Competition drives the trucking industry

In the wake of deregulation and the intense competition that followed, the trucking industry has radically changed the quality and types of services it provides its customers; today, the emphasis is on efficiency, and the ultimate beneficiary is the American consumer

Cynthia Engel

The Nation's freight bill hit an all-time low in 1996, with shipping costs accounting for only 6 percent of gross domestic product, compared with 7.6 percent in 1980.[1] Nearly 75 percent of freight is transported by truck at some point in the distribution chain,[2] and consumers have benefited from a myriad of factors that have improved service and lowered freight costs. The trucking industry has weathered many challenges, some of which emerged from within the industry, and others that sprang up in the economic environment.

The adoption of just-in-time delivery systems, new developments in technology, deregulation, and increasing competition between transportation sectors have forced the trucking industry to pay more attention to customers' needs. In particular, companies have sought to meet requirements for more reliable and frequent deliveries, and thus reduce warehousing and transit costs. These savings, passed on to consumers and businesses, have contributed to more competitively priced products in a global economy.

Cost savings have been achieved largely at the expense of for-hire truckdrivers,[3] whose real average hourly earnings (in 1982 dollars, as deflated using the Consumer Price Index for Urban Wage Earners and Clerical Workers) declined by 40 percent[4] between 1978 and 1996, compared with a 13-percent decrease for all private sector workers. But while the payments for labor services in trucking have declined in real terms, the demand for these services is increasing. The industry gained 586,000 jobs between 1980 and 1994, and trucking jobs are projected to increase by 299,000 between 1994 and 2005,[5] which places them among the top 25 occupational groups for projected employment growth. Increased demand and deteriorating wages have resulted in an industry that is plagued by frequent labor shortages.

This article examines some factors that have affected trends in employment and wages of for-hire trucking employment over the last 30 years. First, we review employment trends in the industry, and then look at the changing character of the trucking labor market, as well as other factors that have wrought change in this industry.

Trucking employment

Employment growth related to industrial production. Trucking employment[6] generally correlates with industrial production,[7] declining in recessions and increasing during recoveries. (See chart 1.) The cyclical pattern of employment in trucking thus contrasts with that of the other private service-producing industries. For example, employment in the service-producing sector actually increased during the 1973–75 and 1980–1982 recessionary periods, while industrial production and trucking employment fell. Although employment trends in trucking appear to have been less cyclical in the

