IMPACTS OF DEREGULATION ON THE PERFORMANCE OF TRUCKING FIRMS

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16. Abstract Regulatory reform has changed the domestic trucking industry from one of the most heavily regulated settings in the U.S. industry prior to the 1970s to a market-oriented system. This reform has been accomplished through a number of legislative and administrative measures, the primary vehicles being the Motor Carrier Act of 1980 (MCA) and the Trucking Industry Regulatory Reform Act of 1994 (TIRRA). The MCA eliminated the federal regulation, and the TIRRA removed the states' regulation. By opening the trucking industry to market competition, deregulation has led to significant changes in the way rates are set and the rates shippers pay, the service that is provided, and the carrier operations. The results of this study suggest that policymakers should continue to promote competition among trucking firms. Different interest groups will, of course, continue to press for changes in policy, up to and including the restoration of regulation. Thus, it is crucial that policymakers do not undermine support for deregulation by advancing policies inconsistent with its aims.			
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Abstract

Regulatory reform has changed the domestic trucking industry from one of the most heavily regulated settings in the U.S. industry prior to the 1970s to a market-oriented system. This reform has been accomplished through a number of legislative and administrative measures, the primary vehicles being the Motor Carrier Act of 1980 (MCA) and the Trucking Industry Regulatory Reform Act of 1994 (TIRRA). The MCA eliminated the federal regulation, and the TIRRA removed the states' regulation. By opening the trucking industry to market competition, deregulation has led to significant changes in the way rates are set and the rates shippers pay, the service that is provided, and the carrier operations.

Studies find mixed results on the impacts of federal deregulation on the trucking industry. A number of studies raise the concern that the industry has become more concentrated since enacting the MCA. The purpose of this study is to assess quantitatively the impacts of motor carrier deregulation on the performance of trucking firms in the years encompassing the TIRRA. The assessment is based on a broad set of measures that includes variables representing financial performance, competition, and earning potential monopolistic profit.

The results of this study indicate that trucking firms had declining profitability relative to railroad firms in the period from 1991 to 1997. Their efficiency improved in the study period, but railroad firms gained efficiency even more. What is significant about the performance investigation is that trucking firms had invested heavily in fixed assets that are measured by capital expenditures in this study.

Regarding competition, there is evidence that, overall, the trucking industry became more competitive in the study period, which is confirmed by decreasing values of the Herfindahl index. There is no evidence that large trucking firms had reaped supra-competitive profits, although these firms had total freedom to set rates in the era of deregulation. This study also shows that smaller trucking firms did not perform worse in this time period than larger trucking firms. They had even enhanced their profitability over the years relative to larger firms.

The results of this study suggest that policymakers should continue to promote competition among trucking firms. Different interest groups will, of course, continue to press for changes in policy, up to and including the restoration of regulation. Thus, it is crucial that policymakers do not undermine support for deregulation by advancing policies inconsistent with its aims.

I. Introduction

A central issue in the economics of regulation is whether regulatory actions benefit the economic agents they are intended to benefit. A large body of literature exists examining the economic effects of regulation. Much of this literature has utilized the concepts and methods of welfare economics to assess the extent to which regulation affects market reactions. For example, in his seminal article, Stigler (1971) envisions a positive economics of regulation to specify the arguments underlying the supply and demand for regulation. Therefore, the good being transacted in the political market is a transfer of wealth, with constituents on the demand side and their political representatives on the supply side. Accordingly, the market distributes more of the good to that group of constituents whose effective demand is highest. Thus, in this economic approach to regulation, legislators do not necessarily promote the general welfare because any benefits are captured by a small but dominant group with the largest per capita stake.

Government regulation of the trucking industry began in 1935. Spurred by strong lobbying by railroads fearful of growing motor carrier competition, Congress enacted the Motor Carrier Act of 1980 (MCA) and gave the Interstate Commerce Commission (ICC) authority over rates and entry into markets.

In the era of regulation, the ICC rigorously controlled what routes each trucking firm could serve, what commodities it could haul, and what price it could charge. Trucking firms were required to have operating rights to carry a specific commodity regularly between two points. Operating rights could be obtained either by petitioning the ICC or by purchasing them from others. Entry by new carriers or by existing carriers into new markets was permitted only if the carrier could justify its entry on the grounds of public convenience and necessity. Any authority that was granted specified the commodities that could be hauled and the routes along which each commodity could be carried.

Most industry rates were set collectively—subject to ICC approval—by formal groups of trucking companies and shippers called rate bureaus that operated under an exemption from the antitrust laws granted by the 1948 Reed–Bulwinkle Act. Most trucking

companies were required to file their rates with the commission.[1] Shippers and rival carriers could easily protest filed truck rates, leading to expensive and time-consuming commission proceedings to change the filings.

A. The MCA

Critics of motor carrier regulation contended that regulatory rate and entry controls restrained competition, raised the price of transportation services, redistributed income from consumers to carriers, misallocated traffic among transportation modes, and allowed firms to achieve monopoly gains. Regulated motor carriers countered that the industry was characterized by economies of scale that would, in the absence of regulation, give rise to increasing concentration and monopoly power and profits for a few large carriers.

The ICC took its first steps toward recognizing competition as a policy objective in 1975. In 1977, the Commission created a Motor Carrier Task Force to study problems with existing motor carrier regulation and began implementing changes recommended by the group. In the fall of 1978, there was a tremendous surge in ICC activity that led to a number of proposed rules, final rules, and policy statements all directed toward increasing competition in the motor carrier industry and eliminating the Commission's historic protectionist bias toward existing carriers.

Congressional action on trucking regulatory reform was spurred by the ICC's "campaign." Senator Edward Kennedy initiated Congressional hearings on motor carrier regulation in 1977, but Congress did not make progress toward legislation until late 1979. The MCA, passed in June 1980, was above all a compromise. It legislated most of the reforms the ICC had already established, but went no further than the Commission had already proposed, and in some cases prohibited the Commission from adopting proposed policies. The MCA was more important for reinforcing the legal position of the Commission and for reducing uncertainty over reform than for contributing independently to the movement toward deregulation.

Complete deregulation would have removed all entry and pricing controls. Neither the ICC nor the MCA went this far. Nevertheless, substantial reforms were effected, and the

[1] The filed-rate doctrine is the statute that required interstate common carriers to collect only those rates published in their tariffs filed with the ICC.

impacts on the industry were substantial. Rules governing entry and new services were greatly liberalized. The burden of proof in an entry application was no longer on the applicant, but on existing carriers who could block entry only if they could show that it would be inconsistent with public convenience and necessity. Operating rights became much easier to secure, and trucking firms were almost free to enter new markets.

The legislation also cleared the path for more motor carriers to hold contract authority, giving them flexibility to tailor their customer service and charges without filing rates with the ICC. Collective rate-making was prohibited. This practice had been previously exempted from antitrust laws. Thus, in implementing this legislation, the ICC had relaxed both rate and entry controls and had allowed a proliferation of less restrictive operating authorities.

Although carriers lost protection from open competition and the resale values of their interstate operating rights, they also gained new opportunities to achieve efficiency in operations, adjust freight rates to market forces, reduce costly service competition, and expand markets. Because reform legislation, such as the MCA, was a package of economic trade-offs, it was possible that its advantages could offset its disadvantages so that few industry-wide economic losses would result.

