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Improving Railroad Productivity: Implications of U.S. Experience For Canadian Railroads

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INTRODUCTION

The recent experience of the U.S. rail industry is seen by some people in Canada as a blueprint for revitalizing the Canadian railways. In 1980, the Staggers Act gave the U.S. rail industry significantly greater freedom in marketing and in network rationalization. In the following years, the industry improved its financial performance and, by some measures, its productivity. During this period, the U.S. railroads' most visible and aggressive efforts were those aimed at downsizing both their physical plant and their labor force. The end result is usually portrayed as evidence of the great success of deregulation and a valuable improvement in productivity.

Before simply replicating the U.S. experience in Canada, however, it would be well to reflect upon some missed opportunities. Since rail deregulation has yet to open up rail facilities to non-union competition, the rail industry has not yet experienced the jolt of competition that has had so great an impact on trucking and air transportation. As a result, the U.S. railroads have made little headway in resolving fundamental labor issues related to work rules and pay scales relative to other industries. Consequently, the costs of providing rail service continue to be inflated far above what is technologically feasible.

The rail industry, whether in the U.S. or in Canada, has two choices. One option is to accept the cost structure and serve only the traffic most suited to rail. This is the approach that has been taken, for the most part, in the U.S. This choice leads inevitably to a greatly reduced role in the market, a smaller work force, and loss of revenue. The other approach is to resolve the impasse with the unions, push unit costs down to reasonable levels, and then compete strenuously for traffic and new transportation opportunities. This paper recommends that the Canadian railroads pursue this path, the path not taken in the U.S.

CHANGES IN PERFORMANCE OF THE U.S. RAIL INDUSTRY

First, it will be helpful to review the performance of the U.S. rail industry during the periods immediately preceding and following deregulation. Between 1978 and 1985, dramatic changes took place in the U.S. rail industry. These changes are well-known and need only be summarized here (1):

Mergers: the number of Class I railroads declined from 41 to 22, primarily as a result of mergers (a Class I railroad has annual revenues of $50 million in constant 1978 dollars).

Line abandonment: the number of route miles declined from 191 to about 171 thousand as more effective abandonment procedures were hammered out between the industry, the states, customers, and the ICC.

Railroad employment: overall Class I employment fell 34% from 491 to 324 thousand; train and engine service employment also fell 34%, from 141 to 93 thousand.

Labor costs: with the decline in employment, labor costs, including benefits, dropped from 51.6% to 46.9% of total revenue.

Regional railroads: in the 1980's, dozens of regional railroads were created as railroads, led by the Illinois Central Gulf, spun off major portions of their route structure to independent operators. In 1985, approximately 25 thousand route miles were operated by other than Class I railroads, up from approximately 15 thousand in 1978.

Intermodal growth: the number of trailers and trailer-sized containers loaded rose 5.4% annually from 3.18 to 4.61 million.

Terminal consolidation: this trend was most evident for intermodal facilities, with the total number of intermodal terminals declining 69% from 1,176 to 361 (in 1986). At the same time, the number of these terminals that were mechanized rose from 131 to 175.

Heavier axle loads: the 100-ton car replaced the 70-ton car as the standard for bulk traffic and the average car capacity rose from 67.1 tons in 1970 to 84.3 tons in 1985. Technological improvements in track components and in maintenance procedures eventually enabled railroads to handle these heavier loads without destroying their track structure or causing undue increases in maintenance costs.

Computer control systems: railroads made tremendous efforts in computerizing their control systems. Advances were especially noteworthy in equipment management and service control.

Marketing orientation: railroads experimented with a variety of forms of marketing organizations as they slowly transferred power from operations to the financial and marketing departments. Aggressive marketing efforts helped railroads to drop unprofitable lines of business and, in some cases, to develop new services.

Financial performance: from 1976 to 1978, net railway operating income averaged under $0.5 million for the Class I railroads; from 1983 to 1985, it averaged over $2 billion, in part but only in part reflecting the shift to depreciation accounting in 1983. Return on investment nearly tripled, reaching as high as 5.7% in 1984.