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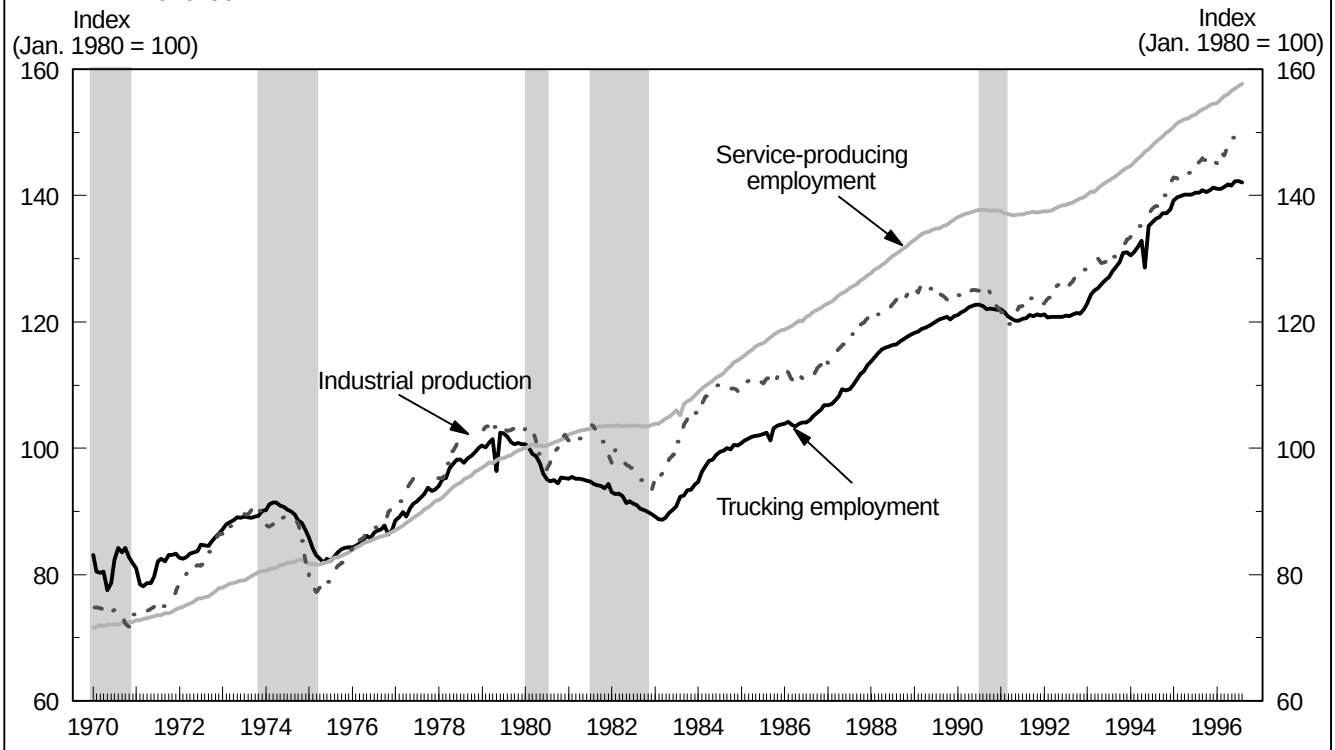
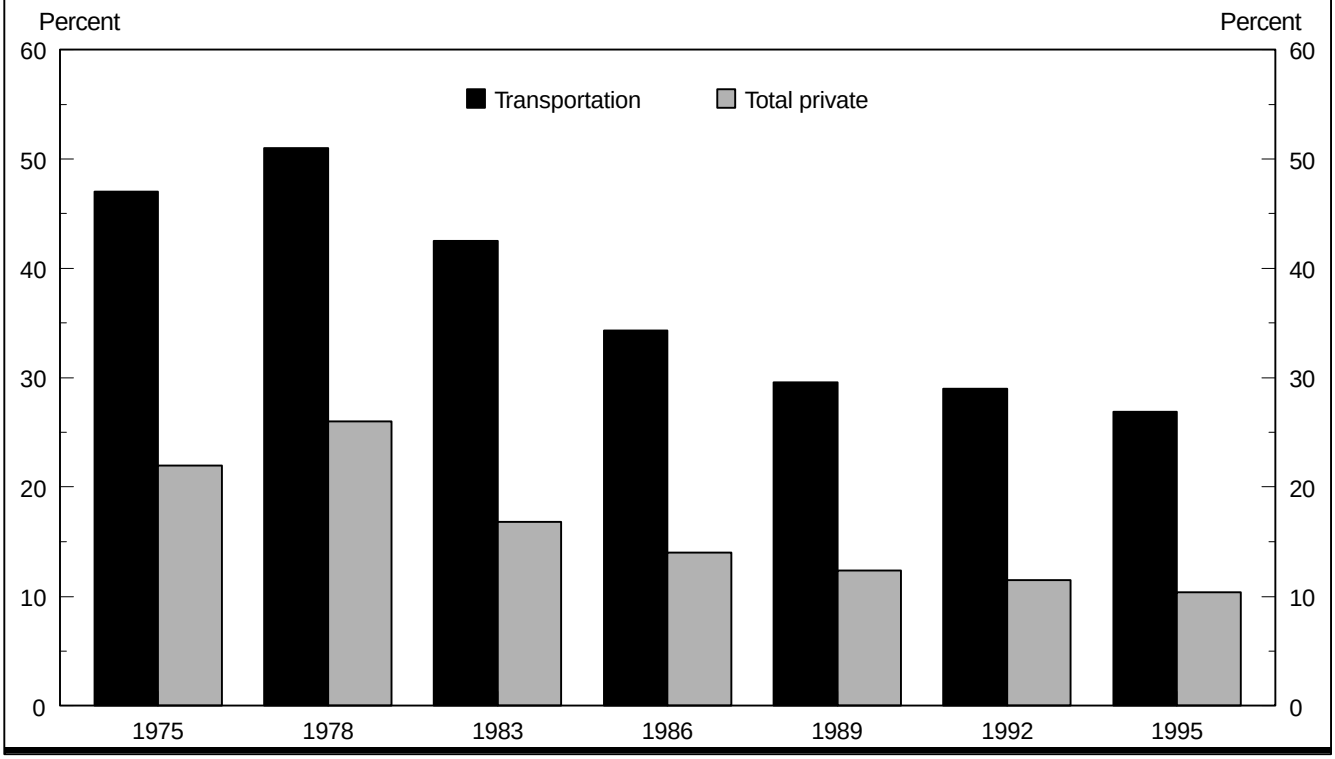
Chart 1. **Indexes of trucking and service-producing employment, and of industrial production, 1970–96**



NOTE: Shaded areas denote recessionary periods, as designated by the National Bureau of Economic Research.

Chart 2. **Percent of employees belonging to unions in the transportation sector and in private industry, selected years, 1975–95**



1990s, a large portion of industry sales continues to originate from the manufacturing sector. Therefore, the trucking industry, while classified among the service-producing industries, still tends to react quite strongly to changes in industrial production, as indicated in the following tabulation of recession-related peaks and troughs in trucking and warehousing employment (monthly data, seasonally adjusted):

Recession		*Trucking employment (in thousands)*		
Peak	*Trough*	*Peak*	*Trough*	*Loss*
November 1973	April 1975	1,198	1,090	108
June 1979	September 1980	1,360	1,256	104
January 1981	February 1983	1,268	1,177	91
June 1990	April 1991	1,632	1,600	32

While most job losses in trucking are related to economic contractions, developments between the 1980 and 1981–82 recessions are in need of explanation. Employment losses over this period may have been due to rapid restructuring in the industry that resulted from new legislation. (See next section.) The combined recessions and industry restructuring resulted in a net job loss of 183,000 between June of 1979, the prerecession peak of the employment series, and February of 1983, the series trough following the second of the back-to-back recessions. Employment losses were not quickly recovered, with the industry taking 2 years to hire up to prior employment levels.

Growth was moderate from 1985 forward. Even the 1990–91 recession had only a modest impact on employment compared to earlier downturns, with job losses measuring about one-third those posted over each of the prior three recessions. However, the subsequent recovery was slow, with almost no employment gains occurring through 1993. The following year was marked by especially strong growth in employment, although increased subcontracting of trucking services from other industries may have accounted for some of this.[8] Thereafter, payroll employment plateaued in 1995 and through 1996.