B. Deregulation of the Industry after the MCA

The MCA only partially reduced the federal regulation of interstate trucking operations. At the state level, the Act left the decision to deregulate intrastate trucking to state regulators who could decide (a) if there should be any intrastate deregulation and (b) if the institutional arrangements under which such deregulation would take place. Although several states subsequently adopted deregulation, most states continued to regulate either the trucking rates charged by intrastate motor carriers, the entry of new carriers, or both.

After passage of the MCA, trucking firms continued to call for the complete elimination of tariff filing and license applications at the ICC. They also argued that substantial savings might accrue if regulation of intrastate trucking was eliminated. The deregulation trend of the trucking industry was continued by a series of legislations in 1982, 1986, 1993, and 1994. In 1982, the ICC eliminated the requirement that trucking

companies file new rates with it before putting them into effect. In 1986, the ICC reduced states' control over freight shipments within their boundaries.

In August 1994, Congress passed the Trucking Industry Regulatory Reform Act (TIRRA), which further eliminated the ICC's supervision of the trucking industry by removing most tariff filing requirements for all trucking firms except household goods carriers. The TIRRA also eliminated the authority of states to dictate routes and rates that truckers could use within their borders. Together with a second bill passed by Congress in August, the TIRRA virtually eliminated all state oversight of intrastate trucking operations.[2] In essence, the TIRRA almost completed the trucking deregulation process begun by Congress in 1980 with the passage of the MCA. Table 1 summarizes important dates and events associated with trucking deregulation, including the MCA of 1980 and the TIRRA of 1994.

C. Impacts of Interstate Trucking Deregulation

Evidence on the impacts of trucking deregulation is extensive, but the review herein focuses on the impacts of deregulation on the trucking industry only. Overall, evidence on the impacts of deregulation on the entire industry is inconclusive. Some studies show that the entire industry has benefited from deregulation, but other studies provide counter evidence.

On the issue of competitiveness and efficiency, Babcock and German (1989) find that motor carriers have raised their competitiveness and gained a market share of manufactured goods from railroads in the 1980s after deregulation of the trucking industry. Winston, Corsi, Grimm, and Evans (1990) provide similar results. Grimm, Corsi, and Jarrell (1989) document that motor carriers have achieved greater efficiency through better vehicle use and higher average loads. On the other hand, Dempsey (1988) points out that the productivity of interstate motor carriers has actually declined since federal deregulation began, despite the introduction of larger and more efficient

[2] The second bill was part of the Federal Aviation Administration's multi-year airport improvement program reauthorization. The proposal allowed any trucking company handling 15,000 packages a year that was part of an air-motor shipment to set up intrastate trucking operations without any state oversight. The company itself did not have to conduct the air operations, only deliver the cargo to an air carrier.

equipment. Using a translog cost function, estimated with pooled cross-section and time-series data for a panel of twelve large trucking companies over the period 1966–1983, Keeler (1986) finds unexpected results on truck deregulation. The trucking firms' costs increase and productivity declines because of deregulation. However, Keeler cautions that the 1982–1983 recession could have been responsible for the post-deregulation productivity decline.

Researchers have also examined the impacts on the profitability of the trucking industry surrounding deregulation. Researchers generally agree that the industry has suffered declining profitability because of deregulation. Corsi and Stowers (1991) conclude that, for the industry overall, profit indicators have taken a turn for the worse, because revenues decreased more than costs during the 1977–1987 period. Dempsey (1988) notes that the profit margins of all manufacturers have been consistently superior to those of interstate motor carriers since deregulation began. Although profit margins for all manufacturers fell during the recession of the early 1980s, the drop was not nearly as drastic as that experienced by the deregulated motor carriers. MacDonald (1991) finds that industry profit margins have not risen above 3 percent and often have been well below 2 percent. Table 2 summarizes the findings of the impacts of deregulation on motor carriers' competitiveness, efficiency, or profitability.

More recently, stock market data have been used to measure the effect of regulatory changes in the motor carrier industry. Both the studies of Rose (1985) and Schipper, Thompson, and Weil (1987) use the event study methodology to investigate short-window regulatory events' announcement-period stock price reactions associated with the MCA and earlier ICC actions. Their results reveal significantly negative cumulative share price reactions associated with the ICC's regulatory actions before the enactment of the MCA, but not for the Act itself. These researchers conclude that the ICC's actions designed to increase competition in the trucking industry actually reduced the market value of established trucking firms. Morash and Enis (1983) compare the stock price performance of 38 publicly held motor carriers before and after the passage of the MCA. Those researchers find that the overall stock price performance of the trucking stocks in aggregate did not differ significantly before and after the passage of the MCA. Table 3

summarizes the findings associated with the impacts of the MCA on the stock price performance of trucking firms.

Probably the most debated issue about trucking deregulation is the impact of deregulation on industry concentration. The presumption is that increased concentration is bad for competition. The fear is that concentration will enable larger companies to use their power to stop price competition and reap monopolistic profit. Studies usually use the percentage of profits (or revenues) captured by the largest trucking firms as evidence of concentration. Corsi and Stowers (1991) find that the top eight Less-Than-Truckload (LTL) firms increased their share of total revenues generated by all LTL firms from 26 percent in 1977 to 49 percent in 1987. But the evidence on the Truckload (TL) segment is less clear. As reported by Corsi and Stowers, the top eight TL firms decreased their share of total revenues from 22 percent in 1977 to 19 percent in 1987.[3]

Dempsey (1988) argues that the trucking industry has become an oligopoly, with the top ten carriers moving 60 percent of general freight and reaping 90 percent of profits. A similar statistic was also reported by the December 22, 1986 issue of *Business Week.* Some analysts predict that, by the turn of the century, a small number of mega-carriers will dominate the entire trucking industry. Table 4 summarizes results presented in studies on the issue of concentration before and after the MCA. Overall, these studies find that concentration in the trucking industry increased from pre-MCA years to post-MCA years.

D. Nonuniform Impacts on Different Trucking Sectors

Researchers, in general, share the view that the larger trucking firms, especially larger LTL trucking firms, have benefited more from deregulation than the TL trucking firms for the following reasons:

1. LTL motor carriers can compete for TL business with virtually no entry cost (Elzinga, 1994).

[3] The LTL trucking firms routes small lots through terminal networks. Major LTL firms use nationwide hub-and-spoke systems of hundreds of satellite terminals and dozens of large consolidation centers.

2. Larger trucking firms have lower costs of capital in financial markets and maintain advantages over smaller firms regarding ownership of resources (Mixon and Upadhyaya, 1995).
3. There are significant financial barriers when entering the LTL sector, and operating economies of size seem to give the larger carriers a possible cost advantage (Rakowski, 1988).
4. Larger firms have the financial resources to acquire and link with smaller players (*Business Week*, 1986).
5. Larger firms enjoy economies of flow or density in that average costs decline as output increases, thus holding the route system constant (Caves and Christensen, 1988).[4]

Overall, studies have found that the entire LTL sector has suffered because of deregulation, but the larger LTL firms have gained at the expense of smaller LTL firms. Corsi and Stowers (1991) find that the profitability—in terms of operating ratio, net income over operating revenues, and net operating income over total assets—worsened significantly from 1977 to 1987 for the LTL sector. This was not the case for the TL sector. Winston, Corsi, Grimm, and Evans (1990) show that the TL sector has benefited slightly from deregulation, but the LTL sector has lost $5.3 billion in profits annually from deregulation. The authors even suggest that deregulation has redistributed wealth from the LTL carriers to shippers and consumers.

