Productivity, Pricing and Profitability
in the Rail Industry: 1995-2004

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INTRODUCTION

Prior research has documented the tremendous productivity improvements achieved by the US rail industry in the latter third of the 20th century (Martland, 1999). These improvements provided annual benefits of $25 billion per year by 1995, most of which were passed on to customers in terms of lower prices, leaving constant-dollar industry profits about where they were in the mid-1980s or even the mid-1960s. Despite massive improvements in physical productivity, rail industry financial performance was essentially unchanged. Competitive pressures released by deregulation were predicted to continue, leading to potential financial problems because the rate of productivity growth was expected to decline.

The earlier research presented a contrarian view of the rail industry, which was in relatively good financial shape in the mid-1990s. Around that time, most industry leaders and consultants lauded prospects for the future – so long as the industry was not re-regulated (e.g. Allen, 1996; Harper, 1996; Gallamore, 1998; and Rennicke, 1998). Industry leaders did not anticipate problems concerning profitability, capacity, or service quality.

This paper updates the trends in productivity, pricing and profitability for the period 1995-2004. During this period, major mergers transformed the national network, while burgeoning traffic challenged the capabilities of the system. Problems in consummating the mergers, difficulties in expanding capacity to keep pace with traffic growth, and severe weather resulted in extended periods of congestion, service complaints, and public outrage concerning rail performance. While the industry did manage substantial improvements in productivity, most of the benefits were again passed on to rail customers in terms of lower rates. While rates did begin to

rise in 2004, the extra funds were largely consumed by the growth in capital investments.

The results presented in this paper therefore confirm the predictions of the earlier research. Productivity did improve, but at a slower rate. Rail rates continued to decline and did offset the financial benefits of the productivity improvements. Various strategic problems, including capacity and service quality did become more pressing. As a result, financial performance for the industry peaked around 1996, then declined until the very end of the period.

TRENDS IN PERFORMANCE 1995-2002

In this research, output was measured in terms of its value to the customer. Each shipment was viewed as a different type of output, and total output was measured by weighting each shipment by the price that was paid. Over time, output can change because of a change in traffic volume, traffic mix, or price. An output index was created for each year by dividing freight revenue by a price index, a technique that has been used in other studies of railroad productivity (e.g. Waters, 1997). The price index was based upon the constant dollar revenue per ton-mile as reported by the Association of American Railroads (AAR).

The first three rows of Table 1 show the absolute values for carloads, tons and ton-miles for the base year 1995 and for 2000 to 2004. The next three rows show the same information as an index, with the base year equal to 100. The last three rows show the key factors used to create a more general output index. Freight revenue was converted to output by dividing by the price index and comparing results to the base year. The output index, which grew to 150 by 2004, increased more rapidly than the indices for carloads, tons, and ton-miles, because it relates to prices rather than to physical measures. Some commodities with relatively high revenue per ton – especially shipments of intermodal containers and of automobiles - have been growing more rapidly than shipments of bulk traffic. The slight shift away from bulk traffic means that the industry is getting slightly more

revenue from commodity groups where revenue per ton or ton-mile is either growing faster or declining less rapidly.

Table 1 Class I Railroad Output, Various Measures, 1995-2004

	1995	2000	2001	2002	2003	2004
Carloads (million)	23.7	27.8	27.2	27.9	28.7	30.1
Tons (million)	1549	1738	1742	1767	1779	1844
Ton-Miles (billion)	1306	1466	1495	1507	1551	1663
Carloads (index)	100	117	115	118	121	127
Tons (index)	100	112	113	114	116	119
Ton-Miles (index)	100	112	114	115	119	117
Freight Revenue (billion)	$31.4	$33.1	$33.5	$34.1	$35.4	$39.1
Price Index	100	86.9	84.3	83.7	82.9	83.3
Output Index	100	121	127	131	136	150

Total inputs include all freight expenses, i.e. all of the people, equipment, facilities, fuel and supplies required to operate the system. The Railroad Cost Recovery Index (RCR), which has been produced by the Association of American Railroads for more than 50 years, was used to restate rail operating expenses in terms of base year costs (Table 2). Table 3 indicates strong productivity growth through 2004, as inputs declined despite substantial growth in output.

