

LIBERALISATION IN THE TRANSPORTATION SECTOR IN NORTH AMERICA

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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LIBERALISATION IN THE TRANSPORTATION SECTOR IN NORTH AMERICA

Executive Summary

- In addition to the increased quantities of goods exchanged which result from trade liberalisation, trade increases may also occur due to lower transportation costs achieved through efficiency gains from deregulation, privatisation and technological improvements. Increased trade does not necessarily result in increased environmental degradation. Total energy use, pollution and congestion may decrease or increase depending on the product and location mix of the items traded.
- The US intercity freight bill as a percentage of GNP dropped substantially after deregulation from 7.8 per cent in 1980 to 6.3 per cent in 1989 (and has since remained at that level) while the average length of haul increased for rail, truck and air. This decrease in cost is primarily the result of traffic being shifted to a more appropriate mode after deregulation, cost reductions due to enhanced competition and technological innovations such as unit trains and doublestack container trains.
- Rail deregulation (the Staggers Act of 1980) changed railroads from being one of the most regulated industries in the United States to a market-oriented system. Rail freight rates declined at an average annual rate of 1.5 per cent after 1980. However, the major benefits of deregulation were due to service improvement including speedier and more reliable deliveries. These benefits were estimated to be worth \$5 billion in 1990. Railroad productivity by employee doubled between 1983 and 1992 allowing railroads to compete with trucks and barges for the first time in decades.
- Railroads in the United States have regained market share of total ton-miles since deregulation by recapturing the haulage of bulk commodities from trucks and by developing long distance TOFC/COFC (trailer-on-flat car/container-on-flat car) routes.
- The use of energy by rail freight in the United States declined by over 26 per cent, or 26 million barrels, from 1980 to 1993 while rail ton-miles increased 27 per cent. As a result of deregulation, rail has been able to reclaim numerous bulk commodity movements. Part of the energy reduction is due to the improved financial state of railroads which has allowed them to purchase new more efficient locomotives and improve infrastructure.
- Rail deregulation has resulted in the realignment of infrastructure and the abandonment of about 25 per cent of US railroads per since 1975. Often, there are favourable environmental impacts when right-of-ways are converted to foot and bike paths. Rail yards in prime locations have been recycled into industrial parks or other higher uses. This frequently reduces traffic congestion and eliminates "visual pollution." New rail infrastructure for

access to cities and ports is generally more energy efficient and reduces rail and/or highway congestion.

- Trucking deregulation in the United States also occurred in 1980. By 1984, deregulation cost savings (to the trucking industry) were estimated to be 23 per cent of 1980. Equipment utilisation in the motor carrier industry improved as a result of deregulation due to the freedom to abandon or adjust routes and the freedom to obtain backhauls. Consequently, there were fewer heavy duty tractors in use in 1993 than in 1980 but inter-city truck ton-miles increased 55 per cent. Although many motor carrier bankruptcies and job losses were attributed to the competitive pressures of deregulation, employment in trucking has grown by over 500 000 since 1980.
- The improved motor carrier (and rail) service that was made possible by deregulation and the tremendous expansion of all types of air cargo allowed the total value of US inventories to be reduced from 9 per cent of GNP in 1980 to 4.2 per cent in 1994. Although this was accompanied by an increase in transportation energy consumption, the environmental degradation was mitigated by the reduction of environmental impacts elsewhere in the economy, e.g., less warehouse space to construct and maintain, less obsolescence and waste, etc.
- Deregulation of railroads and trucking, along with advances in technology, have led to the rapid expansion of all types of intermodal traffic in the United States. All TOFC/COFC traffic grew at a compound rate of 7 per cent from 1980 to 1994. The number of doublestack container trains from the West Coast to the Midwest and East has increased from one train per week in 1984 to 241 per week in 1993 (including 5 to Mexico City). Much of this growth was originally transported in ocean containers but the two largest truckload carriers subsequently switched in 1994 to truck-rail intermodal almost exclusively for long distance moves. Double stacks require less energy and cause less congestion than regular trains and require much less energy (as well as less labour and other resources) than conventional long haul trucks. New technologies like roadtrailers are also contributing to increased efficiencies and reductions in energy consumption and congestion.
- Inland waterway traffic was never effectively regulated so has not been affected directly by deregulation. Although waterways are fuel efficient and highway and rail traffic congestion are reduced when traffic goes by water, the environmental movement has generally been opposed to expanding the use of this mode in the United States. Traffic has grown, however, as the waterways are generally the low cost mode for bulk commodities for a large part of the United States. Because of the high-value, time-sensitive nature of containerised freight, barges do not generally participate in intermodal container movements. However, rail-barge bulk movements have greatly increased with the new land-locked short-line railroads transferring at river terminals.
- Coastal shipping is not an important part of US commerce. However, the Jones Act of 1920 restricts cabotage on the "non-contiguous" ocean routes from the US mainland to Alaska, Hawaii and Puerto Rico. The lack of competition on these routes is estimated to cost US consumers \$10 billion per year. Potential savings from abolishing the Jones Act would result from competition by foreign ships and not from domestic deregulation.
- Air cargo has grown the most rapidly of all the modes in terms of tonnage, ton-miles and revenue since deregulation. Air cargo is a niche market for shippers, requiring speed and a high level of service and reliability at a premium price. However, the average air shipment

size has decreased from 18 pounds in 1986 to 10.8 pounds in 1995, partly due to the growth of innovative express services that guarantee overnight and two- or three-day deliveries which use motor carriage when applicable.

- The North American Free Trade Agreement (NAFTA) is likely to change the traditional transportation trading and infrastructure patterns of the three North American countries from an east-west orientation to more of a north-south one. Cross border rail and intermodal movements from eastern Canada and the United States to Mexico are expected to increase as rapidly as the Mexican infrastructure can be improved. Although technically possible prior to NAFTA, this cross-border traffic is driven by increased demand from trade liberalisation and relaxation of barriers to foreign investment in infrastructure in Mexico.
- Motor carriage harmonisation between the United States and Canada has proceeded relatively smoothly. The United States, Mexico and Canada have all accepted the principle of adopting comparable standards with enhanced safety and all three countries have made significant progress in several areas. However, the United States and Mexico are behind schedule in resolving the cross-border size, weight and safety differences that would allow increased trade using motor carrier transport between the two countries.
- NAFTA has increased competition for international cargo (as well as land bridge traffic) between US and Canadian ports. When Mexico's transportation and port infrastructure is sufficiently improved, Mexican ports, especially those on the Gulf of California, are expected to compete for traffic between the Pacific Rim or the West Coast of South America with all three NAFTA countries. These shifts will generally result in reduced energy consumption and congestion and be environmentally friendly if the appropriate infrastructure is provided.
- The end of the Crow Rate subsidies to Canadian agriculture in August 1995, in combination with trade liberalisation, is expected to change the location of livestock production and processing in Canada and expand North-South trade corridors such as the Western Alberta and California corridor. Rapid growth is expected in the quantities of Canadian grain moving through the United States by railroad or river. Seven to 20 per cent of Canada's traditional grain markets can be serviced at a lower landed cost through US Gulf of Mexico ports than from Canadian ports if moved through the United States by rail or rail-barge at US rates. Positive environmental effects include reduced total traffic and energy consumption, shifts to the more appropriate water mode and less intensive animal agriculture with reduced reliance on fertilisers, herbicides, pesticides, etc.

