RAILROAD DEREGULATION: IMPACTS ON RATES AND PROFITABILITY

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I. INTRODUCTION

With the imminent bankruptcy of six of the nation's major railroads (most notably the Penn Central), the fragile condition of the United States rail industry became apparent to all in the early 1970s. Economists and other observers had been critical of the regulations placed on railroads for several years, complaining that the regulatory policies were threatening the industry's viability and placing a substantial burden on shippers.

While the problems facing the industry were apparent, legislators were slow to act. Moreover, many feared that relaxing the regulations placed on railroads would result in price increases or reduced railroad profitability. Two early studies by Thomas Moore (1975) and the Interstate Commerce Commission (1977) provided conflicting results. Moore estimated that surface freight regulation was imposing costs on society in amounts between $6.5 billion and $15.2 billion in 1975 dollars. In contrast, the ICC estimated these costs to range from a negative $2.8 billion to a positive $1 billion.

Finally, Congress passed the Railroad Revitalization and Regulatory Reform Act (4-R Act) in 1976. This Act gave the railroads greater pricing flexibility, and eased restrictions on railroad track rationalization and mergers. However, significant regulatory changes did not occur until 1979 (MacDonald, 1989). In 1979, the Interstate Commerce Commission introduced confidential contract rates, exempted some commodities from regulation, and encouraged rail rationalization. The final piece of legislation deregulating the rail industry took place with the passage of the Staggers Act in 1980. In many ways, the Staggers Act validated what the ICC had already done (MacDonald, 1989).

Several studies have investigated the impact of deregulation on rates, providing somewhat differing results. Boyer (1987) found a slight increase in rail rates, while Barnekov and Kleit (1988) found decreases. In studies examining the rate effects on specific commodities, MacDonald found a decrease in rail grain rates, while Atkinson and Kerkvliet found increases in rail coal rates. Recently,

a study by McFarland examined the effects of deregulation on rates and labor productivity, while also examining post-regulation profits. He found that shippers have received better service without higher rates, and labor productivity has increased substantially. Furthermore, he found a lack of excess profits in the deregulated environment. This paper attempts to improve on the rail rate estimation employed by McFarland, while also measuring the impact of deregulation on rail profitability. While excess profitability is an important consideration in the deregulated environment, it is equally important to consider the financial viability of the railroads and how it has changed with deregulation. Because deregulation was largely an attempt to preserve the financial viability of the rail industry, improved profitability without large increases in rates would show further benefits of deregulation. Section II presents some background information on the arguments behind deregulation and also the approach of McFarland. Section III presents an extension of the approach used by McFarland by providing an improved rate estimation model, and by introducing a profit estimation. Section IV describes the data sources and the empirical estimation techniques used. Section V presents empirical estimates, and the final section discusses implications and presents concluding remarks.

II. THE ARGUMENTS FOR AND AGAINST DEREGULATION, AND THE FINDINGS OF MCFARLAND

Prior to deregulation, several observers argued that regulation was imposing a large burden on consumers, railroads, and society in general. Studies by Friedlaender (1971) and Moore (1975) estimated the costs of surface freight regulation to be high. Friedlaender and Moore both argued that regulation of the railroads was forcing traffic that would be more efficiently transported by rail to be transported by truck, because of the high rail rate structure imposed by regulation. In fact, their estimates showed welfare losses ranging between $1.7 and $2.4 billion.

Thomas Moore's study was the most often cited quantification of the costs of regulation by proponents of deregulation (ICC, 1977). Because of its major role in the deregulation debate, it is

worthwhile to go into some more detail regarding Moore's findings and the counterfindings of the Interstate Commerce Commission. Moore estimated three main types of losses from surface freight regulation, in general:

(1) losses due to inefficient use of mode

(2) losses due to traffic shifted to alternate mode

(3) losses due to traffic not carried

For the first type of loss, Moore argued that regulation allowed the various surface transport modes to operate inefficiently. He argued that both rail and truck would have to reduce costs under deregulation. In particular, he estimated that deregulation of trucking would result in a reduction in truck rates by twenty percent.[1] After estimating the own-price elasticity of demand for rail and the cross-price elasticity of demand for rail with respect to truck rates to both be unitary, he argued that the drop in truck rates would force railroads to drop rates by twenty percent, leaving total rail revenues unchanged. Railroads, in turn, would have to reduce costs significantly as an increase in traffic with no change in total revenues would result in a loss without such a reduction. Studies by Alexander Morton (1969) and the Interstate Commerce Commission (1977) both found the own-price elasticity of demand for rail traffic to be inelastic, suggesting that such a drop in rates could lead to the financial ruin of the rail industry.

