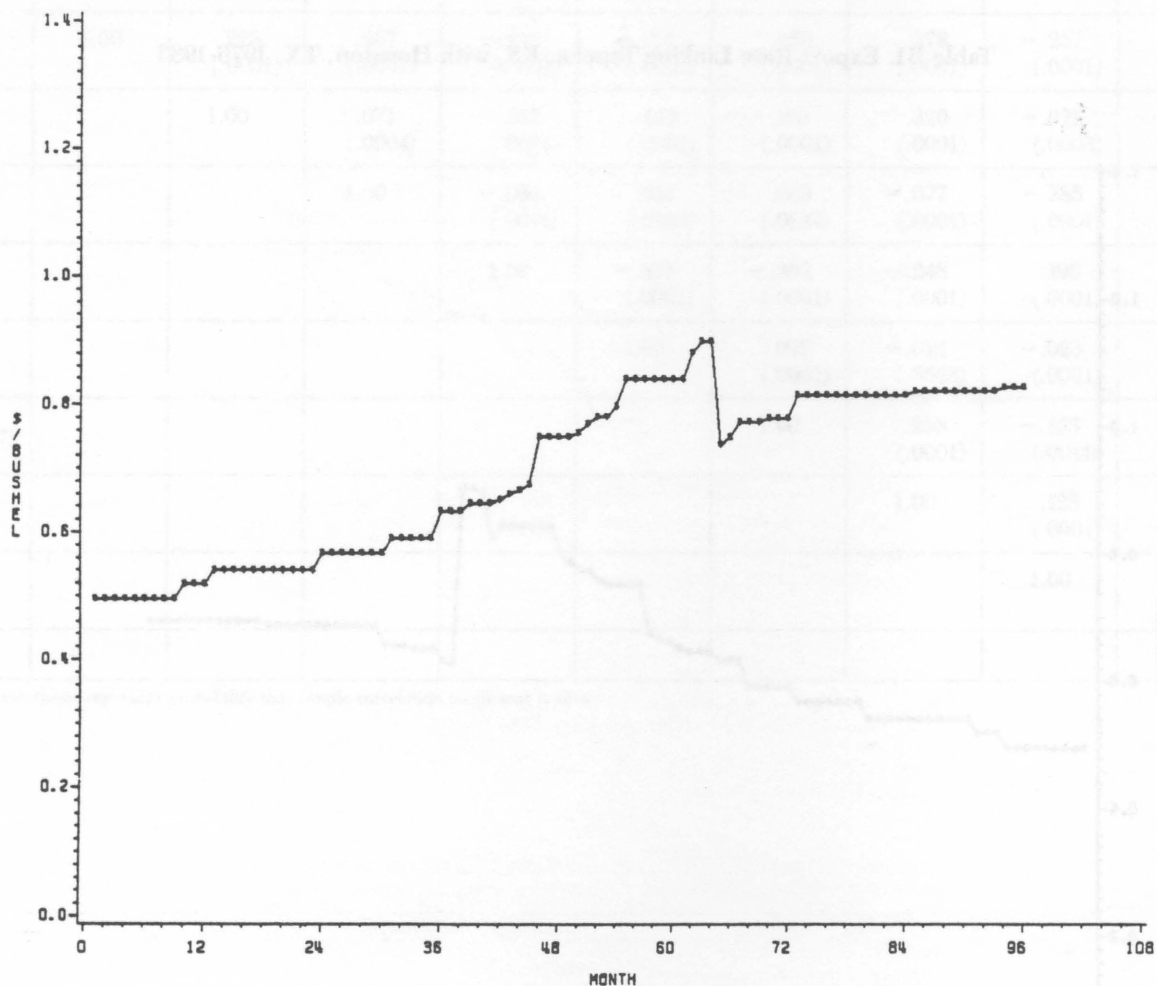


Table B3. Export Rate Linking Salina, KS, with Beaumont, TX, 1976-1983

