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RENT & REGULATION IN UNIT-PRICE RATE DETERMINATION
REGIONAL DISCRIMINATION AND LOCAL LEVEL COMPETITION

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1. INTRODUCTION

The precipitous rise in the price of oil caused large changes in relative fuel prices. The rise in the relative price of oil made coal and nuclear power more attractive alternatives. In response, the existing mix of electric generating capacity is being altered as new plants are built and old plants are retired. Current plans for new electric utility plants are almost exclusively for coal-fired and for nuclear plants.¹ This shift in the demand for fuel by electric utilities will put upward pressure on the price of coal. In the long run, the supply of coal is elastic and, even under optimistic assumptions about demand growth, coal prices are forecasted by many observers to remain below oil prices.² Under this scenario, oil will disappear from electric utility boilers as new capacity is brought on stream.

This situation creates potentially appropriable rents. Utilities would pay higher prices for coal before switching to alternative fuels. If the coal producers possessed monopoly power, they could exploit this range of inelastic demand, and the price of coal would rise to the price of oil. However, all indications suggest that the coal industry is competitive and producers will be unable to exploit the steep rise in alternative fuel prices and capture for themselves the consumer surplus.³

Other economic agents are more favorably positioned in the race to capture the surplus. The United Mine Workers Union possesses some degree of monopoly power, although the present disarray of the union, and increasing competition from non-union coal makes it difficult to predict whether they will be able to capture a portion of the surplus.⁴ Individual coal producing states will attempt to set excise taxes that capture the surplus. Montana has already levied a

30% severance tax, only to see new production growing much more rapidly in Wyoming, where taxes are "only" 18%. Debate is now going on in Wyoming as to the proper tax. It can be expected that there will be changes in the tax in both states in the coming years. Whether a "tax cartel" emerges remains to be seen.⁵

Finally, the railroads are in a position to attempt to garner the potential rents. Transport costs account for a significant portion of the delivered cost of coal. In many areas there is no alternative but rail, and in many areas there is only one possible railroad to carry the coal. This suggests that railroads will attempt to take advantage of the increased attractiveness of coal and raise rates accordingly, with the result that delivered coal prices will indeed rise toward oil prices.

The railroads, however, are not completely unfettered in their attempt to capture the consumer surplus. The rates they charge are set in bargaining with utilities that possess a degree of monopsony power. Furthermore, the resulting rate is subject to regulation by the Interstate Commerce Commission. These factors will serve to keep down the delivered cost of coal. What the net result of these influences will be on delivered coal costs is the subject of the analysis that follows. We will examine what influence higher alternative fuel prices have had and will have on the cost of transporting coal to electric utilities.

We begin by examining the process by which rates are set for shipping coal, paying particular attention to the scramble for the potentially appropriable surplus. We estimate a model whose parameters measure both the results of the bargaining process between utilities and railroads and the effect of regulation on the bargaining process.

The next section presents some necessary background material and discusses previous work in this area. The investigation considers two sub-periods - pre- and post-1970. In section 3 a model of rate determination is developed. Section 4 discusses estimation problems. In section 5 the model is estimated for the pre-1970 period. Section 6 considers the evolution of rates in the post-1970 period. The concluding section summarizes the results and discusses the implications of the results for public policy.

2.1 PREVIOUS WORK

The typical method for shipping large quantities of coal is by unit-train. These are trains dedicated to a particular shipment between a mine and a point of consumption. The trains run on a regular schedule and avoid costly switching expenses. Because of the steady schedule utilization rates of cars and locomotives are much greater, leading to lower capital costs. In 1976 unit-trains accounted for about 25% of total rail shipment of coal, and it is expected that in the future this fraction will rise.

The first and most important look at the economics of unit-trains was by MacAvoy and Sloss [1]. They investigated the long delay between the development of the unit-train concept and its introduction into the U.S. coal industry. Their conclusion was that regulation by the Interstate Commerce Commission retarded the introduction of this service innovation. The Interstate Commerce Commission prevented discrimination between regions on the introduction of a new service. MacAvoy and Sloss maintain that this anti-discrimination policy caused the delay in the introduction of unit-train service. The railroads would like to have introduced unit-trains and have offered lower rates on the east coast to compete with imported residual fuel oil. But, the ICC would have required the same service along with lower rates to inland

stations. MacAvoy and Sloss calculate that until the early 1960's the gain in profits on the east coast was less than the loss on shipments to inland stations. During the early 1960's, the situation reversed itself and the service was introduced.

MacAvoy and Sloss are careful to distinguish between the policy toward the introduction of unit-train service and the policy toward the rates that would eventually emerge. If unit-train service were offered to coastal stations, it must also have been offered to other areas along with some reduction in rates. MacAvoy and Sloss don't consider the possibilities for discrimination in rates between areas, once the service was introduced. Could railroads discriminate among shippers as long as unit-train services were offered? How far could rates diverge to similarly situated purchasers of coal?

In their study, MacAvoy and Sloss estimate the cost savings of unit-trains, focusing on the short-run variable costs and utilizing reported expenditures on various categories of cost. Government studies have attempted to infer costs directly from rate data [2,3]. These studies also ignore the important effect of market power on rates. They typically regress the rate charged on miles shipped and other cost-related characteristics. This assumes that rates are set at cost and ignores the impact of market power.

Explicit recognition of monopoly power was part of an analysis of unit-train rates by Charles River Associates [4]. In an attempt to account for competitive effects they ran the following regression:

$$\log t = \alpha_0 + \alpha_1 \log M + \alpha_2 L + \alpha_3 \log \text{COAL} + \epsilon$$

where

t = rate per ton in dollars

M = miles

L = loading and unloading time in hours

COAL = percent of fuel burned accounted for by coal in the given electric plant.

The percent of fuel burned accounted for by coal was added to try to reflect the competitive position of the utility. The hypothesis was that the greater the percentage of fuel represented by coal, the less the competitive advantage of the utility and, consequently, all other things constant, the greater the tariff they would be forced to pay.

