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An Assessment of the Rail Competitive Motor Carrier Industry (1977-1986)

*by K. Eric Wolfe, Vijaya Krishna, and William F. Huneke**

ABSTRACT

During the last decade, significant demographic changes in the rail competitive motor carrier industry have occurred. These changes have been brought about by not only motor carrier deregulation (Motor Carrier Act '80, and the Surface Transportation Assistance Act '82) but also by many exogenous factors. Other factors which have influenced these changes are: the overall economy, fluctuating energy prices, altered tax structures (Economic Recovery Act '80, Tax Overhaul '86), and the rate of assimilation at which these new opportunities have been implemented by different sectors of the motor carrier industry. Examples of these changes include:

1. Energy price increases (during the late 1970's) in combination withhistorically high (real and nominal) interest rates only to significantly decline six years later;
2. Interstate highway weight limits were increased to a uniform nationwide level of 80,000 lbs;
3. Motor carrier entry into new markets was eased by reduction/removal of entry restrictions and motor carriers were allowed greater pricing freedom; and,
4. Larger vehicles were allowed (e.g. single trailer lengths up to 53', abolition of overall vehicle length laws, 108" trailers, nationwide 28' doubles).

The purpose of this paper is to focus on the intercity truckload sector of the motor carrier industry, (the sector which offers the greatest direct competition to the railroad industry) in order to identify, qualify, and quantify the impact of these changes on the motor carrier industry. The analysis will examine changes in tractor and trailer characteristics, annual mileages, wages, commodities, and other salient competitive factors.

The analysis concludes by identifying certain important trends in the truckload sector: the vast increase in non-union company drivers, longer trailers, increased productivity, and changes in commodity mix. All of these trends underlie, and help predict, future increases in the competitiveness of the truckload motor carrier sector.

I. INTRODUCTION

This paper presents and analyzes major demographic changes which have occurred over the last decade in the rail-competitive sector of the motor carrier industry. The term "rail-competitive sector" applies to those motor carriers which are engaged in long haul truck-load (TL) transportation under single bills-of-lading. Costs and operational methodologies of TL firms differ significantly from those associated with the movement of less-than-truckload (LTL) quantities, as LTL operations include terminal and overhead costs associated with the consolidation of small shipments before transit. Traditionally, rail-competitive TL motor carriers were categorized as: Irregular Route Common Carriers, Contract Carriers, Agricultural and Exempt Carriers, Private Carriers, and Owner Operators.[1]

Before deregulation, extensive federal and state motor carrier regulation served to maintain distinct boundaries between the different types of motor carrier operations. As a relatively narrow set of limits on the size and weight of equipment prevailed, (e.g. total vehicle length limitations effectively limiting trailer length to 45 feet or less), analysis of the rail-competitive motor carrier industry was relatively easy. Published tariffs and operating rights defined market opportunities and the rates charges in those markets. Extensive use of unionized labor allowed the analyst use of the National Motor Freight Agreement as a bench mark for labor costs. Motor carriers were required to file extensive annual reports with the Interstate Commerce Commission while the Federal Government undertook wide-range surveys of truck inventory and use, and manufacturers at regular 5 year intervals.[2] Other public sector companies also produced extensive data bases which allowed monitoring of the essentially static motor carrier industry.[3]

Since deregulation, the boundaries which once set these motor carrier categories distinctly apart, have largely dissolved. For example, private carriers can now obtain common carrier back-haul authority, owner operators can obtain their own operating authority, contract carriers are no longer arbitrarily limited to the number of firms they may serve.[4] Additionally, motor carrier deregulation coupled with a decreased Federal presence in data collection significantly curtailed the ability to examine the now rapidly evolving rail-competitive motor industry. Although much has been written concerning the new opportunities under deregulation, relatively little analysis on this specific sector of the total motor carrier industry has been performed to monitor the actual adoption and incorporation processes of these new market and operational opportunities. The effects of exogenous factors such as energy prices, and interest rates on this adoption process have also been largely ignored. Of course, much of the reason for this absence of research has been an absence of reliable and consistent data from the pre- and post-regulatory period.[5] Even from a post-regulatory perspective only, many current motor carrier analysts are stymied by an information shortage.[6]

This study will be using a proprietary longitudinal data base, specifically designed to evaluate on an on-going basis this market segment. Changes in rail-competitive motor carrier operational characteristics

will be evaluated with respect to both the regulatory and economic environment which existed during the study period 1977 to 1986.

II. EXOGENOUS EVENTS AFFECTING MOTOR CARRIERS

A number of exogenous events have buffeted the motor carrier industry during the study period. These include deregulation, changes in truck size and weight limits, variations in fuel prices, insurance rate increases, and rail deregulation.

A. Deregulation

The Motor Carrier Act of 1980 substantially deregulated trucking by reducing entry requirements for new carriers and allowing new and existing carriers to serve larger market areas. The granting of 48 state operating authority is now routine and route restrictions have been eliminated. Carriers also have far greater pricing freedom to meet changing market conditions.

Deregulation also spawned a far more competitive and dynamic motor carrier industry. Observation of firm entry and exit rates show just how dynamic trucking has become. From 1980 to 1985, 15,000 new firms have entered the trucking industry while about 7,500 firms left the industry.[7] In spite of the continuing economic recovery, the number of motor carrier failures continues to increase because of intense competition in the marketplace. (Refer to Table 1)

Passage of the Stagger's Act in 1980, which deregulated the railroad industry, has also affected the status of the rail-truck competition. Under deregulation, railroads could now vary their rates (within a zone of rate flexibility) and service levels, and rationalize their plant size to meet changing market conditions. Additionally, deregulation also permitted the formulation of contracts between shippers and railroads.

If markets change (and trackage becomes unprofitable) it used to take years before the railroads were allowed to abandon that trackage. Under the Railroad Revitalization and Regulatory Reform Act (4-R Act enacted in 1976), unprotested trackage abandonments take effect in 75 days while protested cases must be settled within 225 days. Deregulation (starting with the 4-R Act) has seen the need for revenue adequacy as a basis for future railroad growth and stability. Instruments such as the Rail Cost Adjustment Factor (RCAF) allow the railroads to recoup inflationary cost increases and obviate the traditionally lengthy and expensive general rate increase procedure. Due to the highly-competitive environment, however, the rail industry has declined to take the full amount of the inflation-recoupment increases allowed under the RCAF. This is understandable as both inter-modal and intra-modal competition is intense.[8]

However, the trends after rail and truck deregulation have usually favored trucking in that railroads have generally have only been able to use their deregulatory freedoms to try to retain market share rather than increasing market penetration. This phenomenon is not limited to the higher-valued manufactured commodities as several bulk commodities have also been affected.[9] For example, railroads have seen their market shares fall for coal and grain since deregulation.