MEASURING RAILROAD PRODUCTIVITY

While it is clear that great changes too, took place in the U.S. rail industry, it is not clear that productivity improved to any great extent. For productivity to improve, it is not sufficient simply to reduce inputs. It is also necessary to reduce the ratio of output produced per unit of input.

Measuring productivity is a difficult task, especially in the service industries. Partial measures of productivity are sometimes used, such as gross ton-miles (GTM) per employee-hour, which grew at an annual rate of 4.7% from 1970 to 1985. This measure, however, gives the misleading impression that railroads were in the forefront of productivity improvement during a period when they were actually fighting for survival. In fact there are several good reasons for using more sophisticated measures. As an output measure, GTM lumps together widely divergent rail services, including unit coal trains, piggyback trailers, and boxcars originating on light density branchlines. Economists prefer to measure railroad output as a weighted sum of ton-miles in various commodity groups, using the average revenue per ton-mile, the average expense per ton-mile, or the average employee hours per ton-mile as a weighing factor. Likewise, they prefer to use a more complete measure of railroad inputs than employee hours, since capital costs, equipment rents, and fuel together account for more than half of all railroad expenses. Even as a labor measure, man-hours fails to distinguish among different categories of employees in terms of either the type of work or the pay scales.

A number of serious efforts to measure the productivity of the U.S. railroad industry have gone well beyond the simplistic GTM per employee hour (McCullough, 1983). Measurements of average labor productivity have been complied on an annual basis by the U.S. Department of Labor's Bureau of Labor Statistics (BLS) since 1959. In a more detailed study of labor productivity, Banner and Brosnan (1983) divided labor into several categories and related the productivity of each category to an appropriate measure of railroad output. A more comprehensive measure of the combined productivity of labor and capital was suggested by Kendrick and adopted by the American Productivity Center (APC) in 1977. More complete estimates, taking into account intermediate material inputs as well as capital and labor were developed by Meyer and Morton (Task Force on Railroad Productivity, 1973) and Caves, Christensen and Swanson (1980).

Caves et al. summarized the various approaches toward measuring railroad productivity over the period 1951 to 1974 (Exhibit 1, Part A). In these approaches, various techniques were used to measure railroad output as a weighted combination of passenger-miles and one or more separate categories of ton-miles. As more inputs were included, measured rates of productivity growth declined. The slower rates of productivity growth were below the national averages for this period and were consistent with the rail industry's increasing financial difficulties.

From 1976 to 1981, when the GTM per employee hour grew at an annual rate of 4.8%, the more complete measures again showed less productivity growth (Exhibit 1, Part B). In the first two methodologies summarized in this exhibit, passenger operations were excluded and the output was a weighted combination of ton-miles in various commodity categories. As in the earlier period, adding capital as an input reduced the

EXHIBIT 1

Estimates of Railroad Productivity Growth

	Methodology	Inputs	Annual Growth
A.	**1951-1974**		
	BLS	Employee-hours	3.6%
	Kendrick	Employee-hours and capital costs	2.8%
	Meyer and Morton	Labor, capital and material	2.4%
	Caves *et al.*	Employee-hours, capital costs, fuel and materials	1.7%
B.	**1976-1981**		
	BLS	Employee-hours	4.0%
	BLS Output, APC Input	Employee-hours plus capital	2.9%
	Banner and Brosnan	Employee hours, in 4 separate categories	1.5%
	APC	Employee-hours plus capital	0%

measured growth in productivity, this time from 4.0% to 2.9%. The other 2 methodologies used different approaches to measuring output to produce still lower estimates of productivity growth. Banner used car miles, carloads, or train miles as output measures for each of 4 categories of employee hours; his results suggest that improvements in ton-miles per labor hour resulted mainly from changes in traffic mix, not from the average annual improvement of only 1.5% in the productivity of individual categories of labor. In the APC study, output was a financial measure, namely value added, and no productivity growth at all was observed. This suggests that the market value of railroad output declined enough over the period to offset the slight gains in productivity as measured by the other approaches.