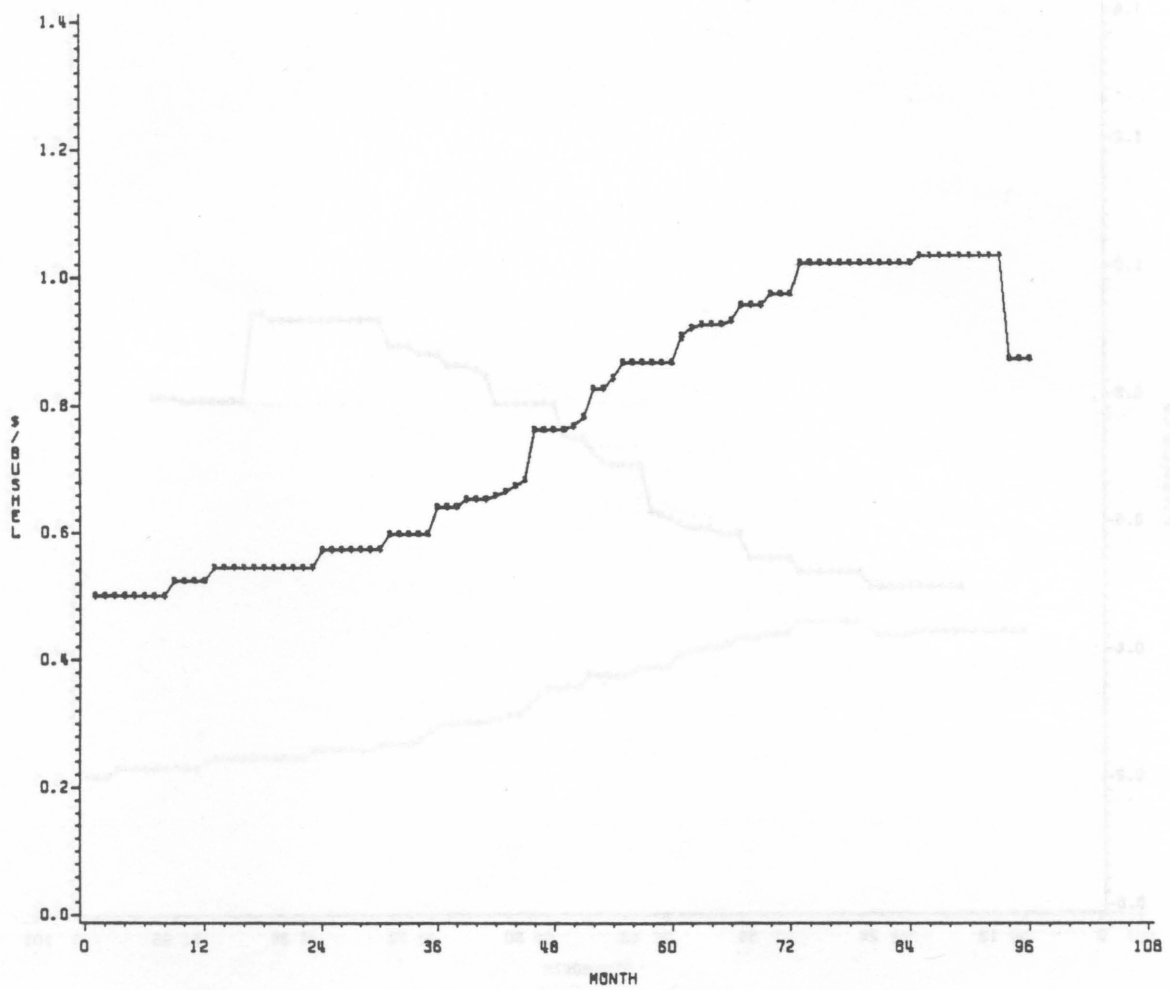


Table B4. Export Rate Linking Wichita, KS, with Galveston, TX, 1976-1983

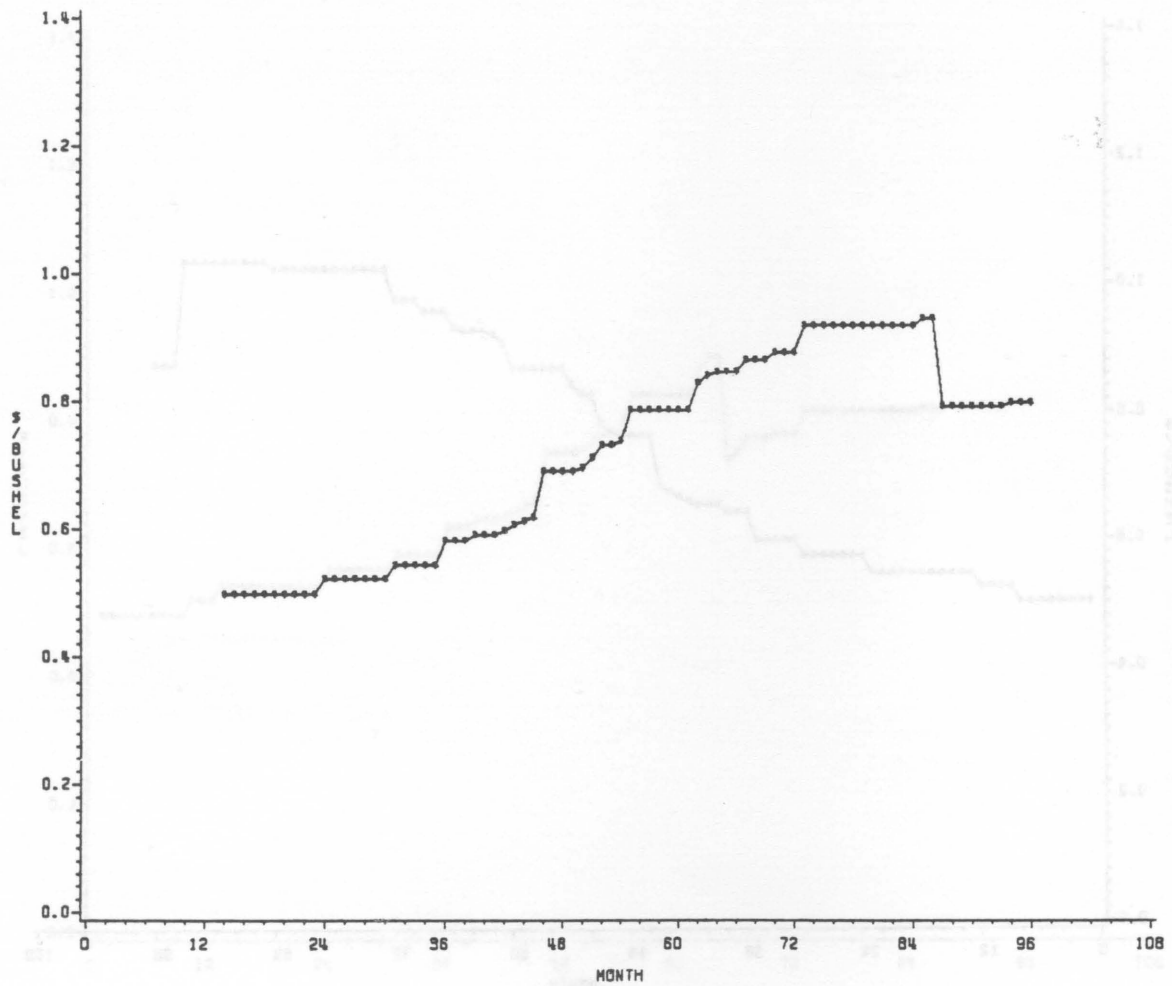