COMMODITY GROUP	1980 RAIL MARKET SHARE	1985 RAIL MARKET SHARE
Coal Shipments	62.9%	60.7%[10]
Grain Shipments	40.9	25.6[11]
Total Intercity Freight	37.5	36.9[12]

B. Changes in Truck Size and Weight Limits

The Surface Transportation Assistance Act of 1982 (STAA) mandated nationwide weight limits to 80,000 pounds, allowed 102" wide trailers and forbade overall length limits. In addition the Act mandated that the maximum trailer length limit (set by the states) could not be less than 48 feet. Congress began the move to the 80,000 pound limit in the Federal-Aid Highway Amendments of 1974 by changing the allowable gross weight limit from 73,280 to 80,000 pounds. However, until the STAA, Illinois, Arkansas and Missouri held to the lower weight limit. These states thus created a barrier to nationwide legal operation of 80,000 pound vehicles before 1983.

Several states, particularly in the midwest, have recently enacted legislation to increase trailer lengths to 53 feet. There are now 26 states that

TABLE 1

Motor Carrier Failure Rates Have Increased Since Deregulation

YEAR	FIRM FAILURES	TOTAL NUMBER OF FIRMS	FAILURE RATE (PER 10,000 FIRMS)
1977	274	Not Available	Not Available
1978	162	67,038	24.2
1979	186	68,451	27.2
1980	382	72,146	52.9
1981	610	75,167	81.2
1982	960	79,715	120.4
1983	1,228	83,262	147.5
1984	1,409	78,078	180.5
1985	1,533	80,621	190.1
1986	1,548	85,008	182.1

Source: American Trucking Association

permit trailer lengths greater than 48 feet. (Refer to Table 2) Such length increases would have a more dramatic effect on rail-truck competition were the 80,000 pound limit to be increased.

C. Fuel Cost Changes

During the 1977 to 1986 study period, fuel prices have risen and fallen dramatically, especially when adjusted for inflation. Fuel costs represent 17.5 percent of the costs of a rail-competitive truck while they only make up 10 percent of railroad costs.[13] Thus, increases in fuel prices are a competitive advantage for railroads while decreases benefit trucks.

Table 3 displays the variation in real fuel prices. The oil price rise brought by the Iranian Revolution increased real diesel fuel prices by 70 percent from 1978 to 1981. However, Organization of Petroleum Exporting Country's (OPEC) continued inability to control oil production and prices has allowed oil prices to recede. Adjusted for inflation, fuel prices are now less than they were in 1977. With modest decreases in energy prices forecast for the near future, the motor carrier industry will continue to benefit relative to the railroad industry.[14]

D. Insurance

Trucking industry sources claim that their insurance premiums rose from 50 to 600 percent from mid 1984 to late 1986.[15] This equates to an average increase in truck costs (on a loaded mile basis) of about four percent. Property damage and liability insurance now makes up about 5 percent of truck costs or 5.4 cents per loaded mile.

Unable to pool their risk to as great an extent as the larger motor carrier firms, Owner-Operators (O-O) have been harder hit by insurance cost increases. It is estimated that 1985 insurance costs for O-Os are 22 percent above those for company operations.[16]

In general, the insurance cost increases have hit the trucking industry a little harder than railroads because railroads are essentially self insured. As the railroads are such a large exposure base, they essentially pay their own property and casualty losses over the long-run.[17] Since the implicit cost for railroad insurance must also reflect the on-going liability crisis, rail insurance cost advantages are thought to be small.

E. Tax Reform

Tax reform has mixed results for rail-truck competition. The 1981 legislation allowed railroads to make their tax accounting similar to other industries like trucking by allowing railroads to change the method for depreciating track assets. The result was a large and extraordinary write-off of track assets—assets that previously had to be kept on the books without being depreciated, some for as long as 99 years.[18]

TABLE 2

State Maximum Semi-Trailer Length Regulations
(as of January 1987)

	Maximum Semi-Trailer Lengths			Total Truck Lengths
	48'	48'1" to 52'11"	53' or more	
Number of States:	25	4	19	3*
States:	Alabama	Arizona	Delaware	Colorado
	Alaska	Louisiana	Idaho	Nevada
	Arkansas	Mississippi	Illinois	North Dakota
	California	Tennessee	Indiana	
	Connecticut		Iowa	
	D.C.		Kansas	
	Florida		Kentucky	
	Georgia		Michigan	
	Hawaii		Missouri	
	Maine		Nebraska	
	Maryland		New Mexico	
	Massachusetts		Ohio	
	Minnesota		Oklahoma	
	Montana		Oregon	
	New Hampshire		Pennsylvania	
	New Jersey		South Dakota	
	New York		Texas	
	North Carolina		Wisconsin	
	Rhode Island		Wyoming	
	South Carolina			
	Utah			
	Vermont			
	Virginia			
	Washington			
	West Virginia			

* These three states do not have maximum semi-trailer length limitations but do have overall tractor and semi-trailer length restrictions. Each of three states allow sufficient overall length to permit the use of a 53' semi-trailer, without the need for a special permit.

Source: Telephone interviews with transportation agency representatives in the various states.

TABLE 3
Average Real Diesel Fuel Price

YEAR	SIX MONTH PERIOD	PRICE (Cents/Gallon)
1977	2	51.9
1978	1	48.6
1978	2	50.1
1979	1	65.9
1979	2	79.4
1980	1	79.4
1980	2	82.4
1981	1	85.8
1981	2	84.7
1982	1	78.7
1982	2	76.8
1983	1	63.7
1983	2	66.9
1984	1	64.0
1984	2	66.6
1985	1	61.4
1985	2	68.1
1986	1	38.0

Sources: National Energy Information Center & Highway Statistics. Fuel price is deflated by using the GNP deflator reported in The Survey of Current Business.