A. Background

It is probable that in North America the effects of transportation deregulation, improved technology, infrastructure investments and industry rationalisation due to privatisation, deregulation, etc., over the last 15 years are more significant than the impacts of liberalised trade. That is, the benefits to these economies from cost savings and service improvements in transportation over that time period were more important than those resulting from liberalised trade. Although some of these technology and infrastructure changes are driven or encouraged by increased international trade, the factors cited above have had major impacts on transportation. And, through change in modal split and energy intensity, these have also impacted on the environment in the United States and more recently Canada. When comparing US and North American transportation modal trends and shifts with those of other trading nations, one should recognise that the long distances between raw material sources and manufacturing centres allow

efficient rail movements that can compete on economic grounds with truck transport: e.g., Chicago is over 2 000 miles from the West Coast ports, 800 miles from New York and 900 miles from New Orleans. Consequently, the tremendous efficiency obtained in North America through long distance unit trains, piggybacking, micro-land bridges and mini-land bridges¹ might not be applicable to other parts of the world including the EU where most cities are less than 300 miles from major ocean ports. The compatibility of the North American rail system especially between the United States and Canada, provides advantages compared to the EC where, e.g. locomotives and drivers must change at the Dutch-German border².

Table 1 shows the trends of average trip length by mode. Both rail and truck trip lengths have continued to increase since deregulation.

Table 1. Average Number of Miles of Domestic Freight Haul, 1960-1992

Year	Rail	Truck	Air	Rivers/Canals
1960	489	272	953	282
1970	546	263	1014	330
1980	587	363	1052	405
1985	614	361	1157	448
1990	646	391	1389	449
1991	662	398	1346	450 ^a
1992	673	410	1391	450 ^a
^a Estimated.				
Source: <i>Transportation in America</i> (Washington, DC: Eno Transportation Foundation Inc., 1995, p. 71.				

B. Results of Rail Deregulation

Deregulation of the railroad industry by the US Staggers Act of 1980 (and the 3R and 4R acts and Interstate Commerce Commission (ICC) rulings of the 1970s) changed railroads from being one of the most regulated American industries to a market-oriented system. The Staggers Act relaxed controls on rates, allowed railroads to contract to provide specific services to individual firms, to enter into long-term contracts, and made mergers between railroads and the abandonment of non-profitable branch lines easier. Railroads were not completely deregulated as the ICC retained the ability to regulate maximum rates and other oversight powers. By the early 1990s, however, more than three-fourths of rail traffic was not subject to rate regulation because rates were below threshold levels or because the ICC had exempted the traffic entirely. Exempted classes included boxcars, TOFC\COFC and perishable agricultural products, lumber and products and transportation equipment. A major change from the common carriage principal of public and non-discriminatory rate tariffs was the ability of the railroads to enter into confidential binding contracts for both rates and services. These contracts must be filed with the ICC but are not public. Most rail traffic now moves under contract and hence is not subject to rate regulation.

Freight rates have declined at an average rate of 1.5 per cent annually since 1980. Following deregulation, however, there were significant differences in rate changes across commodities with rates for many increasing because of the greater market power of the railroads. By 1988, deregulation had resulted in lower rates for most commodities suggesting that increases in productivity and competition generally had overcome the initial rise in railroad market power. According to Clifford Winston, et al, deregulation has also resulted in a reorganisation of rates between commodities, for example those for grain falling and those of coal rising.

However, the major benefits from rail deregulation have probably not resulted from rate reductions but rather from service improvements including increasing the speed and reliability of freight delivery. Winston, et al., estimate the value of these improvements to be in the order of \$5 billion a year in 1990.³

The railroads have been able to abandon thousands of miles of track (Table 2), merge systems and spin off short line railroads. The number of smaller railroads has increased from 212 in 1980 to 550 in 1994. Many of these regional or short-line railroads have done well because of regulatory reforms. Labour can be paid at local instead of national wage levels, and work rules have been relaxed so employees can do multiple tasks. This has resulted in reductions in both rates and number of employees. In addition, the regional railroads have been more responsive to local service requirements.

Table 2. Rail Employment (000) and Railtrack (miles)1960-1994

Year	Employment	Railtrack
1960	885 000	217 552
1965	735 000	211 925
1970	627 000	206 265
1975	538 000	199 126
1980	532 000	179 000
1985	346 000	153 052
1990	285 000	145 979
1993	247 000	138 443
1994	240 000	n/a

n/a: not available
Source: *Transportation in America*, 1995, pp. 61 and 64.

The railroad industry has been able to reduce the number of employees by almost 300 000 between 1980 and 1994, a greater than 50 per cent decrease. As a result railroad productivity measured by revenue ton-miles per employee increased faster than almost any other industry, doubling between 1983 and 1992. Consequently, railroads are able to compete successfully with trucks and barges for the first time in decades.

As a result of deregulation and their improved profit outlooks railroads have much more control over capital investment (and disinvestment). This includes the investment in facilities and equipment for intermodal operations. Intermodal will be discussed in a separate section as one of the major success stories of deregulation and the adoption of new technology.

C. Motor Carrier Deregulation

The US Motor Carrier Act (MCA) of 1980 followed substantial liberalisation of trucking regulation by the ICC in the late 1970s. This included reducing entry barriers, loosening restrictions on contract carriers and allowing unregulated agricultural carriers to carry regulated commodities on back hauls. The MCA went further and allowed applicants to enter the industry when the service was found to meet a "useful public purpose" reversing the previous burden of proof from the entrant to the existing carriers. The MCA permitted common carriers to raise and lower rates by 10 per cent annually without regulatory interference and the ICC was granted the discretion to permit even greater price freedom in the future. Antitrust immunity which allowed carriers to discuss and vote on rates was reduced and eventually eliminated.