The difficulty with this approach is that there is a simultaneous system at work. The percent of fuel burned is itself a function of the transport cost. A utility facing low rates might be expected to burn all coal, even if rates were competitively set.

In addition, the form of the estimated function is somewhat puzzling. The interaction of the variables implied by the log form is not justified. The effect, for example, of loading time should be purely additive and not depend on distance or competitive effects.

In what follows we attempt to answer the question about what happened to unit-train rates once the service was introduced, i.e. was discrimination among users allowed? But, to answer that question we must estimate how costs varied by user. In the sections below we specify and estimate a model of rate determination that deals simultaneously with both costs and the degree of discrimination.

2.2 INTER-FUEL COMPETITION

In order to understand the pattern of rates one must examine them in historical perspective. During the late 1950's and early 1960's coal lost its markets on the east coast of the United States to residual fuel oil. The high cost of transporting inland the viscous fuel oil prevented oil from competing in the interior. The major inland competition for coal throughout the 1960's was natural gas. Electric utility consumption of natural gas increased

from 1725 to 3894 mcf between 1960 and 1970. In 1960, natural gas accounted for 13% of electric utility fuel burn and by 1970 it represented 30%. Coal had to meet competition from gas in wide areas of the United States. Consequently, the pattern of rates that emerged reflected the necessity on the part of the railroads to meet competition from natural gas.

This competitive pattern changed dramatically in the 1970's when shortages of natural gas began to appear in wholesale markets.⁶ The Federal regulation of natural gas created shortages so that new contracts of natural gas became unobtainable. Contract prices then reflected past history, but provided no indication of current costs.

Because of this changing nature of competition, we examine the evolution of rates by examining two historical periods - the situation as it evolved to 1970, when natural gas was a factor in the market and fuel prices were relatively stable, and the post 1970 period when gas no longer was a viable option for new fuel purchase by electric utilities, and fuel prices were rising rapidly.

3. A MODEL OF UNIT-TRAIN RATE DETERMINATION

The following citation from a recent Interstate Commerce Commission [3] investigation of unit-train rates indicates the forces influencing the rate-determination process:

Carolina Power and Light Company decided that increased demand for electrical energy in western North Carolina was going to require the construction of a new plant at Skyland, N.C. The location was selected after weighing the cost of transporting fuel to the plant as against the cost of transmitting electricity to the load center. Similarly, after determining that a steam-electric plant would be constructed rather than

a hydroelectric or nuclear power generating plant, the choice of whether to use coal or natural gas as the fuel depended upon a weighing of the delivered costs of each. At the time Carolina Power and Light entered into discussions with the railroads to find out whether the existing coal rates could be reduced, the estimated cost advantage in favor of natural gas was \$294,000 per year. But, before any change could be made in the coal rates, a reduction in the gas rates increased the advantage to \$467,000 per year.

To secure the use of coal at Skyland, the carriers agreed to reduce the existing rates by 45 cents per ton. It was anticipated that 500,000 tons of coal would be required each year. Thus, the annual reduction in the delivered price of coal as a fuel was \$225,000. In order to realize savings in transportation costs to the fullest extent possible, concentration rates were made applicable only to movements of not less than 1,000 tons, concentrated at Asheville, N.C., or Knoxville, Tennessee, and shipped in one day from one shipper to one consignee at one destination; the rate reduction was conditioned on prompt loading and unloading of cars; and finally, the reduced rates applied only when shipments were made in cars having a capacity of 70 tons or greater.⁷

Having decided to build a plant, Carolina Power and Light was looking for the cheapest fuel available. As long as the delivered cost of coal remained below the delivered cost of gas, coal was the preferred fuel. Above that price, gas would have been chosen.

Figure 1 describes this situation in which the utility would pay up to OC for coal delivered to its station. The FOB mine cost is OA and the true cost of shipping is AB. The railroad can charge up to an additional amount of BC, and it will attempt to capture that surplus. The utility, on