However, the 1986 reform favors less capital intensive industries like trucking rather than railroads. Under tax reform the motor carrier industry on the whole will benefit due to lower corporate tax rates and acceleration of depreciation for motor carrier assets.[19] Although both the truck and rail industry lost tax benefits (due to repeal the of the investment tax credit), the alternative minimum tax will have a larger adverse effect on railroads. With the minimum tax, if railroad earnings continue to fall, railroads could pay as much as $1 billion more in taxes over the next six years. The repeal of the investment tax credit could cost the railroad industry $4 billion over the next six years.

F. General Economic Conditions

The domestic economy has also undergone many changes which impact on the level and type of transportation services demanded. Historically high real interest rates and intense foreign competition have forced domestic manufacturers to reduce inventory levels and adjust the size of orders to match production needs. Shipments of large quantities have been replaced with smaller shipment sizes. This shift in transportation demand is illustrated (in the rail industry) by the decline in boxcar loadings in favor of trailer or container loadings.

RAIL CARLOADINGS ORIGINATED
(Percent of Total)

Year	Total Boxcar*	TOFC/COFC
1980	19.4%	9.1%
1981	17.1	9.6
1982	15.3	11.9
1983	14.1	13.9
1984	12.7	14.7
1985	12.4	15.8
1986	11.7	16.6

*Includes equipped, unequipped and refrigerated boxcars
Source: Form CS 54, Transportation Division, AAR

The continued shift from a production to service economy has also accelerated. In 1950, goods as opposed to services, represented 56.3 percent of the Gross National Product (GNP). By 1980 this figure had slipped to 48 percent, while 1986 figures indicate goods represent only about 40 percent of total GNP.

Downsizing of products in response to the energy crisis has also curtailed the size and scope of many traditional transportation markets. Smaller automobiles, housing units with lesser square footage (thereby requiring less lumber, concrete, roofing singles, etc.) illustrate the effects of such downsizing.

Although high real interest rates adversely affected the motor carrier industry by increasing equipment carrying costs, especially among owner operators, continued excess capacity in the motor vehicle manufacturing industry depressed equipment prices.[20] As a result, equipment carrying charges did not rise as sharply as interest rates alone would have dictated. Volume purchasers, those able to buy in lots of 100 or more pieces of equipment, were actually able to save significantly on their equipment acquisition costs.

Higher interest rates tend to favor motor carriers over rail in that trucks generally carry smaller shipments, have shorter transit times, and allow the shipper to hold smaller inventories. With high real interest rates, these factors become more important, and thus tilt shippers toward motor carriers.

III. PREVIOUS RESEARCH

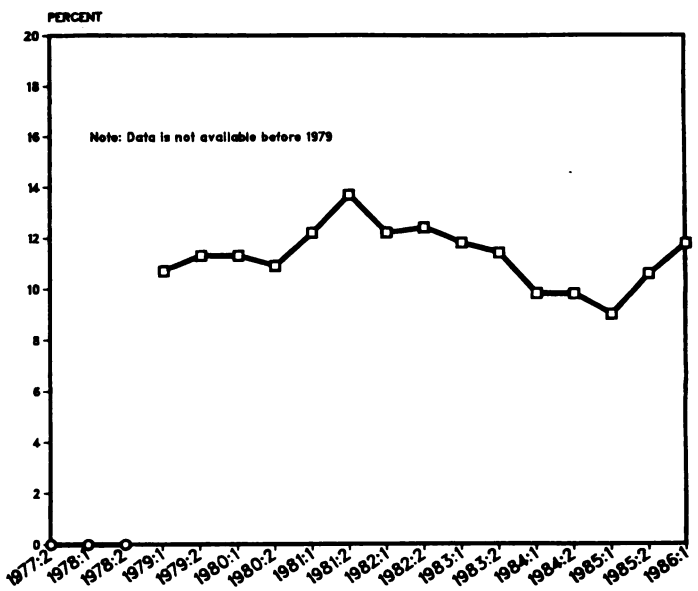
Recent studies using the National Motor Transport Data Base (NMTDB) have focused on the rail-competitive segment of the motor carrier industry. In examining changes during the 1977 to 1982 period, Larkin and Wolfe (1983) reported that significant increases in efficiency had occurred and were continuing to occur, although the full effects of the Surface Transportation Act had yet to take effect. Among several examples of cost-cutting they cited were: owner-operators were increasingly entering

into lease arrangements which served to guarantee them traffic while in effect replacing the use of union-company drivers as union wages continued to out pace non-union wages (in nominal and real terms); the "standard" 40 foot long trailer was rapidly being replaced with 45 foot equipment; although larger engines (greater than 400 horsepower) were being increasingly employed, fuel efficiency was also increasing.[21] The derived demand sensitivity of the motor carrier industry to overall economy was also illustrated as the average length of haul and annual miles travelled by motor carriers rose and fell in step with the overall economy. Corsi, et.al. (1985) comparing the O-O segment of rail-competitive motor carriers between 1978 and 1984 concluded that the O-O segment had not improved their efficiency since the passage of the Motor Carrier Act in 1980. This finding was determined by examining two efficiency measures: the portion of total loaded to total empty trips, and the portion of trips were deadhauling occurred.[22] As neither of these ratios improved during their study period, it was concluded that no efficiency gains had taken place. O-O's were seen to be in a deteriorating position as the average age of their equipment was rising while gains in revenue were only just keeping pace with increases in cost thus endangering their future ability to recapitalize their equipment. Corsi concluded by stating that although the then recent ICC decision to allow direct leasing of O-Os by private carriers might reveal new opportunities, it was too early to tell especially in light of the "decline in the overall share of trips carried by private carriers."[23]

Although there would appear to be major differences between the conclusions reached in the two studies using essentially the same data from the NMTDB, these differences can be readily explained. The declining share of private motor carriers in the data base can be explained by the method under which the data is collected. When a private motor carrier is transporting its own traffic it is properly reported as a private carrier. However, when that same private carrier exercises its common carrier backhaul authority, it may be instead reported as an irregular route common carrier. Although the O-Os did not reduce their empty to loaded ratio of trips, this is not the only measure of efficiency. During this time frame, the O-Os did slightly reduce their portion of total empty miles. (Refer to Figure 1) In effect they were deadheading more to obtain new opportunities, i.e. backhauls. While it is true that O-Os (referring to Figure 1) have apparently only held their own (in terms of group efficiency) during the longer period of 1977 to 1986, increased productivity and operational efficiency (e.g. longer, wider trailers, heavier loads permitted, and more fuel efficient tractors) has allowed them to remain a force in an increasingly competitive marketplace. The fact that their margins did not increase is the result of rate compression due to increased intra- and inter-modal competition. It is generally recognized that the O-O portion of the motor carrier industry is very volatile. Although a large portion of the individual O-Os may leave the industry due to economic downturns, inefficient management or operational procedures, other individuals continue to enter the market to replace them.[24] As the O-O share of all movements in the data base has not seriously declined, it appears that productivity gains have allowed the O-Os to remain a significant factor in an every more competitive marketplace.