It is possible to relate productivity to commonly used measures of railroad activity and financial performance. This approach was demonstrated in an earlier study that investigated year-to-year changes in revenues and costs between 1973 and 1j983 (Martland, 1984). Freight revenues for the Class I railroads were deflated by the BLS price index using 1978 as the base year, while freight service expenses were deflated by the association of American Railroad's cost index.

Freight revenue was then related to physical activity as measured by various service units. In some cases, the ratio of service units to freight revenue change markedly over the study period. Carloads originated and gross ton-miles increased while train and yard switching-hours decreased substantially. These changes reflected the shift to bulk traffic, which was typically handled in unit trains at lower than average rates. The costs or savings associated with these changes were then estimated using unit costs per service unit based upon 1978 cost levels (2). From 1973 to 1978, rail costs increased by $165 million as a result of the relative changes in service units. From 1978 to 1983, costs increased another $255 million. Basically, the added carload and gross ton-mile costs more than offset the savings in switching.

The next step of the analysis examined changes in factor productivity. For labor productivity, the approach was similar to that used by Banner and Brosnan, who emphasized the need to look at the productivity of distinct groups of rail employees. Absent any change in employee productivity, the number of employees in each category was assumed to vary with railroad activity represented by a particular service unit:

1. Maintenance of way employees with gross ton miles
2. Maintenance of equipment employees with car miles
3. Dispatchers, telegraphers, and road train and engine employees with train miles
4. Yard employees with yard switching hours
5. Executives, professional, clerical, and other transportation employees with carloads

The productivity of a group of employees was said to decline if the ratio of employees to service units declined. The benefits of the improved productivity were estimated using the average annual wages for that group of employees in 1978. In 1978, labor productivity was slightly worse than in 1973, adding $21 million to rail costs. By 1983, however, drastic cuts in rail employment led to substantial improvements in labor productivity, with savings estimated at $672 million relative to the base year of 1978. Note that Banner and Brosnan's analysis cited above extended only to 1981; the dramatic cutback in employment occurred after that date.

Capital productivity is more difficult to measure. In general, however, it is clear that output fell much more rapidly than did rail equipment and facilities. To quantify the changes in capital productivity, three categories of capital were compared to an appropriate service unit. Freight cars were measured relative to carloads, locomotives relative to locomotive-miles, and miles of road operated relative to freight revenues, all of which declined dramatically over the study period. The cutbacks in freight cars, locomotives, and route miles did not keep pace with the cutbacks in rail revenue.

Next, the decline in capital productivity was related to operating costs by estimating the fixed costs associated with a single vehicle or mile of track. In 1978, the fixed costs of ownership plus the net rental payments (which reflect in part the use of non-railroad owned equipment) amounted to about $1,000 per car and $11,400 per locomotive. Vehicle maintenance expenses were not included, because these were assumed to vary with vehicle miles. Then, 20% of 1978 maintenance of way expenses, or $4,200 per route mile, were assumed to vary with route miles. With these admittedly crude estimates, the decline in capital productivity added roughly $300 million to costs from 1973 to 1978 and another $300 million by 1983.

In addition to labor and capital, railroads use a variety of materials and services. Significant improvements were obtained in two areas. First, fuel efficiency rose from 471 to 543 gross ton miles per gallon, for a savings of $182 million in 1983 at 1978 prices; the 15% increase in fuel efficiency was the same as that achieved by rail competitive trucks over the same period (Wolfe, 1987). Second, loss & damage dropped from over 1.5% of revenue to less than 0.5%, which was equivalent to adding more than 1% or nearly $160 million to net freight revenue by 1983, again in 1978 prices.

By combining all of these analyses, it was possible to relate the changes in factor productivity and prices to changes in overall railroad performances. Exhibit 2 ranks 14 major factors that were each estimated to affect industry costs by at least $100 million annually in 1983 as compred to 1973. More than $1 billion was saved because of a reduction in yard and train switching, while another $647 million was saved by an improvement in the productivity of maintenance forces. On the negative side, the increase in GTM per unit of output, quite likely caused by the shift to bulk traffic, in effect added $1.26 billion to operating expenses, while a decline in freight car utilization added $431 million. It is interesting to note that the third largest negative factor, at nearly $188 million, was the decline in productivity of train and engine service employees. Overall, the positive factors barely outweighed the negative factors, and the net productivity savings amounted to only $65 million over the entire period (Exhibits 2 and 3). The