Rakowski (1988) analyzes the performance of the 100 largest Instruction 27 carriers.[5] He finds that the three largest carriers alone accounted for almost 31 percent (61) of the total revenue (operating income) generated by all 100 firms in 1985, whereas the figure was only 21 percent (41) in 1979. The ten largest carriers accounted for almost 53 percent (69) of the total revenue (operating income), while the figure was only 41 percent (61) in

[4] The concept of economies of density is different from that of economies of scale. Economies of scale refer to a long-run average cost curve that declines as the size of the firm increases (i.e., the larger the firm, the lower the cost per unit of output). Whereas this issue is of considerable importance (e.g., with respect to merger policy in the industry), the critical determinant in pricing and (dis)investment policies is whether or not there are economies of density.

[5] This definitional group means that the firms derive at least 75 percent of their revenues from the intercity transportation of general commodities. In other words, it eliminates specialized carriers.

1979. The larger carriers controlled an even greater share of LTL revenue in 1985 relative to 1979. The top three LTL carriers in 1985 had 35 percent of LTL revenue, compared with 31 percent in 1979. For the top ten, it was 57 percent of LTL versus 53 percent of the total revenue.

Dempsey (1988) states that the top ten LTL carriers delivered 39 percent of the industry's shipments in 1978. By early 1985, the top ten had 60 percent of total shipments. He attributes the increased concentration to the high costs of entering the LTL sector, the considerable economies of scale in the LTL sector, and the market clout enjoyed by the top companies. The December 22, 1986 issue of *Business Week* shares the same concern, claiming that the top companies would soon use their power to stop still vigorous price competition and to exploit monopolistic profit. Corsi and Stowers (1991) show that, in almost all sectors, operating expenses per mile as well as revenues per mile declined significantly by 31.6 percent and 33 percent. The declining operating revenues per mile proved that there was still significant competitive pressure during this period despite increased industry concentration.[6]

E. Impacts of Intrastate Trucking Deregulation

Evidence on the impacts of intrastate trucking deregulation is not as extensive as its counterpart on interstate trucking deregulation. In addition, most studies in this area tend to focus on the experience in one single state. In general, studies have found that the intrastate deregulation has increased the amount of trucking competition, and decreased the rates and profitability. Allen, Maze, and Walter (1993) provide a comprehensive review of the studies on intrastate deregulation. The authors note that, "… in general the studies of state regulation and deregulation of intrastate trucking indicate that substantial savings might accrue if regulation of intrastate trucking is eliminated."

II. Research Questions

This study uses the most recent data available to investigate the impacts of intrastate deregulation on the trucking industry. Deregulation of the trucking industry was completed in 1994. Using recent data will provide an updated picture on the impacts of

[6] They did not show the change in costs and revenues per mile separately for larger and smaller firms.

deregulation. When examining industry performance, most studies focus on the profitability of the industry; this study looks at various aspects of the operating performance of the industry using different variables.

In examining these variables, this study will provide a detailed analysis of the industry operation in recent years. A limitation of existing studies is that they look only at the trucking industry. The studies do not compare the performance of the trucking industry with a control group. It is likely that the poor (or good) performance of the industry is partly driven by the general economic condition. Without comparing the industry's performance with a control group, the macroeconomic condition cannot be controlled. In this study, we compare the trucking firms' performance with a properly chosen control group. The next section gives a detailed explanation about the operating variables examined in this study.

Research Question 1: On average, do trucking firms' operating performances change because of intrastate deregulation?

Opponents frequently cite the increased industry concentration ratio taken by certain large trucking firms as the indicator for potential monopoly power. However, it can be argued that, although the industry becomes more concentrated, this does not necessarily imply that the competition is diminishing. Trucking firms are competing with each other even if there are only a handful of large firms. Trucking firms also compete with other types of transportation firms such as railroad firms and barge firms. An industry's market power is measured by its Herfindahl index, a commonly used measure based on the extent of concentration in market shares. Thus, when the Herfindahl index is higher, the degree of competition is lower.[7]

Research Question 2: Does the trucking industry's competition, measured by the Herfindahl index, decrease because of intrastate deregulation?

This paper also asks whether, given that trucking firms now have almost total freedom to set their rates, competition is sufficient to keep trucking firms from making supra-

[7] The Herfindahl index has been used widely in finance literature as an indicator for industry concentration. Some recent studies include Lang and Stulz (1992), Erwin and Miller (1998), and Laux, Starks, and Yoon (1998).

competitive profits. Opponents of truck deregulation constantly contend that trucking firms are using their ability to set rates to wield substantial monopoly power. In particular, these opponents contend that large trucking firms are able to charge unreasonably high rates to captive shippers, those who are served by only one trucking firm and who cannot easily use other forms of transportation. Proponents of deregulation contend that competition between trucking firms and other modes of transportation and among the trucking firms themselves will adequately restrain trucking rates.

Research Question 3: Does intrastate trucking deregulation enable trucking firms, especially large trucking firms, to make monopolistic profits?

The economic theory of Stigler (1971) posits that one group or coalition can use the regulatory process to improve its relative competitive position within the industry. Posner (1974) points out that the differential effects of regulatory change in various industry members will cause members to campaign for regulation in a differential manner. More specifically, Stigler (1971) argues that the incentive of large firms within the industry may differ substantially from their smaller counterparts. It, therefore, becomes an empirical question as to whether the performances of larger and smaller trucking firms differ from each other because of deregulation.

Research Question 4: Do larger trucking firms gain more from intrastate deregulation than smaller firms?

III. Methodology

A. Data

This study investigates the long-term operating performance of the trucking firms surrounding the recent intrastate trucking deregulation movement. The performance of trucking firms is compared with a selected group of large railroad firms to remove the potential impacts of the overall economy on the entire transportation industry. The trucking firms and railroad firms used in this study come from COMPUSTAT, which is a computerized database covering financial data for all NYSE, AMEX, and certain NASDAQ firms. The Standard Industrial Classification (SIC) code for trucking firms is 4213, according to COMPUSTAT, which includes trucking firms, with the exception of

local firms. The SIC code for railroad firms is 4011, which includes line-haul operating railroad firms.

B. Analysis

The financial performances of trucking firms and railroad firms are compared for a seven-year period from 1991 to 1997. Trucking firms have gone through a series of deregulation in the late 1980s and early 1990s. It takes time for the cumulative impacts to take hold. This time period is chosen to examine whether there is a significant change in trucking firms' performance associated with the recent round of intrastate deregulation movements. There is also a comparison of trucking firms' performance in this time period with the results from some earlier studies, which, in general, show that trucking firms' performance worsens because of deregulation. However, the performance of trucking firms is also affected by extra-industry reasons, such as economic-wide circumstances. To control the economic-wide factors, the performance of trucking firms is compared with that of railroad firms. Railroad firms and trucking firms are similar in the sense that both types of firms are sensitive to economic conditions. These firms tend to use similar factors in generating revenues. Financial information for all the trucking firms and railroad firms in our study is obtained from Standard & Poor's COMPUSTAT Annual File.

The examination is based on a broad set of measures that includes profitability, activity, leverage, and liquidity, as well as measures indicating the investment and dividend policies of trucking firms. At least one measure represents each of the factors of financial performance. The factors and associated variables include profitability (operating income to assets, operating income to sales, and earnings per share), activity (sales to total assets, sales to total employees), financial leverage (total debt to total assets), and liquidity or asset structure (working capital to total assets).