The results of trucking deregulation were substantial and far reaching. Many new carriers entered the industry. The number of firms increased from 16 000 in the mid-1970s to over 49 000 in 1992. Prior to deregulation, there was little distinction between truck load (TL) and less-than-truck load (LTL) carriers. TL carriers usually haul freight directly from shipper to receiver without going through sorting terminals. LTL carriers specialise in transporting shipments of less than 10 000 pounds and the LTL market requires pickup and delivery, sorting terminal and regional and national networks. Unlike the TL business, there are significant economies of scale in LTL operations. Consequently, few new LTL firms entered the industry after 1980 and the top four LTL firms doubled their market share from 18 per cent in 1977 to 37 per cent in 1987. Many of the recent motor carrier entrants provide innovative services such as small packages pickup, package express or air cargo, or are subsidiaries of freight forwarders, ocean carriers, brokers or other third parties. In this case deregulation has led to innovations which have completely blurred the old artificial distinctions between modes and service types that were the result of regulation.

Studies have identified the benefits of cost savings due to trucking deregulation. For example, Ying explored changes in the cost structure of trucking firms following 1980 and found that while deregulation raised costs by 7 per cent in the first year, by 1984 cost savings amounted to 23 per cent.⁴ Winston, et al. estimated that trucking deregulation has lowered operating costs for own firm trucking, generating \$3 billion per year in benefits to shippers. Increased competition among common carriers has resulted in rate reductions that amount to \$4 billion a year in benefits. Service improvements have produced another estimated \$1 billion annually in benefits to shippers.⁵

In addition to the above identified cost savings, shippers have received benefits in the form of more responsive and dependable service as a result of the new market discipline imposed by competition. These have allowed shippers and customers to develop just-in-time inventory management by transporting smaller shipments more frequently, in turn substantially reducing inventories and inventory carrying costs. In 1980 the cost of inventory was 9 per cent of US gross domestic product and by 1994 it had fallen to only 4.1 per cent.⁶

Unlike the rail industry, employment in trucking has grown by over 500 000 jobs. However, not all types of workers have gained. Because of competition, owners of many trucking firms went bankrupt after deregulation. When the market was regulated, ICC approved rates enabled unionised labour to extract rents from carriers in the form of high wages and high levels of employment. Even in 1994 unionised drivers still earned approximately 20 per cent more than non-union drivers but the number of union drivers had declined to 120 000 in 1994 from 210 000 in 1980. However, employment growth is occurring in the trucking industry and there are recurring reports of truck driver shortages.

Equipment utilisation in the trucking industry has also improved. Table 3 shows that the number of heavy duty tractors dropped by 280 000 units, or 20 per cent, in the first 6 years of deregulation and their number is still below that of 1980. Trailers increased less than 20 per cent from 1980 to 1990 after having almost doubled from 1970 to 1980. However, intercity truck ton-miles have increased over 55 per cent since 1980 with the smaller quantities of equipment.

A major concern prior to motor truck deregulation in the United States was the possible loss of service to small communities. However, subsequent studies have shown little change in quality and availability of service and small benefits in lower rates.⁷

Safety was another concern of opponents of trucking deregulation. Opponents argued that the financial difficulties of some carriers would result in poorly maintained vehicles on the roads and that pressures on drivers' wages would cause them to drive more miles and possibly become fatigued or drive faster. However, studies show no adverse effects due to deregulation. Fatality and injury rates have been lower since deregulation than before, despite the increase in truck traffic. (Factors contributing to lower accident rates would include higher vehicle operating and safety standards and highway improvements.)⁸

Table 3. US Trucking Equipment (in thousands of units)

Year	Heavy Duty Tractors	Full/Semi-Trailers
1960	618	1 110
1965	736	1 358
1970	897	1 760
1975	1 116	2 578
1980	1 402	3 313
1985	1 150	3 413
1990	1 240	n/a
1991	1 236	n/a
1992	1 279	3 802
1993	1 289	3 906

Source: Transportation in America, p. 63.

D. Intermodal

The growth of intermodal freight in the United States is an example of the joint effects of technological improvements and deregulation. Although the ICC-approved piggyback or TOFC plans had been in effect for years, growth of truck-rail intermodal freight in the United States developed slowly until after 1980. Then the passage of both the Staggers Act and the MCA led to the freeing of the rail portion of piggy-back from all deregulation and the exemption of truck rates from regulation for joint operations with rail. From 1980 through 1994, intermodal freight was the only category of rail traffic to increase steadily every year regardless of domestic and international economic conditions and despite the financial pressures on rail and motor carriers during the first years of deregulation (Table 4). This compound annual growth rate of 7 per cent was finally interrupted by a decline in 1995.

Table 4. US Rail Intermodal Movements 1979-1995 (in thousands)

Year	Containers	Trailers	Total
1979	n/a	n/a	3 278
1980	n/a	n/a	3 059
1981	n/a	n/a	3 151
1982	n/a	n/a	3 397
1983	n/a	n/a	4 090
1984	n/a	n/a	4 566
1985	n/a	n/a	4 591
1986	n/a	n/a	4 997
1987	n/a	n/a	5 504
1988	2 299	3 481	5 780
1989	2 491	3 496	5 987
1990	2 755	3 452	6 206
1991	3 034	3 209	6 243
1992	3 363	3 265	6 628
1993	3 692	3 464	7 157
1994	4 376	3 752	8 128
1995	4 551	3 520	8 070

Source: Traffic World, February 19, 1996, p. 55

COFC/TOFC growth has been driven by a number of factors. Prior to deregulation, long haul truckers were able to price their services below regulated rail piggyback rates. After deregulation, railroads were free to compete on price for any piggyback traffic they desired. As a consequence, freight forwarders and consolidators were able to compete with truck load operators by dealing directly with the railroads. Other third parties including ocean shipping lines and their representatives which entered the industry and developed land bridges and mini-land bridges and then marketed containers for back hauls to coastal areas as well as to the export trade. Technology improvements led to doublestack rail equipment, multiple-platform cars and concepts such as roadtrailers to provide intermodal services. A roadtrailer is a highway trailer equipped with both rubber tires for highway operations and steel wheels for operating on rails. This eliminates the weight of the rail flatcar and reduces loading and unloading time. Doublestack services were initiated in 1984 when an ocean carrier contracted with railroads to operate doublestack trains from West Coast ports to inland points. Railroads invested in infrastructure including higher clearance tunnels and high capacity hub terminals with crane lifts instead of small, fixed circus ramps. Finally in 1993, the nation's largest truck load carrier, J.B. Hunt switched most of their long distance traffic from semi-trailers to specialised intermodal containers that are seamless to the traditional motor carrier shipper. The second largest carrier, Schneider National, made a similar switch a short while later. Schneider has estimated that its use of doublestack rail saves the company approximately \$400 per container compared with over-the-road highway movements between Chicago and Los Angeles.⁹ The effect of the switch of these dominant truck load carriers from semi-trailers to containers can be seen in Table 4. Note the rapid shift in the 1990s when container shipments increased by over 1.5 million units while semi-trailers remained relatively constant.

