Patterns of Restructuring in US Class I Railroads: 1984-2004*

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Abstract

After deregulation, the most striking restructuring measure adopted by US railroads was dramatic labor downsizing: employment was reduced by 60%. But little is known about its actual effects. There was also widespread rail lines abandonment. Both measures form part of the defensive restructuring story: their primary goal is the immediate survival of the enterprise through reduction of costs and scaling down. They contrast with strategic restructuring, which implies the introduction of new product lines and processes, new technologies and investments. This paper analyzes the role of defensive and strategic restructuring as determinants of railroads financial performance.We find that when not controlling for the interaction of both restructuring types, the only significant and positive effect on performance is for line abandonments. Labor downsizing *per se* does not yield performance benefits. However, taking into account interaction gives a much clearer picture: labor downsizing has a positive impact on performance when accompanied by particular changes in output mix. Also, the positive impact of line abandonment is larger when combined with these output mix changes. Occupational restructuring also enhanced performance. Our results support the view that defensive restructuring has a larger positive impact on performance when combined with strategic restructuring.

Keywords: defensive and strategic restructuring, performance regression, panel data.

JEL Classification Codes:

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1 Introduction

Deregulation returned US Class I Railroads to the competitive marketplace after nearly a century of tight government regulation. Since passage of the 1980 Staggers Railroad Act, the main regulatory reform, competitive pressures forced railroad firms to reduce costs and restructure.

The most striking restructuring measure adopted by railroads was dramatic labor downsizing: employment was reduced by 60% between 1981 and 2004. But little is known about its actual effects.

There was also widespread abandonment of rail lines: with deregulation, railroads were not forced to serve unprofitable, light-density lines anymore.

Both labor downsizing and the abandonment of lines form part of the defensive restructuring story. Defensive or reactive restructuring means taking measures aiming to reduce costs and scale down enterprise activity. This implies cutting the obsolete production lines, shedding labor, getting rid of non-productive assets, etc. These measures are defensive in the sense that their primary goal is the immediate survival of the enterprise (Grosfeld and Roland, 1996).

These type of measures contrast with strategic restructuring, which implies the introduction of new product lines and new processes, new technologies and new investments. This includes changes in the composition of the labor force and investment in fixed capital as well as "soft" capital, such as research and development, marketing and training (Domadenik et al., 2003).

This paper exploits a unique firm-level data set to try to answer the following questions: Which were the effects of labor downsizing and the abandonment of rail lines, the two defensive restructuring measures, on railroad performance? Were they accompanied by strategic restructuring measures? If they were so, which was the effect of each type of restructuring in the performance of railroads? Was there any interaction between the different type of restructuring? To the best of our knowledge, this is the first time that the role of defensive and strategic restructuring as determinants of financial performance are studied in the particular case of US Class I railroads after deregulation.

We find that when one does not control for the interaction of defensive with strategic restructuring measures, the only significant and positive effect on performance is for abandonment of lines. Labor downsizing has no significant effect on performance. That is, labor downsizing *per se* does not yield performance benefits. However, when one takes into account the interaction between defensive and strategic restructuring measures we get a much clearer picture: labor downsizing has a positive impact on performance when

accompanied by changes in output mix consisting in an increase in the share of intermodal type of traffic. Moreover, the positive impact of abandonment of lines on performance is larger when combined with these increases of intermodal type of traffic.

We also find that occupational restructuring enhanced performance. Furthermore, the degree with which firms adapt their personnel composition to changes in output mix yields a positive and significant impact on performance.

All our results support the view that defensive restructuring exerts larger positive impact on financial performance when combined with strategic restructuring.

2 The Concept of Defensive and Strategic Restructuring

Enterprise restructuring refers to the reorganization of a company in order to attain greater efficiency and to adapt to new markets. A useful distinction between defensive and strategic restructuring was introduced by Grosfeld and Roland (1997), which has been widely used in the transition literature.

The concept of defensive and strategic restructuring has been used so far just in the framework of countries in transition to market economies. However, it is relevant for analyzing all types firms that are forced to react to external shocks or changes in the institutional environments, such as deregulation of product markets. This is the case of US Class I railroads after the passage of the Staggers Railroads Act in 1980.

Defensive or reactive restructuring means taking measures aiming to reduce costs and scale down unprofitable enterprise activity. It implies actions such as cutting the obsolete production lines, shedding labor and getting rid of unproductive assets. Their primary goal is the immediate survival of the enterprise under the new economic conditions.

Strategic restructuring consists in a thoughtful business strategy responding to the necessity of a redeployment of assets. It includes changes in the output mix, the introduction of new product lines and processes, new technologies and investments and changes in the composition of the labor force.

As it is argued by Grosfeld and Roland, defensive restructuring must not necessarily precede strategic restructuring. In fact, both parts can be done more or less simultaneously.

2.1 Defensive and Strategic Restructuring in the US Class I Railroads Post-Deregulation Framework

Again, we identify as *defensive or reactive restructuring* the following two cost-reducing actions:

- labor downsizing: as in virtually all transport sectors, labor costs account for a large share of total railroads operating costs. This partially explains why one central strategy for reducing cost was this decrease in the labor force size.
- abandonment of lines: after deregulation, railroads were not forced to serve unprofitable, light-density lines anymore.

We identify as *strategic restructuring* the following actions:

- occupational restructuring: work force restructuring has as main objective the improvement of labor productivity. As already mentioned, one of the distinguishing features of railways is its labor-intensive nature. Hence, this type of restructuring becomes extremely relevant in our framework.
- output restructuring or changes in the mix of output, consisting essentially in the increase of intermodal type of traffic.

From these two basic actions we derive another proxy for strategic restructuring, namely the *adaptability* of firms to changes in output mix in terms of personnel composition. This is captured by the cross-effect of the two types of actions.

We argue that these actions are triggered by regulatory changes explained in detail below. We hence use the variation in explanatory variables generated by changes in regulation laws (thus, we use variations that are plausibly exogenous) to explain changes in railroad financial performance.

3 Related Literature

3.1 Downsizing Literature

One branch of related literature focus on the study of the most noticeable and controversial form of restructuring: labor downsizing. These studies cover an heterogeneous selection of industries.

Some examples are the paper by Baily et al. (1996), where they examine the micro-economic evidence of the conventional wisdom that the rising productivity in the U.S. manufacturing sector in the 1980s was driven by downsizing over this period. They use plant level data from the Longitudinal Research Database (LRD). In contrast to the conventional wisdom, they find that plants that increased employment as well as productivity contributed almost as much to overall productivity growth in the 1980s as the plants that increased productivity at the expense of employment. They find that while downsizing was associated with increases in productivity, there were in fact many establishments where a reduction in employment accompanied productivity losses.

Collins and Harris (1999) present further evidence of the downsizing-productivity relationship in the UK motor vehicle manufacturing industry for the period 1974-1994. They use detailed plant-level data from the UK Annual Census of Production (ACOP). They provide substantial evidence that productivity growth was higher in those plants that successfully downsized, but that those plants that were unsuccessful at downsizing tended to have among the worst rates of productivity growth. Indeed, the unsuccessful downsizers accounted for a significant part of the overall decline in productivity after 1989.

Cascio et al. (1997), use data from companies in the Standard&Poor's 500 between 1980 and 1994 to examine 5479 occurrences of changes in employment in terms of profitability, measured by return on assets, and return on common stock. They find that firms that engaged in pure employment downsizing were generally not performing better that average companies in their own industries. However, companies that combined employment downsizing with asset restructuring generated higher returns on assets and stock returns than the rest of firms.

Baumol et al. (2003) do an empirical analysis of the downsizing phenomena in U.S. motivated by the wave of what was called "downsizing" swept corporate America during the late 1980s and, especially, the early 1990s. They focus basically on the U.S. manufacturing industry and on the retail and service industries. They explore three main issues: the extent to which firms actually downsized, the factors that triggered changes in firm size, and the consequences of downsizing. Some of their main findings are that the most significant trigger leading to long-term downsizing was the rapid change in technology and that most of the time employment decrease was also accompanied by employee restructuring. In the particular case of the manufacturing sector, their data shows that downsizing has not contributed to productivity, contrary to what is frequently conjectured. Nevertheless, it has been profitable in part because it has helped to hold down wages.

Rama and Newman (2002) used panel data on Colombian enterprises for the period

1977-1991 to assess the productivity impact of public sector downsizing. Their results suggest that the productivity gains from downsizing might be larger in state-owned enterprises than in private enterprises. In particular, while the increase in value added per worker was similar in both cases, state-owned enterprises experienced an increase in total value added, and in value added per unit of capital, whereas both indicators declined in private companies. The difference, which could simply reflect the larger extent of initial inefficiency in state-owned enterprises, did not appear to depend on the degree of competition in product markets.

3.2 Transition Economies

Several studies address the issue of enterprise restructuring during the transition to a market economy.