Profitability measures are used to indicate the amount of return on a firm's sales, asset, and equity bases. Gordon (1995) notes the widespread acceptance of such measures as indicators of firm performance. Profitability is evaluated with three commonly used ratio measures: (1) operating profit margin, (2) return on assets, and (3) earnings per share. The profit margin shows the proportion of each revenue dollar that is translated into

operating income. Return on assets indicates how efficiently a firm is using its assets, by measuring the proportional rate of return on each dollar invested in assets. Finally, earnings per share measures the dollar return for each share of common stock outstanding. The latter index is watched frequently by investors who often use earnings per share and the trend in earnings per share to establish the transaction price per share of common stock.

A second method to evaluate financial performance is to determine how efficiently a firm is using its human resources and assets to produce sales. Measurement of efficiency is important because, among other consequences, improved efficiency is thought to be associated with successful turnarounds (Hambrick and Schecter, 1983; Robbins and Pearce, 1992). Two ratios are used to measure efficiency: (1) sales per employee and (2) sales to total assets. The first ratio indicates the sales in dollars generated by each employee, and the second ratio shows the sales produced by each dollar of assets.

A third aspect of financial performance is liquidity, which involves a firm's ability to meet its current debt obligations. Short-term creditors, such as suppliers and bankers, are particularly interested in a firm's liquidity. We measure liquidity with the working capital ratio, which divides the difference between current assets and current liabilities by total assets.

Finally, we use the leverage ratio to evaluate the capital structure of the firms in our study group. The leverage ratio indicates what portion of a firm’s total assets is financed with borrowed money and what portion with investment capital. An increase in leverage involves additional risk for a firm, because debt requires periodic cash outlays to cover principal and interest payments. Our specific measure of leverage is the book value of total liabilities divided by the book value of total assets.

Measures of fixed investment (capital expenditures), production (total number of employees), and dividend policy (dividends per share) allow inference of management’s expectations of future prospects. Examining capital expenditures and changes in capital expenditures over time is equivalent to examining the result of trucking firms’ capital budgeting policy. Trucking firms’ employment level measures the extent to which fixed investments are used. In conjunction with expenditures for plant and equipment, the

measure also indicates trucking firms' substitution of labor for capital. Table 5 presents the financial variables and their definitions used in this study.

The intertemporal analysis is used to investigate changes in financial measures across time. This analysis helps determine whether changes in financial condition after deregulation tend to indicate deterioration or improvement. In addition, the intertemporal analysis seeks to determine the responses of the trucking firms to the deregulation.

Table 6 presents some selected summary statistics for the trucking firms and railroad firms in our study at the end of 1997. Based on 1997 data, the average revenues in our trucking sample are $541 million, which are significantly less than the average revenues of $3,233 million in our railroad sample at the 0.01 level, with a *t*-statistic of –2.70. Likewise, the average total assets in our trucking sample of $322 million are significantly less than the corresponding figure in our railroad sample of $7,916 million at the 0.01 level, with a *t*-statistic of –3.66. The other two measures, average employees and average market value, also indicate that the trucking sample is significantly smaller than the railroad sample. The trucking firms in this study vary in sales from the smallest of $69 million to the largest of $3,349 million.

IV. Results

A. Financial Performance

To answer Research Question 1, we first average COMPUSTAT data for the trucking firms and railroad firms in our study. These averages are computed for the seven-year period from 1991 to 1997. Averages are calculated for all of the financial performance variables listed in Table 5. These figures are presented in Table 7.

As shown in Table 7, all the profitability measures for trucking firms follow a steady downward trend in the time period under study. The return on assets ratios (operating income over total assets) declined from 21.1 percent in 1991 to 17.6 percent in 1997. The decline was significant at the 0.10 level with a *t*-statistic of –1.70. Likewise, the operating margin ratios dropped from 14.3 percent in 1991 to 13.3 percent in 1997. The drop was not significant with a *t*-statistic of –0.50. On the contrary, railroad firms improved their return on assets from 9.5 percent in 1991 to 11 percent in 1997, and

improved their operating margin from 20.2 percent in 1991 to 29 percent in 1997. The improvements in return on assets and operating margin between 1991 and 1997 were significant at the 0.1 level and the 0.05 level, with *t*-statistics of 1.74 and 2.13, respectively.

As shown in Table 7, sales to total assets for trucking firms increased from a 1.621 multiple to a 1.682 multiple in 1997. The same multiplier for railroad firms was 0.398 in 1991 and 0.405 in 1997. Relative to railroad firms, trucking firms were more efficient in using assets to generate revenues. Over the years, trucking firms had slightly improved their average ratio of sales to total assets. However, when the activity is measured by sales per employee, the results differ. In the first year of the study period, both groups had similar dollar sales per employee (about $100 thousand). In the last year of the study period, railroad firms enjoyed much higher sales per employee figure than trucking firms ($175 thousand vs. $113 thousand). The difference in sales per employee between railroad firms and trucking firms in 1997 was significant at the 0.01 significance level with a *t*-statistic of 4.78.

It appears that railroad firms had done a better job than trucking firms in improving their employees' productivity. It can also be argued that if the entire trucking industry was in a more competitive environment than the railroad industry, it would be difficult for trucking firms to significantly raise employees' productivity. This phenomenon may also be caused by larger mergers and acquisitions occurring in the railroad industry during this time period. There were a number of large-scale railroad mergers occurring in the late 1980s and early 1990s. Merged railroad firms tended to reduce significantly their combined employees and thus caused an upward impact on sales per employee.

Trucking firms, on average, had a stronger liquidity position than railroad firms did. Trucking firms maintained stable working capital ratios in the study period. The lowest ratio was 6.8 percent and the highest was about 10 percent in the period of 1991 to 1997. On the other hand, railroad firms had a negative one percent working capital ratio in 1991. That means they had less current assets than current liabilities in 1991. Although they had improved their liquidity position over the years, it was barely positive in 1997. In the area of financial leverage, both trucking firms and railroad firms maintain stable

debt ratios in the study period. For trucking firms as a whole, this ratio was 47 percent in 1991 and 46 percent in 1997. Railroad firms, on average, had a debt ratio of 39 percent in 1991 and 37 percent in 1997. Neither of the differences was significant at the 0.1 significance level.

It seems that both trucking firms and railroad firms had adopted a more conservative dividend policy during this time period. On average, trucking firms had reduced their average dividend per share from $0.094 in 1991 to $0.036 in 1997. The reduction was not significant at the 0.1 level, with a *t*-statistic of –1.04. The railroad firms had lowered their average dividend per share from $0.605 in 1991 to $0.471 in 1997; again, the decrease was not significant at the 0.1 level with a *t*-statistic of -0.60.

Both groups had increased their capital spending during the period from 1991 to 1997. In 1991, trucking firms, on average, spent $28.9 million on capital equipments, and railroad firms spent $404 million. In 1997, trucking firms, on average, spent $54.90 million, and railroad firms spent $634.92 million. The difference in average capital spending between 1997 and 1991 for trucking firms was significant at the 0.1 level, with a *t*-statistic of 1.69, and it was not significant for railroad firms, with a *t*-statistic of 1.09. The percentage increase for trucking firms was 90.2 percent, and it was 57.2 percent for railroad firms. It appears that trucking firms, on average, adopted a very aggressive capital budgeting policy during that time period.