Finally, the adoption and diffusion process of any

Figure 1.
Owner Operator Empty to Total Mileage Ratios Have Remained Essentially Stable



new idea or technology takes time. Only now, after several years of deregulation and an expanding economy (to provide and finance these new market opportunities) may the enhanced competitive results of deregulation be better observed.

IV. DATA BASE DESCRIPTION

The primary source of data employed in this paper is from the National Motor Transport Data Base (NMTDB). This data base was begun in 1977 under a joint effort by the Economics and Finance Department of the Association of American Railroads (AAR) and Transportation Research and Marketing (TRAM). Since 1983, TRAM has continued to interview motor carriers at an average of eighteen strategically located truck stops along the interstate highway system. Except for the first half of 1977, when the original questionnaire and enumeration process were being developed, an average of over 16,000 questionnaires are collected annually. As each questionnaire can record two loaded and empty movement pairs (current and previous movements), over 300,000 movements were recorded during the 1977 to 1986 study period. In addition to information regarding loaded and empty movements, information on driver, equipment, and operational characteristics are also collected.

In the actual analysis of data, no statistical significance tests were performed owing to the light density of the sample.[25] Finally, although the Regular Route Common Carriers (RRCC) aré not considered to be directly rail-competitive, they are occasionally interviewed. In this paper all observations recording the use of RRCC were excluded from the analysis as were team driver operations. The latter make up a very small portion of the sample.[26] Data from the top 50 TL carriers (in terms of revenues) as compiled by Data Resources Incorporated was also employed to provide perspective for many of these changes.[27]

V. CHANGING RAIL-COMPETITIVE MOTOR CARRIER CHARACTERISTICS

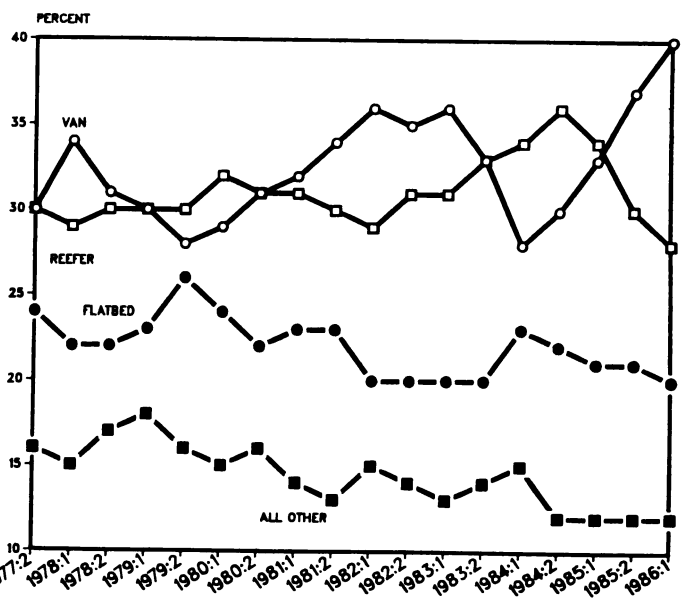
To evaluate the new opportunities afforded the motor carriers industry since deregulation, three demographic areas were investigated. These included: equipment, driver and commodity characteristics.

A. Equipment

One key development during the 1977-1986 period has been improved equipment utilization. Annual tractor mileages have increased from 108,000 to 117,000 while the number of loaded trailers reported fully loaded (from either a cubical or weight perspective) has increased from 55 to 93 percent. During the DRI study period of 1980 through 1985, TL drivers were seen to travel an additional 13,000 miles per year.[28]

During the period 1977 to 1984, the relative mix of trailer types remained constant. Flatbed trailers posted a slight decline in percent of the fleet reflecting the downsizing of the domestic steel industry. Dry van and the more versatile and costly refrigerated van trailers competed for dominance with approximately equal shares. (Refer to Figure 2) However, since 1984, the less costly dry van has been employed in ever increasing numbers.

Figure 2. Trailer Distribution (1977-1986)



Perhaps the single largest change observed among the equipment related data is the market penetration of larger trailers. During the 1977 to 1983 time frame, the 45 foot trailer made steady progress in domination of the fleet. (Refer to Figure 3) Nearly 60 percent of the rail-competitive intercity truck trailer fleet in 1983 was 45 feet in length. Although the STAA had allowed 48 foot trailers in 1982, it was not until 1983 that the shift away from the 45 foot standard became apparent. Within just two years, the longer trailers went from less than 2 percent to over 60 percent of the market, while the 45 foot trailer fell back to 1977 levels. The one year delay between the STAA and market response can be explained in several ways. First, between July 1981 and November 1982, the economy was in recession. Existing equipment was able to handle demand and little excess funds were available for new capital equipment. In addition, many carriers also took a "wait and see attitude" before making the several year commitment that the new equipment would encumber.[29] Overall, DRI reported that equipment expenditures doubled between 1980 and 1985 from 900 million to 1.8 billion dollars.

The increased use of higher horsepower engines which had been the trend since 1977 leveled off at the beginning of 1984. Tractors with power plants of less than 350 horsepower actually rose slightly since 1983. (Refer to Figure 4) Unless the Pinwheel Amendment or other similar legislation is passed, this leveling in the use of highly powered tractors may continue as those carriers who employed them in markets requiring heavier loads and high speeds (e.g. Western doubles) have already done so.[30] Despite the use of more powerful and larger engines, and self-reported transit speeds that averaged more than 63 miles per hour, the data indicates that fuel efficiency has also increased. (Refer to Figure 5)

In addition to the adoption of this more efficient technology is the more productive use of these motor carrier assets. While motor carrier equipment utilization is generally a mirror of the overall economy, motor carriers are increasingly filling their larger equipment. (Refer to Figure 6)

From 1977 to 1986, the more efficient use of larger, more fuel efficient equipment has enabled the motor carrier industry to reduce costs (in real terms) by 10 percent.[31]

B. Driver

As large gains in equipment efficiency have taken place, so to have cost reductions occurred in human capital. During the later 1970's as many as one in four intercity drivers was a union member. With a brief hiatus during 1981, unionization among these drivers has fallen to where less than one in twenty is union member. (Refer to Figure 7) Non-union members earning 23 cents per loaded mile are far more attractive than union members drawing 28 cents per loaded mile. (Refer to Figure 8) In either case, motor carrier real wages have actually declined since 1977 by 22 to 24 percent. During the 1981 to 1985 time frame, DRI reported annual wages decline 7 percent in real terms.