Moore also estimated losses from traffic being carried by truck when it could be more efficiently carried by rail. In his view, rail rates on long-haul traffic were held at inefficiently high levels under regulation, preventing the most efficient mode (rail) from transporting some of this traffic. The Interstate Commerce Commission argued that rail rates may in fact rise with

[1]This was based on the USDA's estimate that truck rates on fruits, vegetables, and poultry dropped 20 percent as a result of deregulation in the early 1950's.

deregulation. They pointed to the need for improved service by railroads in attempts to recapture long-haul traffic, necessitating large capital expenses.

Finally, Moore suggested that some traffic was not hauled at all because of regulation. According to his argument, freight rates of all modes were held so high under regulation, that some shipments were not worthwhile to customers under any mode. If the arguments put forth by Moore were correct, deregulation should have led to a reduction in rail rates, a reduction in rail costs, and no loss in profitability of the railroads.

Moore and Friedlaender were not the only critics of rail regulation. The industry had seen a consistent decline in market share and in profits. Critics pointed to several problems in the industry; many that were perceived to be the result of regulation. A list of adverse regulatory policies cited by the U.S. DOT for the decline included the following:

- **Lengthy abandonment hearings** – The rail industry was suffering from overcapitalization, as it was forced to maintain road mileage that had very low traffic densities. The overcapitalization of the industry was not due to an Averch-Johnson type effect, as rate of return regulation was not practiced in the rail industry, but was due to rail's status as a common carrier (i.e. railroads were not allowed to adjust capital stock to permanent changes in demand). This overcapitalization led to high costs and low profitability for many of the nation's railroads.

- **Lack of flexibility in rate making** – Facing stiff competition from trucking and waterway traffic, railroads faced great delays in changing rates and had little flexibility in doing so. Most rates were set by rate bureaus, eliminating competition between railroads. This discouraged innovation in pricing and service, and may have resulted in lost traffic to competing modes.

- **Lengthy merger proceedings** – Merger proceedings were long and drawn out, possibly slowing down some of the eventual benefits of mergers. Several studies had shown economies of density and economies of scale in rail operations. Furthermore, mergers may have eliminated duplication of service. Thus, mergers may have had a positive impact on societal welfare through a reduction in overall costs.

- **Prohibition of joint usage** – Regulation did not allow joint usage and control of common trackage between two carriers. This most likely led to duplication of service, and high costs.

Other problems in the industry included inflexible management, outdated operating procedures, and a lack of intermodalism and innovation in the industry. These problems also appeared to have regulatory underpinnings.

Some advocates of regulation argued that easing of these procedures would lead to a lack of service and higher rates. They felt that speeding up abandonment proceedings could result in many rural areas losing rail service. Furthermore, reducing the length of merger proceedings could result in a great deal of monopoly power. Finally, many believed that rate flexibility meant rate increases. With increasing concentration through mergers and increased pricing flexibility, prices could skyrocket.

Others examined the rail tonnage regressions performed by Alexander Morton (1969) and the Interstate Commerce Commission, and felt that deregulation could result in further rail bankruptcies. They argued that increased competition could lower rates, leading to decreased revenues (due to an inelastic demand), which would result in decreased profits.

Thus, there were two conflicting views prior to deregulation. Those that supported deregulation believed that it would result in decreases in costs, increases in profitability, improvements in service, and decreases in rates. Those opposed to deregulation felt that deregulation could lead to poor service, higher rates, or increased rail bankruptcies.