E. Inland Waterways

Unlike the other modes of transportation in the US, barges were not subject to extensive economic regulation. The Transportation Act of 1940 placed water-barge transportation under the regulatory authority of the ICC but kept private carriage, most bulk carriage and liquid cargo exempt from regulation. Consequently shipments of bulk commodities such as grain, coal, chemicals, petroleum and products were all generally exempt from rate regulation. Consequently, although barges were technically deregulated in 1980 there were few direct impacts. The industry, however, immediately felt the impact of competition from the deregulated railroads. In fact, the barge industry was financially devastated in the early 1980s by the increased competition from rail and the slowdown in US grain and coal exports and has only recently recovered its financial well-being. (Note that Table 7 shows a small decrease in intercity river ton-miles from 1980 to 1985 followed by a substantial increase to 1990.

In spite of its low cost and energy efficiency, barge transportation in the United States has been a subject of criticism by environmentalists. Fuel user charges for commercial barges were instituted in 1980 as part of a compromise agreed by the barge industry, shippers and the US Army Corps of Engineers (COE) with the railroads and environmentalists to replace and enlarge Lock and Dam 26, near St. Louis. This lock was a major bottleneck for traffic between the Upper Mississippi and Illinois Rivers and the Lower Mississippi. The lack of capacity at Lock and Dam 26 had slowed river traffic growth in the 1970s. The commercial navigation fuel user charge has gradually been increased to 20¢ a gallon today and has reduced the cost advantage of water transportation over rail. These user fees are dedicated for waterway improvements while the operation and maintenance of the waterways costs of the COE continue to be paid out of general tax revenues. The barge industry and waterway users now face efforts by environmentalists (and budget balancers) every budget cycle to increase the user fees.

Other compromises between the barge industry, the COE and environmentalists on topics such as channel maintenance and dredging have added to the industry's operating costs and underlying cost structure. For example, Upper Mississippi river channels are not maintained as wide or dredged as deeply as before 1980. This causes slower operating speeds, more difficult manoeuvring and greater energy use because of increased drag in shallow channels.

There are also environmental-oriented water management proposals that will add to the cost of barge operations and, in some cases, make river navigation more reliable. These proposals include closing down Columbia River navigation during salmon migrations, restoring a more "natural" seasonal flow pattern on the Missouri River to enhance bird nesting habitat and changing pool levels on the Upper Mississippi River to allow increased back water flows and reduce sedimentation. All these changes would increase barge operating costs and/or shipper safety stocks and inventory carrying costs and affect barge competitiveness *vis-à-vis* rail.

There has been no noticeable increase in conventional "intermodal" container type of river traffic since deregulation. This is not likely to occur because of the inherent conflict between the high value and premium freight nature of container traffic and the slow speeds associated with river transportation. However, the development of independent short-line railroads since deregulation has led to innovations in rail-barge or barge-rail shipments of bulk commodities like coal and export grain. Examples include three land-locked shortline railroads in Iowa, Minnesota and South Dakota that run shuttle trains of grain for export from inland country elevators to barge terminals on the Upper Mississippi River. These trains, which operate three- to five-day cycles, successfully compete for grain that the major railroads would like to haul to Pacific or Gulf ports.

F. Coastal Shipping and Non-contiguous Waterborne Transport

Coastal shipping has not been a very important part of US commerce in recent years. Although it is possible that some energy or cost efficiencies would be gained by increased intercoastal movement, these are not expected to be large. The existing inland infrastructure, including pipelines, is generally competitive with the East Coast and Gulf intercoastal movements while the Pacific coast is not well suited for intercoastal movement. However, the situation is different for the non-contiguous routes which include traffic originating in or destined to Hawaii, Alaska, Puerto Rico and Guam. The US International Trade Commission estimated that the lack of competition on non-contiguous domestic routes due to the Jones Act, costs consumers as much as \$10.4 billion in higher prices and costs the US treasury as much as \$3 billion a year in lost taxes.¹⁰

The Jones Act restricts waterborne carriage between US ports to US-built, US-crewed, US-flagged and US-owned vessels. It costs up to 400 per cent more to ship grain from Tacoma, Washington, to Hawaii than it does to Japan. Consequently, Hawaii uses Canadian wheat to mill flour and Hawaiian cattle producers ship feeder cattle to Canada rather than import grain from the US mainland.

If the Jones Act were repealed, most of the expected economic benefits would be on the deep water non-contiguous routes. The projected benefits are primarily cost savings from the use of third-nation crews, construction and maintenance and service and price competition rather than from better space utilisation, scheduling or route rationalisations.

G. Trends in US Modal Shares' Costs and Energy Consumption

It should be noted that in terms of freight revenues as opposed to ton-miles, truck and air transporters have continued to gain market share at the expense of rail, water and pipeline since deregulation in 1980 (Table 5). A small percentage increase in the rail ton-mile share from a low of 35.2 per cent in 1978 prior to deregulation and other reforms was the result of rail capturing long distance bulk movements with its unit trains and the increase in movements. It was not due to rail increasing its share of revenue in the merchandise and general freight categories. What has happened is that shippers and carriers have responded to the rate and service adjustments made possible by deregulation. Shippers of high value and time-critical freight are frequently willing to choose truck or air carriers which involve higher rates. On the other hand, railroads have been able to respond by reducing rates to capture low value and/or bulk commodity movements from trucks. An excellent example of this is short-line movements of grain to interior river ports that had previously been moved by truck. Rail is inherently more efficient for many of these moves but was unable to compete due to institutional rigidities imposed by regulations. Also, as is noted later in the section on the development and growth of intermodal movements, rail is now moving a large amount of merchandise that used to be high revenue boxcar freight as low rate TOFC/COFC movements. This increase in long intermodal movements by TOFC/COFC is due to price competition and pricing flexibility that was not possible under regulation.