When we examine the employment measures, we notice that trucking firms increased their average number of employees during the study period. The average number of employees increased from 3.46 thousand to 5.304 thousand, but the increase was not significant, with a *t*-statistic of 0.79. The percentage increase was 53 percent. On the other hand, railroad firms decreased their average number of employees from 22.52 thousand in 1991 to 17.70 thousand in 1997; the decrease was, again, not significant, with a *t*-statistic of –0.79. One can at least argue that deregulation simply did not make trucking firms hire fewer employees. Data on the average number of employees also confirm our previous result that railroad firms became more efficient over the years, as measured by sales per employee. It may also be consistent with the conjecture that, when

railroad firms engaged in mergers, they normally reduced their combined number of employees to improve their efficiency.

During this study period, trucking firms also increased their average salary per employee. The average salary per employee increased from $30 thousand to almost $40 thousand from 1991 to 1997—an increase of 31 percent. The average salary per employee in the railroad industry increased from $44.3 thousand to almost $56 thousand—an increase of 26 percent. Relative to railroad firms, trucking firms had increased salary per employee to a growing size of employees.

Overall, trucking firms' profitability suffered a decline in this study period. When compared with railroad firms, trucking firms' profitability performance was lower. Both trucking firms and railroad firms maintained stable ratios of sales to total assets; however, railroad firms generated higher sales per employee. Trucking firms had stable leverage ratios when leverage ratios are measured by total debt to total assets. These firms also had a stronger liquidity position than railroad firms. On average, trucking firms became more aggressive in their capital budgeting policy but more conservative in their dividend policy. One possible explanation is that trucking firms saved cash to pay for capital expenditure expenses by cutting dividend payments to shareholders.

B. Competition and Monopolistic Profit

To answer Research Question 2, we use the Herfindahl index as a proxy for the degree of competition. The Herfindahl index is the traditional measure of concentration used in the industrial organization literature and is widely viewed as a proxy for the degree of imperfect competition [see Lang and Stulz (1992) for a detailed discussion of the Herfindahl index.]. The Herfindahl index is calculated as the sum of the squared market shares for all firms in an industry. In an alternative method, the Herfindahl index can be measured as the sum of squared market shares of the rival firms, and, as such, it measures the concentration of industry sales.

First, all the sales for all the firms in our trucking sample in each year are summed. Then, each individual firm's sales is divided by industry sales to obtain the fraction of industry sales by each individual firm. The fractions are squared, and the squared fractions are summed to get the Herfindahl index for each individual year. The

Herfindahl indexes for all the years from 1991 to 1997 are presented in Table 8. This index was 0.217 in 1991 and 0.154 in 1997. Over the years, this index showed a downward trend. The evidence presented indicates that deregulation did not exacerbate competition in the trucking industry. On the contrary, the industry became more competitive surrounding the years of deregulation.

To understand the competitive positions of top firms and bottom firms in the industry, we compute the three largest firms' and the three smallest firms' contributions to each year's Herfindahl index and present them in Table 8. The ranking is based on the each firm's sales in 1991. The figure was 94.79 percent in 1991 and 87.35 percent in 1997 for the three largest firms—a decrease of 7.8 percent. There is no evidence that top firms had gained market shares at the expense of bottom firms in our sample. On the contrary, the three smallest firms in our sample increased their combined contribution to the Herfindahl index from 0.05 percent in 1991 to 0.21 percent in 1997—as increase of 3.2 times. The evidence presented herein may also give some clues to our last question concerning whether larger firms have gained more from deregulation than smaller firms?

We use value of Tobin's *q* as the basis to answer Research Question 3 concerning whether, given that trucking firms now have almost total freedom to set their rates, competition is sufficient to keep trucking firms from making supracompetitive profits. Tobin's *q* is the ratio of the market value of a firm's securities to the replacement cost of its assets. The use of Tobin's *q* as an indicator of monopoly profits was pioneered by Lindenberg and Ross (1981). It has also been used by Salinger (1984); Smirlock, Gilligan, and Marshall (1984); Hirschey (1985); and McFarland (1987).

In this study, we use the method proposed by Chung and Pruitt (1994) to estimate values of *q* for trucking firms. The estimation uses the sum of a firm's market value of equity, liquidating value of a firm's outstanding preferred stock, the value of a firm's short-term debt net of its short-term assets, and the book value of a firm's long-term debt as the numerator for calculation of values of Tobin's *q*. The denominator is the total value of a firm's assets. Chung and Pruitt (1994) have shown that their approximate *q* values are very close to the *q* values obtained via Lindenberg and Ross' (1981) more theoretically correct model.

Table 8 shows the average *q* values for trucking firms in our sample from 1991 to 1997. Similar to the trend observed in the Herfindahl index, the average value of *q* decreased from 1.102 in 1991 to 1.038 in 1997. The average value of *q* for the top three trucking firms decreased from 1.189 in 1991 to 0.953 in 1997. For the three bottom firms, the average value of *q* increased slightly from 1.029 in 1991 to 1.083 in 1997. There is no indication that trucking firms or even the largest trucking firms have taken advantage of deregulation to reap monopolistic profit.

C. Larger and Smaller Trucking Firms

Answering the last research question requires additional analysis. We begin by splitting the study group at the median of sales amount in 1991: $177 million. Trucking firms whose size fell below the median are classified as smaller firms, while those above and including the median are classified as larger firms.[8] The average of the sales was $81 million for smaller firms in 1991 and $473 million for larger firms. The average of the sales for larger firms was significantly greater than that for smaller firms at the 0.05 level. Then, the same type of analysis reported in Table 7 is repeated, but yearly performance is averaged separately for smaller firms and larger firms. Those averages are presented in Table 9.

When the profitability ratios of smaller firms are compared with those of larger firms, it appears that the smaller firms performed better than the larger firms in the study period. For example, smaller firms, on average, had a lower return on assets ratio than larger firms did in 1991 (20.78 percent vs. 21.43 percent). The trend reversed itself in the last two years. When examining the same ratio for each group of firms separately, both groups are found to suffer a decline in return on assets from 1991 to 1997. However, the decline was only significant at the 0.1 level for larger trucking firms, with a *t*-statistic of –1.70. Smaller firms presented a brighter profitability picture relative to larger firms in the latter years of the study period, even if they still had, on average, a lower return on assets ratio in 1997 vs. 1991.

[8] The results are qualitatively the same if we omit the median firm from both groups of smaller and larger firms, or if we put the median firm into the group of smaller firms.

Larger firms were more efficient in using assets to generate sales. This ratio was 1.37 multiple for smaller firms and 1.93 multiple for larger firms in 1991, and the difference is significant at the 0.05 level, with a *t*-statistic of –1.97. In 1997, larger firms were still ahead of smaller firms by the similar margin with a similar *t*-statistic of –2.17. Smaller firms became more efficient in using employees to generate sales during this time period. The sales generated by each employee increased from $73 thousand in 1991 to almost $100 thousand in 1997—the improvement was significant at the 0.05 level, with a *t*-statistic of 2.42. Larger firms had similar sales to employees' ratios in 1991 and 1997. It was $127 thousand in 1991 and $125 thousand in 1997; the decline was not significant at the 0.1 level, with a *t*-statistic of -0.04.

The debt ratios for smaller and larger firms were very similar, although larger firms increased their average debt ratio slightly from 1991 to 1997. The evidence on working capital ratios indicates that larger firms had, on average, a more liquid position than smaller firms. The average of capital expenditures for smaller firms was $16.54 million in 1991 and $30.28 million in 1997. Larger firms spent $41.23 million in capital expenditures in 1991, and 77.05 million in 1997. Both groups increased their capital spending during the study period, but the increases were not significant at the 0.1 level, with *t*-statistics of 1.54 and 1.22, respectively. The percentage increase for smaller firms was 100 percent and 87 percent for larger firms.