Improvements in productivity do not necessarily translate into financial improvements, which also depend upon trends in rates and

Table 2 Railroad Inputs, 1995-2004

	1995	2000	2001	2002	2003	2004
Class I Railroads						
Operating Expense (Billions)	$27.90	$29.04	$29.16	$29.59	$31.44	$35.11
Railroad Cost Recovery Index	100	116.6	120.0	120.8	125.19	132.11
Input Index	100	89.2	87.1	87.8	90.0	95.3

Table 3 Railroad Productivity
(Estimated as the ratio of the output index to the input index)

	1995	2000	2001	2002	2003	2004
Output Index (Table 1)	100	121	127	131	136	150
Input Index (Table 2)	100	89.2	87.1	87.8	90.0	95.3
Productivity Index	100	136	146	148	151	157

in unit costs. If productivity improves and rail prices keep pace with inflation in costs, then profits also improve. Table 4 provides summary comparisons for productivity, prices, and profits. Productivity rose sharply during this period, but prices not only failed to keep price with inflation, but declined. Taking 1995 as the base year, the ratio of the price index to the cost index fell to 0.63 by 2004. The overall effect on profitability was very small, as is evident in the combined index, which is the product of the factors shown in the first two lines of the table.

Table 4 Productivity, Prices, Profits, and Taxes

	1995	1997	1999	2001	2002	2003	2004
Productivity	100	118	124	146	148	151	157
Price Index/ Cost Index	100	.90	.84	0.70	0.69	0.66	.63
Combined Index	100	1.054	1.038	102.3	102.6	100.2	.992
NROI (billion)	$2.9	$4.0	$4.0	$4.1	$4.2	$4.1	$4.1

This analysis confirms the results of the previous study. Overall productivity continued to rise in the rail industry through 2004, but the benefits to the railroads were again offset by declines in rail rates. As a result, net railway operating income (NROI), which peaked in 1996 at $4.34 billion, dropped to about $4.1 billion thereafter.

Have Rates Really Declined?

The Surface Transportation Board (STB) estimated that the reductions in rail rates since deregulation in 1980 were equivalent to nearly $32 billion in 1999. Several challenges have been made to the STB's methodology, with strong views against (e.g. Wilner, 2000) and in support of the STB results (Rockey, 2001).

Shippers are usually more concerned with comparative rates than with absolute rates. It appears that rate differentials have increased for some, even while rate levels have declined for most. The STB response is that deregulation has provided railroads the freedom to set differential rates, depending upon the value of the service to customers and the extent of competition for the product (Office of Economics, Environmental Analysis, and Administration, 2000). While some rates may well have risen, the STB concludes that the overwhelming evidence is that average rates have fallen.

Another complaint is that there has been a shift in traffic mix that results in a lower average rate, even though the rates may have been

the same or higher for each traffic class. The STB addressed this issue by breaking out separate rate indices for eastern and western traffic; while the western traffic did indeed show a greater decline than in the east, the declines in both regions were steady and substantial. The STB also points out the average revenue per ton has declined or remained stable for most of the major traffic groups for the entire period since deregulation in 1980, despite longer hauls.

A more serious contention is that the services provided by the railroads are not the same services that were once provided. The railroads have shifted much of the burden of fleet ownership to the customers. However, the STB concluded that the total cost would amount to only about $3 billion/year, which is about 10% of the savings passed on to customers in the form of lower rates.

Another concern is that the railroads have achieved a considerable portion of their productivity savings through rationalization of the network and structuring rates so as to promote multi-car shipments and unit trains. To take advantage of these services, some customers have had to invest in facilities capable of handling much larger shipments, while others – especially farmers – have complained that their costs have risen for bringing their product to the rail head. The reductions in rail rates therefore do not equal the savings to shippers, who may face higher logistics expense elsewhere.