Table 5. Share by Mode of US Freight Market 1960-94

Year	Total (billion of \$)	Truck (%)	Rail (%)	Water (%)	Oil Pipe (%)	Air (%)
1960	47.8	68	19	7	2	1
1970	84.0	74	14	6	2	1
1980	213.7	73	13	7	4	2
1985	273.6	76	11	7	7	3
1990	351.9	77	9	6	2	4
1993	396.3	79	8	5	2	4
1994 ^a	420.5	79	8	4	2	4

^aPreliminary. Numbers do not add up to 100% because of other shipper costs.

Source: Computed from *Transportation in America* (Washington, DC: Eno Transportation Foundation, Inc., 1995, p. 40.

Table 6 (overleaf) shows the trends in US intercity tonnage by transportation mode. Note rail's share of tonnage has essentially stabilized near its 1980 level. However, all trucks increased their share of intercity tonnage from 36.3 per cent in 1980 to 44.9 per cent in 1994 at the expense of all modes but air.

Table 7 shows the trends in US intercity ton-miles by mode. Rail has recently been gaining share of ton-miles. The trend was essentially flat throughout the 1980s after rising from its all-time low of 35.2 per cent in 1978. Although not shown in Table 7, both regulated and non-regulated trucks lost market share of ton-miles after deregulation in 1980. Trucking recovered in the mid-1980s and now has its highest-ever share of ton-miles.

Table 6. Domestic Intercity Tonnage by Transportation Mode 1950-1994 (millions of tons)

Year	Rail	%	ICC Truck	%	Non-ICC Truck	%	Rivers/ Canal	%	Great Lakes	%	Coastwise	%	Pipeline	%	Air	%	Total
1950	1 421	46.7	213	7.0	581	19.1	191	6.3	170	5.6	183	6.0	284	9.3	.4	0.0	3 043
1960	1 301	36.1	387	10.7	794	22.0	291	8.1	155	4.3	209	5.8	468	13.0	.6	0.0	3 606
1970	1 572	31.1	681	13.1	1 167	23.1	472	9.3	157	3.1	238	4.7	790	15.6	2.9	0.1	5 060
1980	1 589	28.7	851	15.4	1 156	20.9	535	9.7	115	2.1	330	6.0	961	17.3	4.1	0.1	5 542
1985	1 553	27.5	850	15.1	1 281	22.7	535	9.5	92	1.6	310	5.5	1 019	18.0	5.8	0.1	5 646
1990	1 738	27.1	1 029	16.0	1 560	24.3	623	9.7	110	1.7	299	4.7	1 057	16.5	7.5	0.1	6 424
1991	1 728	26.7	1 060	16.4	1 624	25.1	600	9.3	103	1.6	295	4.6	1 048	16.2	7.4	0.1	6 465
1992	1 794	26.7	1 126	16.8	1 712	25.5	621	9.2	107	1.6	285	4.2	1 069	15.9	7.9	0.1	6 722
1993	1 805	26.0	1 247	18.0	1 814	26.1	607	8.7	110	1.6	272	3.9	1 082	15.6	8.7	0.1	6 946
1994	1 904	26.0	1 380	18.9	1 905	26.0	614	8.4	113	1.5	278	3.8	1 112	15.2	10.1	0.1	7 316

Source: *Transportation in America*, 1995, p. 46.

Table 7. Domestic Intercity Ton Miles by Mode 1950-1994 (billions)

Year	Rail	%	ICC Truck	%	Non-ICC Truck	%	Rivers/ Canal	%	Great Lakes	%	Pipeline	%	Air	%	Total
1950	597	56.1	66	6.2	107	10.1	52	4.9	112	10.5	129	12.1	.3	.03	1 083
1960	579	44.1	104	7.9	181	13.8	121	9.2	99	7.5	229	17.4	.89	.07	1 314
1970	771	39.8	167	8.6	245	12.7	205	10.6	114	5.9	431	22.3	3.3	.17	1 936
1980	932	37.5	242	9.7	313	12.6	311	12.5	96	3.9	588	23.6	4.84	.19	2 487
1985	895	36.4	250	10.2	360	14.6	306	12.5	76	3.1	564	22.9	6.71	.27	2 458
1990	1 091	37.7	311	10.7	424	14.6	390	13.5	87	3.0	584	20.2	10.42	.36	2 897
1991	1 100	37.7	320	11.0	438	15.0	387	13.3	84	2.9	579	19.8	9.96	.34	2 918
1992	1 136	37.5	342	11.3	473	15.6	397	13.1	85	2.8	589	19.4	10.99	.36	3 035
1993	1 183	38.0	365	11.7	496	15.9	381	12.2	86	2.8	593	19.0	11.54	.37	3 116
1994 ^a	1 275	38.9	391	11.9	517	15.8	386	11.8	88	2.7	608	18.6	12.70	.39	3 278

Source: Transportation in America, 1995, p. 44.

Table 8. US Transportation Costs and GNP 1960-1994 (billions of \$)

Year	Nation's Freight Bill	GNP	Freight Bill as a % of GNP
1960	47.8	515.3	9.3
1965	64.9	705.1	9.2
1970	84.0	1 015.5	8.3
1971	91.2	1 102.7	8.3
1972	97.2	1 212.8	8.0
1973	107.9	1 359.3	7.9
1974	116.0	1 472.8	7.8
1975	115.8	1 598.4	7.2
1976	133.4	1 782.8	7.5
1977	150.8	1 990.5	7.6
1978	172.9	2 249.7	7.7
1979	193.2	2 508.2	7.7
1980	213.7	2 742.1	7.8
1981	228.4	3 063.8	7.5
1982	222.1	3 179.8	7.0
1983	243.3	3 434.4	7.1
1984	268.0	3 801.5	7.1
1985	273.6	4 053.6	6.8
1986	281.0	4 277.7	6.6
1987	294.2	4 544.5	6.5
1988	313.0	4 908.2	6.4
1989	329.1	5 248.2	6.3
1990	351.6	5 567.8	6.3
1991	355.1	5 737.1	6.2
1992	375.1	6 025.8	6.2
1993	396.3	6 347.8	6.2
1994 ^a	420.5	6 726.9	6.3

^aPreliminary.

Source: Computed from *Transportation in America*, 1995, p. 38.

Table 9. Energy Usage Trends 1965-1993 (millions of barrels)

	Rail Freight	Per cent of US
1965	75.91	3.79%
1970	84.79	3.19%
1975	87.45	2.82%
1980	99.61	2.92%
1985	75.87	2.14%
1990	76.84	1.99%
1992	71.55	1.80%
1993	73.52	1.85%

Source: Transportation in America, 1995, p. 56.