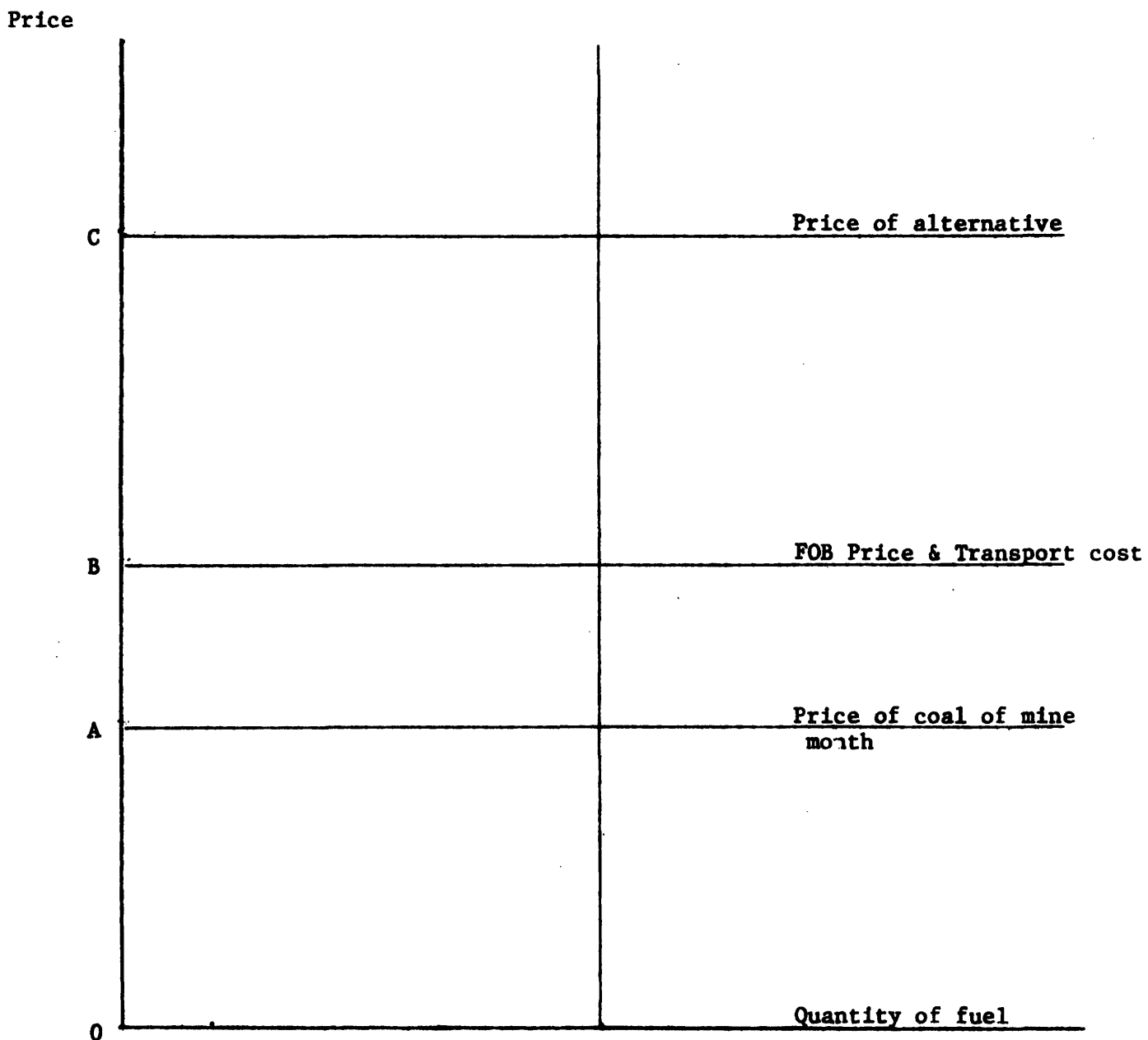


FIGURE 1

the other hand, would like to pay as close to AB as is possible. The rate that emerges from this bargaining process will be between AB and AC. The railroad will accept a rate no less than AB, since that is the cost. The utility will pay no more than AC since at AC it would move to an alternative fuel.⁶

Each party bargains with some degree of market power. The railroad in many cases is the only means of transporting the coal. In some cases a small number of alternative railroads are available. The utility typically also possesses some monopsony power, as it accounts for a large proportion of coal purchases in a given area. The rate that emerges therefore is the result of a bilateral monopoly bargaining process.

From a modeling standpoint, the eventual outcome of the bargaining process is indeterminate. The indeterminacy arises for two reasons. The relative strengths of the bargainers depend upon variables that are unobservable. For example, alternative locations available to the utility are unknown. If the utility was bargaining when the plant was under construction, the location was still open. Therefore other railroads were possible haulers of the coal to the plant. Similarly, other mines in the area might have provided the coal and other railroads might have hauled the coal from the mine. In sum, key factors affecting the bargaining process are unobservable. Secondly, even if the conditions were observed, there is an inherent indeterminacy in a bargaining process between bilateral monopolists. The model specified in the following section deals with this stochastic nature of the bargaining process.

4.1 MODEL SPECIFICATION

The process described above can be modeled in the following way. The \hat{t} be the true cost of hauling coal. Let PGAS be the price of gas delivered to the electric utility, and FOBCOAL be the mine-mouth price of coal. Then the rate that emerges lies somewhere in between \hat{t} and $\hat{t} + (PGAS - FOBCOAL - \hat{t})$.

Let the fraction of the surplus captured by the railroad be β . The rate, t , is then

$$t = \hat{t} + \beta(PGAS - FOBCOAL - \hat{t}). \quad (1)$$

Since β depends on the outcome of an indeterminate bargaining situation, β itself is a random coefficient. Equation (1) can be rewritten as:

$$t = \hat{t} + (\bar{\beta} + \eta) (PGAS - FOBCOAL - \hat{t}) \quad (2)$$

where $\bar{\beta}$ is the expected value of β , or the mean outcome of the bargaining process. The term η reflects the stochastic behavior, or indeterminacy of the bargaining process. Rewriting equation (2) yields

$$t = \hat{t}(1 - \bar{\beta}) + \bar{\beta}(PGAS - FOBCOAL) + \eta (PGAS - FOBCOAL). \quad (3)$$

The true cost portion of the tariff is simply a function of the characteristics of the shipment. We express cost as a linear function of miles shipped, the annual volume shipped, and the loading and unloading time, which yields the following equation to be estimated:

$$t = \alpha_0 + \alpha_1(1 - \bar{\beta})M + \alpha_2(1 - \bar{\beta})IMAT + \alpha_3(1 - \bar{\beta})L + \bar{\beta}(PGDD) + [\eta(PGDD - \alpha_0 - \alpha_1M - \alpha_2IMAT - \alpha_3L) + \epsilon]. \quad (4)$$

where

t = tariff in dollars per ton

m \equiv miles shipped one-way

$IMAT$ \equiv 1/minimum annual tonnage required for the rate in thousands

L \equiv loading and unloading time in hours

$PGDD$ = (price of gas - price of coal FOB mine) expressed in dollars per ton of coal.

Miles shipped reflects line-haul costs. Loading time influences rates since faster loading and unloading of cars means better rates of capital utilization and hence lower capital costs. Annual tonnage reflects the fixed costs. The rate charged is an average per ton charge. Higher volumes mean that fixed cost per ton is lower. The $PGDD$ variable measures the difference between delivered gas prices and the FOB cost of coal.