Several recent studies have explored these issues. Research examining rates or profitability will be reviewed here. MacDonald (1989) examined the change in rail rates for export bound grain following the Staggers Act. He estimated rates on individual shipments, using measures influencing costs and demand elasticities for rail shipments. The author found that rail rates for export bound

grain did in fact decline following deregulation. In a similar study, Atkinson and Kerkvliet (1986) found that deregulation had caused an increase in rail coal rates.

Another study by Boyer (1987) examined average revenues per ton-mile for the industry. The author's estimated regression showed no effects from deregulation, although the author contends that the most likely effect of deregulation was an increase in rates. However, the results of the study are somewhat questionable, since the rate estimation used in the study only included shipment weight, a time variable, and a deregulation indicator as explanatory variables. In addition, only sixteen observations were included in the regression.

Finally, McFarland (1989) estimated the impacts of deregulation on industry revenues per ton-mile, as well as the impacts of deregulation on labor productivity. Furthermore, he tested for the presence of excess profits in the industry following deregulation. His rate model included density, length of haul, the percentage of shipments that were bulk shipments, GNP, time, and a deregulation indicator as explanatory variables. In general, his results were consistent with Boyer's in that he found no significant effect of deregulation on rates. However, the only significant parameter estimate in his regression was that attached to time. As in Boyer's model, the lack of precision in the estimates was probably (at least partially) the result of limited degrees of freedom. Moreover, an improved specification can be formulated. In examining the impact of deregulation on labor productivity, Boyer found that deregulation had made a significant improvement. Finally, the author estimated rail profitability with Tobin's q to show that railroads had not gained excess profits after deregulation.

III. AN EXTENSION OF THE APPROACH

While McFarland's approach provides a basis for examining the impact of deregulation on overall rates in the rail industry, several improvements can be made. First, McFarland's study only included twenty-one observations, but had seven variables. As stated previously, the lack of degrees

of freedom is probably one reason that few of the variables in his estimation were significant. This study will expand the data set by ten observations, by using data from 1960-1990. 1960 is an appropriate starting point, since it is after the deregulation of fruit, vegetable, and poultry truck shipments, and is also after the development of the interstate highway system. Any attempts at going back further than 1960 would require shift parameters to measure the impacts of these events, and any attempt at finding a precise date for such shift parameters would be subjective.

Moreover, several improvements in McFarland's model specification can be made. First, Gross National Product is probably not a good measure for estimating variations in transport demand, as there has been significant growth in the service industry in the U.S. economy. Variations in the volume of services sold in the U.S. certainly do not measure changes in transport demand. A better measure is the Federal Reserve's Index of Industrial Production. Second, inclusion of a concentration measure will likely influence rail rates, since greater concentration suggests more pricing power by firms in the industry. Finally, McFarland's use of the proportion of shipments that are bulk as an explanatory variable probably measures both cost and demand factors. As an alternative, inclusion of the proportion of shipments that are composed of truck competitive commodities and the average load per shipment will measure demand and cost factors separately.

The approach can be further extended by examining the impacts of deregulation on rail profitability. Many recent studies seem to have lost sight of the original purpose of rail deregulation. Unlike many other industries, rail deregulation was pursued mainly for the benefit of the railroads themselves. Continued rail service to the nation was considered to be vitally important to the economy, to the national defense, and to society. Because of the fragile condition of the rail industry at the time that deregulation took place, it is of vital importance to investigate the change in rail profitability (and therefore viability) that took place due to deregulation.

IV. DATA AND METHODOLOGY

This study uses industry data from 1960-1991. Data are obtained from Moody's Transportation Manual and AAR Railroad Facts, and are compiled from the financial reports of all Class I railroads. It would be preferable to use either pooled cross-sectional time series data at the firm level, or at the individual shipment level. This would provide greater degrees of freedom, and would shed some insight into the differential impacts of deregulation on various commodities and locations. However, given the short-time frame in which this study was conducted, consistent data were not available at the firm or shipment level.

Industry revenues per ton-mile can be estimated by the following:

$$R = R(c, e, d)$$

where:	R	=	Revenue Per Ton-Mile
	c	=	a vector of operating and supply characteristics
	e	=	a vector of variables affecting demand
	d	=	deregulation

The vector of operating and supply characteristics includes factors influencing costs such as density, average length of haul, and the weight per shipment. All of these factors have an inverse relationship with rail costs, and therefore, are expected to have an inverse relationship with revenues per ton-mile. Industry concentration is expected to have a positive relationship with revenues per ton-mile.

