BEFORE EMERGENCY BOARD No. 243

Between

The Railroads Represented
By The National Carriers’ Conference Committee

And Their Employees
Represented By
American Train Dispatchers Association,
International Association of Machinists and Aerospace Workers,
International Brotherhood of Electrical Workers,
Transportation Communications International Union,
Transport Workers Union,
And
The Rail Labor Bargaining Coalition.

National Mediation Board Case Nos. A-13569; A-13570;
A-13572; A-13573; A-13574; A-13575; A-13592

CARRIERS’ EXHIBIT No. 8:

REPORT OF DR. B. KELLY EAKIN AND DR. PHILIP E. SCHOECH
LAURITS R. CHRISTENSEN ASSOCIATES, INC.

October 10, 2011
EXECUTIVE SUMMARY

We have been asked by the Carriers to analyze the Unions’ contention that improvements in “labor productivity” (which the Unions define in terms of freight revenue ton-miles per manhour) in the railroad industry should be considered by the Presidential Emergency Board (“PEB”) in determining employee compensation. We conclude that the Unions’ productivity arguments are flawed, and that productivity improvements in the railroad industry do not justify increases in employee compensation. Our specific conclusions are summarized as follows:

First, the Unions improperly rely on output-per-manhour (commonly, but misleadingly, referred to as “labor productivity”) as the primary productivity metric to support their arguments for substantial increases in their compensation. Output-per-manhour is only a partial and incomplete measure of productivity. Because many factors unrelated to productivity can impact output-per-hour, we have analyzed productivity growth in the freight rail industry using multifactor productivity analysis, not output-per-manhour. Given the many input and output variables that can effect improvements in productivity, increases in output-per-hour do not indicate that labor per se has become more productive.

Second, there is no correlation – either as a matter of economic theory or as an empirical matter – between changes in productivity and employee compensation. An industry with improving productivity could have declining total compensation per worker, or vice versa. This is, again, because the sources of productivity frequently have nothing to do with labor.
Third, we have found no empirical basis for concluding that increased effort or skills by railroad employees substantially contributed to the improvements in output-per-manhour in the freight rail industry (the Unions offer none). Rather, our analysis indicates that railroad productivity improvements have largely resulted from operational and technological improvements in operations that are wholly unrelated to labor. More specifically, much of the productivity growth since the passage of the Staggers Rail Act of 1980 can be traced to elimination of regulations, which facilitated innovations in service offerings, contract terms, and rate design. The Staggers Act also allowed the Carriers to rationalize their networks, significantly reducing excess trackage and equipment. These reductions, coupled with industry consolidation, liberalized work rules, and substantial growth in longer-haul coal and intermodal traffic, led to dramatic productivity improvements. Technological changes, such as increased locomotive efficiency, innovations in car design (including increased capacities), longer train lengths, improvements in operating practices, and technological innovations in train control, also contributed to the increase in productivity. None of these factors relates to increased effort or skills contributed by railroad workers. Indeed, these developments resulted in significant decreases in the need for labor in the freight railroad industry in the decade after the enactment of the Staggers Act.

Fourth, most of the benefits from productivity improvements since the Staggers Act have gone to railroad customers in the form of lower rates. Based upon our analysis, we conclude that approximately 80-85 percent of the benefits associated with
improvements in railroad productivity have been passed through to shippers in lower rates.

Fifth, in recent years, railroad productivity improvements have leveled off significantly. While gains were substantial in the immediate aftermath of the Staggers Act, railroad productivity increases have slowed in the last few years. From 1996 through 2009, productivity growth in the freight rail industry slowed to an average rate of 1.8 percent per year while the rate of productivity growth in U.S. private business sector increased to 1.2 percent per year. In other words, since 1996, railroad productivity growth has been much more comparable to the productivity growth in the broader U.S. economy.

Sixth, and perhaps most importantly, continued productivity growth in the freight rail industry will require substantial capital investment. The sort of changes that generated productivity improvement in the aftermath of the Staggers Act – such as consolidations, market liberalization, and significant reductions in the size of the Carriers’ rail networks and their workforces – have largely been exhausted. The Carriers will need to invest in infrastructure and technology to achieve future gains. See Carriers’ Ex. 7 (Report of Dr. Gallamore and Mr. Gray) at 23-29. Above-market increases in employee compensation could reduce the amount of funds for capital investments and, in all likelihood, impede future productivity growth.

For all of these reasons, we conclude that productivity improvements in the railroad industry are an inappropriate basis for determining the compensation of the
railroad workers represented by the Unions. We address all of these points in greater

detail in the sections below.

DISCUSSION

I. MULTIFACTOR PRODUCTIVITY IS THE CORRECT MEASURE OF PRODUCTIVITY.

Productivity is a measure of economic efficiency which shows how effectively
economic inputs are converted into output. Typically, several inputs (e.g., labor, capital,
materials, energy) are used to produce an industry’s output. Consequently, a meaningful
measure of productivity must consider the combined impact of all inputs involved in
production, not just a single factor such as labor.

A. The Unions’ Measure of Productivity is Incomplete.

Multifactor productivity compares an index of output production to an index of all
input usage. Multifactor productivity (henceforth, “productivity”) is the comprehensive
measure used by the U.S. Bureau of Labor Statistics (“BLS”) to monitor productivity in
the major sectors of the U.S. economy and individual industries. The measure is
designed to measure the joint influences on economic growth of technological change,
efficiency improvements, returns to scale, and other factors.