Pinto et al. (1993) study the transformation of State-Owned Enterprises in Poland by examining various adjustment indicators (labor shedding, material and energy costs, bank borrowings, and export performance) and correlating these with firms classified by 1992 financial performance. They use data from 63 large SOE from 5 manufacturing sectors (metallurgy, electromachinery, chemicals, light manufacturing and food processing). The data covers statistical information for the period June 1989 - June 1992 on monthly firms profits, employment, wage bill, quarterly structure of costs, yearly investment expenditures and answers to a qualitative questionnaire administered during visits to firm managers. The questionnaire includes questions on long-run strategy, sequencing of restructuring, organizational changes and different aspects of adjustment behavior in firms. They show that significant differences exist between successful and unsuccessful firms. Managers in successful firms have tended to stress a change in product mix, have generally become more efficient in the use of materials and energy, have maintained labor productivity and have shown restraint in setting wages and in borrowing from banks.

Carlin et al. (1994) analyse enterprise restructuring in Central and Eastern European Countries for the period 1990-1993. They survey a comprehensive collection of case studies of over 450 firms conducted between those years in Poland, Czech Republic, Slovakia, Hungary, Russia and Ukraine (prior to the split of the Soviet Union). The individual and enterprise datasets they use are mostly collected by government or intergovernment agencies. In their paper, restructuring refers to actions taken to change the structure of the enterprise along four dimensions: internal organization (e.g.unbundling), employment (e.g. labor shedding), output (e.g. product mix) and investment (e.g. capital equipment). They identify three broad patterns of behavior which characterize enterprises

in the CEECs: 'restructuring' (enterprises undertaking restructuring actions consistent with the development of a competitive market economy), 'passive' (enterprises showing minimal organizational and behavioral changes) and 'ambiguous' (enterprises where active behavior is recorded but it is unclear the extent to which this is consistent with the furthering of the market economy reforms).

Estrin and Rosevear (1999) test hypotheses on the effects of privatization on restructuring and enterprise performance, the latter being measured qualitatively, by using data from a random survey of 150 Ukrainian enterprises in 1997. The data yields qualitative information about company behavior in 1997 and a panel of economic data going back to 1991. The sample of industrial firms is drawn from the population of firms listed at the State Property Fund. They measure enterprise performance by operating profitability and labor productivity. They categorize restructuring into five broad areas: product restructuring, input restructuring, management and labor restructuring, asset disposal and financial restructuring. They find no evidence that private ownership is associated with improved economic performance. However, they find that private ownership is related to several of the qualitative restructuring indices. It is insider rather than outsider ownership that leads to greater restructuring, specifically with respect to products and inputs.

Carlin et al. (2001) use a survey of 3300 firms in 25 transition countries to study the factors that influence restructuring by firms and their subsequent performance as measured by growth in sales and in sales per employee over a three-year period. The survey is a cross-section composed by newly-established private firms, firms privatized to insiders, firms privatized to outsiders and firms that remained state-owned. They are divided fairly evenly between industry and services. They find that new product restructuring, a form of strategic restructuring, increases with market power and firms subjected to pressure from foreign competitors and suppliers do more new product restructuring. By contrast, firms that do not face much competition do less defensive restructuring (taking the form of labor shedding and plant closures). State-owned firms do less new product, but more defensive restructuring. In turn, new product restructuring is an important contributor to firm performance.

Domadenik et al. (2003) study the extent of several forms of restructuring in 130 privatized firms in a model transition economy (Slovenia) during the 1996-1998 period. Their sample consists in a panel of annual 1996-1998 firm-level data on 130 largest firms that were privatized in the 1993-1995 period. They divide restructuring into defensive (related to short-term cutting costs) and strategic (focused on increasing revenues through investment). Their empirical strategy consists in estimating a firm-level labor demand equation to test defensive restructuring and an augmented investment equation to asses

strategic restructuring. Their labor demand estimates point to relatively slow defensive (short-term) restructuring, while the investment model estimates indicate the presence of credit rationing and bargaining in most types of soft investment.

3.3 Skill-Biased Technology Change

Another branch of related literature adresses the issue of skill-biased technology change (SBTC). The SBTC hypothesis is based on the idea that there is strong complementarity between technologies and skilled workers. These new technologies lead to higher productivity, but only some workers possess the necessary skills to use them (Machin, 2001). In the particular case of railroads, changes in output mix bring about the introduction of new technologies. This may have triggered changes in their personnel composition.

There are several studies providing substantial evidence supporting the STBC hypothesis in the U.S. Among the most recent representative papers, there is the one by Berman et al. (1994), where they show that production labor-saving technological change was the chief explanation for the shift in demand away from unskilled and toward skilled labor in U.S. manufacturing over the 1980s. They do find a positive and significant relationship between skilled labor and both within-industry R&D investment and the increase in computer investments.

Doms et al. (1997) document how plant-level wages, occupational mix, workforce education, and productivity vary with the adoption and use of new factory automation technologies in some U.S. manufacturing sectors. They use data from the 1988 and 1993 Survey of Manufacturing Technology to get information on technology use and adoption and from a matched employer-employee dataset to get information on worker characteristics. Their cross-sectional results show that plants that use a large number of new technologies employ more educated workers, employ relatively more managers, professionals, and precision-craft workers, and pay higher wages.

With regard to a particular sector, Adams (1999) used a panel of U.S. manufacturing plants owned by chemical firms covering the period 1974-1988 to explore the effect of research and development (R&D) and capital on factor intensity and skill bias. He finds that R&D expenditure and innovative investments increased the relative demand for skilled labor in this industry.

Machin and Van Reenen (1998) use industry-level panel data for the manufacturing sectors of seven OECD countries over the period 1973-1989 to show that there existed important skill-technology complementarities across all countries. Their finding was robust to experiments using different measures of skill, introducing trade variables, and instru-

menting R&D. Thus, it was likely that the move toward higher R&D intensities and increased computer usage were factors that contributed to reducing the relative demand for the unskilled.

For Spain, Aguirregabiria and Alonso-Borrego (2001) used a panel of 1080 manufacturing firms along the period 1986-1991 containing information on five different labor inputs, physical capital stock and R&D and technological capital to check for the hypothesis that the adoption by a firm of new technological capital entails a deep reorganization of the workplace, which is usually complementrary with high skilled labor. They observe that the introduction of new technological capital into the production process contributes to explain sizable changes in occupational structure.

4 Background and Data

4.1 Background

In the railroad industry, regulation imposed lengthy merger proceedings and route abandonment hearings, lack of flexibility in rate setting, prohibition of joint use of common track between two carriers, leading to duplication of service, a lack of innovation, loss of market share and higher costs[1]. The combination of these elements explains the poor financial condition for the industry beginning in the early 1970s.

The Staggers Rail Act, passed by the US Congress in 1980, marks the beginning of the post-deregulation period for this industry. The basic principles of the Staggers Act were that rail management, not regulators, should run the railroads, and that the establishment of rail rates should rely on competition and demand for services[2]. The reform allowed railroads to price competing routes and services differently, to reflect the demand for each; allowed railroads to enter into confidential rate and service contracts with shippers, permitting long term contracts with customers; and eased procedures for the abandonment and sale of rail lines.

The main effects of this reform were first, an increase in shipment density and shipment size. Second, long term contracts between railroads and shipping lines were vital to the initiation of double-stack container train service, because of the high level of strategic and financial commitment, including the substantial specialized capital required. Third, there was an increase in market concentration (from 38 firms in 1978 to 7 in 2004) and fourth,

[1] *Railroad News*, Bulletin No.2, March 1998.

[2] Association of American Railroads, *Railroad Facts: The impact of the Staggers Rail Act of 1980,* January 2004.

a large decrease in employment.

Growth in competition due to deregulation compelled railways to use their assets and work forces more productively and also forced them to refocus their strategies. Thus, they were pressed to carry out restructuring. In most cases restructuring necessitated reducing the cost structure. Given that labor costs represent a significant cost of production in railroads, one central strategy for reducing costs was labor downsizing. In most cases, however, restructuring could also dictate investment to enter new markets or to provide new services[3]

4.2 Data

The source for the firm-level data is the annual *Analysis of Class I Railroads* published by the Association of American Railroads. It is derived from regulatory reports that railroads submit to the Surface Transportation Board (STB), formerly being the Interstate Commerce Commission (ICC). It provides detailed information on several aspects of railroads including financial, technological, output and employment information. It includes also detailed information on employee composition.

The data on mergers comes from a compilation of data from different sources, including the papers by Davis and Wilson (1999), Ivaldi, McCullough and Linari (2002), and publications by the General Accounting Office on Freight Railroad Regulation.

The sample we use contains annual data on Class I US railroad firms for a twenty-year period, from 1984 to 2004[4] . Hence we observe firms in the post-deregulation period when they could carry out defensive and strategic restructuring.

The data set is unique in that it covers a considerably large period of time and broad and detailed firm-level data. The completeness of this data allows us to check for the interaction between firm financial performance, making use of information on the operating ratios, firm characteristics, such as output mix, network and technological features, and key restructuring variables, such as employment decrease and occupational restructuring.

Some firms were deleted because of missing or questionable values for some variables. Then, the final data set provides an unbalanced panel consisting of 18 Class I US firms and 219 observations.

[3]Best Methods of Railway Restructuring and Privatization. CFS Discussion Paper Series, Number 111, p. 9.

[4]We chose to start from 1984 because the previous years there were some employee categories disappearing later on and this could contaminate our index of occupational restructuring, one of our main variables of interest.

4.3 Descriptive Statistics

Table 1 provides summary statistics for the whole sample period, and Table 2 reports it for the years 1984 and 2004 separately. Both statistics are also divided between big firms and small firms, where the classification criteria has been miles operated.