The ability for owner operators to lease their services to motor carrier firms under trip or permanent lease arrangements helps guarantee them work. Currently, more than 90 percent of all O-Os report that they were involved in some sort of permanent lease arrangement. (Refer to Figure 9) Although it was

Figure 3.
Since The STAA Was Passed, Longer, More Productive Equipment is Being Used (All Trailer Types)

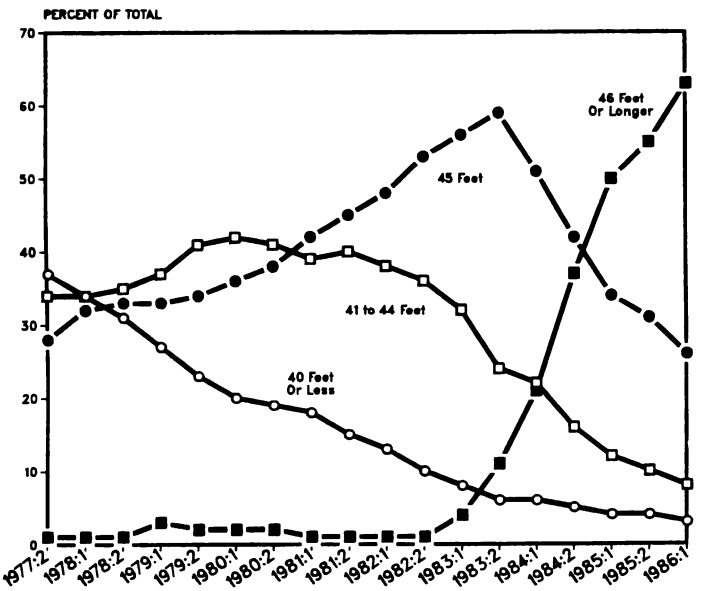


Figure 4.
Larger Engines are Being Used Allowing Drivers to Haul Larger Loads and Maintain Higher Highway Speeds

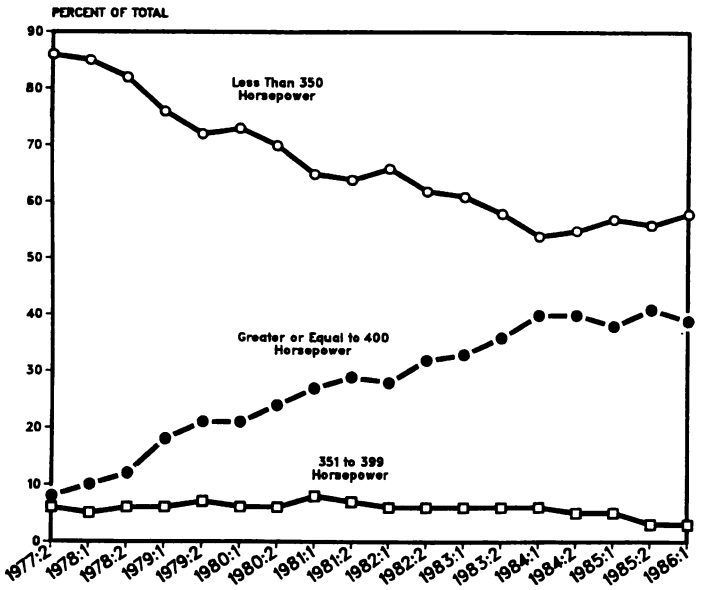


Figure 5.
Average Fuel Efficiency Has Increased (All Trailer Types)

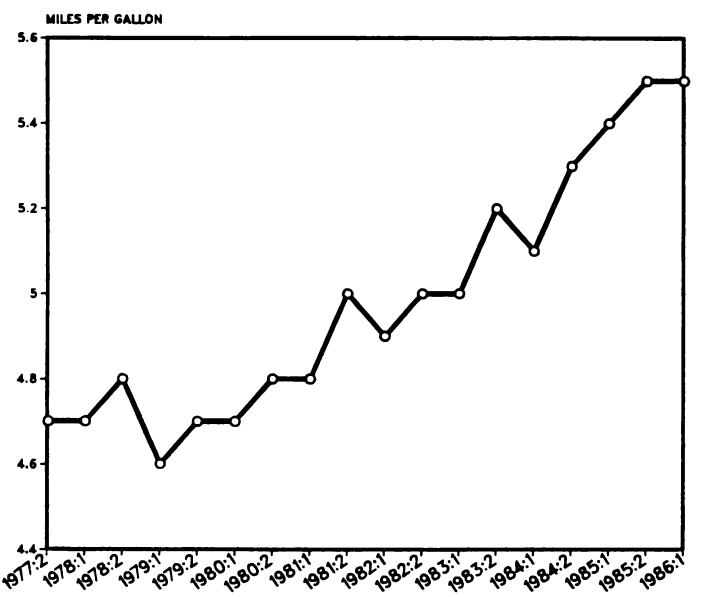


Figure 6.

Motor Carriers Have Increased Utilization
(Percent of Trucks Reported to be Fully Loaded)

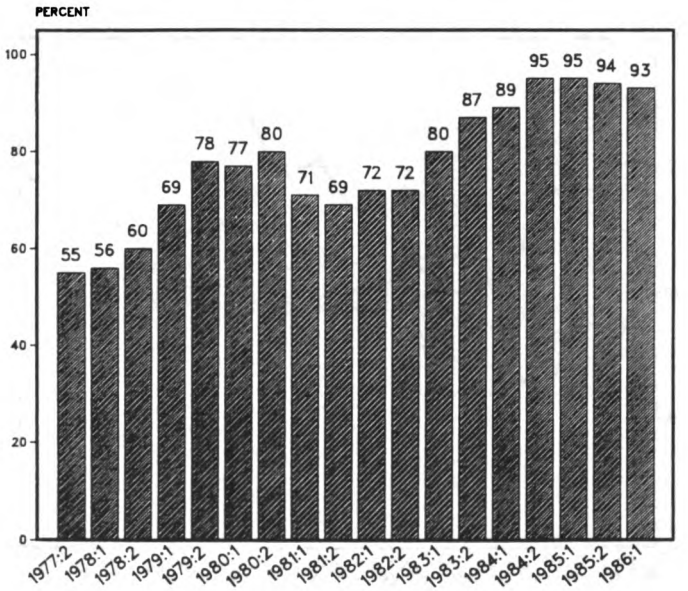


Figure 7.