Table B5. Export Rate Linking Toledo, OH, with Baltimore, MD, 1976-1983

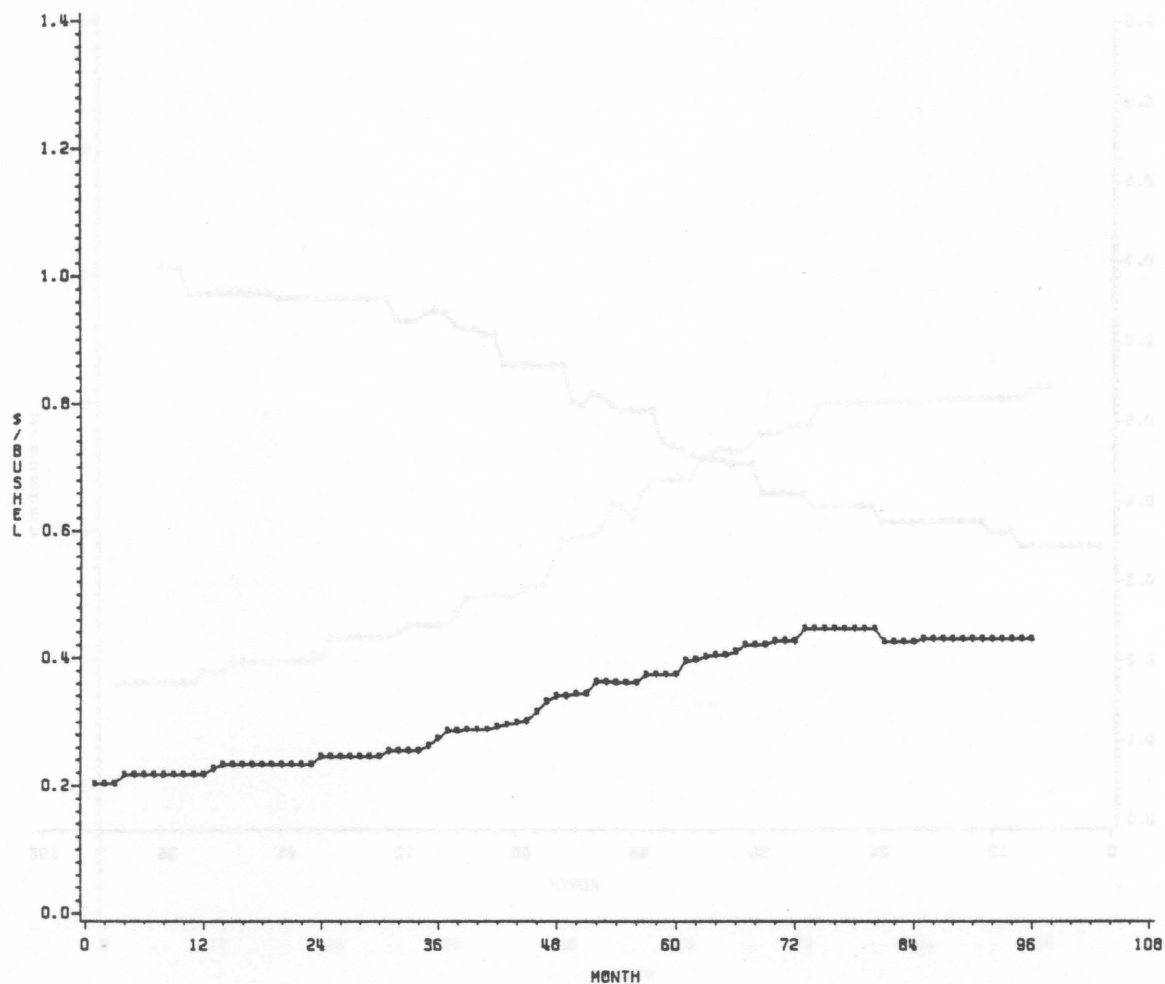