The average firm in the sample achieves a ratio of operating freight revenue over operating freight cost (the inverse of the operating ratio), our measure of firm performance, equal to 1.09. From Table 2 we observe that there has been a general improvement in performance between those years. Big firms display better performance than small firms.

Concerning output mix, big firms devote a larger share to intermodal type of traffic than small firms do. Moreover, the difference has increased when comparing both points of time.

The sample provides evidence of significant concentration process: average market share is significantly larger in 2004 than in 1984 and the gap between big and small firms becomes much bigger in 2004.

Employment decrease have been roughly the same in big and small firms over our sample period[5].

Firms have done more occupational and output restructuring in 1984 than in 2004. The restructuring process has been more intense in small firms than in big firms over the whole sample period. The difference in output restructuring becomes more important in 2004, while this is not the case for occupational restructuring: during this year, big firms have done more occupational restructuring than small firms.

Some figures on variables of interest are presented in the Appendix. Figure 1 shows improvement in performance. Figure 2 plots the evolution of output mix in railroads: rail intermodal traffic, that is, the share of commodities transported by containers or trailers by rail and at least one other mode of transportation, has more than tripled in just over 20 years. In fact, it has been rising from 3.1 million trailers and containers in 1980 to nearly 10 million units in 2003. Intermodal today accounts for about 22 percent of rail revenue. In 2003, for the first time ever, intermodal surpassed coal in terms of revenue for US Class I railroads. Figure 3 shows the evolution of average employment, and Figure 4 plots the evolution of employee composition: the share of train and engineering has increased over the last years, while the share of professional and administrative has decreased. Figure 5 provides evidence of a significant concentration process.

[5]Employment decrease in not reported in tabular form for the years 1984 and 2004 because it turns out that there was increase in employment on average those years.

5 Empirical Specification

Our objective is to examine the determinants of Railroads Class I performance during the post-deregulation period and, more specifically, to assess the role of different strategic and defensive restructuring measures as determinants of firms performance.

In particular, we look at financial performance. We proxy it by the ratio of freight operating revenue over freight operating cost. This is simply the inverse of the operating ratio, a measure of financial performance extensively used. It is a measure extremely easy to interpret, and appropiate for our purposes. We also tried with other measures of financial performance, such as free cash flow, but it was showing a very cyclical behavior, probably due to the inclusion of different investment elements.

Our strategy is to estimate equations for financial performance, which we take to depend on five types of variables (see Table 6 for a complete description of each variable):

- *network characteristics* (X_1) including:

  - *miles operated:* miles of road operated, a measure of firm size.

  - *length of haul:* average length of haul. This length is positively related to the use of unit trains, which carry only a single commodity from a single source and to a single destination.

- *output mix* (X_2)*:* calculated by using the share of key products carried by railroads[6] over total carloads (physical measure representing the shipment of not less than 5 tons of one commodity) transported.[7] [8]

- *technological characteristics* (X_3) including:

  - *average freight car capacity*: related to the increase in shipment density and shipment size resulting from regulatory changes.

  - *speed:* proxied by the ratio total freight train-miles/freight train hours in road service (includes train switching hours)

[6] Railroads key products are determined from a ranking of total tons shipped by STCC (Standard Transportation Commodity Code) category from highest to lowest which are available in the R-1 data.

[7] Some of these products are added up because of being transported in the same type of cars (chemicals and food) and because of being considered of the same category (coal and grain are both bulk products, also transported in the same type of cars)

[8] We also tried to use loaded car-miles, which may be thought as being a better measure of output composition, but the fit of the model was worsened and the results were quite unclear. This may be due to the fact that loaded car-miles still reflect the length of the system, and this generates a geographic artifact.

- *restructuring variables* (X_4) including:

  - *employment decrease:* calculated by

$$\frac{(\text{employment}_{t-1}\text{-employment}_t)}{\text{employment}_{t-1}}$$

where subscript t index time.

- *miles operated*: it becomes also a restructuring variable in that it allows to check for the effect of the abandonment of lines. That is, the role of this variable is twofold: network characteristic and restructuring variable control.

- *occupational restructuring:* a measure of the degree to which the occupational structure shifts over time. We use the standard similarity index for firm j between two time periods 1 and 2, employed by Baumol et al. (2003)[9], given by:

$$SI_{12} = (\sum_i m_{ij1}m_{ij2})/\left[\sum_i (m_{ij1})^2 \sum_i (m_{ij2})^2\right]^{1/2}$$

where m_{ijt} is share of occupation i in firm j at period t.

The index SI_{12} is the cosine of the angle between two vectors and varies from 0 (when the two vectors are orthogonal) to 1 (when the two vectors are identical). From this, we define the index of occupational dissimilarity, our measure of occupational restructuring, as:

$$DIOCCUP_{12} = 1 - SI_{12}$$

- *output restructuring:* a measure of the degree to which the output structure shifts over time. It is built in the same way as the preceding index, but now m_{ijt} is share of output i in firm j at period t.

- *control variables* (X_5), composed by:

  - *merger variables* including:

- *years since merger:* merger trend = 1 in the first year following a merger, 2 in the second year, and so on until the firm merges again or the sample ends.

- *1BM:* dummy variable taking the value of 1 the year before a firm is acquired. This variable is included to check for the existence of performance patterns of these firms the previous year of being acquired.

[9] In their study, j stands for industry.

- *market share:* the market share of each railroad in terms of loaded car-miles (physical measure)

The basis of our empirical analysis is then formed by the equation:

$$Performance_{it} = Performance_{it}(X_{1_{it}}, X_{2_{it}}, X_{3_{it}}, X_{4_{it}}, X_{5_{it}}) + u_{it} \quad (1)$$

where subscripts i and t index firm and time.

A time trend is also included. All variables except time related effects (time trend and merger trend) and employment decrease are in logs.

The model used is the one-way fixed-effect panel data, where the error component structure is of the form:

$$u_{it} = \alpha_i + \varepsilon_{it}$$

α_i being the time-invariant firm fixed effect and ε_{it} the i.i.d. component. The firm fixed effect is meant to capture non-observed firm characteristics such as managers ability.

5.1 Fixed Effects Treatment

As already mentioned, our sample is an unbalanced panel of 18 Class I firms which operated in the US during 1984-2004. The population consists in two type of firms:

- firms that have not been involved in any merger activity. For this type of firms, we keep the same firm specific fixed effect over the entire sample period.
- firms that have been involved in merger activity. We can distinguish between three types of firms:

  - merging or acquiring firms

  - merged or acquired firms

  - new firms resulting from mergers, for which we follow the accounting entities presented in the *Analysis*. In some cases, the name of the acquiring firm is kept. In others, a totally new entity is created.

6 Results

We first want to assess the effect of the two defensive restructuring measures in the performance of US Class I Railroads. As already argued, these defensive measures take

the form of labor downsizing and abandonment of rail lines[10]. In what follows, we will show that when one does not control for the interaction of these defensive restructuring measures with strategic restructuring measures, the only significant and positive effect on performance is for abandonment of lines. Labor downsizing has no significant effect on performance. That is, labor downsizing *per se* does not yield performance benefits. However, when one takes into account the interaction between defensive and strategic restructuring measures we get a much clearer picture: labor downsizing has a positive impact on performance when accompanied by changes in output mix consisting in an increase in the share of intermodal type of traffic. Moreover, the positive impact of abandonment of lines on performance is larger when combined with increases of intermodal type of traffic. We will go further on studying the joint effect of the two different types of restructuring measures by introducing some cross-effect variables which are of interest. In particular, we will show that the degree with which firms adapt their occupational composition to changes in output mix also yields a positive and significant impact on performance.

Table 5 reports results for performance. The table lists five different regressions. All the performed F tests support the existence of firm fixed effects.

Regression 1 becomes our benchmark equation. This regression is meant to assess the impact of labor downsizing and abandonment of lines, the two defensive restructuring strategies of railroads, in their performance. We control for basic network and technological characteristics, using variables extensively used by preceding railroad literature: miles operated, average length of haul and speed; we also control for output mix and occupational restructuring. A time trend is included. Again, the role of *miles operated* is twofold: it allows us to control for network characteristics and to assess the effect of abandonment of lines.

The regression delivers a positive and highly significant coefficient for the share of *intermodal* type of commodities. This result is robust across all the equations. This finding is interesting, given that intermodal has become the predominant traffic for railroads over the last years, even surpassing coal in revenue terms. Also, we argue that this indirectly measures the effect of the introduction of new technology, namely double-stack cars (allow containers to be stacked)[11].

[10] The majority of railroad firms in our data set have been decreasing their number of miles operated over the whole sample period.

[11] In fact, railroads have spent tens of billions of dollars on intermodal-related investments in infraestructure and equipment, including scores of new or expanded intermodal terminals, thousands of new intermodal freight cars, new state-of-the-art locomotives dedicated to intermodal services, raised clearances on bridges to accommodate the additional height that modern intermodal trains require, and added track

The negative and highly significant coefficient for *miles operated* tells us that the abandonment of lines played an important role in the generalized improvement of performance of US Class I railroads, as expected. After deregulation, railroads were not forced to serve unprofitable, light-density lines anymore.