1. Labor Productivity and Costs: Frequently Asked Questions (FAQs), U. S. BUREAU OF
2. The U.S. Bureau of Labor Statistics, the government agency that measures and monitors
productivity in the U.S. economy, categorizes production inputs into capital, labor, energy,
materials, and services. Multifactor Productivity, U. S. BUREAU OF LABOR STATISTICS,
3. Multifactor productivity is also called total factor productivity.
In contrast, single-input measures, such as output-per-manhour, are incomplete and inaccurate measures of productivity. In prior proceedings, the Unions have focused on one metric – freight ton-miles-per-manhour – to argue that the intrinsic productivity of railroad workers has increased. This view of productivity is incomplete because it ignores the rest of the spectrum of inputs that are transformed into industry output.5

Because it focuses solely on labor, the Unions’ incomplete measure is also inaccurate. If industry output and the labor input were to stay the same from one year to the next, the Unions’ measure would indicate no change in productivity regardless of any changes in the other inputs. In this case when there are changes in the other inputs, the Unions’ measure would erroneously indicate that industry productivity does not change when in fact it does. Similarly, the Unions’ metric inaccurately measures productivity because the freight ton-mile-to-manhour ratio can change for reasons wholly unrelated to productivity. For example, changes in the relative prices of the inputs would induce some substitution of the now relatively cheaper inputs in place of the now relatively more expensive inputs.6 Neither the change in input prices nor the subsequent adjustment to the input mix represents a real change in productivity per se. But the Unions’ measure would erroneously indicate a change in productivity when there is none.


For these reasons, the output-per-manhour analysis offered by the Unions is woefully incomplete and inaccurate as a measure of industry productivity. Merely looking at changes in the ratio of freight ton-miles to manhours reveals nothing conclusive about actual productivity changes in the railroad industry. In fact, the Unions’ analysis vastly overstates the productivity improvements achieved by the railroads. In prior proceedings, the Unions have presented data showing that employment (manhours) in the railroad industry decreased by more than sixty percent (60%) while freight revenue ton-miles doubled between 1978 and 2009. Consequently, they claim that output-per-manhour measure increased by more than 400 percent during this period. However, when the correct measure of multifactor productivity is calculated, the data indicate that productivity actually increased by less than 200 percent.7 Thus, the Unions’ measure overstates the increase in railroad productivity between 1979-2009 by more than 100 percent.

B. The Unions’ Measure of Productivity Is Misleading.

By applying the commonly used (but misleading) term “labor productivity” for output-per-manhour, the Unions imply that labor has contributed significantly to the railroad productivity improvements and therefore should be compensated with larger wage and benefit increases. Almost fifty years ago, the noted economist Solomon Fabricant warned of the confusion created by calling output-per-manhour “labor productivity.”

7 P. E. Schoech and J. A. Swanson, Patterns of Productivity Growth for U.S. Class I Railroads: An Examination of Pre- and Post-Deregulation Determinants (Christensen Associates 2010).
productivity.” He wrote that labor productivity “will occasionally be read to mean that labor is wholly responsible for productivity and for increase in it, which is not the case.”

Despite Professor Fabricant’s warning, the Unions are making this flawed argument. But the Unions’ evidence is only that less labor is being used, not that changes in labor effort and skills have made rail labor intrinsically more productive. We find no evidence that rail labor jobs are more difficult, require more skill or effort, or that rail labor has in any other way become inherently more productive than labor in general. To the contrary, our analysis below demonstrates that many factors unrelated to labor explain the productivity improvements achieved by the freight railroad industry.

II. **INDUSTRY PRODUCTIVITY AND INDUSTRY LABOR COMPENSATION ARE NOT CORRELATED.**

A. **Economic Principles Do Not Establish a Relationship Between Industry Productivity and Compensation Paid.**

Productivity in an industry does not determine labor compensation in that industry. As explained in more detail by Dr. Kevin M. Murphy in his submission, compensation growth ordinarily is driven by productivity growth in the *market*, not by productivity growth that occurs in any particular industry or at any particular employer. Carriers’ Ex. 3 (Report of Dr. Murphy) at 24–27. Furthermore, increases in productivity do not necessarily mean the firm or industry has the ability to pay above market wages. That is, even if an industry greatly increases its productivity, competitive market pressures might prevent that industry from capturing its productivity gains as profits or paying above-

---

average compensation. An example of such a market is the computer equipment market, where almost all productivity gains have been passed through to the consumers in the form of substantially lower prices for substantially increased computing power, while real compensation in the industry has actually decreased. Thus, increased productivity does not necessarily indicate a greater ability to pay higher compensation.

B. The Empirical Evidence Shows there is Not a Connection Between Industry Productivity and Labor Compensation.

Our empirical research and analysis of data across a broad set of industries confirms the economic principle that there is no inherent correlation between productivity and compensation. We examined data published by the Bureau of Labor Statistics for 86 manufacturing industries defined at the four-digit level of the North American Industrial Classification System (NAICS). Table 1 presents a scatter plot of the 1987-2008 average annual growth rates of Multifactor productivity and real average hourly total compensation for the 86 industries.

---

9 Data from the U.S. Bureau of Labor Statistics indicate that between 1987 and 2008 multifactor productivity in computer and peripheral equipment (NAICS 3341) increased at an average rate of sixteen percent per year while real hourly compensation in the industry decreased by 1.2 percent per year.

10 The NAICS is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. The Bureau of Labor Statistics has a well-established methodology to measure productivity and these data represent the most detailed and comprehensive information available.