Thus far, the evidence indicates that smaller trucking firms in our sample performed no worse than larger trucking firms. In some measures, such as profitability, they even did better than larger firms. It appears that larger firms have not gained, at the expense of smaller firms, from the recent deregulation.

V. Conclusions

The results reported in this study provide a detailed picture of large trucking firms' performance during the period from 1991 to 1997. This view improves our understanding of the impacts of recent intrastate deregulation on trucking firms' financial performance. Compared with a group of large railroad firms, trucking firms performed

worse than railroad firms in terms of profitability during this study period. Railroad firms had an improving profitability performance relative to trucking firms. In terms of efficiency, both groups had similar trends in their sales to total assets ratio, but railroad firms increased their employees' efficiency more than trucking firms. They also maintained similar leverage ratio trends from the beginning to the end of the study period. Trucking firms had a more liquid position than railroad firms, and they also increased their capital spending in percentage more than railroad firms.

On the hotly debated issue of competition, this study does not find evidence that competition was stifled because of deregulation. Contribution to the Herfindahl index indicates that, in terms of sales, the top three trucking firms reduced their combined concentration, and the three bottom trucking firms increased their concentration during this time period. Regarding monopolistic profit, our results also indicate that there is no evidence of abnormal profits reaped by trucking firms especially large trucking firms. The results presented in this study also indicate that larger firms have not benefited from deregulation at the expense of smaller firms. The smaller firms even increased their profitability more than larger firms.

It appears that the trucking industry has become more competitive in recent years. Our results show that the whole industry is competitive enough so that there is no existence of monopolistic profit enjoyed by the largest trucking firms. Trucking firms have been willing to spend money to upgrade their facilities to remain competitive. Based on our results, the fear that larger trucking firms would reap huge profit from deregulation is not warranted.

Policymakers should continue to promote competition among trucking firms. Different interest groups will, of course, continue to press for changes in policy, up to and including the restoration of regulation. Thus, it is crucial that policymakers not undermine support for deregulation by advancing policies inconsistent with its aims.

REFERENCES

Adrangi, B., and Chow, G., and Raffiee, K., 1995, Analysis of the Deregulation of the US Trucking Industry: A Profit Function Approach, *Journal of Transport Economics & Policy*, vol. 29, pp. 233-246.

Allen, B., Maze, T., and Walter, C., 1993, Intrastate Trucking Deregulation: Have Both the Negative and Positive Impacts Been Overstated? *Transportation Journal*, vol. 33, pp. 30-42.

Babcock, M., and German, W., 1989, Changing Determinants of Truck-Rail Market Shares, *Transportation Journal*, vol. 25, pp. 251-270.

Brunning, E., and Morash, E., 1983, Deregulation and the Cost of Equity Capital: The Case of Publicly Held Motor Carriers, *Transportation Journal*, vol. 22, pp. 72-81.

Caves, Douglas W., and Christensen, L.R., 1988, The Importance of Economies of Scale, Capacity Utilization, and Density in Explaining Inter-Industry Differences in Productivity Growth, *Logistics & Transportation Review*, vol. 24, pp. 3-32.

Chung, K.H., and Pruitt, S.W., 1994, A Simple Approximation of Tobin's *q*, *Financial Management*, vol. 23, pp. 70-74.

Corsi, T., and Grimm, C., and Feitler, J., 1992, The Impact of Deregulation on LTL Motor Carriers: Size, Structure, and Organization, *Transportation Journal*, vol. 32, pp. 24-31.

Corsi, T., and Stowers, J., 1991, Effects of a Deregulated Environment on Motor Carriers: A Systematic, Multi-Segment Analysis, *Transportation Journal*, vol. 30, pp. 4-28.

Dempsey, P., 1988, The Empirical Results of Deregulation: A Decade Later, and the Band Played On, *Transportation Journal*, vol. 17(1), pp. 31-100.

Elzinga, K., 1994, The Relevant Market for LTL Freight: Deregulation's Consequences, *Transportation Journal*, vol. 34, pp. 29.

Erwin, G.R., and Miller, J.M., 1998, The Intra-Industry Effects of Open Market Share Repurchases: Contagion or Competitive? *Journal of Financial Research*, vol. 21, pp. 389-406.

Ettorre, J., 1988, Feds May Be Out of Trucking Regulation, But Not States, *Transportation & Distribution*, vol. 29(4), pp. T19-T22.

Glaskowsky, N., 1986 and 1990, Effects of Deregulation on Motor Carriers. Eno Foundation for Transportation, Inc.

Gordon, L.A., 1995, Managerial Accounting: Concepts and Empirical Evidence. New York: McGraw-Hill.

Grimm, C., Corsi, T., and Jarrell, J., 1989, U.S. Motor Carrier Cost Structure under Deregulation, *Transportation Journal*, vol. 25, pp. 231-248.

Hambrick, D.C., and Schecter, S.M., 1983, Turnaround Strategies for Mature Industrial-Product Business Units, *Academy of Management Journal*, vol. 26, pp. 231-248.

Hirschey, M., 1985, Market Structure and Market Value, *Journal of Business*, vol. 58, pp. 89-98.

Kahai, S., and Ford, J., 1997, Economics of Intrastate Trucking Regulation: Some Empirical Evidence, *Logistics & Transportation Review*, vol. 33E, pp. 139-145.

Keeler, T.E., 1986, Public Policy and Productivity in the Trucking Industry: Some Evidence on the Effects of Highway Investments, Deregulation, and the 55 MPH Speed Limit, *American Economic Review*, vol. 76, pp. 153-158.

Khan, A., and Reinsch, R., 1989, The Deregulation Debate Continues: Is ICC Control Over the Trucking Industry Necessary? *Mid-Atlantic Journal of Business*, vol. 26(1), pp. 67-79.

Lang, L.H.P., and Stulz, R.M., 1992, Contagion and Competitive Intra-Industry Effects of Bankruptcy Announcements, *Journal of Financial Economics*, vol. 32, pp. 45-60.

Laux, P., Starks, L.T., and Yoon, P.S., 1998, The Relative Importance of Competition and Contagion in Intra-Industry Information Transfers: An Investigation of Dividend Announcements, *Financial Management*, vol. 27, pp. 5-16.

Lindenberg, E., and Ross, S., 1981, Tobin's *q* ratio and Industrial Organization, *Journal of Business*, vol. 54, pp. 1-32.

MacDonald, M., 1991, It's Still Survival of the Fittest: Cover Story, *Traffic Management*, vol. 30, pp. 30.

McFarland, H., 1987, Did Railroad Deregulation Lead to Monopoly Pricing? An Application of *q*, *Journal of Business*, vol. 60, pp. 385-400.

Mixon, F., and Upadhyaya, K., 1995, An Empirical Analysis of Firm Size and Vertical Integration in Motor Carrier Industry, *Transportation Journal*, vol. 31, pp. 21.

Morash, E.A., and Enis, C.R., 1983, Investor Perceptions of the Impact of Deregulation on Motor Carrier Earnings, *Logistics and Transportation Review*, vol. 19, pp. 309-324.

Neely, W., and Taylor, P., 1998, The Process of Post Regulatory Changes and Industry Development following Motor Carrier Deregulation: An Invention and Profitability Study, *Journal of Applied Business Research*, vol. 14(3), pp. 37-52.