EXHIBIT 2

Major Input-Related Factors Influencing Railroad Productivity, 1973-1983

Positive Factors ($ million)		
1.	Reduction in yard switching per dollar revenue	$891
2.	Productivity of maintenance of equipment employees	471
3.	Increase in GTM/gallon	230
4.	Decline in "Other Transportation" employees	224
5.	Reduction in loss & damage	209
6.	Productivity of maintenance of way employees	176
7.	Productivity of professionals	155
8.	Reduction in train switching hours per unit of revenue	138
	Total, All Positive Factors	$2,494
Negative Factors ($ million)		
1.	Increase in GTM per unit of revenue	$1,260
2.	Freight car utilization	431
3.	Productivity of road train & engine employees	188
4.	Increase in road train miles per unit of revenue	119
5.	Decrease in revenue per route mile (i.e. excess route mileage)	127
6.	Productivity of executives, officials, and staff assistants	99
	Total, All Negative Factors	$2,224
	Net Savings, All Major Factors	$272
	Net Savings, All Factors	$65

annual changes in profitability were therefore attributed to relative changes in rail rates and the unit costs of rail inputs.

THE CONTINUING PROBLEM OF LABOR COSTS

The previous two sections showed that overall railroad productivity did not improve much if at all in the years after deregulation despite drastic downsizing. The apparent benefits of network rationalization were offset by the loss of traffic. To understand what happened during this period, it is important to recognize that very little progress was made toward reducing labor costs and labor productivity, especially within the operating crafts. Between 1978 and 1985, the average annual wage rose 8% annually (71% overall) from $20,314 to $34,991. The annual wages of the highly paid train and engine service employees also rose 8% annually, from $24,025 to $41,139. By way of comparison, average wages for non-union drivers in truck load operations rose only 3.5% annually over the same period to an average level of $0.23 per mile (Wolfe, 1987), which would be only $23,000 for someone driving 100,000 miles in a year.

Wages were not the only problem, however, Railroad operations were still hampered to a very

EXHIBIT 3

Summary of Changes in Productivity of U.S. Class I Railroads, 1973-1983

	Annual Savings ($ million)		
Category	**1973-78**	**1978-1983**	**Total**
Service units per unit of revenue in 1978 constant dollars in 1978 constant dollars	($165)	($255)	($420)
Labor Productivity	(21)	672	651
Capital Productivity	(288)	(317)	(605)
Fuel Efficiency	48	182	230
Loss & Damage	50	159	209
Total	($376)	$441	$65

great extent by labor agreements that severely restricted operating flexibility and increased operating costs. The primary problems concerned the crew consist, the basis of pay, and restrictions on inter-divisional operations, because constraints in these areas directly affected the ability of railroads to offer competitive levels of freight service. The typical crew consist in included an engineer, a conductor, and two brakemen, despite the fact that many trains could safely be operated with just two people (Martland, 1982). Agreements that allow operation with only one brakeman were achieved in both Canada and the U.S. during the late 1970's, but these agreements returned the majority of the alleged benefits to the members of the union; these agreements therefore provided little incentive to operate more trains (McCabe, 1987). Despite these agreements, the average crew consist was over 4.2 people as of 1981, since most trains not only had two brakemen, many still had a fireman (USRA, 1982).

The dual basis of pay, which dates back to the steam era, inflated crew costs in another manner. Steam engines needed to take on water every 100 or miles or so and they seldom ran more than 100 miles in a single shift. Labor agreements evolved whereby train crews received additional pay if they worked extra time or travelled extra miles. The dual basis of pay survived with only minor changes despite the shift to diesel locomotives and the advent of run-through freight trains that travel several hundred miles in less than 8 hours. Crews on these trains received several days pay for each shift, thereby capturing much of the economic benefits of running faster trains. Inter-divisional constraints posed a different kind of a problem in that they required new crews to be used in each crew district, even if each crew only worked a few hours. In metropolitan areas, especially in the northeast, such restrictions severely hampered the ability of railroads to offer new services.