Employment and legislation. Major legislation affected the trucking industry in the 1980s and 1990s. Industry restructuring occurred beginning in 1980, when air, rail, and trucking services were all deregulated to some extent. The Motor Carrier Act (MCA) of that year allowed for interstate competition in the for-hire trucking industry, Standard Industrial Classification (SIC) 42, which accounts for a small portion of the Nation's trucks, but a relatively large portion of freight movement. Yet, interstate deregulation was only the beginning of renewed competition.

Shortly after the deregulation of interstate operations, *intrastate* regulations also were dismantled. Before Federal preemption of States' authority in 1995, most States controlled the routes, rates, and services of motor carriers within their borders. Continued circuitous routing of shipments and use of empty trailers on return trips were common, both examples of inefficiency. Deregulation of intrastate trucking first began in Florida in 1980, followed in Maine and Arizona in 1982, and later in five other States.[9] Then, in 1995, the Trucking Industry Regulatory Reform Act (TIRRA) prohibited all States from regulating carriers' routes, rates, or services. States were still allowed to regulate such areas as safety, financial fitness, hazardous material movement, and vehicle size and weight.

While the impact of deregulation is difficult to separate from other factors, it is evident that growth in employment (including self-employment) was stronger during the period just prior to deregulation. At that time, the Interstate Commerce Commission (ICC) lowered restrictions for new entrants to the industry in anticipation of deregulation.

Because deregulation and recessionary economic conditions coincided, it is unknown how much of the reduction in employment between 1979 and 1983 is due to industry restructuring, and how much is due to economic conditions. One can speculate that it is a bit of both. The official estimate of total savings due to the Motor Carrier Act of 1980 is about $10 billion annually.[10] When savings in inventory costs are added, gains have been estimated to be 6 times that figure.[11]

The economic situation at the time when the Trucking Industry Regulatory Reform Act took effect bears some resemblance to that at the time when the Motor Carrier Act was implemented, in that industrial production had begun to decline. There was a marked slowdown in payroll employment growth after TIRRA. However, when growth among the self-employed in 1995 is factored in, there appears to be little change in employment trend. (See next section). Nevertheless, increased efficiency arising from TIRRA will generate a $43 billion savings over 5 years, according to a source in the logistics industry.[12]

Trucking-related jobs. While employment in transportation and warehousing comprises the majority of trucking jobs, it does not include almost 500,000 jobs among self-employed truckers[13] and transportation brokers. (See table 1, which illustrates growth between employment peaks.) Among self-employed truckers, only those supporting trucking and warehousing are reflected here; these workers account for 80 percent of all self-employed truckers, with the remaining jobs supporting other industries. Most of the increase among the self-employed occurred between 1975 and 1982, with growth subsequently flat until 1995, when TIRRA was passed. (As mentioned earlier, employment of self-employed truckers picked up in 1995 when growth in the number of workers on payrolls in the trucking industry slowed.)

Both the self-employed and subcontracting trucking companies are involved in leasing arrangements with trucking companies. Insight into this contracting activity is captured in the Census Bureau's Motor Freight Transportation and Warehous-

Table 1. Employment in trucking and trucking-related jobs, 1983–1996

[Numbers in thousands]

SIC	Trucking industry segment	1983	1992	1995	1996	1983–92		1992–95		1995–96	
						Change	Annual rate of growth	Change	Annual rate of growth	Change	Annual rate of growth
	Total jobs	1,454	1,970	2,273	2,343	382	2.9	302	5.1	70	3.1
	Payroll jobs in:										
42	Trucking and warehousing	1,216	1,611	1,867	1,878	395	3.6	256	5.3	11	.6
421	Trucking and courier services	1,132	1,484	1,721	1,725	353	3.5	237	5.3	4	.3
422	Public warehousing and storage	85	124	142	149	39	5.1	18	4.9	7	4.7
473	Freight transportation arrangement	—	134	167	182	—	—	33	8.1	15	9.1
42	Self-employed truckers	238	225	239	283	–13	–.6	14	2.1	44	18.4

ing Survey, which indicates that the leasing of drivers with equipment increased by 50 percent between 1986 and 1995, averaging an annual growth rate of 6 percent per year.[14] Leasing the services of drivers accounted for 66 percent of purchased transportation by trucking companies in 1995.[15] Growth among the self-employed between 1995 and 1996 is corroborated by an increase of 80 percent in miles driven by leased drivers.[16] Further evidence of the participation of truckers in leasing arrangements comes from the Current Population Survey, which shows that truckers are represented heavily among on-call workers.[17]

As inter- and intrastate deregulation opened new routes and introduced new suppliers, third-party transportation brokers and freight forwarders rushed in to connect suppliers of freight services with customers. Transportation brokers operate between the shippers who need to move goods and the (truckload) carriers, creating a link between the two. Growth in this industry, captured in SIC 473, Freight Transportation Arrangement, has been dramatic. Only 75 transportation brokers were licensed by the ICC in 1975. Subsequently, the business grew by leaps and bounds to approximately 6,100 brokers in 1988 and more than 8,000 by the end of 1993.[18] Employment in this industry segment rose at an annual rate of 7 percent between 1988 and 1996, more than twice as fast as jobs in trucking services. Demand for brokers' services was so great that their employment increased throughout the 1990–91 recession, and, unlike for-hire trucking, brokers have posted accelerated job growth since the passage of TIRRA.