Nelson, J., 1987, Politics and Economics in Transport Regulation and Deregulation—A Century Perspective of the ICC's Role, *Logistics & Transportation Review*, vol. 23(1), pp. 5-23.

Posner, R.A., 1974, Theories of Economics Regulation, *Bell Journal of Economic & Management Sciences*, vol. 5, pp. 3-35.

Rakowski, J.P., 1988, Marketing Economics and the Results of Trucking Deregulation in the Less-Than-Truckload Sector, *Transportation Journal*, vol. 27, pp. 11-22.

Robbins, D.K., and Pearce, J.A., 1992, Turnaround: Retrenchment and Recovery, *Strategic Management Journal*, vol. 13, pp. 287-309.

Rose, L., 1985, The Incidence of Regulatory Rents in the Motor Carrier Industry, *Rand Journal of Economics*, vol. 16, pp. 299-318.

Salinger, M.A., 1984, Tobin's *q*, Unionization, and the Concentration-Profits Relationship, *Rand Journal of Economics*, vol. 15, pp. 159-170.

Schipper, K., Thompson, R., and Weil, R., 1987, Disentangling Interrelated Effects of Regulatory Changes on Shareholder Wealth: The Case of Motor Carrier Deregulation, *Journal of Law & Economics*, vol. 30(1), pp. 67-100.

Smirlock, M., Gilligan, T., and Marshall, W., 1984, Tobin's *q* and the Structure-Performance Relationship, *American Economic Review*, vol. 74, pp. 1051-1060.

Stephenson, F., and Stank, T., 1994, Truckload Motor Carrier Profitability Strategies, *Transportation Journal*, vol. 34, pp. 5-17.

Stigler, J., 1971, The Theory of Economic Regulation, *Bell Journal of Economic & Management Sciences*, vol. 2, pp. 3-14.

Welles, C., Payne, S., Seghers, F., and Ichniowski, I., 1986, Is Deregulation Working? *Business Week* Issue, 2978, pp. 50-55.

Winston, C., Corsi, T.M., Grimm, C.M., and Evans, C.A., 1990, *The Economic Effects of Surface Freight Deregulation*, Brookings Institution.

Table 1

Important Events and Dates Associated with Trucking Deregulation*

Date	Events
781107	The Chairman of the Interstate Commerce Commission, Daniel O'Neal, called for the agency to give up a substantial part of its control over the trucking industry.
790615	Senator Edward Kennedy and the Carter Administration joined forces on a legislative plan to deregulate the trucking industry.
800131	Key congressional committees drafted legislation that would reduce governmental regulation of the trucking industry more extensively than industry leaders had expected.
800416	Senate passed a bill to significantly deregulate the trucking industry.
800620	The House passed a bill to substantially deregulate the trucking industry. The Senate was likely to accept the House legislation in the June 20 vote.
800702	President Carter signed into law a bill that will substantially deregulate the trucking industry.
831222	The Interstate Commerce Commission proposed to eliminate the requirement that trucking companies file new rates before putting them into effect.
860424	The Interstate Commerce Commission, in a move extending trucking deregulation, reduced states' control over freight shipments within their boundaries.
940805	House and Senate conferees agreed on sweeping language to be inserted into a bill appropriating $890 million for airport spending that would end state and local regulations of trucking rates and services.
940817	The House approved a measure eliminating rate-filing requirements for most trucking companies.
941231	A new federal law, which took effect in January 1995, prohibited states from regulating the rate for in-state transportation of non-household goods.

*Data Sources: The *Wall Street Journal Index* and the *New York Times Index*. The dates are the dates that the events actually appeared in the newspapers.

Table 2
Summary of Studies on the Impact of the Motor Carrier Act on Motor Carriers' Competitiveness, Efficiency, or Profitability

Study	Performance Factor Investigated	Impact
Babcock and German (1989)	Competitiveness	Positive
Winston, Corsi, Grimm, and Evans (1990)	Competitiveness	Positive
Corsi and Stowers (1991)	Profitability	Negative
Dempsey (1988)	Productivity	Negative
Dempsey (1988)	Profitability	Negative
Grimm, Corsi, and Jarrell (1989)	Efficiency	Positive
Keeler (1986)	Productivity	Negative
MacDonald (1991)	Profitability	Negative

Table 3
Summary of Studies on Motor Carriers' Stock Price Reactions to Deregulation Actions

Study	Actions Investigated	Abnormal Stock Return
Rose (1985)	ICC Actions (1977-81)	–19.2%***
	Congress Actions (1977-81)	–3.4%
	Post-Motor Carrier Act	1.7%
Schipper, Thompson, and Weil (1987)	ICC Actions (1974-79)	–0.85%**
	Motor Carrier Act (1980)	–0.27%
	ERTA (1981)[a]	7.32%***
Morash and Enis (1983)	MCA	No effect[b]

** Significant at the 0.05 level.

*** Significant at the 0.01 level.

ICC, Interstate Commerce Commission; ERTA, Economic Recovery Tax Act; MCA, Motor Carrier Act.

[a]The 1981 ERTA allowed trucking firms to deduct the value of their operating rights over a five-year period.
[b]Morash and Enis (1983) compare the motor carriers' stock prices before and after the passage of the MCA and find that the difference is not significant.

Table 4

Summary of Studies on Industry Concentration Before and After Deregulation

Study	Measure	Number of Top Firms Selected	Industry Sector	Time Frame	Percentages of Concentration
Business Week (Dec. 22, 1986)	Profits	Top 10	LTL	1986	90
	Shipments	Top 10	TL	1986	60
Corsi and Stowers (1991)	Revenues	Top 4	LTL	1987 vs.1977	36.9 vs.18.3
	Revenues	Top 8	LTL	1987 vs.1977	49 vs. 26
	Revenues	Top 20	LTL	1987 vs.1977	67 vs. 41
Dempsey (1988); Glaskowsky (1986)	Shipments	Top 4	LTL	1985 vs.1978	35 vs. 20
	Shipments	Top 10	LTL	1985 vs.1978	60 vs. 39
	Shipments	Top 20	LTL	1985 vs.1978	67 vs. 43
Glaskowsky (1990)	Shipments	Top 4	LTL	1987 vs.1985	40 vs. 35
	Shipments	Top 10	LTL	1987 vs.1985	64 vs.60
	Shipments	Top 20	LTL	1987 vs.1985	73 vs.67
Rakowski (1988)	Operating Revenues	Top 3	100 Largest Instruction 27 Carriers*	1985 vs.1979	31 vs. 21
	Operating Revenues	Top 10	100 Largest Instruction 27 Carriers	1985 vs.1979	53 vs. 41
	Operating Income	Top 3	100 Largest Instruction 27 Carriers	1985 vs.1979	61 vs. 41
	69 versus 61	Top 10	100 Largest Instruction 27 Carriers	1985 vs.1979	69 vs. 61

*Instruction 27 carriers are carriers that derive at least 75 percent of their revenues from the intercity transportation of general commodities.

LTL, Less-Than-Truckload; TL, Truckload.