4.2 DATA

The sample consists of unit-train rates as of August 1970. The survey was conducted by the Peabody Coal Corporation. Only rates for steam coal used by electric utilities were used in our sample, since metallurgical coal rates clearly depend on different competitive factors.⁹ In addition, the investigation is limited to shipments in railroad-owned cars specifying annual volumes. Utilities sometimes purchase their own cars and are given lower rates. The sample is limited to railroad-owned cars so that the cost parameters measure the full costs of shipment. Only that way can we measure the appropriate rent.¹⁰ Including only rates with annual volume provisions insures that we do not mix train-load shipments with unit-train shipments. The price of gas comes from the National Coal Association's Steam Electric Plant Factors [5] and represents the gas price in the area of the specific electric utility plant.¹¹ The price of coal comes from the Bureau of Mines' Minerals Yearbook [6], and is the average value of coal in the traditional

supply area for the given utility.¹² The gas price is converted to an equivalent cost per ton of coal, and the PGDD variable is measured in dollars per ton of coal equivalent.

The gas price is not a perfect measure of the true cost of gas. Shortages were not a problem in the period under consideration. However, gas was purchased largely on an interruptible basis. This meant that service was subject to interruption during periods of peak demand. This was not true with coal where coal deliveries were firm. In most cases, however, interruption, while a possibility, was rarely interruption in fact. Secondly, interruptible contracts during off-peak months were of sufficient volume so that it was competing with large-volume coal shipments.

The only problem for the estimation is that the gas price mixes firm and interruptible sales. But, even this mixing problem is small since firm contracts were a small proportion of the consumption.¹³

4.3. ESTIMATION

The random coefficient model presented in (4) presents problems for estimation. It is assumed that η is distributed normally. This is a problem since β must, in theory, be between zero and one. In fact, this is not a serious problem. Miscalculation by railroads or utilities could result in a value outside these limits. Thus, we might observe a β greater than one or less than 0, but the probability will be small. In fact, as we shall see below, the variance of β is so small relative to the mean, $\bar{\beta}$, that there is only a very small probability of an observation outside those limits.

A more serious problem is the heteroskedasticity of the variance; the variance of the disturbance term is:

$$\sigma_{\eta}^2(\text{PGDD} - \alpha_0 - \alpha_1 M - \alpha_2 \text{IMAT} - \alpha_3 L)^2 + \sigma_{\varepsilon}^2 \quad (5)$$

where σ_{η}^2 and σ_{ε}^2 are the constant variances of η and ε respectively.

The correct estimator is weighted least squares. However, the weights depend on $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \sigma_{\eta}^2$, and σ_{ε}^2 , all of which are unknown. Normally, this problem might not be worth correcting. Ordinary least squares is inefficient, but still unbiased. Nevertheless, in this case it is worth adjusting for heteroskedasticity since we obtain an estimate of σ_{η}^2 which, as we see below, has important economic significance.

Ordinary least squares estimates of equation (4) are consistent. We therefore estimate (4) by ordinary least squares to get consistent estimates of $\alpha_0, \alpha_1, \alpha_2, \alpha_3$. We then form a vector of residuals from those OLS results. The square of these residuals, e^2 , provides an estimate of the variance of the equation. We then run the following regression:

$$e^2 = \sigma_{\varepsilon}^2 + \sigma_{\eta}^2(\text{PGDD} - \alpha_0 - \alpha_1 M - \alpha_2 \text{IMAT} - \alpha_3 L)^2 + \psi \quad (6)$$

where ψ is the stochastic term in the regression. The resulting coefficient estimates provide estimates of σ_{ε}^2 and σ_{η}^2 . We then use these estimates to perform weighted least squares on equation (4). The weights are the square roots of the fitted values of equation (4). This is clearly an iterative procedure. The weighted least squares estimates can be used to calculate new residuals and the following steps repeated.

4.4 POSSIBLE RATE PATTERNS AND THE IMPORTANCE OF σ_{η}^2

Aside from correcting for heteroskedasticity, this procedure provides an estimate of the parameter σ_{η}^2 . The variability in β tells us how able railroads are to discriminate. A large value for σ_{η}^2 would indicate that railroads differ in their ability to capture the surplus. A small value for σ_{η}^2 would indicate that there are constraints operating that reduce the opportunities for discrimination.

The model as formulated in equation (4) can lead to two alternative rate patterns. The variable PGDD will vary from region to region. But, over a fairly wide geographical area the prices of gas and of coal available to utilities are not likely to vary significantly. Utilities in the consuming region will draw from the same coal and gas fields. As distances between utilities get greater both transport costs and supply regions will change. Thus, within a region the variability in surplus captured from utility to utility will depend upon the variability of β , or on σ_{η}^2 . The variability reflects the different unobserved circumstances of the bargaining process. We might expect to see some variability in this coefficient due to the different circumstances surrounding each individual rate. Even different plants of the same electric utility would have different circumstances surrounding the bargaining over rates.

On the other hand, there are strong a priori reasons why one would expect β to demonstrate low variability. These reasons all relate to regulatory behavior. The negotiations between the railroad and the utility are ultimately subject to regulation by the Interstate Commerce Commission. In practice, the Interstate Commerce Commission does not enter the process unless a rate is challenged. A rate is challenged when there is an aggrieved party, in most cases an electric utility, that feels it is being charged too high

a rate. The clearest signal to a utility that a rate is too high is a rate out of line with other rates in the area. This is also the best evidence the utility can present to the Interstate Commerce Commission to demonstrate that is being "unfairly" discriminated against. This has been demonstrated most recently in a case between the City Public Service Board of San Antonio, Texas and the Burlington Northern Railroad. City Public Service is claiming that the rate it is being charged is too high. It claims that considering the cost on comparable shipments, it is being charged too much. Burlington Northern Railroad agrees that the rate is higher than other rates, but their claim is that there are no other comparable shipments, since this shipment is to an area where coal has not been shipped before and new investment is necessary. In other words, both agree the criterion for a "reasonable" rate is rates on comparable shipments. They just differ over what are comparable shipments.