These trucking-related job gains have come on top of the already significant job gains evident in the for-hire industry. The new jobs contribute to a more flexible and dynamic trucking operation. Next, we review changes in pay and working conditions for persons employed in trucking services.

Hours and earnings

The transportation sector is more heavily unionized than private industry as a whole, but its trends in unionization are similar. (See chart 2.[19]) Union membership was even more prevalent in the trucking industry than in the rest of transportation prior to deregulation, according to unpublished data from the Current Population Survey. Sixty-two percent of for-hire truckers were unionized in 1973; this fell by half to 30 percent by 1984.[20] In 1996, 23 percent of truckers were unionized.[21]

National bargaining by the International Brotherhood of Teamsters facilitated widespread divergences between union and nonunion labor rates, with the widest occurring among the more heavily unionized operations. With the onset of price competition, nonunion carriers easily won business on the basis of lower labor costs,[22] causing union representation in the trucking industry to decline sharply. In response, unions appear to be increasing operational flexibility in recent contracts, especially in the 1994 National Master Freight Agreement.[23]

Earnings. Although wage levels are higher in trucking than in the total private economy (chart 3), real earnings in trucking have declined more rapidly since the early 1970s. The more severe reductions in wages have occurred among unionized employees. Union real wages for truckers averaged $12.45 (1985 = 100) during the 1973–78 period, and $11.15 during the 1979–85 period, according to Current Population Survey data.[24] Nonunion truckers' real wages changed very little between the two periods, suggesting that the wage premium for union truckers was declining. One estimate[25] yields a premium of 49 percent before deregulation and 26.5 percent afterwards, while another[26] yields a similar 48-percent union wage premium prior to deregulation and 30 percent thereafter. Other measures also point to dramatic reductions in union wages relative to nonunion wages.[27]

While these studies view the premium in terms of an hourly wage, a decline in nonunion hours mitigates the difference in weekly earnings. Paid hours of work by both union and nonunion laborers fell over the 1973–85 period, but evidence suggests that nonunion drivers experienced a greater drop in hours,[28] resulting in only a modest decline in the union weekly earnings premium.

The dramatic drop in weekly pay may partly have been a re-

Chart 3. **Real average hourly earnings in trucking and warehousing and in the total private economy, 1970–96**