Table B6. Export Rate Linking Des Moines, IA, with New Orleans, LA, 1976-1983

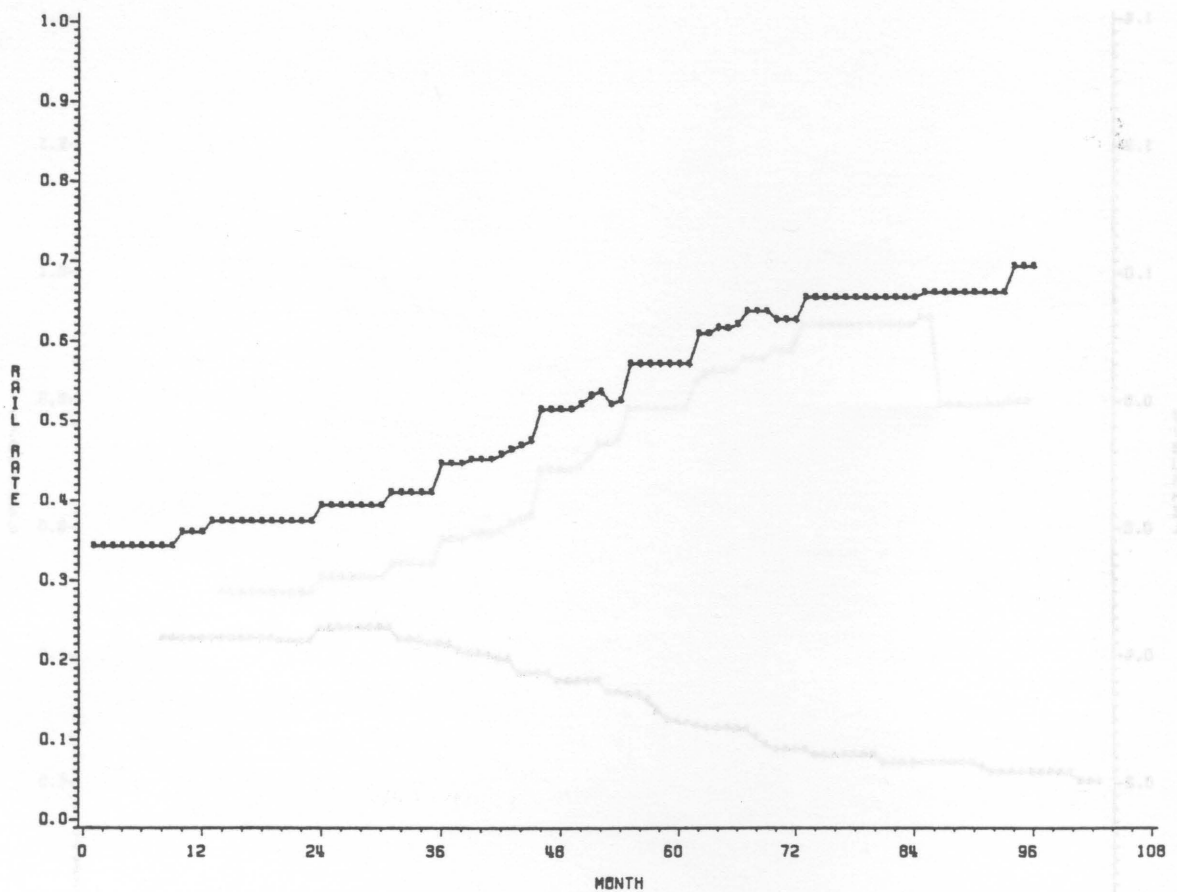