11 Total compensation includes wages and benefits. Average hourly compensation in an industry in a year is the total compensation divided by the number of hours worked. For each year, average hourly compensation in an industry is divided by the consumer price index for urban consumers (CPI-U) to give real average hourly compensation.
Table 1
Average Rates of Change in Multifactor Productivity and Real Average Hourly Compensation in 86 U.S. Manufacturing Industries, 1987-2008 (4-Digit NAICS)

Source: U.S. Bureau of Economic Analysis
As this table shows, there is no consistent pattern across industries relating real compensation growth to productivity growth. The correlation coefficient between the two variables plotted is small and not statistically different from zero, consistent with the conclusion that economic principles do not establish a relationship between the productivity in an industry and the compensation that labor receives.\(^\text{12}\) This is a long-established finding.\(^\text{13}\) Consequently, productivity improvements in the railroad industry are an inappropriate basis for determining the compensation of the freight rail workers.

III. **RAILROAD PRODUCTIVITY IMPROVEMENTS ARE LARGELY THE RESULT OF FACTORS OTHER THAN LABOR.**

Partial deregulation of the U.S. railroad industry thirty years ago unleashed productivity growth that greatly outpaced the rate of productivity growth in the U.S. economy overall. But that trend has been fueled by sources other than changes in labor skill or effort.

A. **The Significance of the Staggers Act.**

De-regulation was the primary catalyst for the Productivity improvements achieved by the freight rail industry.\(^\text{14}\) The U.S. freight railroad industry was partially

\(^{12}\) Similar analysis comparing output-per-hour and average real hourly labor compensation across the 86 manufacturing industries also shows no statistical correlation.

\(^{13}\) For example, Fabricant analyzed 80 manufacturing industries for the period 1899 to 1953. He concluded “the relation between change in an industry’s hourly earnings and a change in its own output per manhour is quite minor, if not negligible.” See S. Fabricant, *Productivity and Wages*, CHALLENGE, Vol. 11, No. 2 (Nov. 1962), at 35-39.

de-regulated thirty years ago by the passage of the Staggers Act. The Staggers Act, the culmination of railroad reform legislation, was enacted in response to the deteriorating financial situation in the industry at the time, largely attributed to regulation of the railroads.\textsuperscript{15} The passage of the Staggers Act explicitly established a new market-driven rail transportation policy. Key among the policy objectives were: (a) allowing competition where feasible, (b) maintaining reasonable rates in the absence of effective competition, (c) minimizing Federal regulatory control, and (d) achieving a financially healthy industry with sufficient industry revenues to maintain the rail system and attract capital.\textsuperscript{16}

Under the Staggers Act, railroads were allowed pricing flexibility to assure revenue adequacy under different market circumstances, and shippers were protected from the exercise of excessive market power by railroads.\textsuperscript{17} With the passage of the Staggers Act, there was widespread hope that loosening the reins of regulation would rescue the railroad industry.\textsuperscript{18} These hopes have largely been realized. Indeed, the

(continued…)


\textsuperscript{17} Christensen Associates, \textit{A Study of Competition in the U.S. Freight Railroad Industry and Analysis of Proposals that Might Enhance Competition, Report to the Surface Transportation Board}, Vol. 3, Ch. 20 (2008).

Staggers Act ushered in an era of substantial productivity gains that allowed the railroad industry to regain its financial health.19

B. Productivity Improvements in the Post-Staggers Era.

Table 2 compares the multifactor productivity measure for Class I railroads with the multifactor productivity measure for the private sector from 1980 to 2009.20 Over this period, the private sector had fairly stable productivity growth of about 0.9 percent per year, while railroads had more volatile productivity growth averaging about 3.5 percent per year. The differential in growth rates has narrowed considerably since 1996. Between 1980 and 1996, railroad productivity grew by almost seven times the rate achieved by the private sector. Between 1996 and 2009, however, railroad productivity growth has slowed dramatically to an average of 1.8 percent per year while private sector productivity has been growing at an average of 1.2 percent per year. In Section IV of this report, we explain in detail the reasons behind the slowdown in rail productivity.

Table 2
Private Sector and Railroad Multifactor Productivity
1980-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Private Sector MFP</th>
<th>Railroad MFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td>1986</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>2.20</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>2.40</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>2.80</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>3.00</td>
<td></td>
</tr>
</tbody>
</table>


Table 3 below shows the logarithmic values for post-Staggers railroad productivity. By presenting the logarithmic values, the vertical difference between any two adjacent data points measures the year-to-year continuous growth rate, and the slope of the line segment between any two points indicates the average annual compound growth rate over that time span. Between 1980 and 2009, railroad productivity increased.
by an average of 3.5 percent per year. The bold solid line in the exhibit indicates two distinct sub-periods in railroad productivity growth. Between 1980 and 1996, railroad productivity increased by an annual average rate of 4.7 percent. Since 1996 through 2009, however, railroad productivity has grown by only 1.8 percent per year, dramatically less than the earlier pace.

Table 3
Railroad Multifactor Productivity Growth
1980-2009
(logarithmic values)

@ +4.7%/yr
@ +1.8%/yr


21 P. E. Schoech and J. A. Swanson, Patterns of Productivity Growth for U.S. Class I Railroads: An Examination of Pre-and Post-Regulation Determinants (Christensen Associates 2010). We have updated the railroad productivity calculations to include 2009.
C. Several Non-Labor Factors Explain Railroad Productivity Improvements in the Post-Staggers Era.