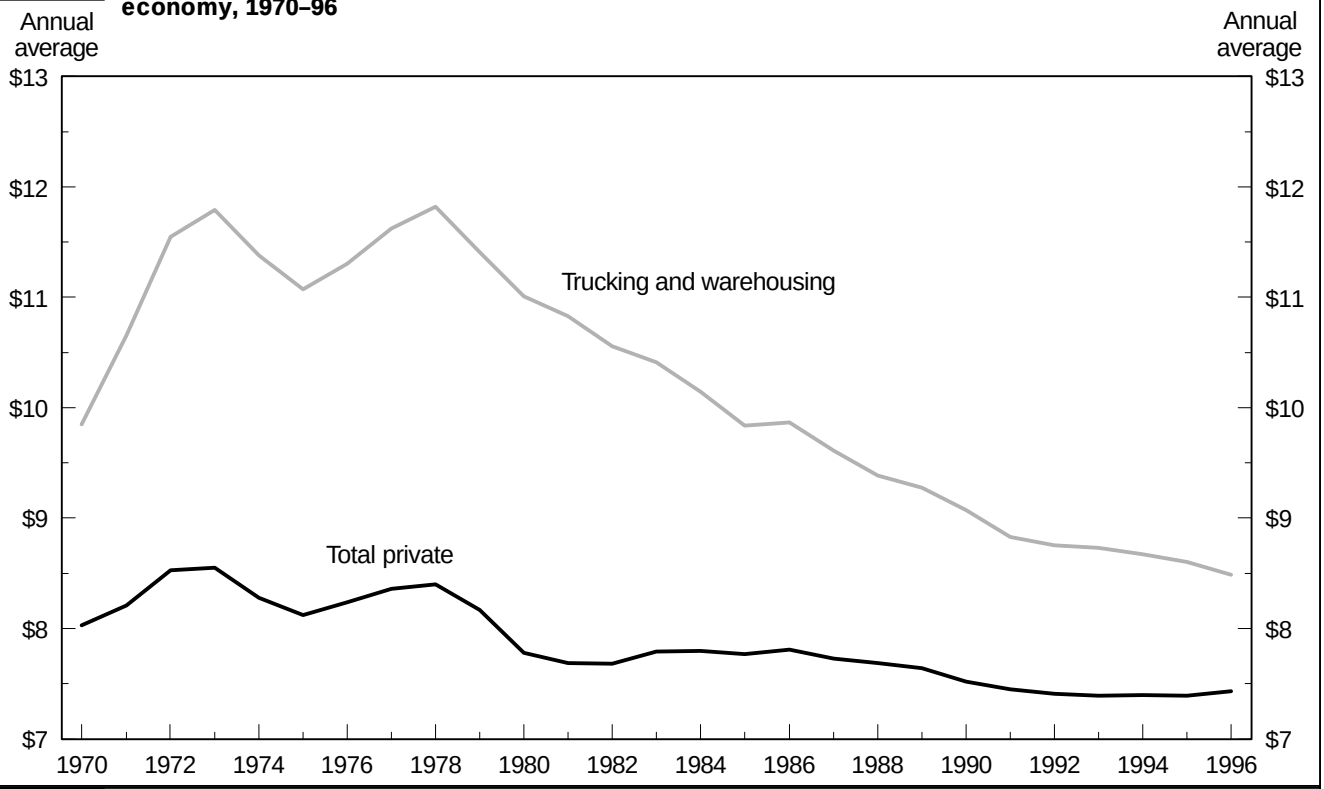
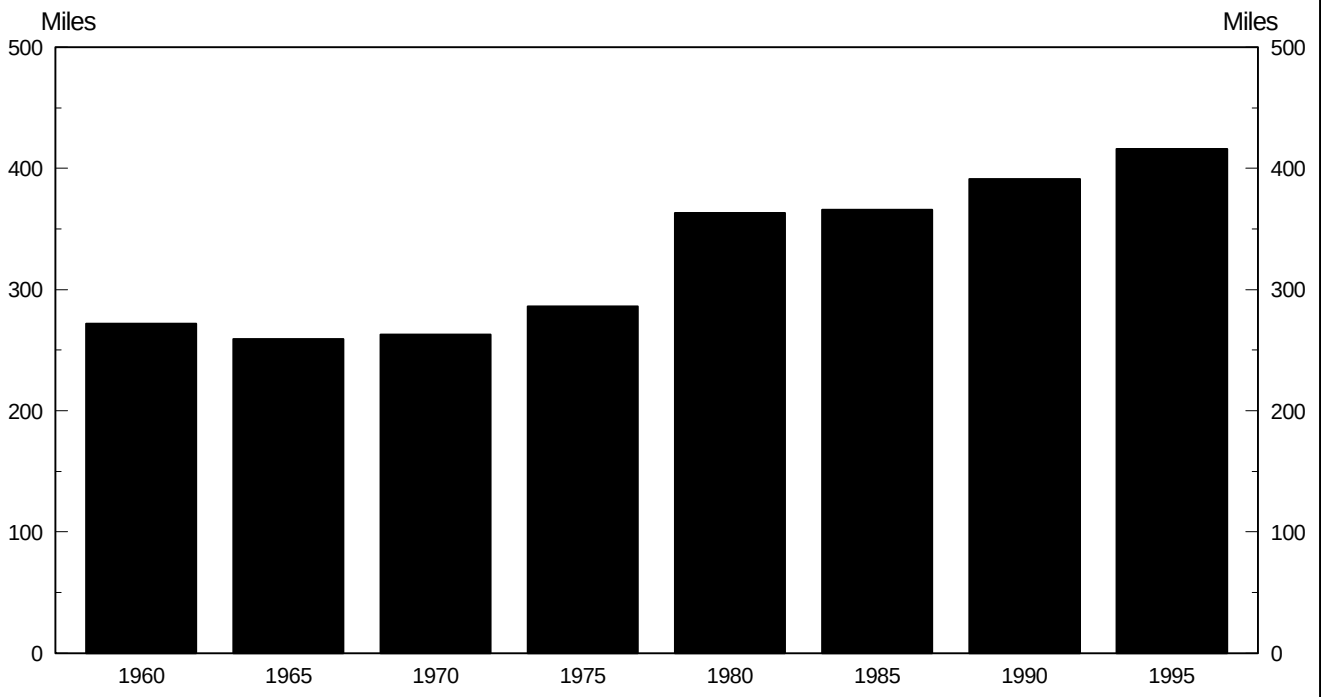


Chart 4. **Average length of haul in interstate freight, selected years, 1960–95**



NOTE: Data relate to Class I motor carriers of freight generating revenue of $10 million or more.
SOURCE: *National Transportation Statistics, 1997*, p. 21.

sult of a change in compensation plans as unionization waned, rather than a change in average miles driven. While union contracts more often guaranteed covered workers pay for their time, nonunion competitors often pay employees on other bases, such as mileage or freight, or some other contingent measure.[29] For these drivers, increases in hours do not increase pay when they are stalled in traffic. Carriers thus have shifted the burden of unforeseeable delays onto the truckers, who may then earn less per hour on the road. Moreover, real employee compensation per mile fell by an average of 44 percent between 1977 and 1987.[30] This demonstrates that drivers are bearing more of the cost of delays, that labor is being outsourced,[31] that labor efficiency is increasing, or a combination thereof.

Workload statistics. Traffic measures imply an increasing workload for most trucking employees. For example, the average length of haul for interstate freight increased dramatically between 1975 and 1985,[32] as trucking firms expanded their geographic coverage. (See chart 4.) Increased average hauls are normally associated with more time away from home, because most hauls are delivered by one operator (although this is not always the case).[33] Growth of intrastate freight and increasing "just-in-time"[34] demands may have caused trip lengths to decline for intercity movements,[35] although overall lengths of hauls have increased.[36]

High labor turnover. Increasing workloads and less-attractive pay have contributed to an extremely high driver turnover rate. Recent labor turnover statistics show that within the large truckload sector, labor turnover ranges between 80 and 100 percent a year; smaller carriers in the truckload sector experience turnover in the 60- to 80-percent range.[37] In the less-than-truckload[38] sector, which is generally better paid, turnover is closer to 15 percent.[39] One study calculated a 38-percent turnover rate for both types of carriers combined, compared with only 12 percent in manufacturing.[40] The high turnover rate in trucking is indicative of an occupation that is relatively easy to enter (highly labor-elastic), but difficult to perform over an extended period. For companies, high turnover results in a greater share of resources devoted to recruitment. Companies are beginning to experiment with wage increases in an effort to reduce these turnover costs.[41]