Table 8 shows the US "Freight Bill" and GNP. It can be observed that freight costs as a percentage of GNP were relatively constant throughout the 1970s. However after deregulation a significant drop occurred which was followed by a gradual decline to current levels. That is since deregulation in 1980, the nation's freight bill as a percentage of GNP has declined by one-fifth from 7.8 per cent to 6.3 per cent.

Table 9 shows energy consumption trends for the two major modes of freight transportation in the United States. Note that rail freight now consumes less total energy (73M barrels) than in 1960 and that rail freight energy consumption peaked about 1980. On comparing Tables 7 and 9 observe that rail ton-miles more than doubled from the mid-1960s to 1993 but total fuel consumption declined. Specifically, rail ton-miles increased 27 per cent from 1980 to 1993 but total rail fuel use declined by more than a quarter.

H. NAFTA Trade Liberalisation and Deregulation Considerations

Historically, the domestic and international trading patterns of Canada, the United States and Mexico have basically had an East/West orientation. This was due to geographic features, the East/West orientation of the major US and Canadian railroads, domestic settlement patterns and historic trading patterns with their largest international trading partners. In spite of this East/West orientation, a large amount of trade (over \$180 billion at the time of the free trade agreement) flowed between the United States and Canada. In 1994 (before the collapse of the peso), two-way trade between the United States and Mexico and between Canada and Mexico was US\$76 billion and US\$2.5 billion, respectively. As a result of trade liberalisation this East/West orientation is likely to change and trading patterns and transportation infrastructure will take on more of a North-South orientation.

The US-Canadian Free Trade Agreement which started January 1 1989 gave a new impetus to the reduction of trade barriers and restrictions between the two countries. This agreement, as well as deregulatory initiatives, particularly in the rail and motor carrier modes, enacted by the Canadian government in 1986 resulted in easier access for new industry entrants. This, along with deregulation, reduced both trucking and rail costs between the two countries. The free trade agreement made possible the potential for reduced mini-bridge and land-bridge costs for containers and allowed Canadian ports such as Montreal, Halifax and Vancouver to compete effectively with US ports south of the border for containers and cargoes of either country.

The North American Free Trade Agreement (NAFTA) came into effect in 1994. This agreement opened trade and transportation possibilities between Canada, the United States and Mexico, creating a free trade area with 360 million people and a combined 1994 output of over \$6.0 trillion. Tariffs on industrial and agricultural goods of all three countries have either already been removed or will be phased out over five to ten years. Along with tariff elimination, NAFTA also has a timetable for the removal of barriers affecting the free movement of international cargo and passengers. Formal procedures have been established to develop uniform technical and safety standards for land transport modes in North America. Trilateral working groups of experts are considering motor vehicle standards and specifications, motor vehicle emissions and size, weight and dimensions, and technical standards and safety in railroads, and hazardous materials transportation.¹¹ Unfettered trade and cargo movement between countries will allow companies to change their distribution strategies including where their distribution centres are located. These changes in distribution centre locations and related business strategies have implications for trucking, rail, water, intermodal and air transport.

NAFTA ensures that US and Canadian railroads and intermodal companies will be able to build on previous informal agreements with Mexico. These agreements affect the ability to market services, operate unit trains, construct, own and operate terminals and to finance rail infrastructure. Examples of these have all occurred but progress has been slow since the 1995 Mexican financial crisis. Major infrastructure investments and joint US-Mexican rail operations are expected when *Ferrocarriles Nacionales de Mexico* (FNM) is privatised. Currently, as discussed in more detail in the US-Mexico agricultural trade section, US rail cars and sometimes unit trains are operated in Mexico. It is anticipated that both US and Canadian high speed container trains originating in Eastern Canada and the United States will move on Mexican railroads soon after, if not before, privatisation. NAFTA also opens up full investment and operating rights in Mexico's port facilities to US and Canadian companies.

Regarding motor carriers, it was intended that Mexican trucks be allowed in 1995 to carry their cargoes anywhere in the four border states of California, Arizona, New Mexico and Texas (as opposed to being limited to cities and counties adjacent to the border crossing). US trucks were also to get similar privileges at the same time. However, implementation was postponed by the United States due to concerns about safety. Despite this, truck traffic from Mexico to the US has increased 27 per cent in the last four years.¹²

There are legitimate short term motor carrier harmonisation needs. Mexico allows larger and heavier trucks (up to 80 000 pounds gross weight) to operate on its system while the US highway system is designed for vehicles of up to 80 000 pound maximum. However, US trucking firms are reluctant to let their lighter weight equipment operate in Mexico because of potential damage due to the poor infrastructure. According to the original agreement, by the year 2000, all restrictions on cross-border access are to be lifted and trucks from each of the three countries will be able to travel within each other's borders to deliver or pick up international cargo.

On the US-Canadian border, motor carrier efficiency due to NAFTA and deregulation has been obtained relatively quickly. US and Canadian motor carriers had access to operating rights across the border prior to the FTA. There are some harmonisation problems but these are as likely to be between Canadian provinces as between Canada and the United States. Cabotage restrictions on motor carriers in the US, Canada and Mexico have been basically identical regarding the ability of foreign-based carriers to transport cargo to a third country. However, it is worth noting that Canada negotiated a Memorandum of Understanding with Mexico in April 1994 that gives its carriers access to Mexico's frontier zone for the purpose of dropping off or picking up cargo.

There is a need for infrastructure improvement between the three countries if NAFTA is to result in transportation savings. For the United States and Canada, much of the infrastructure is in place although there is a need to constantly improve the corridors that will experience an increase in North/South transportation. It is anticipated that much of the infrastructure improvements needed between the United States and Mexico will be funded by private companies who will charge tolls (which will be established and enforced by the government) to pay off bonds and investors.

As noted earlier, it is expected that US railroads and other investors will invest in Mexico's railroads after privatisation. US railroads have been experiencing a 10-15 per cent increase in cargo to Mexico in recent years. As noted earlier, rail traffic between Mexico and Canada over US railroads is expected to increase. (Both major Canadian railroads have US subsidiaries that could conceivably merge with a US North/South road or obtain trackage rights or establish joint-line through trains.)

There will be major changes for ocean transportation as well. The increased competition between US and Canadian ports was discussed earlier. However, various restrictions have reduced marine transportation between Mexico and its two northern neighbours.