A final valid concern is that service levels have not been constant. Between 1995 and 2004, the rail industry suffered through a series of prolonged periods of congestion that were highlighted in the general business press and generally attributed to difficulties in mergers (Jesdanum, 1999; Machalaba, 1999; and Gallagher, 2002). Another explanation could be that decades of down-sizing coupled with strong growth in train-miles had put the industry on a course where the shrinking facilities reached the point where they were unable to handle the incremental traffic. Whatever the ultimate cause, there were major service complaints following UP's mergers first with C&NW and then with SP; a couple of bad winters led to serious problems for grain exports in the northwest, especially for the

Canadian ports; the CSX and NS acquisition and division of Conrail led to more problems. Congestion increases trip times, reduces reliability, and forces customers to pay more for inventory, to use more expensive modes, and to lose business or hurt relationships with their customers.

To summarize, it is clear that the price reductions cited above, while real to the rail industry, have to some extent been offset by costs shifted to rail customers. The railroads have also achieved some of their productivity gains at the expense of losing capacity and therefore increasing congestion within the system. Nevertheless, it is clear that rail rates indeed declined by amounts that are sufficient to explain why the more than $25 billion in annual productivity improvements did not result in higher rail profitability.

SOURCES OF PRODUCTIVITY IMPROVEMENT, 1995-2001

The aggregate analysis shown above cannot shed much light on the sources of productivity improvement. More detailed analysis was therefore conducted for the major categories of improvement.

Heavy Haul Railroads: as traffic mix, equipment types, and operating practices change, the amount of inputs required to move a particular type of freight changes. Major trends include larger cars, unit trains, and a shift away from yard-intensive general merchandise equipment to intermodal. The benefits were estimated using a service unit costing approach taking into account revenue ton-miles, train-miles, car-miles, carloads, and tons. After calculating the ratio of service units per unit of output for the base year and subsequent years, it was possible to calculate the service units that would have been required for each year if the ratio were the same as in the base year. Table 5 shows estimated cost savings of $10 billion in 2004 compared to what costs would have been in 2004 if 1995 conditions had prevailed. Similar results are shown for 1995 vs. 1983.

Fuel Efficiency: the introduction of larger, more efficient locomotives helped railrods improve fuel efficiency, as did the

reduction in tare weights mentioned earlier. The first two rows of Table 6 show the gallons of fuel used by the Class I railroads and their average price per gallon. The next three rows show results from applying the service unit methodology to fuel. There was a reduction in gallons per unit of output, in part because of the efficiency of new locomotives and in part because of the changing nature of the output. However, fuel prices in 1995 were only $0.60 per gallon; increases to $1.07 in 2004 more than offset all of the fuel economy savings.

Table 5 Estimated Savings from Changes in SU/Unit of Output

Service Unit	**Unit Cost**	**SU/Output, 2004**	**Reduction in SU 2004**	**SU Savings 2004 v. 1995**	**SU Savings 1995 v. 1983**
Train-miles	$5	.779	267 million	$1.3 billion	$1.0 billion
Car-miles	$0.06	.811	18.49 billion	$1.1 billion	$0.6 billion
Carloads	$150	.846	15.01 million	$2.3 billion	$1.9 billion
1000 Gross Ton-miles	$0.0025/	.849	829 billion	$4.1 billion	$1.5 billion
Yard Sw-Hours	$100				$1.7 billion
Total				$10.1 billion	$6.7 billion
Savings/yr.				$1.1 billion	$0.55 billion

Table 6 Fuel Efficiency and Fuel Cost, 1995-2004

	1995	2000	2001	2002	2003	2004
Gallons (million)	3480	3700	3710	3730	3826	4059
Price/gallon	$0.60	$0.87	$0.86	$0.73	$0.89	$1.07
Gallons/unit output	100	87.5	84.0	82.5	80.7	.778
Reduction in gallons	0	794	998	1118	1387	2024
Benefit @ 1995 price	0	$476	$599	$671	$832	$1215
Effect of change in fuel price (million)	0	($1016)	($947)	($497)	($1109)	$1907
Net benefit (million)	0	($576)	($418)	$138	($277)	($692)

Employee Productivity: employee productivity can be estimated by comparing the number of employees in each major category to an appropriate service unit. The goal is to estimate the number and cost of additional employees that would have been required if the ratio of "employees to service unit" was unchanged. Productivity savings increased steadily, exceeding $4 billion annually by 2004 (Table 7). These results indicate a continuing improvement in productivity in each areas. The benefits are in the range of $3 to $4 billion per year, depending on whether constant 1995 or current dollars are used.