As noted above, productivity of an industry is appropriately measured by comparing the industry output to a calculated index of all inputs used in production, not just a single input such as labor. We have thoroughly analyzed productivity changes in the freight railroad industry and have concluded that labor per se was not a significant factor in achieving productivity improvements in the freight rail industry. Instead, we concluded that railroad productivity gains, in large part, resulted from increased traffic density, reduced employment, reductions of inefficiencies, technological advances, market flexibilities and managerial efficiencies enabled by de-regulation.22

1. Impact of Economies of Density.

The most significant factor in achieving productivity improvements in the post-Staggers era was the ability of the Carriers to exploit “economies of density.”23 Economies of density apply to network industries. Economies of density exist if increasing the output produced over a given network results in a less than proportional increase in cost.24 It has been well established that railroads experience economies of density.25 An implication of economies of density is that reductions in network size can

25 Economies of density for the railroad industry have been a consistent finding over many years. See, e.g., R. G. Harris, *Economies of Traffic Density in the Freight Railroad Industry*, BELL JOURNAL OF ECONOMICS, Vol. 8 (1977), pp. 556-64; D. W. Caves., L. R. Christensen, and
lead to reductions in input usage that are more than proportional to the reduction in output. Thus, if there are economies of density, increasing output or reducing network size can lead to productivity growth.26

The post-Staggers railroad industry has been able to achieve both substantial growth of output and substantial reduction of network. Industry consolidation, track abandonment, and growth of traffic volume all combined to produce a tremendous increase in traffic density on the railroad networks.27 This increase in traffic density has been one of the primary drivers of the railroad productivity growth.28

**Table 4** below presents indexes of revenue ton miles, miles of road (a measure of network size), and the ratio of revenue ton miles to miles of road (a measure of traffic density) for the 1980-2009 period. Structural changes in the railroad industry combined to more than triple rail traffic density during this period.29 Rail traffic density doubled between 1985 and 1995 as the revenue ton-miles increased by half and railroads shed a

(continued…)


26 See id.
29 Association of American Railroads, *Ten Year Trends*, various years.
quarter of their miles of road. Since 1995, traffic density has continued to increase, but at only about half the earlier pace. In 2009 density decreased substantially as freight ton-miles plummeted by 14 percent while miles of road remained about the same.\footnote{31}

Table 4
Indexes of Revenue Ton Miles, Miles of Road, and Traffic Density
1980-2009

The slowdown in productivity growth in the last fifteen years also can be explained by the fact that the Carriers have largely achieved all of the potential

\footnote{30}{Id.}
\footnote{31}{Association of American Railroads, \textit{Railroad Ten-Year Trends}, 2000-2009.}
economies of density and now must work harder to achieve productivity improvements.\textsuperscript{32}

As described below, in recent years, the railroads have relied more on operational improvements, technological advancements and changes in product mix to achieve productivity growth.\textsuperscript{33} Moreover, in our view, future productivity improvements will largely be dependent on substantial capital investments.

2. **Significance of Product Mix.**

Between 1980 and 2009, railroad freight tonnage grew by about thirty percent (30\%) and the length of haul increased by fifty percent (50\%), leading to an almost doubling of revenue ton-miles.\textsuperscript{34} The increases in tonnage and length of haul largely reflected the growth of coal and intermodal traffic. **Table 5** shows that these two commodities accounted for most of the growth in rail traffic.\textsuperscript{35} Moreover, by increasing traffic density, the coal and intermodal increases contributed significantly to the productivity improvements achieved by the freight rail industry during these years.\textsuperscript{36}


\textsuperscript{33} Id.

\textsuperscript{34} Association of American Railroads, Ten Year Trends, various years.

\textsuperscript{35} Intermodal shipments fall into numerous commodity categories. Association of American Railroads, Ten Year Trends, publish data on tonnage by commodity group, but not on intermodal traffic *per se*. Consequently, in Table 5 we present an index of the growth in the number of intermodal trailers and containers shipped by rail.

However, as Table 5 illustrates, coal and intermodal shipments have decreased in recent years. Intermodal traffic began to decline in 2006 while coal traffic started declining in 2009.\textsuperscript{37} Moreover, total rail tonnage peaked in 2006 and has declined

\begin{table}
\centering
\caption{Railroad Tonnage and Intermodal Traffic Growth Indexes (1980 - 2009)}
\begin{tabular}{llllllllllllll}
\hline
\hline
COAL TONS & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 & 1.00 \\
INTERMODAL TRAILERS & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 \\
CONTAINERS & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 & 0.50 \\
TOTAL TONS & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 & 1.50 \\
\hline
\end{tabular}
\end{table}

substantially since 2008, reflecting the recent recession.\textsuperscript{38} These trends, if they continue, could erode railroad productivity growth in the future. Moreover, given recent volatility in coal and intermodal volumes, it is unlikely that the Carriers can rely upon these two commodities to fuel productivity growth in the future. Recent public and political attention on the environmental impact of coal-fired electric power generation coupled with renewed emphasis on green energy suggests that the long-term prospects for coal transportation are uncertain.\textsuperscript{39} Further, as the recent recession illustrated, intermodal transportation volumes are susceptible to macroeconomic changes in the global and domestic economy.\textsuperscript{40} In addition, as described by Drs. Gallamore and Mr. Gray, railroads face fierce competition from other modes of transportation (particularly over-the-road trucking) for intermodal shipments. Carriers’ Ex. 7 (Report of Dr. Gallamore and Mr. Gray) at 29-32. Under such circumstances, the Carriers cannot depend on growth in coal or intermodal shipments to generate future productivity improvements.

\textit{3. Technological Improvements}

Railroad productivity gains can also be attributed to technological advances. In particular, there have been significant improvements in locomotives, rails, and communication technologies.\textsuperscript{41} These technological advances have facilitated the increased traffic density as longer, heavier extended trains hauled greater loads longer

\begin{flushleft}
\textsuperscript{38} Id. at 43.
\end{flushleft}
Many of the technological advances have been embodied in capital (e.g., more powerful locomotives, stronger rails, and improved communication technologies) and have resulted in the substitution of capital for labor.