The combined effect of these outmoded aspects of labor agreements was that much of the inherent advantage of rail technology relative to highway technology was frittered away in excess labor costs. While some progress had been made in allowing smaller crews and inter-divisional runs, the typical train was still much more costly to operate than required by the technology.

RESPONDING TO THE COMPETITIVE CHALLENGE

Provision of general freight service is an inherently complex matter for railroads. It is no surprise that railroads were in the forefront of organizational innovation 100 years ago when they learned how to move people and freight over vast networks that they themselves constructed and maintained. The rise of highway competition dramatically changed the strategic position of railroads. They found themselves offering a relatively slow and unreliable service; advances in truck and highway technology even allowed trucks to undercut rail prices. Furthermore, railroads discovered that their extensive bureaucracies were ill-suited for competition with small, flexible trucking companies, including thousands of owner operators.

Nevertheless, the rail industry did respond to truckload competition with serious attempts to provide better service. There were well-publicized efforts that sought to improve coordination within and between railroads, including the formation of the Task Force on Railroad Productivity (1973), the creation of cooperative labor/management programs such as the Houston Terminal Project (1982), and the many studies related to the creation of Conrail. Another example was the Freight Car Utilization Research/Demonstration Program (FCUP), a cooperative program sponsored by the Federal Railroad Administration and the Association of American Railroads. Between 1975 and 1981, the FCUP was instrumental in the development of better techniques for distributing empty cars (Task Force I-1, 1976; Task Force II-4, 1979), for managing railroad terminals (Martland et al., 1983) for coordinating marketing and operations (Task Force I-2), and for controlling rail service (Task Force I-6). The FCUP, which had more than 20 task forces involving many of the most thoughtful people in the industry, also acted as a clearinghouse for ideas. Most railroads did try to improve their service through advances in terminal operations, dispatching, freight car management, and pricing, and many of these efforts were supported by or documented by the FCUP.

Gaining better control over rail performance is but one way to respond to the competitive threat posed by truckload carriers. Another way is to retreat, to give up traffic to the motor carriers in order to concentrate on what railroads do best. By 1970, it was evident to most observers that much of the U.S. rail network was redundant, although it was far from clear how to go about restructuring the system. the early history of Conrail was dominated by the search for a "profitable core", i.e. by attempts to identify those rail lines that had sufficient traffic to justify continued operation. the spotlight on abandonments led to a bitter, protracted, and largely unproductive public debate on what lines should be retained in the rail network. Eventually, procedures were agreed upon that required protestors to contribute to the costs of continuing uneconomic operations over light density lines and the pace of line abandonment accelerated.

Focussing on high-volume shippers and bulk commodities was another form of retreating from competition. Railroads could tailor their schedules to the needs of customers shipping hundreds of cars daily, but had difficulty in dealing with a myriad of small companies shipping only a few cars each per week. For example, railroads developed special equipment to handle autoparts and automobiles and created special techniques for managing this equipment. For bulk commodities, railroads eventually overcame regulatory resistance and developed high-capacity cars and unit train service, which dramatically cut transportation costs and enabled railroads to compete more effectively with both water and highway carriers.

The box car was the main casualty during the retreat to the profitable core. Once the ubiquitous work horse or the industry, the box car required too much care and attention to compete with trucks. Between 1978 and 1985, the number of plain box cars in service dropped nearly 50% from

263,000 to 141,000, while equipped box cars fell 22% from 173,000 to 136,000. Abandoning light density lines and concentrating on large shippers was easier than revamping and controlling the complicated terminal and train operations associated with single-car movements.

A strong merger movement was a third strategy for improving railroad competitiveness. Mergers had two major advantages. First, they could overcome the Balkanization of the industry and create carriers that served much larger regions of the country. Coverage was believed to be important to enable a single railroad to compete more effectively with motor carriers that enjoyed nationwide operating rights. The larger the carrier, the fewer the problems with interchanging equipment, establishing rates, and coordinating operations. The second advantage was that the merged carrier would be able to consolidate redundant facilities. The problem with mergers was that a great deal of senior management's time and energy was diverted from strategic thinking to the preparation of merger applications and, later on, to the consolidation of companies that had distinct procedures, cultures, and computer systems. Mergers offered the opportunity for achieving economies in operation, but quite possibly at the expense of innovation in marketing and operations.