Table B7. Export Rate Linking Esterville, IA, with Houston, TX, 1976-1983

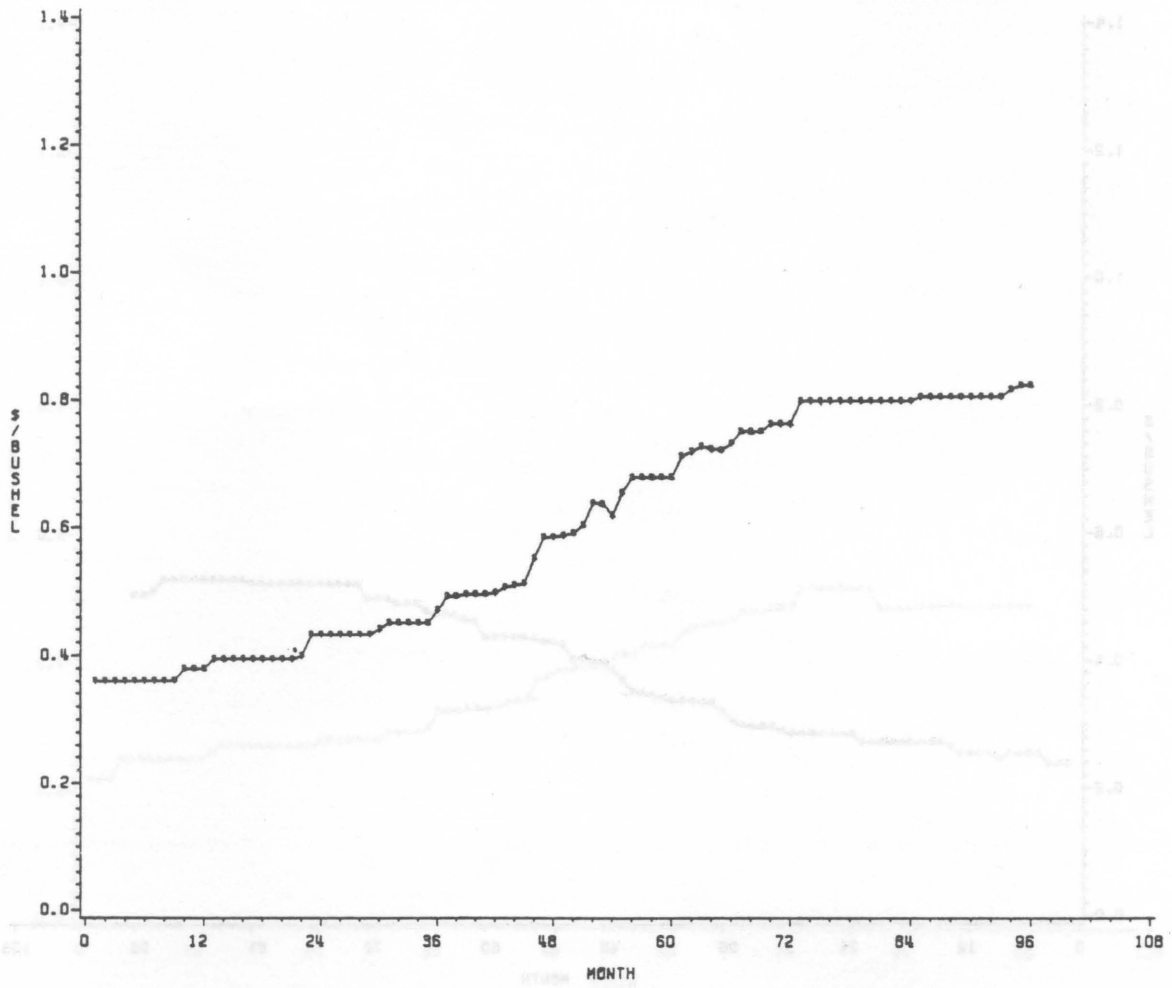


Table B8. Export Rate Linking