The vector of variables influencing demand include the Federal Reserve's Index of Industrial Production and the proportion of rail shipments that haul fruit, vegetables, poultry, meat, petroleum, lumber, and automobiles. Industrial production is expected to have a positive relationship with revenues per ton-mile, while the proportion of shipments that are truck competitive is expected to have a negative relationship with revenues per ton-mile.

Deregulation is measured by an indicator variable, with 1979 used as the beginning of deregulation. This is different from most previous studies, which have used 1980 as the beginning of deregulation. However, as stated by MacDonald (1989), much of the regulatory reform that took place in the rail industry had already been implemented in 1979. Thus, a more accurate impact of deregulation is likely to be measured by using 1979 rather than 1980.

The specific model used to estimate the impact of deregulation on rail revenues per ton-mile is as follows:

$$lnRTM = \beta_0 + \beta_1 lnDens. + \beta_2 lnALH + \beta_3 lnCONC + \beta_4 lnPRPTRK + \beta_5 lnLOAD + \beta_6 lnIP + \beta_7 DEREG$$

where:

RTM	=	real revenue per ton-mile
DENS	=	revenue ton-miles per mile of track
ALH	=	average length of haul
CONC	=	4-firm concentration ratio
PRPTRK	=	proportion of traffic that is composed of truck competitive commodities (fruits and vegetables, poultry and meats, petroleum, lumber and automobiles)
LOAD	=	average shipment weight
IP	=	the Federal Reserve's Index of Industrial Production
DEREG	=	deregulation indicator (1=1979-1993, 0=otherwise)

In this model, all cost variables are expected to have negative signs. All of these variables exhibit a negative relationship with costs, and should also be negatively related to revenues. Cost relationships should be reflected in rates in this estimation, since relevant demand factors are also controlled for. First, density is expected to have a negative influence on rates, as carriers realize significant system wide economies of density. Higher density shows better utilization of capital stock, and represents less wasted resources. Average length of haul is also expected to have a negative parameter estimate, *a priori*. This is the case due to a reduction in average costs as shipment distances

increase. Many rail costs are a function of the shipment (e.g. bookkeeping costs, loading and unloading costs, etc.) and don't vary with shipment distance. Thus, increases in shipment distance cause decreases in average shipment costs. Finally, the average weight per shipment is also expected to be negatively related to revenues per ton-mile. Carriers also realize economies of shipment density. Many rail costs are fixed with respect to the weight of the shipment (e.g. clerical costs, labor costs, etc.). Thus average costs per ton-mile decrease with increases in shipment weight. Insofar as demand variables are controlled for in the rate estimation, the negative influence that system density, average length of haul, and average shipment weight have on costs should be reflected in rates. Another supply variable included in this estimation is 4-firm concentration ratio. The greater the concentration in the industry, the higher the pricing power that exists. Thus, 4-firm concentration ratio is expected to have a positive relationship with revenue per ton-mile.

Demand variables include one that measures the elasticity of demand for rail service (the proportion of shipments that are fruit, vegetables, poultry, meat, petroleum, lumber, and automobiles), and one that measures the overall level of demand (industrial production). First, shipments of truck competitive commodities are likely to be much more price elastic, since they have a competitive alternative mode of shipping. Thus, the proportion of shipments that haul fruit, vegetables, poultry, meat, petroleum, lumber, or automobiles is expected to be negatively related to revenue per ton-mile, *a* priori. Second, the overall level of rail demand is likely to be higher when industrial production is higher, since there are more goods to be shipped. Thus, industrial production is expected to be positively related to revenue per ton-mile.