Motor Carrier Union Membership Has Declined
(1977-1986)

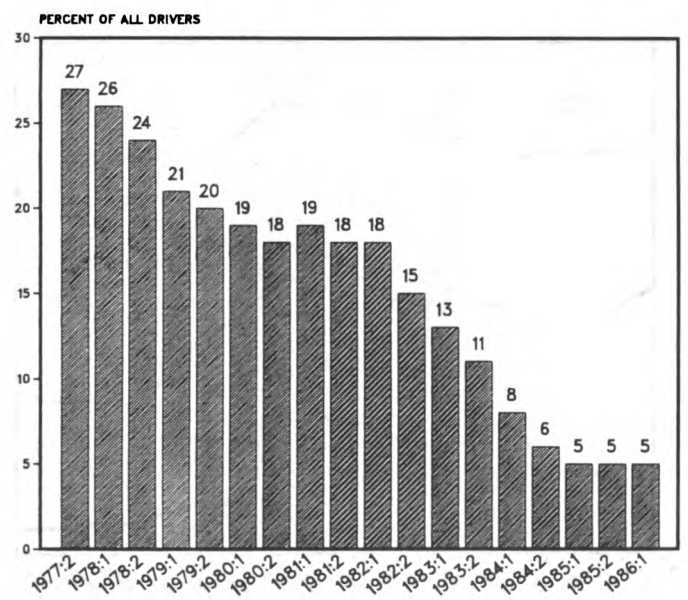


Figure 8.

Union vs. Non-Union Wages
Company Drivers Only
(1977-1986)

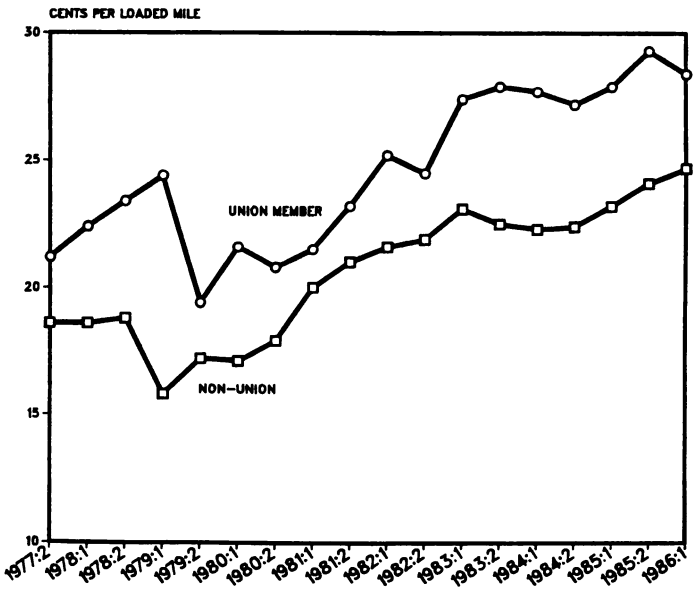


Figure 9.

Owner-Operators Increasingly Enter Into Leasing Arrangements
(Recessionary Periods Are Highlighted in Shaded Areas)

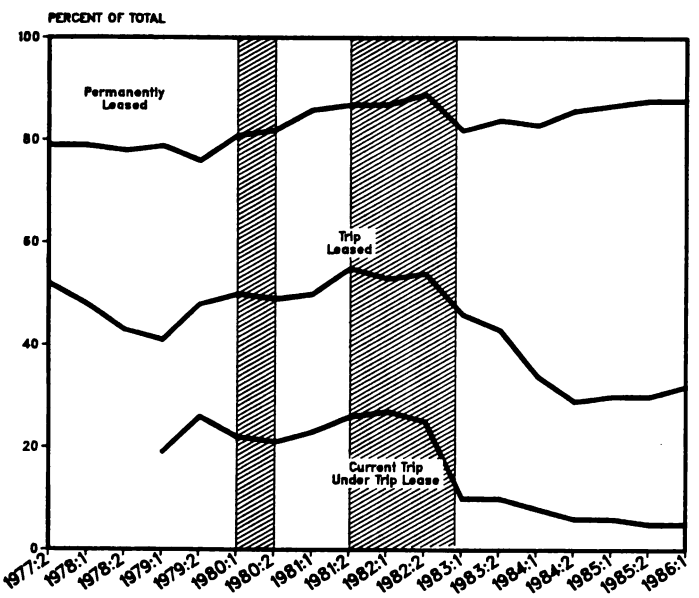
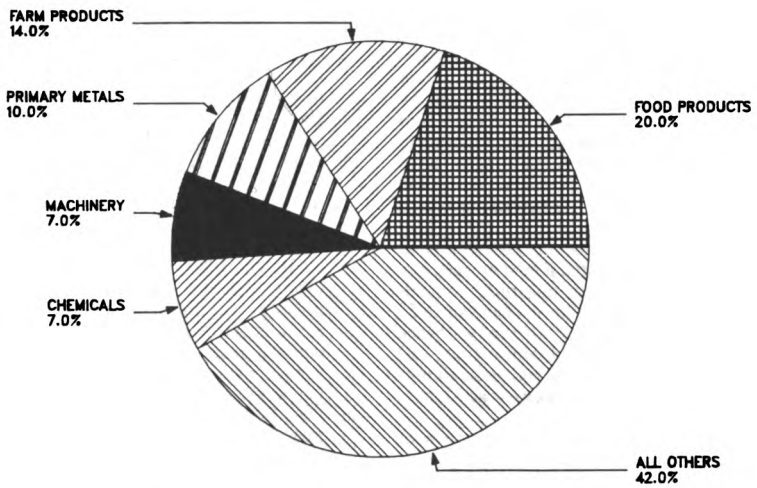


Figure 10.
Food and Farm Products Movements Dominate Intercity Rail-Competitive Motor Carrier Traffic Mixes
(1977-1986 Average)



once common to envision the O-O sector of the market as true independents, due to increased market competition and increased insurance costs, more and more O-Os have sought the protection of lease arrangements.