We get a negative coefficient for *average length of haul.* This is an unexpected result, at least in principle, given the efficiencies generally associated with longer average haul lengths. But one possible explanation for this result could be that railroads with shorter average length of haul tend to have competitive pressures from trucking slightly higher than otherwise. It may be the case that this puts more pressure on those railways to look for operating efficiencies[12].

For *speed* we also get an unexpected result: the coefficient is negative and highly significant. Recall that speed is measured by the ratio of total freight train-miles over freight train hours in road service (includes train switching hours), following literature. We think that a possible explanation could be that railroads have not appropriately adjusted their payment systems to changes in train speed. More precisely, part of the employees (through freight crews, that is, not local, yard, or industry crews) are paid on the basis of miles, with a "basic day" being equivalent to around 130 miles. The basic day is 8 hours, so crews are paid approximately 16.25 miles for each hour paid. On average, the trains operate faster than this, including delay time at origin and destination terminals. The result is that through freight crews are paid for more hours than they actually work[13],[14].

Labor downsizing appears as having no effect on financial performance. In contrast, and interestingly, *occupational restructuring,* representing one form of what we identify as strategic restructuring, has a positive and significant effect. A one standard deviation increase in occupational restructuring index raises performance by about 2%.

In regression 2 we add control variables, namely merger controls (a merger trend and a dummy for the year before a firm is acquired) and *market share* (measured by the ratio of individual loaded car-miles over total loaded car-miles, a physical measure)*;* we also control for *average freight car capacity,* a technological variable. It turns out that none of these variables gets a significant coefficient[15]. We think that the poor result we obtain

capacity and advanced signalling systems to handle faster, more frequent intermodal trains. Association of American Railroads, *Rail Intermodal Transportation,* January 2005.

[12]Another reason for this result can be that the changes in average length of haul we observe are due to a merger artifact. We are grateful to Bob Gallamore for his comments on this point.

[13]We are grateful to Avery Grimes for this information

[14]This result could be related with the one obtained by Bitzan (2000) in which he gets a positive coefficient for speed in a translog cost function for US Class I railroads. He argues that this reflects the increased maintenance of way and capital costs associated with maintaining a higher quality road.

[15]Other variables were used as a proxy for market share, such as individual carloads over total carloads,

for *market share* comes from the difficulty in finding a good proxy for variables related to competitive pressure for railroads. Each railroad competes both with the other railroads operating in its territory and with trucking companies. Depending upon their operating area, railroads may also face competition from river barges (especially for chemical, petroleum and grain)[16].

Regressions 3 to 5 collect the results for performance when controlling for the joint effect of the different types of restructuring strategies.

In regression 3 we add a first set of variables to control for the cross-effect of labor downsizing and changes in output mix, the two most striking restructuring actions. And it is from this regression that we get a very interesting result: a positive and significant at the 1% level coefficient for the cross-effect of employment decrease and share of intermodal type of traffic. Thus, labor downsizing *per se* may therefore not yield performance benefits; the positive impact just shows up when labor downsizing is accompanied by changes in output mix consisting in an increase in the share of intermodal type of traffic. The rest of cross-effect variables get no significant coefficients.

In Regression 4 we add the cross-effect of employment decrease with occupational restructuring. We also include our measure of firm *adaptability*. This last variable relates to the idea of skill-biased technology change: changes in output mix bring about the introduction of new technologies. Ideally, firms should adapt to these changes by recomposing their personnel through increasing the demand for those employees who best complement those new technologies. It is proxied by the cross-product of occupational restructuring and output restructuring (built in the same way as the occupational restructuring index. See table 6 for a complete definition). We get no significant coefficient for the first cross-effect, while the positive effect of firms *adaptability* is economically as well as statistically significant. When doubling output restructuring is accompanied by doubling occupational restructuring, performance increases by 14%. Interestingly, here we get a positive and significant coefficient for employment decrease, while it was positive but not significant in the previous regression. Since the independent variable employment decrease is not logged, this tells us that one standard deviation (0.102) increase in employment decrease raises performance by about 7,8%, and if intermodal share increases by one percentage point, performance increases by about 30,6% for the same employment decrease.

Finally, in regression 5 we include the cross-product of miles operated with intermodal share. This variable is meant to capture the joint effect of one defensive restructuring

intermodal loaded car-miles over total intermodal loaded car-miles and individual intermodal carloads over total intermodal carloads. None of these variables got a significant coefficient.

[16] *A Solid Report Card for Railroads.* BusinessWeek. Insight from Standard&Poor's. April 24 2006.

action, namely abandonment of lines with one strategic restructuring action, namely changes in output mix taking the form of changes in the intermodal share[17]. The result is a negative and highly significant coefficient for this variable. Therefore, the positive impact of abandonment of lines on performance is larger when combined with changes in output mix consisting in increases of intermodal type of traffic.

7 Discussion

We use a unique firm-level panel of Class I Railroads data to analyze the role of defensive and strategic restructuring measures as determinants of their financial performance during the post-deregulation period.

We find that when one does not control for the interaction of defensive with strategic restructuring measures, the only significant and positive effect on performance is for abandonment of lines. Labor downsizing, the most striking fact in the post-deregulation period, has no significant effect on performance. That is, labor downsizing *per se* does not yield performance benefits. However, when one takes into account the interaction between defensive and strategic restructuring measures we get a much clearer picture: labor downsizing has a positive impact on performance when accompanied by changes in output mix consisting in an increase in the share of intermodal type of traffic. Moreover, the positive impact of abandonment of lines on performance is larger when combined with increases of intermodal type of traffic.

Occupational restructuring enhanced performance. We also find that the degree with which firms adapt their personnel composition to changes in output mix yields a positive and significant impact on performance.

All our results support the view that defensive restructuring exerts larger positive impact on financial performance when combined with strategic restructuring.

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TABLE 1
Summary Statistics 1984-2004

						Big Firms		Small Firms	
Variable	Unit	Mean	StdDev	Min	Max	Mean	StdDev	Mean	StdDev
Performance (operating revenue/operating cost)	Ratio	1.092	0.135	0.618	1.410	1.115	0.118	1.066	0.148
Intermodal share	Percent	0.226	0.095	0.037	0.528	0.268	0.086	0.186	0.087
Bulk share (grain+coal)	Percent	0.288	0.161	0.009	0.804	0.285	0.136	0.288	0.185
General share (food+chemicals)	Percent	0.115	0.062	0.023	0.257	0.114	0.059	0.117	0.066
Motor vehicles share	Percent	0.083	0.143	0.0001	0.629	0.057	0.033	0.113	0.202
Rest of commodities share	Percent	0.288	0.119	0.083	0.630	0.281	0.072	0.297	0.157
Average haul	Miles	479	206	175	992	618	191	327	75
Miles operated	Miles	11227	9375	627	33706	18404	7324.1	3127	1795
Market share (loaded car-miles)	Percent	0.087	0.086	0.007	0.389	0.152	0.071	0.014	0.005
Average freight car capacity	Tons	88.6	6.575	74	105	88.8	5.374	88.4	7.765
Speed (freight train-miles/freight train-hours)	Ratio	21.9	3.967	12	38	22.9	4.716	21	2.473
Employment decrease	Percent	0.024	0.102	-1.050	0.302	0.022	0.061	0.026	0.134
Occupational restructuring	Index	0.002	0.005	0	0.0513	0.001	0.002	0.003	0.007
Output restructuring	Index	0.004	0.012	0	0.121	0.002	0.005	0.006	0.016

Note: Big firms = ATSF, BN, BNSF, CRC, CSX, MP, NSC, SP, UP, UPSP, UPSYS. Small firms = CNW, DRGW, GTW, ICG, KCS, MKT, SOO.

Rest of commodities (the omitted ones) include: other farm products, metallic ores, crushed stone, gravel and sand, grain mill products, primary forest products, lumber and wood products, pulp, paper and allied products, petroleum products, stone, clay and glass products, coke, metals and products, waste and scrap material and forwarder.

TABLE 2
Summary Statistics

	1984				2004			
			Big Firms	Small Firms			Big Firms	Small Firms
Variable	Mean	StdDev	Mean	Mean	Mean	StdDev	Mean	Mean
Performance (operating revenue/operating cost)	1.073	0.075	1.104	1.046	1.105	0.080	1.124	1.067
Intermodal share	0.165	0.060	0.175	0.156	0.315	0.089	0.350	0.245
Bulk share (grain+coal)	0.296	0.199	0.283	0.305	0.267	0.079	0.281	0.240
General share (food+chemicals)	0.120	0.069	0.142	0.101	0.110	0.042	0.090	0.150
Motor vehicles share	0.067	0.140	0.050	0.082	0.050	0.036	0.060	0.030
Rest of commodities share	0.352	0.131	0.350	0.354	0.259	0.143	0.219	0.340
Average haul	468	185.2	611	346	605	276.6	724.7	366.5
Miles operated	8678	7186	14269	3885	19096	13231.7	27063.7	3161.5
Market share (loaded car-miles)	0.052	0.046	0.095	0.015	0.162	0.139	0.236	0.014
Average freight car capacity	84	4.924	84	84	97.5	5.470	96.2	100
Speed (freight train-miles/freight train-hours)	23	4.655	27	21	18.8	1.472	18.7	19
Occupational restructuring	0.010	0.005	0.007	0.012	0.001	0.001	0.001	0.0004
Output restructuring	0.004	0.003	0.003	0.005	0.0009	0.0008	0.0005	0.002

TABLE 3
Significant Railroad Unifications, 1984-2004

year	Merging Firms	Merged Firm
1985	Western Pacific/Union Pacific	UP
1986	Missouri Pacific/Union Pacific	UPSYS
1986	Chessie/Seaboard	CSX
1986	Norfolk&Western/Southern Pacific	NSC
1994	Union Pacific/Chicago&Northwestern	UPSYS
1995	Burlington Northern/Atchison, Topeka&Santa Fe	BNSF
1996	Union Pacific/Southern Pacific	UPSP
1999	CSX/Consolidated Rail Corporation	CSX
1999	NSC/Consolidated Rail Corporation	NSC

Note: In 1999 ConRail was divided between CSX and NSC.