Finally, the deregulation indicator has an ambiguous sign, *a priori*. Many proponents of deregulation would argue that the sign on the deregulation indicator should be negative, *a priori*, since deregulation allowed greater pricing flexibility and generated improvements in efficiency. Moreover, they would argue that deregulation of rail and trucking forced a more competitive rail

industry and should have lowered rates. Many opponents of deregulation would argue that the sign on the deregulation indicator should be positive, since railroads would use their new found price flexibility to gather monopoly rents. However, a positive sign on the deregulation indicator may not necessarily provide a condemnation of deregulation. Deregulation was largely pursued for the benefit of the rail industry. Flexible pricing allowed greater differential pricing between elastic and inelastic markets. Greater pricing differentials between elastic and inelastic markets may or may not produce higher overall revenues, and appears to be consistent with greater economic efficiency (Quasi-Ramsey Pricing). Moreover, the deregulation indicator variable only measures the direct impact of deregulation. To the extent that deregulation resulted in increased length of haul, increased density, increased load per train, and/or increased concentration, the secondary effects of deregulation may be much different than the primary effects.

A similar model will be used to estimate the impacts of deregulation on rail return on investment.

$$ROI = ROI\,(c,e,d,a)$$

where:	ROI	=	rail rate of return upon net property investment
	c	=	a vector of operating and supply characteristics
	e	=	a vector of variables affecting demand
	d	=	deregulation
	a	=	accounting change

The vector of operating and supply characteristics, the vector of variables affecting demand, and the deregulation indicator are exactly the same in this model as in the previous model. However, one new variable is added in this estimation. This variable is an indicator variable to take into account a major change in railroad accounting procedures that occurred in 1983. The specific model used to estimate return on investment is as follows:

$$lnROI = \beta_0 + \beta_1 lnDens. + \beta_2 lnALH + \beta_3 lnCONC + \beta_4 lnPRPTRK + \beta_5 lnLOAD + \beta_6 lnIP + \beta_7 DEREG + \beta_8 ACCT$$

Factors influencing costs have an ambiguous relationship with return on investment, *a priori*, since it is not known how much cost savings are passed on to consumers. With a larger data sample it may be desirable to interact deregulation with operating characteristics, since the amount of cost savings that are passed on to consumers is likely to change with deregulation. The 4-firm concentration ratio is expected to have a positive relationship with return on investment, for the same reason that it was expected to have a positive relationship with revenues (i.e. greater pricing power by firms in the industry).

The demand variables are expected to have opposite signs in this estimation. Industrial production is expected to have a positive influence on return on investment, since greater industrial production should correspond with greater demand for rail services. The proportion of rail shipments that are made with truck competitive commodities is expected to have a negative influence on return on investment, since the demand for rail services for these commodities is more price elastic.

In measuring the effects of deregulation on the rail industry, the deregulation indicator in this estimation is perhaps more important than the deregulation indicator in the rate estimation. If deregulation was successful, there should be increased profitability after deregulation. The reason that action was taken to deregulate the rail industry was to save the industry. The next section presents the results of the rate estimation and the profit estimation.

V. FINDINGS ON RATES AND PROFITABILITY

Table 1 presents the results of the estimation of revenue per ton-mile. Over ninety-eight percent

of the variation in revenue per ton-mile is explained in this estimation. Moreover, nearly all of the parameter estimates have the expected signs and are significant at the 5 or 10 percent level. The only parameter estimate that does not have the expected sign is that for the proportion of shipments that are truck competitive commodities. However, this estimate is not significantly different from zero. A more detailed investigation of the commodities that are truck competitive may improve on this result. Nonetheless, given the limited degrees of freedom in this estimation, it is not surprising that some parameter estimates are insignificant.

The deregulation indicator has a positive sign in this estimation, suggesting that deregulation has caused an increase in rates. However, it is important to remember that the deregulation indicator only measures the direct effects of deregulation. To the extent that deregulation has increased density or load factors, rates may have decreased due to deregulation. This analysis estimates the direct effect of deregulation to be an increase in rates by .05 percent.

Table 1: Estimates of ln RTM

Variable	Parameter Estimate	t-ratio
Intercept	6.6198	6.19*
Density	-0.6620	5.95*
Avg. Length of Haul	-0.3622	1.04
4-Firm Concentration	0.2088	2.11*
Truck Competitive	0.0482	0.78
Load per Train	-0.6276	4.61*
Industrial Production	0.4763	6.31*
Deregulation	0.0489	1.98**

Adj. R^2 = .9848 F = 278.06 N = 31

*significant at the 5% level.