The railroads’ improved cash flow and growth under the de-regulated post-Staggers environment allowed the railroads to invest in new technologies. Two examples are improved track structures and locomotives. In both examples, new capital investments represented embedded technical change, also called capital-embodied technical change. Because track structures and locomotives are relatively long-lived, the replacement of older track structures and locomotives would have taken place more gradually had it not been for substantial output growth that justified the new investments. The railroads improved the steel used in rails and turnouts, and installed concrete crossties. These improved materials allowed for more efficient maintenance techniques, making it possible for the railroads to run heavier trains along the enhanced routes. In addition, the improved tracks led to fewer derailments, leading to an improvement in productivity.

---

42 The average train is eight percent longer, has sixty percent more total load weight, and goes fifty percent farther in 2009 than in 1980. Association of American Railroads, *Ten Year Trends*, various years.
44 Id.
45 Id.
46 Id. at 513.
47 Id.
48 Id.
New locomotives achieved greater horsepower, allowing for longer and heavier trains.\textsuperscript{49} Furthermore, these locomotives were more fuel efficient, more comfortable, and had more tractive effort per unit of horsepower, while new communication technologies enabled improved monitoring of locomotive performance.\textsuperscript{50}

The process of innovation in the railroad industry has primarily been one of continual incremental improvements. This process of incremental innovation continues to this day. For example, the use of electronically controlled pneumatic (ECP) braking technology is facilitating the use of 10,000-foot trains.\textsuperscript{51} There have also been efforts to standardize locomotive cabs with ergonomic desktop control stands\textsuperscript{52} and new technologies such as third screens for Electronic Train Management Systems.\textsuperscript{53} By standardizing locomotive cabs, engineers will be comfortable at and familiar with the control stand of any locomotive, regardless of who owns it.\textsuperscript{54} Wireless real-time monitoring through Asset Management Platforms allows railroads to monitor locomotive status and to send alerts based on pre-defined conditions.\textsuperscript{55} Newly built boxcars with high cube volumes are being designed to handle low-mass products.\textsuperscript{56} High-speed, high-production, computer-guided maintenance of way machines such as the Mark IV Tiger

\textsuperscript{49} Id. at 514.
\textsuperscript{50} Id.
\textsuperscript{52} Id. at 40.
\textsuperscript{53} Id. at 44.
\textsuperscript{54} Id.
\textsuperscript{55} Id. at 45.
\textsuperscript{56} Id. at 60.
Tamper and HTT Stoneblowers allows precise and rapid maintenance for railroads that are pressed for track time and capacity on high-tonnage routes.\textsuperscript{57}

In summary, technological advances in railroads have improved infrastructure and equipment, and do not indicate any changes in the intrinsic productivity of labor. Moreover, future productivity improvements will depend upon the availability of capital dollars to fund similar technological improvements. Thus, having to allocate more dollars to extraordinary labor compensation would reduce the capital investments that are contributing to productivity growth, as well as improved safety and reduced environmental impact of railroad operations. \textit{See generally} Carriers’ Ex. 7 (Report of Dr. Gallamore and Mr. Gray) at 26–29, 46-47.

4. \textit{Reduction in Employment.}

Another significant factor behind the railroad productivity gains is the reduction in employment levels. Indeed, improvements in railroad operations and technology since the Staggers Act have enabled the Carriers to substantially decrease total employment, further contributing to railroad productivity.\textsuperscript{58} \textbf{Table 6} shows the substantial decline of employment in the Class I railroad industry between 1980 and 2010. In 1980, approximately 458,000 employees worked in the Class I railroad industry. By 2010, employment had declined by more than sixty percent (60%), down to approximately 152,000 employees.\textsuperscript{59}

\begin{table}
\centering
\begin{tabular}{|c|c|c|}
\hline
Year & Employment & Change in Employment \\
\hline
1980 & 458,000 & \\
2010 & 152,000 & Down by 60\% \\
\hline
\end{tabular}
\caption{Employment in the Class I Railroad Industry}
\end{table}

\textsuperscript{57} \textit{Id.} at 75-81.
\textsuperscript{59} Association of American Railroads, \textit{Railroad Ten-Year Trends}. The 2010 employment figure of 151,870 is preliminary. The 2009 employment level was 151,906.
As shown in Table 6, most of this decline occurred in the 1980s, with continued modest declines in the 1990s. The employment reduction in the first decade of the post-Staggers era came about as a result of (a) the liberalized work rules negotiated between the railroads and the unions, (b) operational changes that reduced the amount of required labor (e.g., elimination of cabooses), (c) reductions in superfluous labor, and (d) capital-embodied technological change (e.g., automated track and wheel inspections).60 Employment has held relatively steady since about 2000.61


Table 6
Index of Employment in U.S. Class I Railroads
1980-2010
(1980 – 1.0)

<table>
<thead>
<tr>
<th>Year</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>1.0</td>
</tr>
<tr>
<td>1982</td>
<td>0.75</td>
</tr>
<tr>
<td>1984</td>
<td>0.65</td>
</tr>
<tr>
<td>1986</td>
<td>0.55</td>
</tr>
<tr>
<td>1988</td>
<td>0.48</td>
</tr>
<tr>
<td>1990</td>
<td>0.40</td>
</tr>
<tr>
<td>1992</td>
<td>0.33</td>
</tr>
<tr>
<td>1994</td>
<td>0.27</td>
</tr>
<tr>
<td>1996</td>
<td>0.22</td>
</tr>
<tr>
<td>1998</td>
<td>0.18</td>
</tr>
<tr>
<td>2000</td>
<td>0.15</td>
</tr>
<tr>
<td>2002</td>
<td>0.12</td>
</tr>
<tr>
<td>2004</td>
<td>0.10</td>
</tr>
<tr>
<td>2006</td>
<td>0.08</td>
</tr>
<tr>
<td>2008</td>
<td>0.06</td>
</tr>
<tr>
<td>2010</td>
<td>0.04</td>
</tr>
</tbody>
</table>