Safety issues. Driver exhaustion and poor working conditions among truckdrivers are of concern, as the safety of trucks on the Nation's highways affects us all. While truck fatalities on highways increased following deregulation, the number of new trucks outpaced additional deaths. Between 1975 and 1990, fatality rates for combination-trucks[42] declined by 59 percent, compared to 40 percent for all highway vehicles.[43] Several initiatives have improved safety in the interim, such as the commercial driver license program mandated by Congress in 1986. Highway fatalities attributable to heavy trucks are now lower than they were before 1980, despite tremendous growth in numbers of trucks and highway congestion.[44]

Other industry developments

As indicated earlier, trucking companies have been aggressive in pursuing strategies that yield cost reductions or increased efficiency. Carriers are faced with the same demands that transportation buyers face: better and faster service, specific delivery and pickup times, and better tracking and tracing of shipments. For shippers, predictable service sometimes is more important than the cost of goods movement, depending on whether the production schedule is "just-in-time" or not. Shippers of high-valued products such as computers, electronics, medical products, and auto parts are especially likely to demand fast, reliable delivery. If market demand can change suddenly, as it does in computer markets, products have shorter "lifespans" and must be turned around quickly. Whatever the case, transportation companies have responded by focusing on better management of time and assets in the delivery process, a strategy that relies on new technologies and less intermediate handling of goods in transport.

Just-in-time delivery. Customers began to demand quicker and more flexible service from the transportation network as they switched to just-in-time processes. In 1990, 18 percent of production was just-in-time, compared with 28 percent in 1995,[45] and inventory-sales ratios declined sharply over that 5-year period. Further improvements in inventory systems are expected to reduce the time that warehouses take to fill orders by 15 to 20 percent over the next 5 years, and to cut transit times by 5 to 10 percent.[46] As world trade grows and the business environment becomes even more sophisticated, demands for efficiency will continue to increase.

Many new technologies have come into play in the search for quicker and better distribution methods. For example, electronic data interchange, new vehicle location detection systems, and voice and data communication services[47] all are improving the logistical management of the trucking operation. Innovations in mobile communication systems have enabled companies to monitor such statistics as mileage traveled on a specific vehicle, fuel efficiency, best fueling locations, and vehicle location and speeds, as well as other data.[48] Companies can better utilize their equipment when they can quickly reschedule or combine existing delivery pickups, vastly improving their ability to manage inventory. Transportation brokers and third-party providers lower the cost of goods movement by filling empty return hauls and increasing freight volume per mile traveled.

More capital-intensive operations. The capital-to-labor ratio increased for the trucking industry in recent decades, due in part to the use of larger and more fuel-efficient trucks. This,

in turn, contributed to a 20-percent increase in the average tonnage of freight hauled between 1975 and 1995.[49] As a result, companies were able to spread variable costs over larger volumes of freight. While the fuel efficiency of the Nation's motor vehicles in general has increased, the move towards larger trucks partially reduced the gains but economized firms' use of labor. Any increased fuel efficiency in freight transportation also has been mitigated by the movement of freight from slow-moving modes (rail) to faster moving ones (air and truck).[50]

Like increasing vehicle size, the growing use of containerization in the intermodal industry also has helped firms to save on labor costs. Intermodal firms link different modes of transportation, often truck and rail or truck and air, for ultimate delivery to the customer. Providing a seamless flow of goods from the Nation's ports to railroads and highways, the intermodal delivery system has been supported through provisions of the Intermodal Surface Transportation Efficiency Act of 1991, which provides funding for intermodal projects. Between 1988 and 1995, the average annual rate of growth in this industry component was 6 percent.[51]

Containerization refers to movement of commodities in large containers or trailers rather than as smaller units, representing a shift to more capital-intensive operations. Use of containers reduces handling costs, costs of damage or theft, and very importantly, time required to transfer cargo. Because commodities are in bulky containers, cargo is moved by crane or forklift, a procedure requiring less manual labor than the handling of smaller packages. Forms of containerization took hold in the early 1980s in both rail-truck transport and truck-water transport,[52] and have continued to become more widespread.

The widening market. Competition is taking place across traditional modes of transport. In fact, in 1996 several major players in the trucking industry were reclassified into the air courier industry, due to a shift over time in their primary product. Because the decision to move freight has become a function of cost and time rather than regulation, traditional market definitions (and concentration levels) no longer apply, and this has resulted in a "market" that encompasses every possible mode of transport.

IN RESPONSE TO DEREGULATION and the intense competition that followed, the trucking industry has changed the quality and types of services it renders By most accounts, the resulting reductions in cost have been passed on to consumers. Today, trucking services are more responsive to our increasingly dynamic and complex economic environment, incorporating improvements in technology that have pervaded all industries.

Competition has resulted in increasing capital intensity in the industry, as firms strive to reduce average variable costs per load. Firms often are coupling with other transportation sectors to minimize the cost for specific delivery requirements by combining the efficiencies of different modes of transport. Increased competition also has led companies to change the character of compensation plans for their workers, replacing those based on time with plans based on output. Over the years, wage premiums for unionized truckers have been bid down, and union representation has fallen dramatically. Increasing workloads and less attractive pay have led to high labor turnover and persistent driver shortages. □

Footnotes

[1] "Low Shipping Prices May Curb Inflation," *The Wall Street Journal*, June 24, 1997, p. A2. The source of the data is Cass Information Systems. Estimates refer to freight movement by truck, rail, and sea. While reductions in the rate of revenue growth per ton-mile have occurred across all sectors, they have been most significant in rail and water transport. Also, see *National Transportation Statistics, Historical Compendium, 1960–1992* (U.S. Department of Transportation, Bureau of Transportation Statistics, 1993), p. 44.