Indianapolis, IN, with Baltimore, MD, 1976-1983

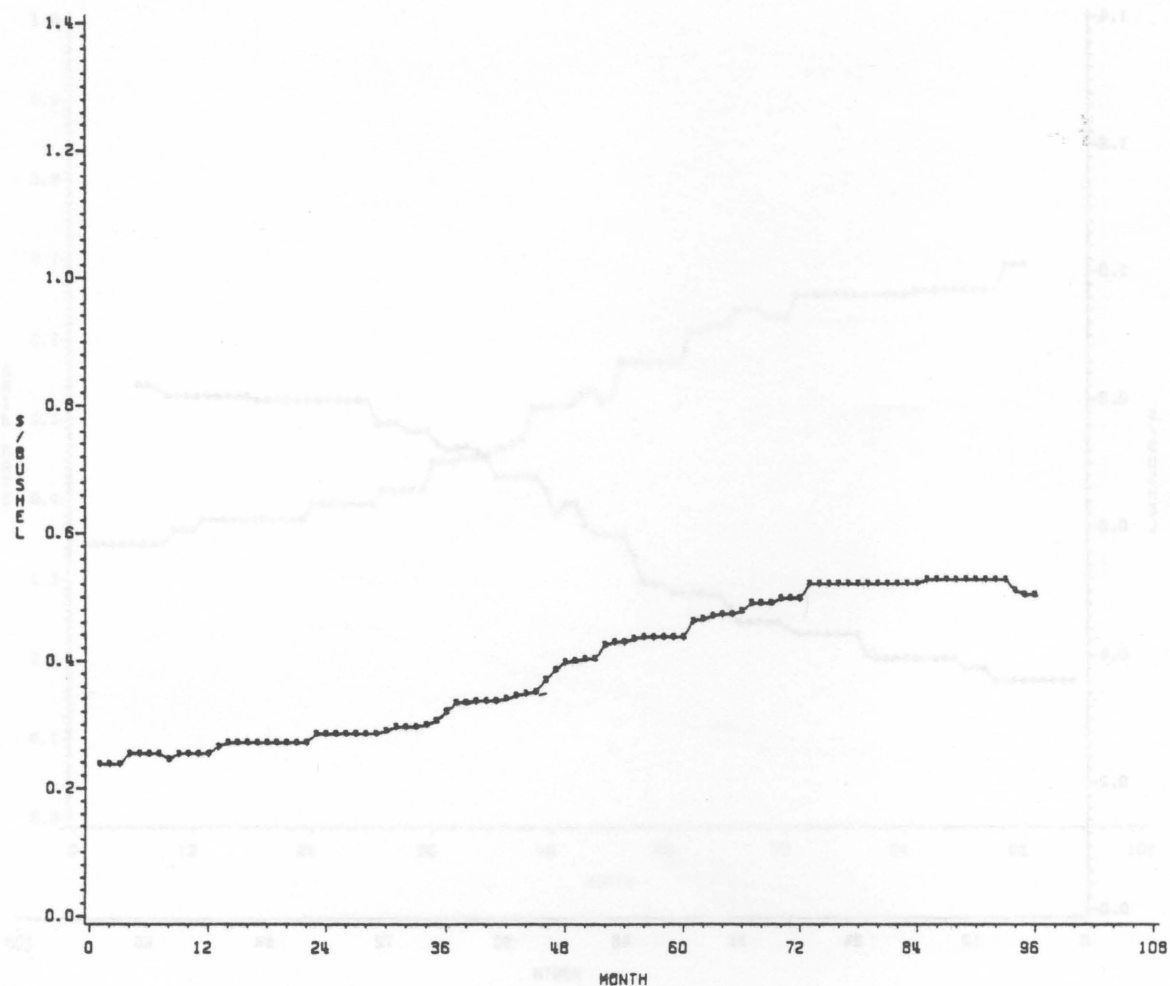


Table B9. Export Rate Linking