D. There is No Evidence That Rail Labor Has Become Intrinsically More Productive Than Labor in General.

The reduction in total employment during a period of increasing revenue ton-miles is indicative of the substitution of capital and other materials for labor in the freight railroad industry. The available evidence on the human capital of rail labor does not indicate that any significant portion of the decrease in employment (or the increase in railroad productivity) is attributable to the improved inherent effectiveness of railroad

---

62 Christensen Associates, *An Update to the Study of Competition in the U.S. Freight Railroad Industry, Report to the Surface Transportation Board* (2010). This study found that technological change in the railroad industry has been labor-saving and capital-using, indicating substitution of capital for labor over time.
labor relative to the general U.S. labor force. Indeed, in many cases, railroad jobs require less skill than in the past due to technological improvements.63

One such indicator of labor’s human capital is the education level of employees in the workforce. **Table 7** compares the educational attainment of railroad employees to that of workers in the general labor force. Railroad labor’s educational attainment profile did not change significantly between 2006 and 2010. Furthermore, examining the change over the longer period 2001 to 2010 reveals that the percentage of railroad labor with a high school degree or less has consistently accounted for about half of the workers, while the percentage of workers with college degrees declined substantially. This lack of increase in the overall educational attainment by railroad labor is consistent with railroad jobs requiring less skill due to technological improvements.

The stagnation of educational achievement by rail labor stands in stark contrast to the experience of the general labor force. **Table 7** shows that the workforce in the broader economy has consistently become more educated between 2001 and 2010. This disparity in educational attainment supports the conclusion that rail labor has not become intrinsically more productive relative to the general U.S. labor force.

---

Table 7
Educational Attainment of Railroad Labor and the General Labor Force

<table>
<thead>
<tr>
<th>Year</th>
<th>Railroad Labor - Employed Age 25 and Older</th>
<th>Labor Force - Employed Age 25 and Older</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High School or Less</td>
<td>Some College</td>
</tr>
<tr>
<td>2001</td>
<td>48%</td>
<td>36%</td>
</tr>
<tr>
<td>2006</td>
<td>49%</td>
<td>41%</td>
</tr>
<tr>
<td>2010</td>
<td>48%</td>
<td>42%</td>
</tr>
</tbody>
</table>


Railroad labor occupations: locomotive engineers and operators; railroad brake, signal, and switch operators; and railroad conductors and yardmasters.

On these data, we find that factors other than human labor have led to the productivity improvements that the freight rail industry has had since implementation of the Staggers Act. Accordingly, railroad workers cannot lay claim to the dividends realized through improved productivity in the industry.

IV. THE UNIONS FAIL TO ACCOUNT FOR THE RECENT SLOWDOWN IN THE RATE OF PRODUCTIVITY GROWTH.

A. The Railroad Productivity Slowdown.

As shown in Table 3 above, the rate of productivity growth in the railroad industry has slowed substantially since 1996. The slowdown in railroad productivity growth occurred during a time period when the broader economy achieved increases in the pace of productivity growth. Between 1980 and 1996, railroad productivity grew on
average by 4.7 percent per year, almost seven times the 0.7 percent per year achieved in the overall private sector.\textsuperscript{64} However, between 1996 and 2009, railroad productivity growth decreased to only 1.8 percent per year while the private sector growth rate increased to 1.2 percent per year. Thus, since the railroad productivity slowdown, the productivity growth rate in the freight rail industry is comparable to the productivity growth rate in the broader economy.

Table 8 below compares year-to-year changes in productivity for the freight rail industry with productivity growth in the private sector of the economy since 1980, when the Staggers Act was passed. The data demonstrate that annual productivity growth is more volatile for the railroad industry than the broader economy, primarily because the Carriers are capital intensive and more sensitive to fluctuations in general economic conditions as compared to the diverse industries within the private sector.\textsuperscript{65} These data also demonstrate the extent to which railroad productivity growth has declined relative to the entire private sector of the economy since 1996. Productivity growth in the private sector actually outpaced that of the railroads in 1997, 1998, 2002, 2003, and 2009. Since recent railroad productivity growth rates have not substantially outpaced the economy at large, productivity does not support the Unions’ current bargaining demands.

\textsuperscript{64} Railroad multifactor productivity come from P. E. Schoech and J. A. Swanson, \textit{Patterns of Productivity Growth for U.S. Class I Railroads: An Examination of Pre- and Post-Deregulation Determinants} (Christensen Associates 2010). We have updated the railroad productivity calculations to include 2009, the latest year for which the railroad data are available. The private sector multifactor productivity data are from the U.S. Bureau of Labor Statistics, \textit{available at} http://www.bls.gov/mfp.

\textsuperscript{65} Between 1981 and 2009, the year-to-year percentage changes in output for the railroads was twice the standard deviation as the year-to-year percentage changes in output in the overall private sector.
Table 8
Yearly Changes in Multifactor Productivity (1981-2009)

<table>
<thead>
<tr>
<th>Year</th>
<th>Private Sector MFP Growth</th>
<th>Railroad MFP Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>-10.0%</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>-5.0%</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>15.0%</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources:

B. Causes of the Railroad Productivity Slowdown.

This railroad productivity slowdown is explained by examining what has happened to the drivers of the productivity growth discussed above. The basic explanation is that traffic density is increasing at a slower rate, employment has stabilized, the rate of technological advances has lessened, and opportunities for reducing inefficiencies have become harder to find.  