[2] When measured by value rather than tonnage. See *1993 Commodity Flow Survey* (U.S. Department of Transportation, Bureau of Transportation Statistics, 1995).

[3] For-hire truckdrivers are those employed in SIC 42, Trucking and Warehousing, rather than across the spectrum of industrial classifications.

[4] Excludes the warehousing and storage component of Trucking and Warehousing, SIC 42. Rate of decline is calculated using annual averages.

[5] According to the 1996–97 *Occupational Outlook Handbook* (Bureau of Labor Statistics, 1996), p. 3.

[6] Employment data are from the Current Employment Statistics surveys as they were published prior to June 1997; some large companies, previously classified as trucking, were recently reclassified as air courier companies (SIC 4513). Data published since June 1997 reflect this reclassification; the new series for both trucking and air courier services begin with data for 1988, and therefore could not be used for long-term analysis.

[7] For freight volume by commodity type, see *American Trucking Trends*, 1996 ed. (Alexandria, VA, American Trucking Association, 1997).

[8] According to "Fleets change with time," *Logistics Management*, May 1996, pp. 35–45, "for-hire and contract carriers frequently are taking over roles traditionally filled by private fleets. Often, those vehicles carrying a company's colors belong to a leasing company…." Cited in the same article, a forecast of U.S. freight transportation to 2004 predicts greater outsourcing of private fleet tonnage, resulting in greater revenue growth for for-hire carriers compared to private carriers.

[9] "Regulation and Economic Performance: Lessons From the States," *Cato Journal*, spring/summer 1994, pp. 55–64.

[10] "The Impact of State Economic Regulation of Motor Carriage on Intrastate and Interstate Commerce," DOTT 9012 (U.S. Department of Transportation, May 1990).

[11] A report by the Brookings Institution estimates annual savings of up to $20 billion. See "The Economic Effects of Surface Freight Deregulation" (Washington, The Brookings Institution, 1990), p. 5. Gains of up to $65 billion have been estimated in "The Disunited States: A Country in Search of an Efficient Transportation Policy," Policy Analysis No. 84 (Washington, The Cato Institute, Mar. 10, 1987). In C. Winston, "Economic Deregulation: Days of Reckoning for Microeconomists," *Journal of Economic Literature*, March 1993, pp. 1262–69, savings were estimated at $10 billion in 1990 dollars, with consumers reaping $15 billion in welfare gains, and producers losing $5 billion.

[12] *Commercial Carrier Journal*, July 1, 1995. Savings estimates are by Cass Information Systems, a logistics company that has been producing an analysis of the logistics industry since 1989.

[13] Data on self-employed truckers are from the Current Population Survey.

[14] Statistics cover SIC 421, Trucking and Courier Services, Excluding Air, and exclude leasing by companies in other industrial classifications.

See *Motor Freight Transportation and Warehousing Survey, 1994* (Bureau of the Census, 1995), pp. 11–12; and *Motor Freight Transportation and Warehousing Survey, 1995* (Bureau of the Census, 1996), p. 6. While leasing is not the exclusive domain of independent truckers, they are an important component.

[15] *Motor Freight Transportation and Warehousing Survey, 1995*, p. 6.

[16] *American Trucking Trends*, 1997 ed., p. 16.

[17] Sharon Cohany, "Workers in alternative employment arrangements," *Monthly Labor Review*, October 1996, p. 43. On-call workers are those workers reporting only when they are asked to do so, typically for temporary work assignments.

[18] "Outsourcing in distribution: the growth in importance of transportation brokers," *Business Horizons*, November 1995, p. 40.

[19] Data are from the May CPS Supplement for 1975 and 1978, while data for 1983 forward are annual averages. The chart refers to the total transportation category, which includes for-hire trucking, railroad transportation, and air transportation. Trucking employment is the largest single component, comprising 37 percent of total employment in that category in 1980.

[20] Barry Hirsch, "Trucking Regulation, Unionization, and Labor Earnings," *The Journal of Human Resources*, summer 1988, pp. 296–319.

[21] Among employed wage and salary truck drivers aged 16 years and older. Estimates are CPS 1996 annual averages.

[22] One study indicates that 63 percent of the reduction in truckload operating costs was due to reduced labor expenditures, while in the LTL (less-than-truckload) sector, it was an even greater proportion of reductions. See T. Corsi and J. Stowers, "Effects of a Deregulated Environment on Motor Carriers: A Systematic, Multi-Segment Analysis." *Transportation Journal*, March 1991, pp. 4–28.

[23] The agreement allowed up to 28 percent of freight to be moved through rail-truck combinations; it also allowed "sleeper teams" of drivers, in which one driver sleeps while the other continues with delivery.

[24] Hirsch, "Trucking Regulation." Real wages are calculated as usual weekly earnings divided by hours worked per week. Earnings are converted to real wages by dividing by the Personal Consumption Expenditures component of the GNP deflator to convert to 1985 dollars.