While further erosion in the union's share of the market would have little additional impact on cost reductions (due to their small presence in the market), relative cost differences between union and non-union drivers may continue to fall as unions accept wage reductions or only nominal increases to maintain employment of their members.

C. Commodity

The broad shifts in the driver sector are not mirrored in commodity shares. Food and farm products accounted for about one-third of total movements throughout the 1977-1986 period. On the average, primary metals had the next largest share accounting for one in ten loaded movements. Machinery and chemicals each maintained a 7 percent share. (Refer to Figure 10)

A few shifts in commodity shares did occur. Primary metals' share fell 42 percent, and machinery's share fell 25 percent. This no doubt reflects the declining importance of the industrial sector to the U.S. economy. On the other hand, chemicals increased their share by 60 percent. (Refer to Table 4).

Rail competitive trucking's reliance on chemicals and food and farm products could increase in the future. Research at the AAR's Intermodal Policy Division indicates that railroads will find it increasingly difficult to hold onto these commodities to avoid diversion to truck competition.[32]

VI. CONCLUSIONS AND IMPLICATIONS

The rail-competitive motor carrier industry has become more efficient and more effective. Due to a variety of reasons, the motor carrier industry did not immediately undergo significant changes in operational methodologies allowed them by deregulation. Given recessionary pressures of low market demand, high interest rates and energy costs, the time required for existing firms to reposition themselves to

TABLE 4
Portion of All Truck Movements

YEAR	FOOD PRODUCTS	FARM PRODUCTS	PRIMARY METALS	MACHINERY	CHEMICALS
1977	19%	14%	12%	8%	5%
1986	19	11	7	6	8

Source: National Motor Transport Data Base

compete with new entrants in the new "open" transportation market, many carriers were unable to make significant changes during the 1980 to 1983 period. However, since 1983 with an expanding economy, relatively low energy and interest costs, significant changes in the rail competitive motor carrier sector have occurred. These changes built upon and exacerbated a consistent trend of increased motor carrier efficiency dating back to at least the beginning of this study's period of analysis. By relying increasingly on non-union drivers, the motor carrier industry has lowered real wages rates by almost one-fourth. They have also lowered per unit equipment costs by increasing annual tractor mileages while lowering empty mileages, and use of larger equipment. With lower costs in labor and equipment, rail-competitive trucking has become a formidable competitor.

The recent enactment of the 65 mile per hour (MPH) speed limit on the rural interstate highway system will have little effect on rail-truck competition.[33] Motor carriers prefer the lower speed since 55 MPH saves not only on fuel but also maintenance and tire expense. At 55 MPH "engines, tires, and other components turn revolutions, and brake linings absorb less energy. The result is less wear and longer service life."[34]

Although the individual motor carrier firm or owner operator may not succeed in today's marketplace, the increased opportunities allowed under deregulation have certainly benefited the trucking industry as a whole. Incremental cost reduction trends and increased competitiveness will continue as the newer technologies and operational methodologies diffuse to a greater extent in the motor carrier industry. Temple, Barker & Sloan (TBS) in its analysis of the rail industry's condition pointed out that the competitive "environment has changed radically and will continue to change". This analysis highlighted reductions in truck costs and growing shipper emphasis on total logistics and higher quality service. These trends will put more pressure on the rail industry especially if the proposed new size and weight limits (as exemplified by the Pinwheel Amendment) are enacted.[35]

ENDNOTES

*Association of American Railroads. The views expressed in this paper are solely those of the authors and may not reflect the views of the Association of American Railroads or its members.

1. Regular route common carriers (RRCC) are usually engaged in relatively short-haul-less-than-truckload (LTL) service. Although the railroad industry does carry LTL freight, it has traditionally represented only a small portion of total railroad tonnage. For example, STCC 47 tonnage originated represented only 0.007 percent of total railroad tonnage originated in 1986. Source; *1986 Freight Commodity Statistics*. While additional LTL traffic moves under other STCCs (e.g. 44 and 45), due to the relatively short lengths of haul involved, it has not been traditionally considered directly competitive with LTL trucking. Additionally, in the collection of the NMTDB, RRCC data is not actively sought. Therefore, while certain LTL movements by RRCC might be rail competitive, and some partial RRCC information is contained within the NMTDB, to provide consistency over the time frame studied, this category of motor carriers has been excluded from the analysis.
2. Examples include the Department of Commerce Commodity Transportation Survey and Truck Inventory and Use Survey.
3. TRNC's "The Blue Book of the Trucking Industry," and the Transportation Association of America once provided a plethora of transportation statistics.
4. Until 1979, contract carriers were not allowed to serve more than eight separate shipper.
5. Wyckoff, D. D. and D. H. Maister, *The Owner-Operator: Independent Trucker*, Lexington Mass, Lexington Books, D. C. Heath, 1975; D. H. Maister, *Management of Owner-Operator Fleets*, Lexington Mass, Lexington Books, D. C. Heath, 1980; and M. H. Agar "Toward an Owner-Operator Theory of the Carrier," *Proceedings the Transportation Research Forum*, 1984, pp 410-414, among others have presented detailed analyses of the rail-competitive motor carrier market from either a pre- or post-regulatory viewpoint.
6. Data Resources Incorporated in a recent assessment of the motor carrier industry after deregulation states "Most portrayals of the motor carrier industry rely on data that come from the handful of carriers (typically less-than-truckload) that are either publicly held or large enough to both filing accurate reports with the ICC." They go on to state "Although lack of reliable data makes a bottom-up analysis of TL activity impossible, individual carrier reports as well as strong circumstantial evidence support the assertion that truckload carriage was the fastest-growing segment in the motor carrier industry during the first half of the 1980's. Source: Data Resources U.S. Review, p. 23-24, March 1987.
7. Glaskowsky, Nicholas A., *Effects of Deregulation on Motor Carriers*, Eno Foundation, Westport, Conn., p. 8, 1986.
8. Over capacity in the inland waterway industry has also added to competition in the area of bulk commodities.
9. The 1977 Commodity Transportation Survey (CTS) indicated that the rail industry transported 24.2 percent of all manufacturing tonnage shipped. (Manufacturing tonnage was defined as those commodities falling within the Standard Industrial Classification (SIC) codes of 20 through 39). By contrast, the 1983 CTS indicated that total rail market share had fallen to 19.6 percent. Source: Bureau of the Census, Business Division, Washington, D.C.
10. Association of American Railroads, *The Coal Book*, 1986, pp. 18, 22, and 24.
11. Association of American Railroads, *The Grain Book*, 1986, pp. 8 and 14.
12. Transportation Policy Associates, *Transportation in America*, 4th Edition, 1986, and Supplement, November 1986.)
13. Lane, L. Lee, *"Innovation in Trucking: Advanced Truckload Firms,"* Transportation Research Board Record, forthcoming; *1986 Yearbook of Railroad Facts*, Association of American Railroads.