However, the rate of improvement has slowed in several important areas. Between 1983 and 1995, the industry implemented reductions in crew consist and changes in labor agreements that had a dramatic reduction in the number of people required to run trains. The average T&E employees per 10,000 train-miles dropped from 2.75 in 1983 to 1.39 in 1995, leading to a benefit of nearly $5 billion per year by 1995. The decline continued, at a much slower rate, to 1.16 by 2003

Table 7 Employee Productivity, 1995-2004

	Service Unit	Productivity Benefit 2004 vs '95	2004 @ 1995 wages	2004 @ 2004 wages
Executives, Officials and staff	Carloads	4,415	$0.35	$0.46
Professional & Administration	Carloads	20,730	.91	1.24
Maintenance of Way & Structures	Revenue ton-miles	17,102	.67	.95
Maintenance of Equipment	Car-miles	14,587	.56	.74
Transportation, other than Train & Engine	Train-miles	3657	.17	.23
Transportation, Train & Engine	Train-miles	10,069	.57	.74
Total ($ billions)			$3.22	$4.36

(and rose to 1.20 in 2004). The average annual incremental benefits from crew productivity dropped below $0.1 billion per year after 1995 compared to $0.4 billion per year previously.

The benefits from office automation were also been smaller. Between 1983 and 1995, the number of employees in the professional & administrative category declined from 68 to 27 thousand for a savings of $1.8 billion. If that number were adjusted for the 25% increase in carloads handled by 1995, then the savings would have been increased to $2.5 billion, i.e. over $0.2 billion per year for the 12-year period. The number of professional & administrative employees continued to decline through 2004, but at a slower pace of about $0.1 billion per year.

Maintenance of Way enjoyed dramatic gains in productivity between 1983 and 1995: the number of employees in this category declined nearly 40%, from 64 to 40 thousand, despite an increase in ton-miles

of nearly 60%! To put this into more understandable terms, employment was declining at 3% per year during the earlier, 12-year period when ton-miles were growing at 4% per year. By comparison, in the more recent 8-year period, employment declined at a rate slightly less than 2% per year while ton-miles were growing slightly faster than 2%. Reducing the work force while the demand on the track structure is growing remains impressive, but not as impressive as in the earlier period when the rate of reduction in the work force and the rate of increase in traffic volume were both much greater.

Facility rationalization is another area where productivity gains have largely played out. Between 1975 and 1995, the route-miles owned by the Class I railroads dropped by 4,000 miles per year, while the track-miles dropped by more than 6,000 miles per year. The reduction in route-miles owned resulted from abandonment of branch lines and spinning off portions of the network to be operated by local or regional carriers. The greater reduction in track-miles reflects the elimination of yard tracks and the reduction of tracks in some multi-track segments. After 1995, the rate of route rationalization declined, and railroads have had to extend sidings and add second or third main lines in order to handle record tonnages.

Overall, the productivity savings achieved by the rail industry between 1995 and 2004 was approximately $12 billion. Most of the benefits resulted from the continuing trend toward heavy haul and intermodal operations, while another $4 billion came from improvements in labor productivity. Fuel efficiency contributed approximately $1 billion, entirely offset by higher fuel prices.

PRODUCTIVITY AND PROFITABILITY

As in prior years, the dramatic productivity benefits were almost entirely given to shippers in the form of lower rates, leaving industry financial performance relatively unchanged, at least through 2003 (Table 8). If net railway operating income (NROI) is viewed in constant dollars, there was no sustained improvement over this period, nor was recent performance superior to what was achieved in

the early 1980s. The NROI was $2.5 billion in 1984, which would be $3.6 billion in 1995 dollars. The same stable performance is evident with respect to return on net investment and rate of return on shareholders equity. If anything, all of these financial measures peaked some time between 1994 and 1996 and declined through 2004.