[25] N. Rose, "Labor rent sharing and regulation: evidence from the trucking industry," *Journal of Political Economy*, December 1987, pp. 1146–78.

[26] Hirsch, "Trucking Regulation."

[27] According to Corsi and Stowers, compensation per employee in the highly unionized LTL (less-than-truckload) sector declined by 25 percent between 1977 and 1987, compared with almost no reduction in the highly competitive TL (truckload) sector. Less than truckload is a quantity of freight less than that required for the application of a truckload rate. It is usually less than 10,000 pounds and generally involves the use of terminal facilities to break and consolidate shipments, which a full truckload shipment would not. See Corsi and Stowers, "Effects of a Deregulated Environment," p. 15.

[28] James Peoples, "Trucking deregulation and labour earnings in the USA; a re-examination," *Applied Economics*, July 1996, pp. 865–75.

[29] "Collective bargaining after deregulation: do the Teamsters still count?" *Industrial and Labor Relations Review*, July 1995.

[30] Corsi and Stowers, "Effects of a Deregulated Environment."

[31] In "Effects of a Deregulated Environment," this argument was rejected because several trucking segments that experienced a decline in operator leasing also experienced a decline in employee compensation per mile.

[32] This also is supported in "Effects of a Deregulated Environment," which suggested an average increase of 100 miles among all truckload carriers between 1977 and 1987.

[33] With growth of just-in-time demands, this is also changing as some companies employ "sleeper teams" of two drivers, so that trucks can keep moving as one driver sleeps and the other completes the delivery.

[34] A method of production planning that minimizes inventory stocks in order to reduce overhead costs. Inventory is ordered "just in time" to meet production needs.

[35] A declining ratio of ton-miles per intercity trucking employee implies shorter trips and/or lighter volumes, although these workers represent only about 40 percent of employment in trucking and courier services. See *National Transportation Statistics, 1996* (U.S. Department of Transportation, Bureau of Transportation Statistics, 1995), pp. 40–42.

[36] Class I and Class II carriers increased their average length of haul, according to "Effects of a Deregulated Environment," p. 20. Also, average miles per truck in the for-hire industry increased according to the *1992 Census of Transportation, Trucking Inventory and Use Surveys, 1987–1992* (Bureau of the Census, 1995).

[37] Large truckload carriers are those earning revenues in excess of $30 million. Data are from the *Trucking Activity Report, 1995–1996* (Alexandria, VA, American Trucking Association, 1996).

[38] Movement of freight that is consolidated into full truck loads at terminals.

[39] "Driver Turnover and Management Policy: A Survey of Truckload Irregular Route Motor Carriers," *Transportation Journal*, winter 1994, pp. 15–21.

[40] "Driver Management Policies and Motor Carrier Safety," *The Logistics and Transportation Review*, February 1988, pp. 153–64.

[41] "J.B. Hunt pay hike will jolt industry," *Journal of Commerce*, Sept. 9, 1996, p. 1A. In the first quarter of 1997, pay raises at Hunt reduced turnover by more than one-half. See also "Pay raises for drivers trim truck companies profit," *Journal of Commerce*, Apr. 17, 1997, p. 2B.

[42] These are trucks that include a separate power unit combined with a trailer (or trailors).

[43] See *National Transportation Statistics, 1995*, pp. 111, 114.

[44] Fatalities were lower in 1993 than in 1975, although an increase in fatalities did occur between 1975 and 1985. See *National Transportation Statistics, 1995*, p. 107.

[45] *Statement of Federico Pena before the Committee on Transportation and Infrastructure Subcommittee on Surface Transportation, May 2, 1996*, Press Release (U.S. Department of Transportation, 1996).

[46] *Intermodal Freight Transportation*, GAO Report NSIAD-96–159 (U.S. General Accounting Office, 1996), p. 20.

[47] For example, Cue Network of Irvine, CA, has about 140,000 subscribers to its paging services, of which more than 50 percent are truckdrivers, according to the *Mobile Data Report* (Alexandria, VA, Telecom Publishing Group, Jan. 15, 1996).

[48] QUALCOMM, Inc. has been marketing state-of-the-art satellite-based mobile communication systems for the transportation industry, as well as decision support tools to achieve the maximum rate of revenue generation for the industry. See *Transport Technology Today* (Maple Publishing Co., November 1995), p. S9–S11. In another example, the truckload motor carrier Contract Freighters combines global positioning system satellite tracking of trucks and equipment with electronic data interchange to provide customers with real-time status on vehicles and shipments. Customized reports identify where delays and added costs in the supply chain are occurring. Improvements have enabled the firm to reduce the number of dispatchers and fleet managers it employs.

[49] Calculated by dividing the ton-miles of intercity freight by annual average trucking employment, where a ton-mile describes the movement of one ton of freight a distance of one mile. Ton-miles are computed by multiplying the weight in tons of each shipment transported by the distance hauled. Increasing weight is correlated with larger trucks. See *National Transportation Statistics, 1997*, p. 20.

[50] *Transportation Energy Data Book*, 16th ed. (U.S. Department of Transporatation, Bureau of Transportation Statistics, 1996), table 2.22.

[51] "Intermodal transportation: evolving toward the 21st century," *Transportation and Distribution*, February 1996, p. 43.

[52] J. Coyle and E. Bardi, *The Management of Business Logistics* (St. Paul, MN, West Publishing Co., 1984), pp. 287–88.