14. Data Resources Incorporated (DRI) forecasts a 3.4 percent decline in the Wholesale Price Index for gas fuels (WPI053) during the 1986 to 1989 period.
15. *Commercial Carrier Journal,* "The Insurance Dilemna," July 15, 1985, p. 143. Thomas Donohue, American Trucking Association President statement to the U.S. Senate Committee of Commerce, Science and Transportation, September 27, 1985.
16. Telephone conversations with several insurance industry agents.
17. The financial vehicle employed to fund these losses is a confirmation of self-insurance of predictable losses and the purchase of insurance to cover catastrophic losses. Refer to Wolfe, *"An Examination of Risk Costs Associated with the Movement of Hazardous Materials,"* Proceedings of the Transportation Research Forum, pp. 228-229, 1984.
18. Under depreciation accounting the initial track installation is added to the property accounts as an asset. The cost of the property (less salvage value) is prorated and annually written off over the life of the asset. Under retirement-replacement-betterment (RRB) accounting the asset was never written down. Track replacements were written off in the year they occurred as expenses. If improvements were made, the incremental investment would be added to the "frozen" asset base. Only when the line was abandoned would the original investment and capital improvements be written off as expenses. Salvage was treated as an asset. Refer to *"Alternative Methods of Accounting for Railroad Track Structures,"* ICC, Docket No. 36988, Decided January 26, 1983.
19. For example, under the old tax plan a $75,000 tractor would be written off in three years ($18,750, $28,500, and 27,750 in annual depreciation). The new tax law accelerated this to ($25,000, $33,332, and 16,668). Source: Ernst & Whinney, *"Equipment Replacement Strategies of Truckload Carriers and the Tax Reform Act of 1986,"* special study prepared for the AAR, p. 13, January, 1987.
20. "Excess production capacity has existed in the tractor manufacturing industry for the past five years. This trend is likely to continue for the next five years, depressing prices for new equipment." Source: Ibid #19, p. 7.
21. Larkin, Frances M., and K. Eric Wolfe, "Rail-Competitive Truck Characteristics," *Proceedings of the Transportation Research Forum,* Volume 2, pp. 145-155, 1983.
22. At the conclusion of a loaded trip, commodities for a return load are often not available at the same location. The process of driving with no load to another location (in order to secure a load for the return trip, the backhaul) is considered to be the deadhaul.
23. Corsi, Thomas M., Michael H. Agar, and Merrill J. Roberts, *"Dynamics of Owner-Operator Behavior and Profitability: 1978 Versus 1984,"* Proceedings of the Transportation Research Forum, pp. 123-136, 1985.
24. When quizzed as to what alternative occupation might be followed if the respondent could not be an 0-0, most 0-0s indicated that they would be farmers, mechanics or join the armed forces. Although 0-0 income has declined in real terms, nominal annual earnings of $22,000, the "psychic income" derived from being "your own boss" continue to draw new entrants into the ranks of the 0-0s. Source: NMTDB.
25. During the study period, the average length of haul reported for solo drivers in the data base was roughly 1,400 miles; the average miles traveled on all annual basis averaged 113,000. Thus, the average truck is estimated to make 81 loaded trips per year. As estimates of the total number of trucks in intercity service range from six to eight hundred thousand, the total loaded truck movements might range between 49 and 65 million. Since the database collects 32,000 or so loaded movements per year, it is sampling all intercity movements at a rate of less than 0.1 percent.
26. In addition to RRCC, observations involving household goods movers, cargo weights of less than 5,000 pounds or lengths of haul less than 250 miles were excluded from this analysis. These excluded observations made up less than 5 percent of the total database.
27. The DRI total motor carrier financial database includes as many as 250 financial and operating statistics for over 2,200 Class I and II motor carriers. For selection of those carriers thought to be the most rail-competitive, only data from the top 50 firms was used. Source: ICC and ATA.
28. Data Resources Incorporated *"Review of the U.S. Economy,"* March 1987, p. 28.
29. Uncertainty as to what extent twin 28 foot and single 48 foot trailers would be allowed to operate in all states also delayed the employment of larger trailers. For example, the Federal Highway Administration had to take the state of Connecticut to court to force acceptance of larger equipment.
30. This plan would allow seventeen western states to raise vehicle weight limits to Federal bridge formula levels. This would mean the end of the 80,000 pound limit in the west. Turnpike doubles (paired 48′ trailers) could be operated at 134,000 pounds and would be especially rail-competitive due to their lower operational cost structures.
31. This estimate (based in constant 1986 dollars) is from the AAR truck cost model based on the following assumptions: 45′ trailer in 1977 versus 48′ in 1986, 4.8 miles-per-gallon in 1977 versus 5.5 in 1986, and 106,000 annual miles in 1977 versus 120,000 in 1986.
32. AAR, Intermodal Policy Division unpublished paper, *"Advanced Truckload Competition,"* 1986.
33. Of the 43,291 miles of the U.S. interstate highway system, over 78 percent (33,910 miles) could be designated for 65 MPH travel. Source: Associated Press/Senator Steve Symms (R-Idaho).
34. Standley, Gerald F., "The Economics of 55," *Commercial Carrier Journal,* December 1986, p. 9. See also *Saving Truck Fuel: 2 Case Histories,* Trucksawe, Ontario Ministry of Energy.
35. Temple, Barker & Sloane, Inc., *"The Changing Rail Industry,"* Washington Representatives Briefing, January 7, 1987.