**significant at the 10% level.

Table 2 presents the results of the estimation of return on investment. In this estimation, only two of the parameter estimates are significantly different from zero. The insignificant parameter estimates for many of the operational characteristics may suggest that cost savings were passed to consumers. Density has a positive and significant parameter estimate. This is not surprising, since greater density suggests greater utilization of track, and therefore a greater return on investment.

The deregulation indicator also has a positive sign and is significant at the ten percent level in this estimation. This suggests that railroad profits increased with deregulation. Moreover, the estimation shows the direct effects of regulation to have caused more than one-half of a percent increase in rail return on investment. As in the rate regression, however, this effect is only the direct effect. To the extent that density was increased by deregulation, the increase in rail profitability from deregulation could be much larger.

Table 2: Estimates of ln ROI

Variable	Parameter Estimate	t-ratio
Intercept	12.5406	0.64
Density	4.4410	2.89*
Avg. Length of Haul	-5.2160	1.08
4-Firm Concentration	-1.4577	1.03
Truck Competitive	0.0563	0.06
Load per Train	-0.7079	0.31
Industrial Production	-1.3225	0.91
Deregulation	0.6289	1.83**
Accounting Change	0.3151	0.93

Adj. R^2 = .5767 F = 6.11 N = 31

*significant at the 5% level.

**significant at the 10% level.

VI. SUMMARY AND CONCLUSION

This study suggests that the direct effects of deregulation have been to increase rates and to increase profitability. This result is interesting in light of the pre-deregulation debate between Moore and the Interstate Commerce Commission. The results may support the findings of Morton and the ICC, in finding an inelastic demand for rail transportation. Nonetheless, increases in rail rates and profits could be consistent with a unitary elastic demand, with significant cost reductions in the industry. Most likely, the increase in profitability was due to a combination of cost reductions and rate flexibility.

Moreover, the rate increases due to deregulation that this study shows are only rate changes due to the direct effect of deregulation. To the extent that deregulation has increased density and load per train, rates may have decreased. Furthermore, to the extent that deregulation has increased industry concentration, it may have caused further increases in rates. More study is needed in this area to assess the impacts of deregulation on production efficiency in the industry, and overall societal welfare (i.e. consumer surplus + industry profits).

Finally, rates are analyzed on an industry wide basis in this study. It would be useful to examine the differential impacts of deregulation on different commodities and different regions. Most likely, the effects were to increase rates for non-geographically competitive commodities and shipments in rail captive regions, while decreasing rates for geographically competitive commodities in transportation competitive regions (e.g. those with barge loading facilities).

REFERENCES

Atkinson, S.E. and J. Kerkvliet. "Measuring the Multilateral Allocation of Rents: Wyoming Low-Sulfur Coal." *Rand Journal of Economics*, 17: 416-30, 1986.

Boyer, Kenneth D. "The Costs of Price Regulation: Lessons from Railroad Deregulation." *Rand Journal of Economics*, 18: 408-16, 1987.

Interstate Commerce Commission, Bureau of Economics. "A Cost and Benefit Evaluation of Surface Transport Regulation." In *Regulation of Entry and Pricing in Truck Transportation,* pp. 47-92, edited by Paul W. MacAvoy and John W. Snow. Washington, D.C.: The American Enterprise Institute for Public Policy Research, 1977.

MacAvoy, Paul W. and John W. Snow, ed. *Railroad Revitalization and Regulatory Reform.* Washington, D.C.: The American Enterprise Institute for Public Policy Research, 1977.

MacDonald, James M. Effects of Railroad Deregulation on Grain Transportation. U.S. Department of Agriculture, Economic Research Service, Technical Bulletin No. 1759, June 1989.

McFarland, Henry. "The Effects of United States Railroad Deregulation on Shippers, Labor, and Capital." *Journal of Regulatory Economics*, 1: 259-70, 1989.

Moore, Thomas Gale. "Deregulating Surface Transportation." In *Promoting Competition in Regulated Markets*, pp.55-98, edited by Almarin Phillips. Washington, D.C.: The Brookings Institution, 1975.