Table 9 below demonstrates that the six identified railroad productivity drivers have lower average annual rates of growth after 1996 than they had in the first sixteen years following the enactment of the Staggers Act. The slowing rate of employment reduction represents the largest differential between the two periods. Between 1980 and 1996, the railroads were reducing employment by almost six percent (6%) per year; but since 1996, the reduction in employment has averaged just over one percent per year.67

The other factors displayed in Table 9 all contribute directly to the measure of traffic density. The second largest differential shown in the exhibit involves the rationalization of the network, as measured by miles of road. Between 1980 and 1996, the Class I railroads reduced the miles of road at a rate of 2.8 percent per year. Since 1996, the pace of shedding road has been less than one percent (1%) per year. The growth rate in the average length of haul has decreased by about almost two-thirds as the traffic mix has become saturated with coal and intermodal shipments and the opportunities for additional long-haul shipments have become scarcer. The growth rate of revenue ton-miles has averaged under one percent, less than half its growth rate in the earlier period. Finally, we note that the growth rate of average train load weight has held relatively steady.

67 Association of American Railroads, Railroad Ten-Year Trends (various years).
In sum, the changes in these traffic density factors have slowed the rate of increase in traffic density from about five percent (5%) per year prior to 1996, to about two percent (2%) per year between 1996 and 2009.68 Furthermore, we have found that the strength of the economies of density has lessened substantially. Specifically, the marginal productivity impact of increasing density in 2008 was only about half of what it

---

68 Id.
was in 1996. In short, the opportunities for increased density have become harder to exploit and, when achieved, they have substantially less impact.

Finally, the pace of technological advance seems to have slowed and the opportunities for weeding out inefficiencies are fewer. It appears the “low-hanging fruit” was harvested in the years immediately following the Staggers Act.

C. Implications for Future Rail Productivity Growth.

Future density increases will be more difficult to achieve and will have smaller impacts. Additionally, because economies of density have been central to the railroads’ productivity improvements, there is a danger that productivity could decrease if density were to decrease. Coal and intermodal traffic appear to present the greatest vulnerabilities in this regard. Environmental concerns may result in a reduction in the consumption of coal while intermodal traffic is sensitive to global economic conditions and subject to international trade disruptions and contractions. Indeed, decreases in coal and intermodal traffic largely explain the absolute decline in railroad productivity between 2006 and 2009. In short, it is clear that future productivity growth will be harder to achieve than in the past.

70 Id.
V. **COMPETITION PRESSURES HAVE PASSED THROUGH PRODUCTIVITY GAINS TO CONSUMERS.**

The allocation of the benefits yielded by rising productivity in the freight rail industry further undermines the Unions’ arguments that they should be awarded above-market wage and benefits increases based upon industry productivity. Since the Staggers Act, the substantial majority of the benefits of improved productivity have been passed onto the rail customers in the form of lower freight rates.\(^{73}\) The Carriers have retained enough of the productivity gains to become financially sound, but not make excess profit.\(^{74}\)

From an economic standpoint, productivity growth benefits both the firms in an industry as well as the consumers of the industry’s goods or services. More productive firms may become more profitable as a result of lower average costs but competitive market forces may lead firms to pass through most or all of those cost decreases to consumers in the form of lower prices.\(^{75}\) The processes of competitive markets do not provide labor with a direct claim to any of the productivity gains.\(^{76}\) That is, competitive markets force the productivity gains downstream into consumer benefits but do not push benefits upstream into the input markets such as labor.\(^{77}\)

---

\(^{73}\) B. K. Eakin and P. E. Schoech, The Distribution of the Post-Staggers Act Railroad Productivity Gains (Christensen Associates 2010).


\(^{76}\) Indeed, as Dr. Murphy observes, total compensation is affected by productivity growth in the economy as a whole, not productivity growth within an industry or enterprise. See Carriers’ Ex. 3 (Report of Dr. Murphy) at 24–27.

\(^{77}\) *Id.*
A. The Vast Majority of the Railroad Productivity Gains have Gone to Consumers.

Railroad productivity gains have not been equally divided among the industry stakeholders. Examination of changes in the ratio of industry revenue to industry cost over time allows us to answer this fundamental question of how the benefits of the productivity improvements were distributed to industry stakeholders. The distribution of productivity gains can be separated into three groups: (a) improved margins for the railroads, (b) mitigation of the cost-induced rate increases faced by shippers, and (c) above average wages received by industry labor.78

Making this three-way separation indicates that, from 1980 to 2008, about eighty-four percent (84%) of the productivity gains have gone to shippers in the form of lower rates, and about fifteen percent (15%) to railroads in the form of improved margins.79 This outcome suggests that railroads in the post-Staggers era have faced a fairly competitive market in which most of the productivity gains have been passed through to the customers.

79 Id.
B. Railroads Have Reinvested the Productivity Gains in Infrastructure and Technology.

As the railroads have been able to retain some of the productivity gains, the Carriers have increased capital investment in improved infrastructure and equipment. Annual capital expenditures by Class I railroads have almost doubled, from $5.4 billion in 2001 to an average of $10 billion per year since 2008. Capital expenditures as a percentage of revenue for the Class I railroads have averaged seventeen percent (17%) since 2000. Carriers’ Ex. 7 (Report of Dr. Gallamore and Mr. Gray) at 24–25.