Although much of the increased trade due to NAFTA will be by rail or truck, especially to Northern Mexico, ocean transportation from Canada and the US to Central and Southern Mexico and the Yucatan will also grow.

Mexico's major seaports are along its Gulf Coast, reflecting the country's long established trade relations with Europe and the US Gulf ports. However, these ports have relatively shallow drafts and need major infrastructure improvement such as deeper channels, modern terminals (and improved rail and highway access).

One innovation resulting from NAFTA was that the Burlington Northern Railroad and a Mexican partner moved barges with 54 US rail cars from Galveston to the port of Coatzacoalcas where they were moved inland by the Mexican state railroad, FNM. This was prompted by the increased trade opportunities and more flexible investment rules resulting from NAFTA and as there were no apparent pre-NAFTA legal barriers to such a movement. However, although the venture appeared to be a technical success, it has been stopped at least temporarily because of Mexico's financial crisis and more efficient utilisation of the rail cars in the United States.

On the west coast, most of Mexico's trade is with Asia. The west coast ports are deeper but not as well developed. Since NAFTA, Canada has been exporting wheat from Vancouver to the west coast Mexican port of Lazaro Cardenas and the Gulf Port of Vera Cruz which are located near population centres such as Guadalajara and Mexico City. Previously, the United States had dominated Mexico's wheat imports, due to the proximity of its wheat growing areas to the Mexican border. Although US and Canadian agricultural interests are arguing about Canadian Wheat Board pricing and US Department of Agriculture Export Enhancement Program subsidies, this movement demonstrates the possibilities of expanded Canadian trade through Mexico's west coast ports and changes in trading patterns that occur after trade liberalisation. (Prior to 1991, CONASUPO, a government agency centrally purchased all the imported milling wheat so Mexican millers did not have the opportunity to multi-source wheat.)

For these changes in trading patterns to occur, some infrastructure development would be needed and some waterway specialists think that the US Inland Waterway should be expanded from Brownsville Texas and Matamoros as far south as the Mexican port of Tampico. This would effectively extend the US low cost shallow draft navigation system and connect cities like Pittsburgh, Chicago, and Pensacola,

Florida with north-eastern Mexico to take advantage of increased trade opportunities resulting from NAFTA.

Further efficiencies due to trade liberalisation are possible for maritime transportation. However, the NAFTA agreement did not include shipping and consequently did not abolish US cabotage laws. The US Jones Act continues to reserve all cargoes and passengers between two US ports for US-built, owned and operated ships. For example, this prohibits the Canadian lakers fleet from taking cargo between two US ports on the Great Lakes or entering into the US coastal trade.¹³

Other increases in transportation efficiencies due to NAFTA will include the relocation of business activities as companies look at North America as a single distribution region. Land-bridge and mini-land bridge opportunities will be exploited and transportation corridors will be developed or expanded. By land, Monterey, Mexico, is closer to Toronto than is Vancouver, British Columbia. The shortest rail route from Kansas City to Pacific tidewater is via the Mexican state railroad (FNM) to the port of Topolobampo (Los Mochis) on the Gulf of California and is 640 km closer than San Francisco. The NAFTA rules on foreign investment and ownership will allow foreign firms to make the necessary infrastructure investments to expand and/or exploit these routes. This routing would not be practical without removal of trade barriers and further harmonisation of rail transport, etc. Long term, this has implications for US grain and agricultural exports to Pacific Rim countries including those on the West Coast of South America (which is 1 760 km closer by water than San Francisco).

In the long run, relaxation of rules on ownership and investments in transportation and port infrastructure may result in Mexican ports on the Gulf of California with US rail connections being able to eliminate the need to transit the Panama canal and thus capture shipments that currently use US Gulf Coast ports.

I. Impact of Trade Liberalisation on Transportation of Grain from the US to Mexico and the Location of Livestock and Meat Production

Mexico is a unique export market for US grain because the Gulf of Mexico and land border with the United States allows a variety of transportation and delivery methods to be used. Trade liberalisation will impact transportation and transportation efficiency through increased volumes due to tariff and quota elimination. Inland grain terminals capable of handling unit trains of US grain were constructed in the state of Monterey in 1994. Further improvements and efficiencies are expected due the privatisation of the Mexican grain trade and other industries, the rationalisation and potential privatisation of FNM, the national railroad of Mexico, rail infrastructure improvements, and closer co-ordination with US railroads, the privatisation of ports, and port infrastructure improvements. These would include increasing depths to allow larger ships and construction of modern grain handling facilities to speed off-loading and transferring to rail or truck.

In the long-run, Mexico's grain trade with Canada will probably be influenced by long distance rail, rail-barge, or ship movements made possible by harmonisation of the three countries' transportation systems.

Currently, Mexico imports wheat by ocean vessel from Canada. Transparent borders for wheat and other bulk commodities will allow efficient rail movements directly between Canada and Northern Mexico and/or barge movement of Canadian or Mexican commodities on the Mississippi River. Although legal, such movements generally did not occur pre-NAFTA because of institutional factors such as the

Canadian Wheat Board's "inability to guarantee quality" if shipped via the United States, and such factors as property and/or import taxes on railcars used in both the United States and Canada.

Prior to NAFTA, historical trade patterns between the United States and Mexico included a significant amount of reciprocal trade in cattle, beef and related products. Mexico shipped feeder cattle to the United States, and imported beef, beef and veal meat, carcasses and related products. However, Melton and Huffman¹⁴ conclude that the long run effects of tariff elimination will be compounded by structural and technological changes with Mexico adopting US-style modern feedlots and meat packing plants while maintaining a labour cost advantage. They predict that low cost US grain, along with technology transfer, will boost beef production and change Mexico into a net exporter of processed beef to the United States rather than an exporter of live cattle and an importer of beef. Among their quantitative predictions, they expect Mexico's cattle herd to double in size from 8.4 to 16.6 million head while the US herd will fall by 13 per cent.