Table 8
Financial Performance of the US Class I Railroads, 1990-2004

Year	NROI $billion	NROI * 1995 $ $billion	Return on Net Investment	Return on Equity	Capital Expenditures $ billion
1990	$2.68	$3.03	8.11%	8.18%	$3.64
1991	$(0.04)	(0.04)	nil	Nil	3.44
1992	1.95	2.09	6.3%	7.93%	3.61
1993	2.52	2.63	7.06%	9.38%	4.18
1994	3.39	3.47	9.37%	12.68%	4.89
1995	2.86	2.86	7.04%	7.93%	5.99
1996	4.34	4.25	9.36%	12.21%	6.10
1997	3.98	3.83	7.56%	9.27%	6.27
1998	3.67	3.79	7.00%	8.69%	7.20
1999	4.05	3.67	6.93%	9.36%	6.63
2000	3.92	3.68	6.48%	7.95%	6.06
2001	4.11	3.67	6.85%	7.96%	5.43
2002	4.25	3.77	7.04%	8.28%	5.67
2003	4.01	3.55	6.33%	6.5%	5.86
2004	4.14	3.52	6.12%	6.16%	6.24

Source: AAR, Railroad Facts
* Deflated using the same approach used by the AAR to deflate revenue per ton-mile

Table 8 also documents the increases in capital expenditures over this period, which is another financial concern. Capital expenditures by

the Class I railroads first exceeded $5 billion in 1995; as of 2004, they had exceeded that amount in every subsequent year. Capital expenditures peaked in 1998, when railroads were struggling to deal with their capacity and service problems.

Complete details for 2005 were unavailable at the time that this paper was written, so it was not possible to include comparable industry-wide results for productivity or financial performance. However, press releases issued by the Class I railroads in early 2006 clearly indicated some marked changes. For the first time since the beginning of deregulation, the railroads were able to obtain significant increases in rates. BNSF, CSX, NS, and UP (along with CP and CN in Canada) all reported double-digit increases in revenue per car and an average reduction of 4% in their operating ratio (the ratio of freight revenues to freight expense). The four major US carriers together reported an increase of 88% ($2.3 billion) in net income, with returns on investment reaching their highest levels in decades. However, capital investments increased by 16% to $6.3 billion as the railroads endeavored to provide the capacity necessary to move more freight. Problems with service and car supply worsened during the year, leading to further complaints from rail customers and public officials.

SUMMARY AND CONCLUSIONS

For most of the period between 1995 and 2004, rail industry performance followed the trends that were evident during the first 15 years following freight deregulation. Productivity continued to decline, and most of the benefits were passed on to shippers. Real rail rates continued to decline through 2004, and return on investment and other financial measures dropped from the peak levels achieved in 1996. While rates did increase on the order of 10% in 2005, they still remained below what they were ten years earlier, and there was no assurance that rates would increase further in the future, especially if service deteriorates further. Competition from the trucking industry has weakened as a result of rising fuel prices, higher wages for drivers, availability of drivers, and growing congestion on the

highway system. However, the logistics system is very flexible, and it can adjust to higher truck costs either by using more rail or by adjusting supply chains to require less use of transport.

Capacity concerns that were just emerging in 1995 have since blossomed into massive service disasters. The ability of the rail network to handle more traffic is now a major concern for state and local transportation officials, who question the willingness and ability of the industry to make the investments that will be required if rail is to maintain or increase its market share and thereby help alleviate highway congestion and promote more efficient logistics (e.g. Grenzback et al., 2003). Enhancing rail system capacity is likely to be a major public policy issue in the next decade, and the rail industry and public agencies will have to work more closely together to achieve what they all desire – an efficient rail system that is able to provide quality service, attract more traffic, and help alleviate problems related to highway congestion, dependence upon imported oil, and environmental quality.

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