The distribution of the post-Staggers productivity gains for the railroad industry differs from the competitive benchmark in which all of the productivity gains would flow to the customers. However, the Class I railroad industry was not in equilibrium in 1980 – it was in a deep hole with revenues insufficient to cover costs. Given the industry’s distress in 1980, the only way to achieve the mandates of the Staggers Act was through an increase in productivity with the railroads retaining some of those gains. By 2008, the railroads had captured enough of the productivity gains to both fund the capital investment that underlies a large part of the industry’s productivity improvement and become financially sound.

81 Id.
82 In 1980, the railroad industry’s rate of return on net investment was only 4.2 percent while its regulatory cost of capital was 12.1 percent. Association of American Railroads, Railroad Facts (2009), at 18–19.
VI. **FUTURE PRODUCTIVITY GROWTH WILL REQUIRE SUBSTANTIAL CAPITAL INVESTMENT.**

Since the Staggers Act, the substantial majority of the benefits resulting from improved productivity have largely been captured by railroad customers in the form of lower freight rates. The portion of post-Staggers productivity gains that were retained by the railroad industry has been sufficient to allow the industry to regain its financial health and to make substantial capital investments. *See generally* Carriers’ Ex. 7 (Report of Dr. Gallamore and Mr. Gray) at 8-9. These capital investments have embodied many of the technological advances underlying the productivity improvements, and have led to a safer, more efficient transportation system. However, because the slowdown has resulted in an increase in the railroads’ cost of achieving additional productivity improvement, future productivity growth will depend, in large part, on continued substantial capital investment.

As discussed in Section IV of this report, the productivity gains from increased traffic density and reductions in employment have largely been realized. Likewise, those opportunities enabled by deregulation to reduce inefficiency and find new market flexibilities are far fewer today than immediately after the Staggers Act was enacted. What is left as the primary driver of railroad productivity today is technological change, much of which is embodied in new capital equipment. Thus railroads will need to continue to re-invest their productivity benefits in order to maintain future productivity growth commensurate with that in the rest of the economy.

84 *Id.*
Requiring the Carriers to pay extraordinary compensation to labor because of increased productivity would impede future productivity growth. First, it would decrease the Carriers’ ability to self-finance capital investment. Second, it would decrease the incentive to make the investments as the net benefit to the Carriers of any future productivity would be less. Accordingly, over-compensating labor could have serious adverse consequences for continued productivity improvements.

**CONCLUSION**

For all of the reasons discussed above, productivity improvements in the freight rail industry do not justify above market increases in the wages and benefits of railroad workers.
Respectfully submitted,

B. Kelly

Dr. B. Kelly Eakin
Dr. Philip E. Schoech
Laurits R. Christensen Associates, Inc.
800 University Bay Drive
Suite 400
Madison, WI 53705
APPENDIX
QUALIFICATIONS

B. Kelly Eakin and Philip E. Schoech are Senior Vice President and Vice President, respectively, of Laurits R. Christensen Associates, Inc. Christensen Associates is a company of more than forty professional economists and engineers located in Madison, Wisconsin. Christensen Associates was established in 1976 and provides research and analysis on a variety of economic issues to governmental agencies, businesses, and the legal profession. In particular, Christensen Associates is noted for its expertise in the area of productivity measurement.

Kelly Eakin has been with Christensen Associates since 1994. He is an expert in industrial organization, specializing in the economic analysis of competitive and regulated markets. Dr. Eakin served as project manager for a recently completed study on the state of competition in the U.S. railroad industry and made a presentation on the study to the Surface Transportation Board. In addition, Dr. Eakin manages the energy practice at Christensen Associates Energy Consulting, LLC, a wholly owned subsidiary of Christensen Associates.

Prior to joining Christensen Associates, Dr. Eakin worked for the U.S. Department of Agriculture from 1992 to 1994. From 1985 to 1992, Dr. Eakin was an assistant professor of economics at the University of Oregon where he taught graduate courses in cost and production theory, industrial organization, regulation, and productivity measurement. Dr. Eakin’s scholarly work has been published in a number of academic...
journals. Dr. Eakin has a B.A. in history from the University of Texas at Austin and a Ph.D. in economics from the University of North Carolina at Chapel Hill.

Philip Schoech has been with Christensen Associates since its establishment, specializing in the areas of productivity measurement, pricing analysis, incentive regulation, and econometric and statistical analysis. He has been a consultant to the U.S. Bureau of the Census on the measurement of output in service industries, and a consultant to the National Research Council Transportation Research Board on transportation infrastructure and national productivity. Dr. Schoech has conducted productivity studies of the railroad, telecommunications, electricity, natural gas, postal services, and manufacturing industries for businesses and government agencies. He provided litigation support to the U.S. Postal Service in four labor arbitration cases, covering issues related to productivity and wage determination. Currently he oversees production of the official U.S. Postal Service multifactor productivity measure, which is reported annually to the Postal Regulatory Commission. Dr. Schoech has also provided testimony and reports to the Surface Transportation Board, the U.S. Federal Communications Commission, the Wisconsin Public Service Commission, the Maine Public Utilities Commission, and the Ontario Energy Board on productivity in regulated industries. Dr. Schoech has a B.A. in mathematics from Northwestern University and a Ph.D. in economics from the University of Wisconsin–Madison.

Dr. Eakin and Dr. Schoech were co-authors on two recent reports to the Surface Transportation Board: 1) A Study of Competition in the U.S. Freight Railroad Industry and Analysis of Proposals that Might Enhance Competition and 2) Supplemental Report
to the U.S. Surface Transportation Board on Capacity and Infrastructure Investment.

They are also co-authors of a recent paper on railroad performance under the Staggers Act that appeared in *Regulation* magazine.