TABLE 4
US Class I Railroads, 1984-2004

Railroad (Abbreviation)	Years observed in the data
Atkinson, Topeka & Santa Fe (ATSF)	1984-1995
Burlington Northern (BN)	1984-1995
Burlington Northern & Santa Fe (BNSF)	1996-2004
Chicago Northwestern (CNW)	1984-1994
Consolidated Rail Corporation (CRC)	1984-1998
CSX Corporation (CSX)	1986-2004
Denver, Rio Grande Western (DRGW)	1984-1993
Grand Trunk Western (GTW)	1984-2001
Illinois Central Gulf (ICG)	1984-2001
Kansas City Southern (KCS)	1984-2004
Missouri-Kansas-Texas (MKT)	1984-1987
Missouri Pacific (MP)	1984-1985
Norkfolk Southern Corporation (NSC)	1986-2004
SOO line (SOO)	1984-2004
Southern Pacific (SP)	1984-1996
Union Pacific (UP)	1984-1985
Union Pacific Missouri Pacific (UPSYS)	1986-1996
Union Pacific Southern Pacific (UPSP)	1997-2004

TABLE 5
Determinants of Railroads Performance, 1984-2004. Fixed Effects Specification.

Independent Variable	(1) Benchmark equation	(2) Adding network and merger controls	(3) Output mix and downsizing cross effects	(4) Adding restructuring cross effects	(5) Adding restructuring cross effects
Intercept	3.972*** (0.754)	4.030*** (1.810)	3.790*** (0.754)	3.904*** (0.742)	3.794*** (0.729)
Time	0.002 (0.002)	0.002 (0.003)	0.0002 (0.002)	0.0005 (0.002)	0.002 (0.002)
1BM		0.028 (0.045)			
Years since merger		0.002 (0.003)			
Market share		0.003 (0.072)			
Average freight car capacity		-0.041 (0.295)			
Speed	-0.313*** (0.085)	-0.303*** (0.089)	-0.312*** (0.084)	-0.286*** (0.084)	-0.209*** (0.086)
Intermodal	0.111*** (0.034)	0.114*** (0.035)	0.111*** (0.034)	0.120*** (0.033)	0.742*** (0.216)
Bulk	0.026 (0.019)	0.027 (0.020)	0.030 (0.020)	0.031* (0.019)	0.032* (0.019)
General	0.020 (0.043)	0.030 (0.045)	0.019 (0.043)	0.038 (0.043)	0.034 (0.042)
Motor vehicles	-0.018* (0.011)	-0.019* (0.012)	-0.019* (0.011)	-0.021** (0.011)	-0.023** (0.010)
Average length of haul	-0.163* (0.100)	-0.158 (0.114)	-0.131 (0.102)	-0.175* (0.098)	-0.036 (0.107)
Miles operated	-0.234*** (0.044)	-0.224*** (0.057)	-0.237*** (0.044)	-0.220*** (0.044)	-0.335*** (0.058)
Employment decrease	-0.108 (0.076)	-0.105 (0.077)	0.489 (0.682)	0.757** (0.345)	0.759** (0.339)
Occupational restructuring	0.009* (0.005)	0.009* (0.005)	0.008* (0.004)	0.019*** (0.007)	0.017*** (0.007)
Employdecr. x Intermodal			0.471*** (0.158)	0.518*** (0.144)	0.485*** (0.142)
Employdecr. x Bulk			0.081 (0.118)		
Employdecr. x General			-0.122 (0.169)		
Employdecr. x Motor vehicles			0.020 (0.029)		
Occup.restr. x Output restr.				0.0014** (0.0007)	0.0013** (0.006)
Occup.restr. x Employdecr.				0.025 (0.055)	0.037 (0.054)
Miles oper. x Intermodal					-0.076*** (0.026)
Number of observations	219	219	219	219	219
Adjusted R-squared	0.49	0.48	0.51	0.52	0.54
F test for no Fixed Effects	5.99	2.81	5.95	5.64	6.30
Pr > F	<.0001	0.0003	<.0001	<.0001	<.0001
Hausman test	chi2(10)= 44,22	chi2(14)= 40,23	chi2(14)= 48,66	chi(13)= 45,18	chi(14)= 14

Notes: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.
Standard errors in parentheses.
Hausman: H_0 = appropriateness of the random effect specification.

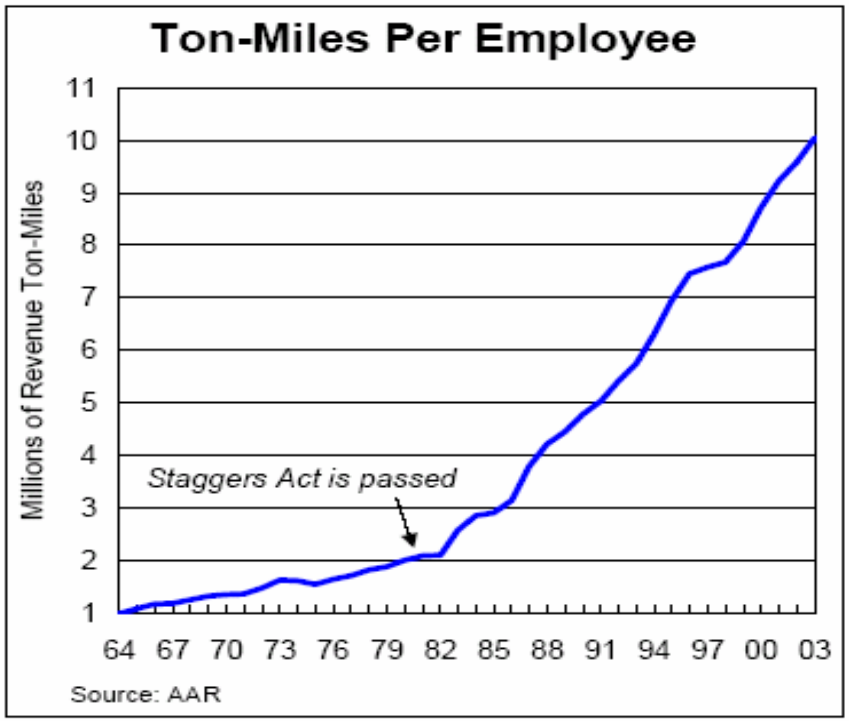
TABLE 6
List of Variables

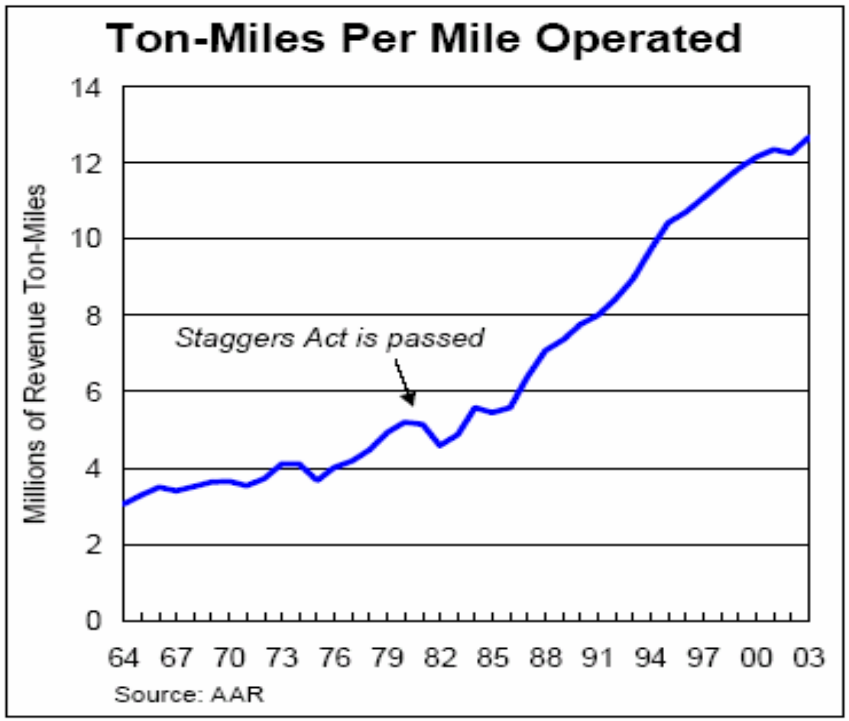
PERFORMANCE	Operating Freight Revenue/ Operating Freight Expense
CONTROL VARIABLES	
One year before merged	Dummy variable taking the value of 1 the year before a firm is acquired
Years since merger	Merger time trend = 1 in the first year following a merger, 2 in the second year, and so on until the firm merges again or the sample ends
Market share	Individual loaded car-miles/total loaded car-miles
TECHNOLOGICAL CHARACTERISTICS	
Average freight car capacity	Average capacity of freight cars measured in tons
Speed	Total freight train-miles/freight train hours in road service (includes train switching hours)
OUTPUT MIX	
Intermodal share	Intermodal type of products share of total carloads (physical measure, shipment of not less than 5 tons of one commodity)
Bulk share	Sum of coal and grain shares of total carloads
General share	Sum of chemicals and food shares of total carloads
Motor vehicles share	Motor vehicles share of total carloads
NETWORK CHARACTERISTICS	
Average length of haul	Average length of haul covered by freight railroads from departure to destination
Miles operated	Miles of road operated by railroads
RESTRUCTURING VARIABLES	
Employment decrease	(Employment$_{t-1}$− Employment$_t$)/Employment$_{t-1}$
Occupational restructuring	Index of occupational dissimilarity between t-1 and t: measure of the degree to which the occupational structure shifts over time 1 - $(\sum_i m_{ij1}m_{ij2})$ / $\left[\sum_i (m_{ij1})^2 \sum_i (m_{ij2})^2\right]^{1/2}$,where m_{ijt} is share of occupation i in firm j at period t
Output restructuring	Index of output dissimilarity between t-1 and t: measure of the degree to which the output structure shifts over time 1 - $(\sum_i m_{ij1}m_{ij2})$ / $\left[\sum_i (m_{ij1})^2 \sum_i (m_{ij2})^2\right]^{1/2}$,where m_{ijt} is share of output i in firm j at period t