The importance of comparable shipments is quite explicit. The complainant's view:

It has been my experience in the establishment of new unit train rates, that due recognition must be given to existing rates applicable under the same or similar terms and conditions, providing such rates are just and reasonable.¹⁴

One method historically used to prescribe a maximum reasonable rate is through a comparison with existing rates.¹⁵

The ICC's view:

"One of the best tests of reasonableness is a comparison with rates on like traffic in the same area."¹⁶

This also appears to be the view of the Railroad:

"Railroads publish tariffs which are a matter of public record and by this means, rates are established which are open to all users of rail service. Under the Interstate Commerce Act, such rates must be fixed at reasonable and non-discriminatory levels and they must be reasonably related to other rates for similar services. Railroads must therefore be prepared to justify their rates in formal proceedings before the ICC which inquire into every element of their formation."¹⁷

This standard of already existing rates makes it difficult for a railroad to take advantage of changed bargaining circumstances. The attempt to get a larger railroad, knowing this, will feel constrained to the prevailing pattern in the region. The Interstate Commerce Commission traditionally rules against discrimination between similarly situated shippers, suggesting that the variability of β will be small.

This does not imply a uniformity of rates between regions. The ICC has traditionally been sympathetic to regional patterns of discrimination. A utility attempting to challenge a rate will be on weak ground if it cites rates in other regions as a basis for its complaint. However, similarly situated utilities are an accepted source for comparison. This suggests a low variability among utilities within a given region but allows for variability between regions. We now turn to a discussion of the results.

5. RESULTS: 1970

The results confirm our a priori expectations. Tables 1 and 2 present the estimates of equations (4) and (6) for the east and midwest respectively. Variable PGDD is seen to be a significant determinant of rates. β is, as expected, between 0 and 1. In the eastern part of the United States, on the average, railroads were able to capture 19% of the surplus. In the midwest, the average percentage of surplus captured was 22%.

The striking result is the low variability of β as measured by the parameter σ_{η}^2 . In the east this is partially attributable to the heavy concentration in the sample of rates in North Carolina. The low variability could be due to the similarity of bargaining circumstances as well as the effect of regulatory behavior. On the other hand, the midwestern sample includes more destinations and the variability in β is still quite small.

TABLE 1
REGRESSION RESULTS FOR EASTERN SAMPLE

EQUATIONS (4) & (6)

Equation	Right-Hand Variable	Estimated Coefficient	Standard Error	T-Statistic
(4)	C	.709877E-01	.330789	.214601
	M	.463206E-01	.672554E-03	6.88727
	IMAT	17.3961	223.858	.777107E-01
	L	.164759E-01	.959643E-02	1.71688
(6)	PGDD	.179329	.487188E-01	3.68090
	R^2	.9801		
	S.E.R.	1.16882		
		N = 15		
(6)	σ^2_η	.198797	.819049E-01	2.42717
	σ^2_ϵ	-.49868E-03	.702568E-03	-.709765
	R^2	.0375		
		N = 15		

TABLE 2
REGRESSION RESULTS FOR MIDWESTERN STATES

EQUATIONS (4) & (6)

Equation (4)	Right-Hand Variable	Estimated Coefficient	Standard Error	T-STATISTIC
	C	-.291604	.244244	-1.19390
	M	.439043	.381158E-03	2.08857
	IMAT	118.932	56.9440	11.5187
	L	659823E-02	.283973E-02	2.32354
	PGDD	.225331	.720623E-01	3.12690
		.582484-01	.113102E-01	5.15005
		-.861889E-04	.221248E-03	-.389558
	$R^2 = .9912$			
	S.E.R. = 1.08138			
	N = 31			
Equation (6)	σ^2_η			
	σ^2_ϵ			
	$R^2 = .0052$			
	N = 31			

There is a difference between regions in the importance of the surplus. In the midwest, the rent was, on average, 32.8% of the tariff. In the east it was only 1.3% on average. The higher importance in the midwest is due to the higher gas prices in the region. The South Atlantic paid lower prices for gas and competition with gas in the South Atlantic region was acute during the 1960's.

In summary, the results are consistent with the model of rate determination presented above in Section 3. Railroads were able to capture some of the surplus, but the utilities were not without bargaining power. In fact, in the 1960's the bulk of the surplus was captured by the utilities and not by the railroads. Furthermore, lower gas prices kept the rate close to cost. In the midwest, on average, the rate exceeded cost by 40¢. In the east this was even smaller, amounting to 12¢ on average.

The other important result of the estimates is the low variability in β as measured by the estimate of σ_{η}^2 . Coupled with the fact that PGDD will not vary significantly within a region, a uniformity of rates within regions results. This is consistent with the above-stated policy of the Interstate Commerce Commission allowing discrimination between similarly situated utilities, but discouraging discrimination between areas.

6.1 CHANGES IN RATES: 1975

The above model provides an explanation for the pattern of rates as of 1970. The situation after 1970 changed dramatically. Natural gas shortages began to appear in wholesale markets. The price of natural gas no longer reflected an alternative to electric utilities. In 1973 oil prices took a huge jump, and more recently nuclear power costs have risen and regulatory difficulties have multiplied. In sum, the interfuel competition that served

TABLE 3
PERCENTAGE CHANGE IN RATES BETWEEN 1970 AND 1975 FOR UNIT-TRAIN
SHIPMENTS IN RAILROAD-OWNED EQUIPMENT*

Tariff #	Origin	<u>Rates Escalated by ICC Decision</u>	
		Destination	Percentage Increase
TL/CTR 115	Pa.	Washington,DC	72.8 - 76.6 **
SPTB954C	Ala,Ky,Tenn.	McManus,Ga.	63.2
CMSTP+P 1859E	Ind.	Ind.	71.3 - 71.5
SWL-22-F	Okla.	K.C.	67.3
PC-24-A	Ohio	Michigan	75.9
NWA 176C	Ky,W.Va.	Toledo,O	72.7
SFTB 1123	Ala,Ky,Va.	Canadys,SC	69.9
SOU 261	Ala.	Ala.	61.7 - 62.5 **
OCTB 28	Ohio	Michigan	73.0
<u>Rates Escalated by Fixed Formula</u>			
BN 38 B	Mont.	Minn.	48.2 - 51.2 **
SFTB 1104	Ky,Va.	N.C.	40.3
BN 54	Ill.	Mo.	43.8 - 45.9