Table 5
Operating Performance Measures*

Profitability Measures
Operating income to total assets: Net sales, less cost of goods sold, less selling and administrative expenses before deducting depreciation and amortization expense (OIBDA, COMPUSTAT item 13) over book value of total assets (6)
Operating income to total sales: Net sales, less cost of goods sold, less selling and administrative expenses before deducting depreciation and amortization expense (OIBDA, COMPUSTAT item 13) over total sales (117)
Earnings Per Share to stock price: Earnings before extraordinary items over the share price (233/24)
Activity Measures
Sales to total assets: Total sales over book value of total assets (117/6)
Sales to total employees: Total sales over the number of total employees (117/29) (117/146)
Financial Leverage
Total debt ratio: Book value of total debt over book value of total assets [(5+9)/6]
Liquidity Measures
Working capital ratio: Working capital (current assets minus current liabilities) over book value of total assets [(4–5)/6]
Investment Measures
Capital expenditures (30)
Employment Measure
Average total employees (29)
Average salary (42/29)
Dividend Payout Measure
Average dividend per share (26)

*COMPUSTAT item numbers are in parentheses.
OIBDA, Operating Income Before Depreciation and Amortization.

Table 6
Descriptive Statistics of Trucking Firms and Railroad Firms Covered in COMPUSTAT at the End of 1997

Descriptive Measure	Mean	Median	Maximum	Minimum	Std. Dev.
Trucking Firms					
Revenues (in millions)	541	262	3,349	68.84	772.0
Total Assets (in millions)	321.6	145.3	1,271	75.96	340.6
Employees (in thousands)	5.305	2.099	34.400	0.721	7.894
Market Value* (in millions)	282.5	107.9	916.5	7.593	316.7
Railroad Firms					
Revenues (in millions)	3,233	622.5	11,079	12.78	4,052
Total Assets (in millions)	7,916	2,083	28,764	24.30	9,275
Employees (in thousands)	17.70	6.34	65.6	0.1	19.96
Market Value* (in millions)	4,773	1,979	15,469	7.49	5,673

*Market value equals the 1991 year-end stock price per share times the number of shares outstanding for each firm.

Table 7

Operating Performance of Trucking Firms and Railroad Firms from 1991 to 1997*

Measure/Year	1991	1992	1993	1994	1995	1996	1997
Profit Measures							
Operating Income/Total Assets	.211(.095)	.223(.111)	.210(.114)	.213(.128)	.182(.129)	.166(.118)	.176(.110)
Operating Income/Total Sales	.143(.202)	.151(.262)	.152(.263)	.162(.297)	.149(.273)	.130(.292)	.133(.290)
Earnings Per Share/Stock Price	-.142(-.019)	.053(-.013)	.052(.040)	.065(.058)	.053(.050)	-.021(.052)	-.173(.052)
Activity Measures							
Sales/Total Assets	1.621(.398)	1.668(.432)	1.618(.446)	1.542(.458)	1.526(.465)	1.613(.411)	1.682(.405)
Sales/Total Employees	101.63(103.31)	104.27(119.00)	106.46(124.88)	102.766(138.76)	104.93(154.46)	111.232(166.92)	113.199(175.16)
Financial Leverage							
Total Debit Ratio	.469(.388)	.449(.396)	.430(0.377)	.433(.365)	.376(.376)	.437(.346)	.457(.366)
Liquidity Measure							
Working Capital Ratio	.078(-.011)	.068(-.018)	.099(-.013)	.101(-.012)	.101(-.019)	.090(.003)	.088(.006)
Investment Measure							
Capital Expenditures (in millions)	28.87(404.12)	42.67(401.47)	52.04(413.70)	59.50(434.66)	52.59(409.13)	45.27(563.40)	54.90(634.92)
Employment Measures							
Average Total Employees	3.464(22.52)	3.601(20.98)	4.215(18.40)	4.607(17.95)	4.805(16.66)	4.961(17.35)	5.304(17.70)
Salary/Employee	30.20(44.34)	33.07(52.38)	33.87(54.79)	36.66(53.23)	37.84(54.89)	39.12(56.95)	39.68(55.82)
Dividend Payout Measure							
Average Dividend Per Share	.094(.605)	.083(.577)	.084(.571)	.085(.555)	.061(.449)	.0369.515)	.036(.471)

*Averages for railroad firms are in parentheses.

Table 8

Values of the Herfindahl Index and Tobin's *q* of Trucking Firms from 1991 to 1997*

Herfindahl Index							
	1991	1992	1993	1994	1995	1996	1997
All Firms	.2169	.1870	.2026	.1755	.1713	.1583	.1542
Top Three Firms' Contribution	.9479	.9332	.9414	.9186	.9109	.8885	.8735
Bottom Three Firms' Contribution	.0005	.0012	.0010	.0014	.0015	.0019	.0021
Tobin's q							
All Firms	1.102	1.341	1.359	1.130	.856	.919	1.038
Top Three Firms	1.189	1.330	1.319	.961	.801	.844	.953
Bottom Three Firms	1.029	.881	1.021	.955	.821	.798	1.083

*The Herfindahl index is calculated as the sum of the squared market shares of all the trucking firms in COMPUSTAT with the same four-digit Standard Industrial Classification (SIC) code. It measures the concentration of industry sales. When the Herfindahl index is higher, the degree of competition within the industry is lower and vice versa. The top (bottom) three firms' contribution is calculated as the sum of the top (bottom) three firms' (in terms of revenues) market shares divided by the Herfindahl Index. Tobin's *q* is calculated as the sum of the market value of equity, market value of preferred stock, difference between current debt and current assets, and book value of long-term debt divided by the total value of assets.

Table 9

Operating Performance of Smaller and Larger Trucking Firms from 1991 to 1997*

Measure/Year	1991	1992	1993	1994	1995	1996	1997
Profit Measures							
Operating Income/Total Assets	.208(.214)	.220(.226)	.201(.218)	.208(.218)	.182(.182)	.168(.164)	.180(.173)
Operating Income/Total Sales	.166(.122)	.174(130)	.173(.134)	.184(.142)	.173(.127)	.152(.111)	.156(.112)
Earnings Per Share/Stock Price	-.098(-.181)	.081(.028)	.062(.043)	.074(.056)	.069(.039)	.057(-.091)	.041(-.365)
Activity Measures							
Sales/Total Assets	1.36(1.93)	1.56(1.89)	1.36(1.81)	1.18(1.72)	1.14(1.68)	1.2(1.72)	1.26(1.8)
Sales/Total Employees	73.61(126.84)	80.98(125.22)	82.29(128.22)	91.54(112.86)	91.94(116.62)	96.20(124.76)	99.60(125.44)
Financial Leverage							
Total Debit Ratio	.47(.468)	.457(.441)	.416(442)	.399(463)	.407(.463)	.422(.449)	.438(.473)
Liquidity Measures							
Working Capital Ratio	.054(.100)	.052(.083)	.105(.094)	.153(.054)	.134(.071)	.089(.090)	.036(.059)
Investment Measures							
Capital Expenditures (in millions)	15.13(41.23)	19.37(63.65)	24.62(76.72)	25.89(89.75)	26.75(75.83)	26.66(63.03)	30.28(77.05)
Employment Measures							
Average Total Employees	1.10(5.58)	1.23(5.74)	1.39(6.75)	1.50(7.40)	1.64(7.66)	1.72(7.88)	1.87(8.39)
Salary/Employee	28.40(31.80)	33.82(32.40)	34.51(33.30)	37.70(35.73)	38.47(37.27)	39.83(38.47)	40.15(39.26)
Dividend Policy Measures							
Average Dividend Per Share	.024(.156)	.025(.135)	.026(.135)	.027(.136)	.028(.091)	.029(.041)	.031(.042)

*Averages for larger trucking firms are in parentheses.