J. The Death of the Crow: Changing Trade Patterns on the Canadian Prairie

The original Crows Nest Pass Agreement of the late 1800s was forged for nation building and to encourage settlement. However, since at least the 1960s there has been general agreement among economists that the low export rates for agricultural products had distorted agricultural production and processing patterns. By 1980 grain rates were about 25 per cent of compensatory rates for similar hauls in the United States

As a result of the demise of the Western Grain Transportation Act in August 1995 (which was primarily due to the WTO agreement and not NAFTA) and trade liberalisation, changes in production patterns and trade flows will occur. These include:

- Expansion of livestock production and processing on the Western prairies. Meat products will move by truck or container from Western Alberta to the closest major markets -- California and the US Pacific Northwest. Produce from California and Mexico will be back hauled.
- The structure of the Canadian grain industry will be adjusted. Inland grain terminals will clean and process grain which was previously done only at the export ports. This meant that the approximately 5 per cent of the weight of the grain, consisting of weed seeds, chaff and dirt unfit for export had been moved across the continent at the below cost Crow rate.
- More grain will be exported to the US for processing. A major US flour miller is building an elevator for that purpose a few miles from the Canadian border in northern Montana.
- Canadian grain will be exported from the US Gulf ports depending on ocean and barge rates. Seven to 20 per cent of Canada's historic grain flows would have had lower transportation and handling costs if shipped south through Gulf Ports instead of east or west to Canadian ports. The primary route would include the Mississippi River, but the Canadian Pacific also has direct lines to Kansas City where a number of US railroads compete to move grain to Gulf Ports.

- Canadian grain interests are responding to potential US grain exporters competing on the West Coast by constructing a modern grain export terminal in British Columbia that can load unit trains directly into ships.

Consequently, although the impacts are just starting to be felt, the demise of the Western Grain Transportation Act will affect transportation and trade patterns throughout North America including rail, trucks, barges and ports. It appears that all these changes will increase economic efficiency and many will reduce transportation energy use and emissions.

K. Conclusions

Deregulation of the transportation industries in the United States has led to major improvements in operating efficiencies, service levels and, for the railroads at least, in profit levels. Improved transportation services have provided major benefits to the rest of the US economy as both transportation costs and inventory levels were reduced for most sectors of the economy.

Although not without controversy, it can be concluded that the results of deregulation, along with technological advances in transportation have been environmentally friendly. Less total energy is used by railroads than in 1980. Doublestack trains (and to a lesser extent roadrailers) have reduced energy and highway congestion. Motor carriers use substantially less energy per ton-mile than in 1980. Motor carrier equipment utilisation has improved and the use of truck-rail intermodal movements have reduced the motor carrier industries relative contribution to road and highway congestion.

There is no strong reason to conclude that removal of trade restrictions among the NAFTA countries should not lead to similar improvements in energy use. Equipment utilisation can be improved and traffic routes can be rationalised. Transparent borders will allow shippers to use the shortest and/or most efficient routes to tidewater. Low cost (and low energy) water routes such as the Intercostal Waterway and the Mississippi River can be used for goods originating in Mexico and Canada and shipped to the other countries of North America or world-wide. Finally, although the environmental impacts of transportation almost always increase with the volume of goods transported, it is possible that when trade is liberalised the environmental impact per unit of consumption will decrease due to the use of a more efficient mix of resources, technology and transportation.

REFERENCES

- Bureau of Transportation Statistics. North American Transportation. Prepared for The North American Transportation Summit. The US Department of Transportation. May 1994.
- Clifford Winston, Thomas Corsi, Curtis Grimm, and Carol Evans, The Economic Effects of Surface Freight Deregulation (Washington, DC: Brookings Institution, 1990).
- Glaskowsky, Nicholas A., Jr. Effects of Deregulation on Motor Carriers. Second Edition. Westport, CT: Eno Foundation for Transportation. 1990.
- Klindworth, Keith A. and Arne J. Martinsen. Shipping US Grain to Mexico. Marketing Research Report Number 630, Washington, DC: USDA/AMS/TMD, 1995.
- Leib, Robert C. Transportation, Fourth Edition. Dame Publications, Inc. 1994.
- Melton, B. and W. Huffman (1993), Implications of the North American Free Trade Agreement for Long-Term Adjustment in US-Mexican Beef Production and Trade. Center for Agriculture and Rural Development, Iowa State University, Ames, Iowa. Working Paper 93-WP 118.
- Muller, Gerhardt. Intermodal Freight Transportation, Third Edition. Lansdowne, VA: Eno Transportation Foundation and Intermodal Association of North America, 1995.
- Smith, Frank A. "Historical Compendium 1939-1985." Transportation in America: A Statistical Analysis of Transportation in the United States. Westport, CT: Eno Foundation, 1989.
- Teske, Paul, Samuel Best, Michael Mintrom. Deregulating Freight Transportation: Delivering the Goods. Washington, D.C.: The AEI Press, 1995.
- Traffic World, Various Issues 1995-96.
- US Department of Transportation, Federal Highway Administration, Landside Access for Intermodal Facilities, National Highway Course No. 15264, August 1995.
- Wilson, Rosalyn A. Transportation in America: Statistical Analysis of Transportation in the United States, Thirteenth Edition. Lansdowne, VA: Eno Foundation, 1995.

NOTES

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- ¹ A micro-land bridge is a through movement in which containerised cargo moves between an inland point and a port via rail or truck connecting with a ship for movement to or from foreign port on a single through bill of lading. A mini-land bridge is a coast-to-coast through movement of cargo (frequently in unit trains) across the US substituting for an all-water route through the Panama Canal.
- ² *Traffic World*, March 25, 1996, p. 39.
- ³ Clifford Winston, Thomas Corsi, Curtis Grimm, and Carol Evans, *The Economic Effects of Surface Freight Deregulation* (Washington, DC: Brookings Institution, 1990), p. 28.
- ⁴ John Ying, "The inefficiency of Regulating a Competitive Industry: Productivity Gains in Trucking Following Reform," in *Review of Economics and Statistics*, 72(1990): 191-201.
- ⁵ Winston, et al., p. 28.
- ⁶ *Traffic World*, February 19, 1996, p. 56.
- ⁷ Interstate Commerce Commission, *Small Community Service Study*, 1982. Cited in Teske, et. al., p. 79.
- ⁸ Citations in Teske et al, p. 81.
- ⁹ Leib, p. 58.
- ¹⁰ *The Grain Journal*, March/April 1996, p. 101.
- ¹¹ *Review of US-Mexico Environmental Issues*, p. 181.
- ¹² *Traffic World*, March 18, 1996, p. 8.
- ¹³ Recently legislation to exempt a major trade route (Puerto Rico) from the Jones Act was introduced in Congress. The stated transportation savings from exempting that trade are estimated at \$500M a year. *Traffic World*, March 21, 1994.
- ¹⁴ Melton, B. and W. Huffman (1993), *Implications of the North American Free Trade Agreement for Long-Term Adjustment in US-Mexican Beef Production and Trade*. Center for Agriculture and Rural Development, Iowa State University, Ames, Iowa. Working Paper 93-WP 118.