NOTES

* For brevity, only rates for shipments using railroad-owned equipment are shown. Thirteen rates for shipper-owned equipment showed similar increases. There were three exceptions. The three tariffs had increases of 80%, 93% and 100%. However, the latter two tariffs also specified rates for either railroad-owned equipment or different volumes which experienced increases of 71% and 67%.

** The range is for different annual volumes.

SOURCE: Peabody Coal Company Surveys in 1970 and 1975.

to moderate rail rates no longer could serve that role. Railroads, even if they continued to receive approximately the 20% of surplus they were receiving in the 1960's could, potentially, dramatically increase their profits on hauling coal. However, the analysis of the previous sections suggest there are limits to the railroads' ability to capture the higher surplus.

Working against the more favorable economic circumstances facing the railroads is the regulatory process. The implication of the preceding analysis is that it will be difficult to introduce a change in the rate pattern, once that pattern is established. If the underlying circumstances change, so that PGDD increases, it will be difficult to introduce any single rate that rises substantially above the already-established pattern. Again, this is because the utility could challenge the rate pointing to others in the region that were set under less favorable circumstances for the Railroad. The utility being charged the new rate will charge unfair discrimination. Inertia plays a large role in rate determination. The same forces that kept the variability of β low could serve to keep the surplus captured by the railroad low under changing circumstances. If captured surplus were to rise, it would have to occur on all rates, even those established when circumstances were less favorable to the railroads, and therefore would require an explicit policy decision by the Inter-State Commerce Commission. Therefore, in regions with well established patterns it would be difficult to break the pattern.

In areas with no established pattern, that is in areas just turning to coal as a source of energy, there is an opportunity to establish higher rates. Inter-regional differences existed in 1970, and we might expect to see them accentuated as rate patterns become established in new regions in the post-1970 period. It is to consideration of this period that we now turn.

6.1 RATE DETERMINATION POST 1970

There are three categories of rates that bear investigation in the post-1970 period. The first class consists of those rates that were published by 1970. They can be changed only after an ICC proceeding, or according to agreed-in-advance escalation clauses. Agreed-to-in-advance clauses adhere to some formula related to the cost index tabulated by the American Association of Railroads. Agreement to such a formula then precludes taking advantage of changing circumstances. Those rates that are not escalated systematically according to an agreed upon formula are escalated when the Interstate Commerce Commission grants periodic increases. For these rates, it is possible that the ICC will adjust rates for changing circumstances and allow higher profits as market conditions permit. Table 3 gives the percentage increases in rates between 1970 and 1975 for 17 different unit-train shipments in railroad-owned cars. These are shipments that were in the original 1970 sample and that were still in existence in 1975. Furthermore, there were no changes in service characteristics for these shipments to complicate the comparison. Over that period the AAR Cost Index increased by 74.3% nationally and ranged from a low increase of 73% in the east to 76% in the west.

The Table suggests that the ICC did not allow changing circumstances to affect rates. The rates that increase with decisions of the ICC all come extremely close to the Cost Index.

The rates using fixed formula are also shown. These had lower increases than the cost increase, but this is spurious. Fixed-formula rates lag behind the Cost Index but increase more frequently than the other types of rates. They catch up and then exceed the rates dependent upon the ICC procedures during the time between ICC decision periods.

The second class of rates are new rates published since 1970, but for a shipment between traditional supplying and consuming regions. For example, a new shipment from Northern Appalachia to Detroit would not represent a departure from traditional shipping patterns. The final class of rate is the entirely new rate, that is a rate for a shipment between a new origin-destination pair. The main examples here are the new rates from the Powder River Basin of Montana to destinations east of the Mississippi River in Illinois and Indiana.¹⁹ Powder River Basin coal was used in Minnesota in the pre-1970 period, but had not penetrated further east nor into regions south of Montana.

We have already established that the old rates escalated at a rate comparable to cost increases. The anti-discrimination hypothesis suggests that new rates in "old" areas would be close to the old rates. However, the increased value of PGDD would lead to higher rates in areas where no established pattern exists.

The above hypothesis is tested using rates on shipments from the Powder River Basin of Montana and Wyoming. Coal output from this region has been growing rapidly in the post 1970 period. The Montana-Wyoming coal, which is low in sulfur, has seen its market expand as utilities have scrambled to secure low sulfur coal to meet anti-pollution requirements. This area is

really the only area where completely new coal shipment patterns are emerging. It is also convenient for testing the above hypothesis here because there was an already established rate from the Powder River Basin to Minnesota in the 1970 period, as well as new rates to Minnesota. We therefore can compare rates all three types of shipment.

Table 4 compares the 1975 cost per ton-mile on the original shipments to points in Minnesota, on new shipments to Minnesota and on shipments to points east of the Mississippi River. The latter represent a completely new pattern of shipment. What emerges from the comparison is that there is a quantum jump between rates on shipments to Minnesota and shipments east of the Mississippi River. Rates to Minnesota, whether pre-1970 shipments, or the more recent shipments are lower than the rates to Illinois, Indiana and Wisconsin east of the Mississippi River. The variability within each class, however, is low. The one low rate east of the Mississippi, the shipment to Wisconsin, is a special case. The coal is transloaded to ships at Superior, Wisconsin and shipped by the Great Lakes to Detroit. The rate had to be lower to enable the western coal to compete with eastern coal to Detroit.