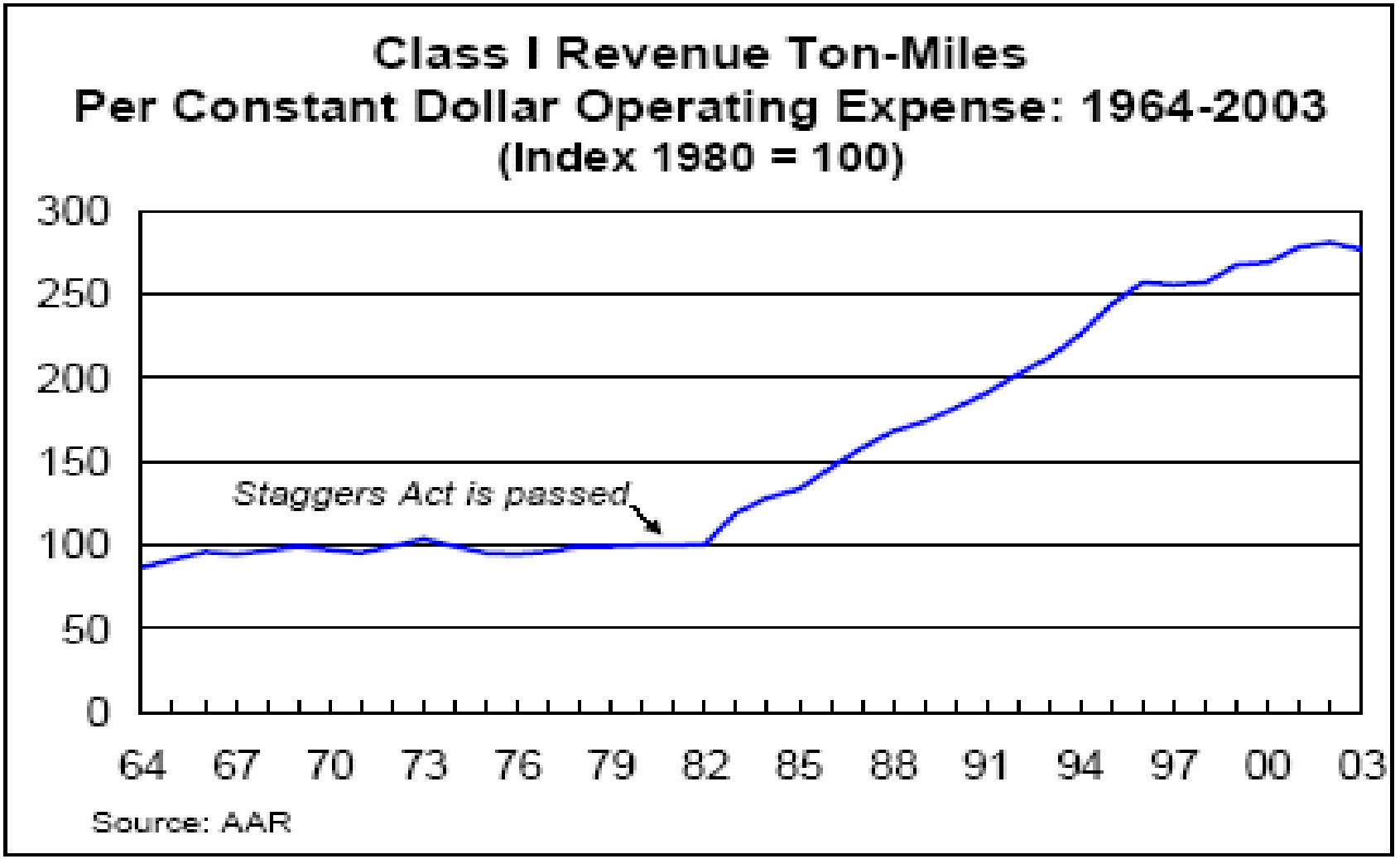
TABLE 7
Changes in Managerial Action Space due to Deregulation

Action space	Before 1981 Staggers Rail Act	After 1981 Staggers Rail Act
Lines served	Restrictive abandonment policies: railroads are required to provide unprofitable services, to maintain light-density routes	Procedures for the abandonment and sale of rail lines were eased. Railroads were allowed to establish their own routes
Rate setting	Lack of flexibility:	Increase in flexibility:
	- "Rate equalization" policy: most rates were set by rate bureaus. Carriers could not tie rates to volume commitments by shippers, and the regulatory pricing system limited opportunities to link rates to service commitments	- Abolishment of collective ratemaking. Railroads could customize their rate structures. They were allowed to enter into confidential rate and with service contracts with shippers, permitting long term contracts customers. They could offer rate incentives to shippers that would induce them to choose low-cost operations
	- Rate ceilings based on fully allocated costs (variable costs plus some arbitrary allocation of fixed costs based on the estimated percent of total costs that are variable) eliminated railroad incentives for efficiency, as any efficiency gains would reduce rate ceilings	- The Act established rate floors and ceilings that allowed railroads considerable rate flexibility. They were allowed to increase rates in line with changes in costs without being challenged
Mergers	Lengthy merger proceedings due to ICC's strict control over rail mergers	Merger restrictions were eased
Joint usage	Prohibition of joint usage and control of common trackage between two carriers	Railroads could exploit joint usage to avoid duplication of service and to save costs
Labor use	System of stringent and well-defined work rules	The Act made virtually no reference to labor, but the less favorable bargaining environment for rail unions resulted in crew-consist concessions (national agreements of 1985 and 1991) and other work rule adjustments. Deregulation gave firms freedom to adapt, change or avoid work rules

Sources: *Railroad News*, Bulletin No.2 March 1998; *The Impact of the Staggers Rail Act of 1980*, January 2004, AAR; *Railroad Deregulation: Pricing Reforms, Shipper Responses, and the Effects on Labor*, October 1996, Industrial and Labor Relations Review; *Technology and Labor Relations: Railroads and Ports,* 2002, in J. Bennett and D. Taras (eds); *Wages in Rail Markets: Deregulation, Mergers, and Changing Network Characteristics*, 2003, Southern Economic Journal; *The Coming North American Rail Mergers*, Strom Thurmond Institute Special Report, 2004


Ton-Miles Per Employee
Millions of Revenue Ton-Miles
11
10
9
8
7
6
5
4
3
2
1
Staggers Act is passed
64 67 70 73 76 79 82 85 88 91 94 97 00 03
Source: AAR


Ton-Miles Per Mile Operated
Millions of Revenue Ton-Miles
14
12
10
8
6
4
2
0
Staggers Act is passed
64 67 70 73 76 79 82 85 88 91 94 97 00 03
Source: AAR


Class I Revenue Ton-Miles
Per Constant Dollar Operating Expense: 1964-2003
(Index 1980 = 100)
300
250
200
150
100
50
0
Staggers Act is passed
64
67
70
73
76
79
82
85
88
91
94
97
00
03
Source: AAR