Champaign, IL, with Philadelphia, PA, 1976-1983

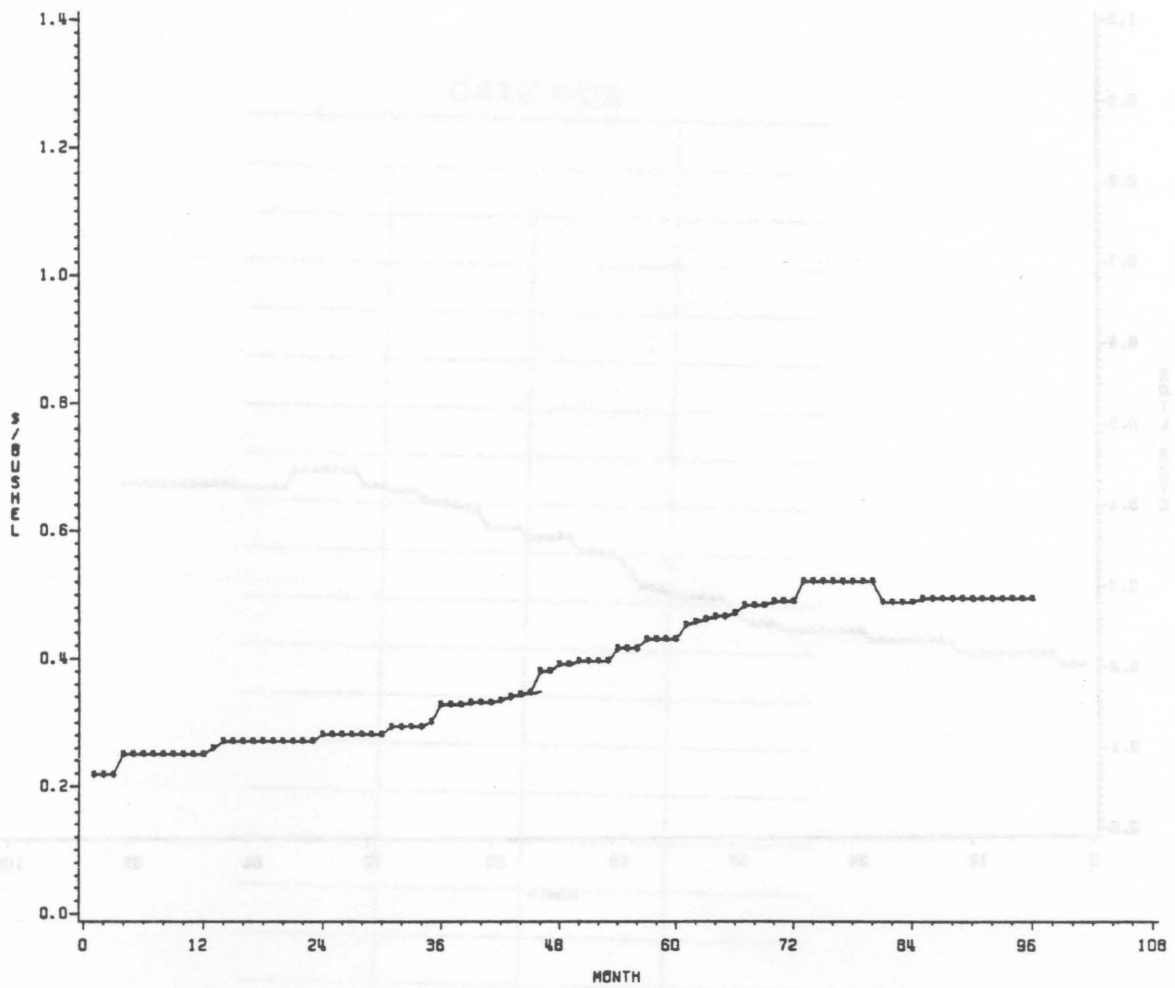
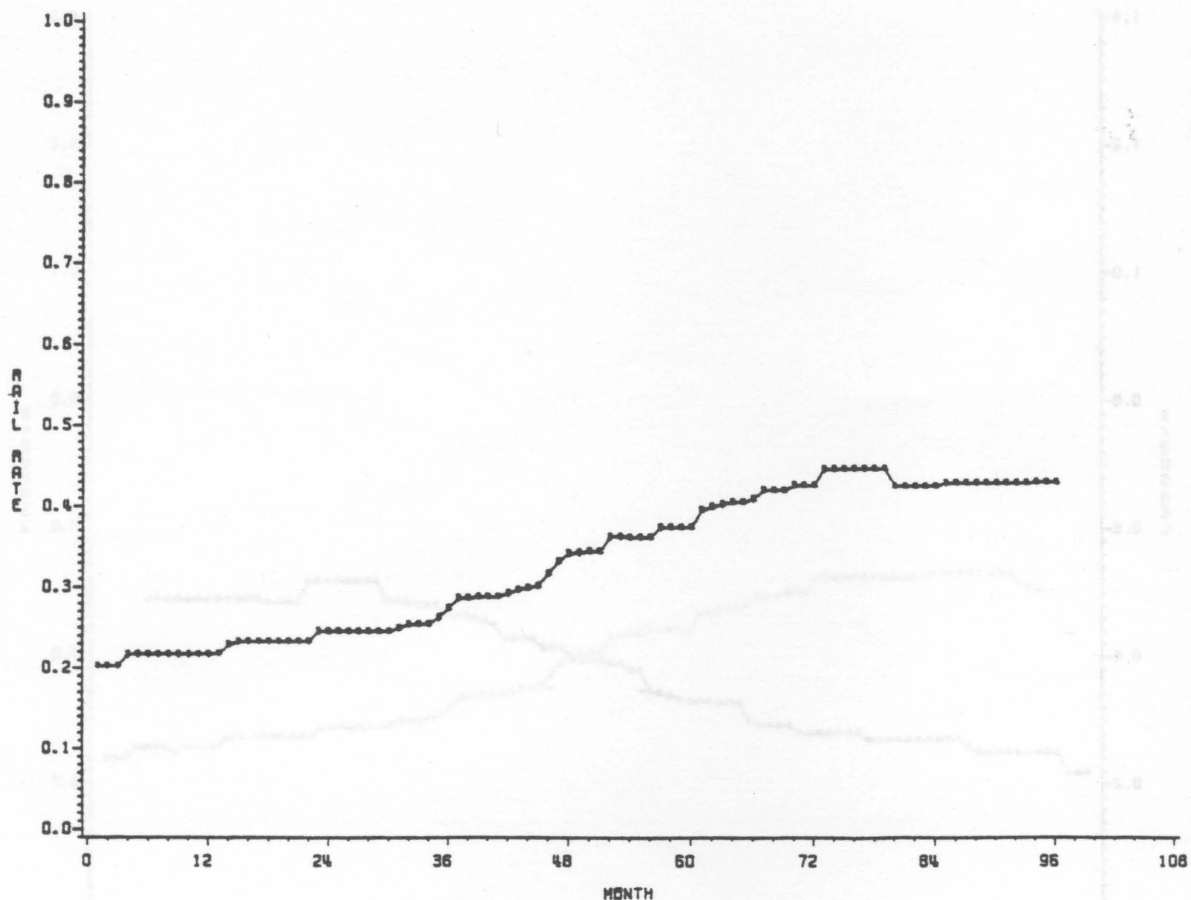




Table B10. Export Rates Linking Columbus, OH, with Philadelphia, PA, 1976-1983



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