In summary, over the past 15 years, the U.S. rail industry simultaneously pursued three strategies for improving its competitive position. Individually and collectively, railroads made many attempts to improve service and reduce costs so as to compete more effectively. The strategy of rising to meet the competition, however, was generally over-shadowed by the other two strategies, namely down-sizing and merger. In fact, the demise of the box car could be viewed as a symbol of the rail industry's failure to meet the truck competition during the 1970's and the early 1980's. Railroads successfully merged into much larger systems, abandoned large portions of their track, consolidated their terminal facilities, and cut back their work force drastically. Nevertheless, to a very great extent, all of this down-sizing simply allowed the industry's costs to remain in line with its diminished traffic base. The industry shifted its focus toward large shippers and bulk traffic much more than it improved its competitiveness or its productivity. The lack of a breakthrough on labor costs certainly favored down-sizing over aggressive competition.

LESSONS FOR CANADA

The recent experience of the U.S. rail industry might suggest that it is possible to make dramatic reductions in equipment, facilities, and personnel while improving financial performance. Indeed, the most common interpretation of this experience is that deregulation allowed the railroads the freedom to innovate and to concentrate on profitable lines of business, thereby becoming competitive and productive. The obvious extension to Canada would be to reduce transportation regulation and to encourage Canadian National and Canadian Pacific to downsize dramatically.

To a large extent this interpretation may be true, but it is not complete. It would be highly desirable to reconsider the first strategy, i.e. the strategy of truly improving the productivity of rail operations in order to compete more effectively for a broad range of traffic. Much of the downsizing of the U.S. rail industry represents a failure rather than a success, namely the failure to take full advantage of rail technology.

The most obvious failure is in the arena of labor relations. Labor, management, and government officials must share the blame for not resolving crew consist, basis of pay, and related issues despite nearly 40 years of negotiation and disputation since dieselization. It is clear that none of these groups has benefited from the impasse. Labor, certainly, has lost vast numbers of jobs as a result of management's emphasis on bulk traffic, large cars, and long trains. The railroads have essentially given up on labor-intensive activities, such as less-than-carload freight, single car service, and retail piggyback. Where possible, they buy machines or find subcontractors to do the work once done by railroad employees. They also encourage shippers and third parties to acquire and maintain equipment that was once built and maintained by railroad employees. When labor costs are high, it is easy for railroad management to retreat into the apparently safe niche of the bulk transporter.

Even intermodal transportation, despite its rapid growth and bright prospects, cannot be considered an unqualified success. Many critics worry about the profitability of the traffic and wonder if intermodal will survive. Others contend that the railroads will act only as intermodal wholesalers, leaving the intricate and potentially lucrative retail side of the business to third parties. Once again, the high costs of rail labor surely hurt financial performance and promote the use of third parties wherever possible.

In Canada, there may still be a chance to compete for more of the traffic that is moving. Even if downsizing is ultimately inevitable, it can be accomplished with more grace and less personal hardship if pursued at a reasonable pace. Is it really necessary to reduce employment much faster than normal attrition? Is it really sensible to let vast numbers of boxcars sit idle with only modest attempts to reduce car hire costs or lower prices? To avoid precipitous downsizing, it will be necessary to restructure labor agreements so that they encourage the use of railway personnel in providing transportation services. There certainly should be enough incentive for management and the unions to negotiate, and for the government to encourage, labor agreements that give the railroads a chance to retain traffic, to recapture traffic thought to be lost, to provide new transportation services, and to offer a future to railroad employees.

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ENDNOTES

1. Except where otherwise noted, the information in this section is taken from *Railroad Facts*, published annually by the Association of American Railroads.
2. The service units and the associated unit costs are as follows: train hours ($57); train and yard switching hours ($100); road train miles ($5); locomotive miles ($1); loaded and empty ($0.60); gross ton miles ($2.50 per 1000 GTM); revenue carloads originated ($150); and gallons of fuel consumed ($0.38).