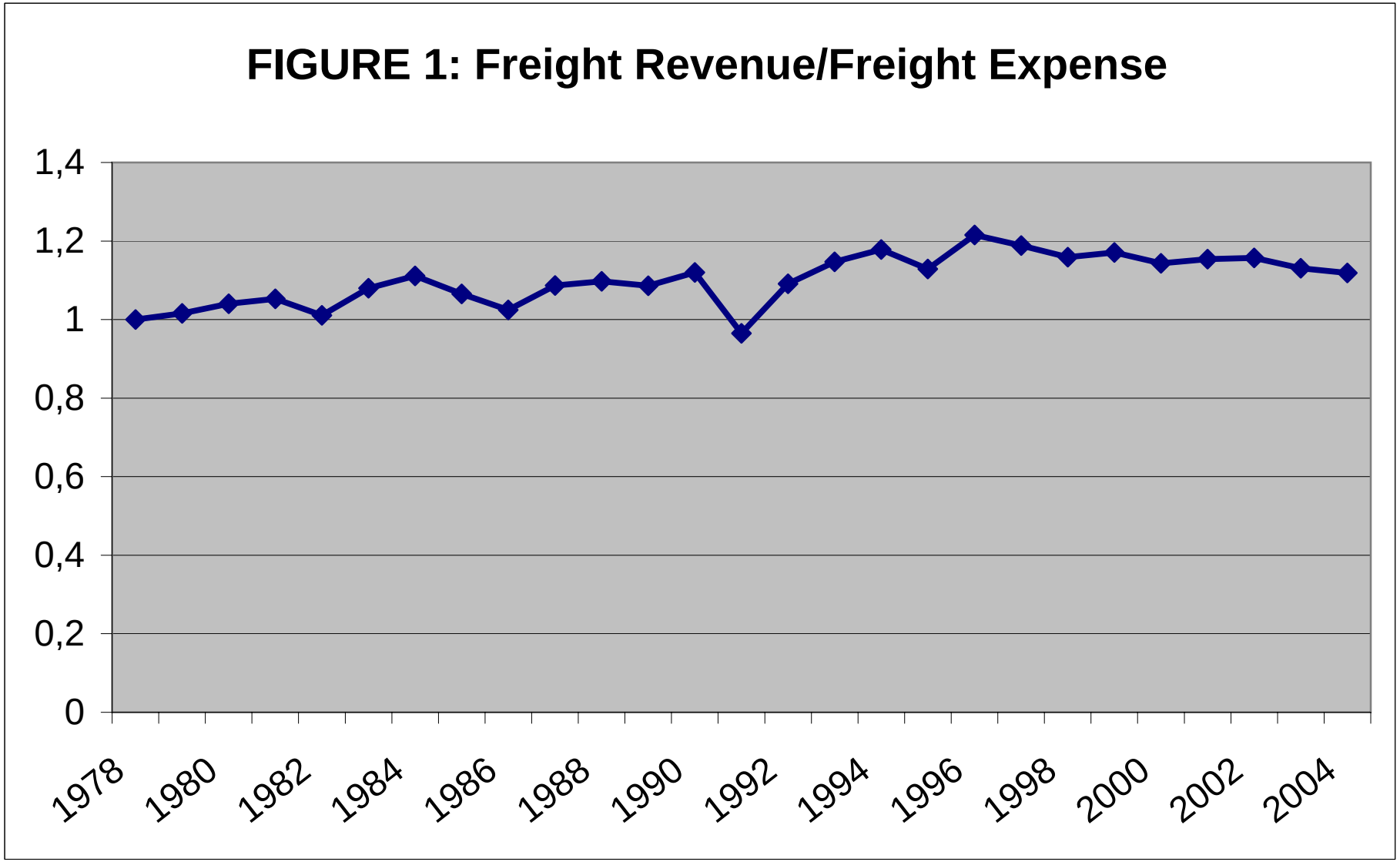


FIGURE 1: Freight Revenue/Freight Expense
1,4
1,2
1
0,8
0,6
0,4
0,2
0
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004