The above pattern is consistent with the explanation of rate determination offered above. The circumstances under which the Minnesota rates were negotiated changed. The early Minnesota rates were introduced when gas was still available to the upper midwest and western coal had to compete with midwestern coal.²⁰ In the post-1970 period gas was no longer competitive. Pollution regulations gave a decided advantage to western coal. However, because of the original rail rate pattern established when circumstances were less favorable for the railroads, the railroad was unable to take great advantage of the new circumstances.

TABLE 4
 RATE PER TON-MILE ON UNIT-TRAIN SHIPMENTS IN RAILROAD-OWNED
 CARS FROM THE POWDER RIVER BASIN (IN \$)

<u>Destinations West of or On the Mississippi River</u>			<u>Destinations East of the Mississippi River</u>											
Tariff#	Destination	Rate	Tariff#	Destination	Rate									
BN5B	Northtown, Minn.	\$.00752*	BN227	Plaines, Ill.	.00892									
BN38B	Cohasset, Minn.	.00561*	BN228A	Peoria, Ill.	.01019									
BN57A	St. Paul, Minn.	.00776	BN119	Havana, Ill.	.00902-.00934									
BN231	Becker, Minn.	.00665	BN199	Plaines, Ill.	.00891-.00903									
BN152A	Becker, Minn.	.00643-.00780	BN209	Waukegan, Ill.	.00933-.00934									
BN164	East St. Louis	.00741	BN238	Superior, Wisc.	.00724									
BN152B	Minneapolis	.00728-.00753												
			<table border="0"> <thead> <tr> <th></th> <th>With Superior, Wisconsin</th> <th>Without Superior, Wisconsin</th> </tr> </thead> <tbody> <tr> <td>mean</td> <td>.00720</td> <td>.00925</td> </tr> <tr> <td>St.Dev:</td> <td>.00065</td> <td>.00037</td> </tr> </tbody> </table>				With Superior, Wisconsin	Without Superior, Wisconsin	mean	.00720	.00925	St.Dev:	.00065	.00037
	With Superior, Wisconsin	Without Superior, Wisconsin												
mean	.00720	.00925												
St.Dev:	.00065	.00037												
			<table border="0"> <thead> <tr> <th></th> <th>With Superior, Wisconsin</th> <th>Without Superior, Wisconsin</th> </tr> </thead> <tbody> <tr> <td>mean</td> <td>.00908</td> <td>.00925</td> </tr> <tr> <td>St.Dev:</td> <td>.00069</td> <td>.00037</td> </tr> </tbody> </table>				With Superior, Wisconsin	Without Superior, Wisconsin	mean	.00908	.00925	St.Dev:	.00069	.00037
	With Superior, Wisconsin	Without Superior, Wisconsin												
mean	.00908	.00925												
St.Dev:	.00069	.00037												

* Shipment took place by 1970.

SOURCE: Burlington Northern Railroad.

The new shipments east of the Mississippi River, where no established pattern existed, provided an opportunity to take advantage of the changed circumstances. To estimate the difference between rates east and west of the Mississippi, the following regression was estimated:

$$\begin{array}{r}
 t = -2.38459 + .00889M + .0365743L + 17.0411IMAT + 2.3789D \\
 \text{s.e.} \quad .880265 \quad .00097074 \quad .0130858 \quad 49.6324 \quad (.436110) \\
 \text{t-statistic} \quad -2.70895 \quad 9.15559 \quad 2.79496 \quad (.343669) \quad (5.45492) \\
 \overline{R^2} \quad .9781 \\
 \text{S.E.R.} \quad .404027
 \end{array}$$

where M, L, IMAT are defined as above and D is a dummy variable with value 1 if the shipment crosses the river and 0 otherwise. The data are 1975 rates on shipments originating in the Powder River Basin using railroad-owned equipment. The results indicate, all other things constant, crossing the river cost an additional \$2.39 per ton. For a shipment to Chicago, this represented in 1975 about 25% of the cost. This constant represents the incremental rent captured on the totally new shipments.²¹

7. SUMMARY & IMPLICATIONS FOR POLICY

We have traced the evolution of unit-train rates. In the period after their introduction and before 1970, the rate patterns were established in face of intense competition from natural gas. The cheaper the gas available, the lower the rate for shipping coal. This pattern largely remains with us. Inertia plays a large role. The inability to discriminate between utilities in the same area makes it difficult to take advantage of changed circumstances in areas with long-established rate patterns.

However, new patterns are emerging with western coal. The rapidly rising alternative fuel prices offer railroads an opportunity. The evidence suggests they are trying to take advantage of it. The above analysis suggests that the process will not be a smooth one. Attempts to capture rents are

leading to challenges. Utilities claim that new origin-destination pairs do not constitute different services as in the case of the Burlington Northern vs. San Antonio Municipal Power Company. The railroads, eager to establish a new pattern of higher rates, defend the new rates as not comparable to old shipments. The railroads are emphasizing new investments necessary for the new shipments. Given the inertia in the system those initial decisions are very important in establishing rates for a long time to come. The ICC, reacting to this situation, is at the present time trying to decide what constitutes a "maximum reasonable rate" on western shipments.

The above analysis also has implications for an important policy issue now being debated in the United States Congress. Several groups have announced plans to build slurry pipelines for the long-distance transport of coal.²² Pulverized coal is mixed with water and the slurry is pumped through a pipeline. This technology will compete with railroads. The railroads have one very effective way of preventing the introduction of this technology. Any long distance route must cross rail lines and the railroad's permission is necessary to do so. The railroads have so far refused permission, forcing the potential pipeline companies to seek eminent domain legislation at both the State and Federal level. The legislation has passed the committee stage in Congress and will be acted upon soon. The argument over slurry pipelines is being cast in terms of which means of transport - unit-trains or slurry pipelines - is less costly. This, however important, is beside the point. The threat of slurry pipelines will serve to limit the margin above cost that the railroads will be able to earn. Granting eminent domain might not serve to build a single pipeline, but the threat could serve to keep rates down.