FIGURE 2: % Commodities Carloads

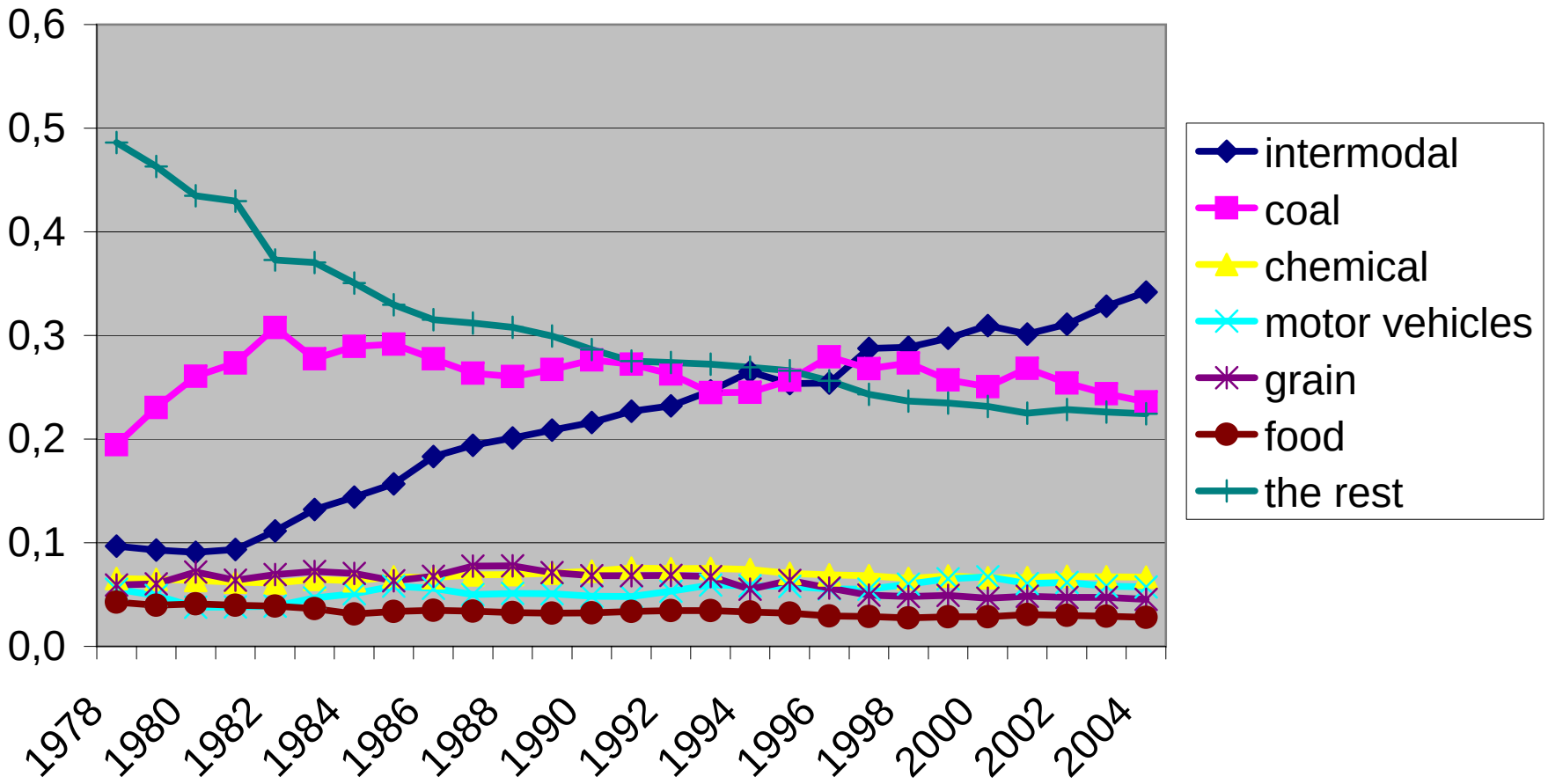


FIGURE 3: Average Employment

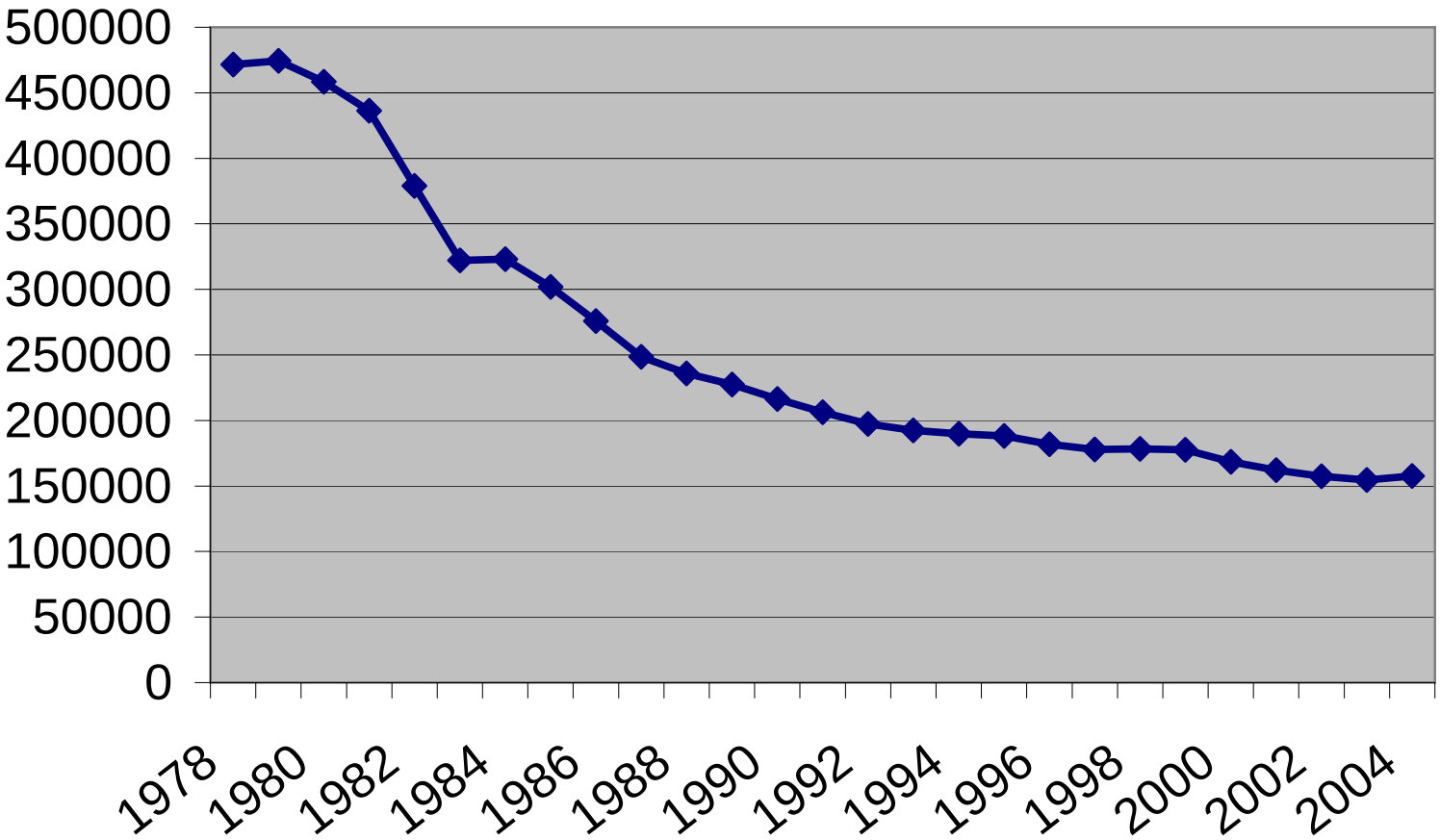


FIGURE 4: Employee Category Shares

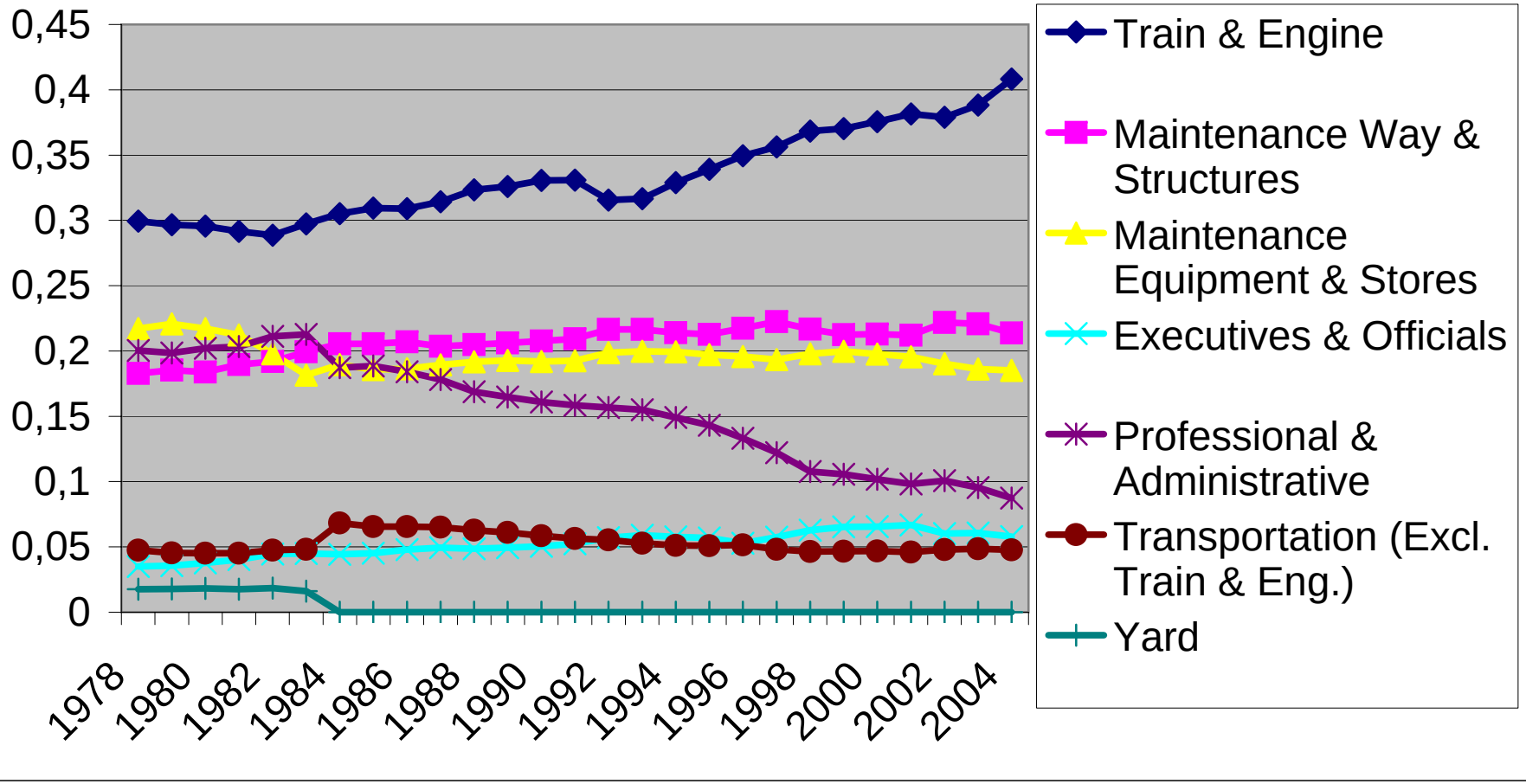
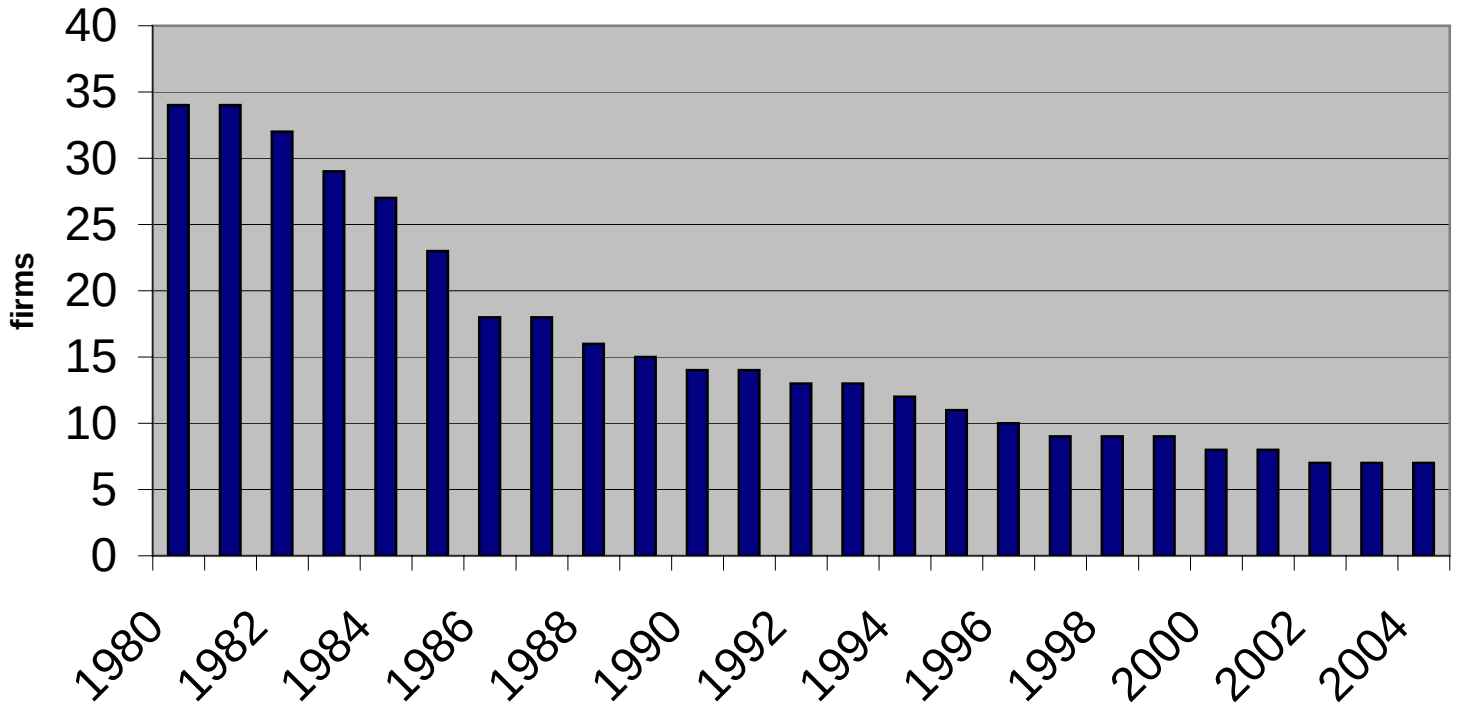


FIGURE 5: US Class I Railroads



Herfindahl	0.073	0.085	0.133	0.152	0.261
CR4	0.424	0.458	0.647	0.685	0.944