Finally, the analyses of this paper provides a partial answer to the question we began with. Will coal prices rise toward oil prices as suppliers of inputs capture a portion of the consumer surplus? As far as the railroads are concerned, the answer appears to be yes. But there are long lags, and the railroads will only gain a portion of the surplus, leaving some of the surplus for state legislatures, and perhaps, the UMW.

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FOOTNOTES

1. Current plans by electric utilities call for the construction of 130 megawatts of nuclear capacity, 129 megawatts of coal capacity and only 14 megawatts of oil capacity between 1977 and 1986. See National Coal Association Steam Electric Plant Factors, 1977, Table 10.
2. Federal Energy Administration, U.S. Energy Outlook, 1976, Washington D.C. February 1976.
3. See, for example, Thomas Ducheneau, Competition in the U.S. Energy Industry, Balinger Publishing, Cambridge, Mass., 1975, p.179.
4. For a view of the UMW that suggests that higher oil prices will not lead to much increased wage demands, see Henry Farber "Individual Preferences and Union Wage Determination: Case of United Mine Workers," Journal of Political Economy, forthcoming, 1978.
5. The low-cost of Montana and Wyoming coal would allow these two states to "export" high taxes to coal consuming states.
6. For a discussion of the shortages see Paul MacAvoy and Robert Pindyck, "The Regulation Induced Shortage of Natural Gas," Bell Journal of Economics, 4, (Autumn 1973), p. 454-498.
7. Reference [3], p. 110.
8. The prices should be interpreted as adjusted for differences in handling costs and expressed on a common basis. Effects of the cost of coal transport on the demand for electricity in the long-run are assumed small. In 1970 fuel accounted for about 1/3 of the delivered cost of electricity. Transport accounted for, on average, 1/3 of delivered coal cost. Therefore, transport cost accounted for 1/9 of electricity. (Source: Edison Electric Institute, Reference [6], p. 328.) Most estimates of the elasticity of demand for electricity in the long-run are around -1, implying that the cross-price elasticity of demand for electricity with respect to transport cost was around -.11.
9. Metallurgical coal is coal used to make the coke used in steel production. Rates are typically higher for shipping this type of coal. The higher rates can be explained by the less elastic demand for this type of coal.
10. Rates for shipments using shipper owned cars will be less because the shipper bears the cost of the cars and their maintenance cost. However, the appropriable rent is the difference between the price of gas and the total cost of the coal shipment.
11. The gas price was the delivered price of gas to the utility in question. When no gas was consumed in 1970, the delivered price to the utility nearest to the plant in question was used. Only areas where there was gas competition were included in the sample.

12. We take as the price of the coal, the average F.O.B. mine value reported by the Bureau of Mines for the district in which the shipment originated. The coal districts correspond to the districts established under the Bituminous Coal Act of 1937. In only one district this procedure was not followed. District 7 coal is biased upward because of the large production of high quality coal used in steel-making. For shipments originating in the district, the relevant cost price was assumed equal to the coal price in neighboring district 8.
13. In the east in 1970, firm sales accounted for about 10% of the total, and in the midwest, firm sales accounted for 15% of the total. See Future Gas Requirements of the United States, Vol. No. 4, October 1971, prepared by the Future Requirements Committee of the Gas Industry Committee.
14. City Public Service Board of San Antonio, Texas vs. Burlington Northern, Inc., et al., Docket No. 36180 before the Interstate Commerce Commission, testimony of Frances R. Weis, p. 110.
15. Ibid, Statement of Leroy E. Peabody, Jr., p. 161.
16. Interstate Commerce Commission, Spokane Culvert and Fabricating Co. vs. The Alaska Railroad, et al., No. 35656, October 30, 1975 (unprinted) at sheet 7 as cited in City Public Service Board of San Antonio, Texas, opening statement of Fact and Argument of Complainant, p. 206.
17. Statement of Louis W. Menk, Chairman of Burlington Northern Railroad before the House Committee on Interior and Insular Affairs, HR 1863, et. al., November 7, 1975, as cited in City Public Service of San Antonio, Texas, op cit., Opening statement of Fact and Argument of Complainant, p. 2.
18. In the Eastern sample, there are 11 different destinations in 5 states. North Carolina accounted for 6 destinations.
19. Shipments to Texas and Colorado from the Powder River Basin are now taking place but were not in the sample of 1975 rates. These new shipments raise issues of comparability such as in the San Antonio case that were not relevant to earlier Powder River Basin shipments.
20. The Cohasset, Minnesota rate is now being renegotiated. This rate is below the other Minnesota rates and was the first one introduced. Testimony in the San Antonio case reveals that Burlington Northern Railroad agreed to that low a rate because it wanted to spur the introduction of western coal. See City Public Service Board of San Antonio, etc.
21. We have concentrated on Powder River Basin rates in order to be able to compare pre and post 1970 rates from the same area. There are now rates for shipping coal from the Hanna Basin of Wyoming that are generally lower than the new Powder River Basin rates. These are the exceptions that prove the rule. Hanna Basin coal is much more costly to produce than Powder River Basin coal and in order to compete for electric utility business, the rates on shipping must be compensatingly smaller.
22. The biggest proposal is for a line from the Powder River Basin to Arkansas. It is a joint project of Bachtel, Lehman Brothers, and Middle South Utilities.

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3. U.S. Interstate Commerce Commission, Investigation of Railroad Freight Rate Structure - Coal, Ex Parte 270 (sub-No. 4), December 3, 1974.
4. Charles River Associates, The Economic Impact of Public Policy on the Appalachian Coal Industry and the Regional Economy, Draft Final Report, June 1972, pp. 3-20.
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6. Bureau of Mines, Minerals Yearbook, 1970.