ENERGY

CONSERVATION

SAN-1176-T1(Vol.3)

ENERGY STUDY OF RAILROAD FREIGHT TRANSPORTATION

Volume 3: Regulation and Tariff

August 1979

Work Performed Under Contract No. EY-76-C-03-1176

Stanford Research Institute
Menlo Park, California

U. S. DEPARTMENT OF ENERGY

Division of Transportation Energy Conservation

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Price: Paper Copy $9.00
Microfiche $3.50

SAN-1176-T1(Vol.3)
Distribution Category UC-95f

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Prepared for:

U. S. Department of Energy
Systems Efficiency Branch
Transportation Programs Office

Stanford Research Institute
Menlo Park, California

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PREFACE

The Energy Research and Development Administration (ERDA)*, recognizing the need for an assessment of energy usage by railroad freight and passenger services and by rail transit systems, has sponsored the Energy Study of Rail Transportation as part of a comprehensive energy conservation program. The objectives of the study were:

- To describe rail transportation systems in terms of physical, operating, and economic characteristics; and to relate energy usage, services rendered, and costs.
- To describe the roles of private and public institutions in ownership, operation, regulation, tariff, and fare determination, and subsidization of rail transportation.
- To describe possible ways to improve efficiency.
- To provide data that the Government may use to determine its future role.

Work was organized in four tasks:

- Descriptions of rail transportation industries
- Regulation, tariff, and institutional relations
- Efficiency improvements
- Industry future and federal role

Results of the study are published in two report series of four volumes each, as follows:

ENERGY STUDY OF RAILROAD FREIGHT TRANSPORTATION:

Executive Summary, Volume I
Industry Description, Volume II
Regulation and Tariff, Volume III
Efficiency Improvements and Industry Future, Volume IV

ENERGY STUDY OF RAIL PASSENGER TRANSPORTATION:

Executive Summary, Volume I
Description of Operating Systems, Volume II
Institutions, Volume III
Efficiency Improvements and Industry Future, Volume IV

* The functions of ERDA have been transferred to the U.S. Department of Energy.

The Energy Study of Rail Transportation was performed by SRI International, Menlo Park, California, under Contract E4-76-C-03-1176. Ms. Estrella Romo and Mr. Richard Alpaugh of ERDA were the contract monitors. Dr. Robert S. Ratner was the project supervisor. Mr. Albert E. Moon was project leader and task leader for freight railroad studies. Mr. Clark Henderson was task leader for passenger rail studies.

This report is Volume III of the Energy Study of Railroad Freight Transportation, reporting on the results of Task 2 of the project. This report on railroad regulation and tariff was written by Stephen J. Petracek. A major contribution was made by Robert A. Nelson, an independent consultant. H. Steven Procter provided assistance in the operation of SRI's Long Run Average Cost Model and wrote Appendix B.

The Energy Study of Railroad Freight Transportation was completed at an earlier date. It has not been printed prior to this time because of delays in its review and so that it could be released simultaneously with its companion piece, the Energy Study of Railroad Passenger Transportation. While more recent statistics are available for some aspects of the study, the generalized conclusions drawn and recommendations made for energy conservation actions still hold. Technologies and practices are little changed and it is believed the report can be as useful in this form as if it were updated, which could only be accomplished at significant cost.

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I INTRODUCTION

Volume 1 of this report described the history of the railroad industry and pointed out that the number of separate companies, their monopoly power, and their trade and labor practices invited regulation by outsiders from the early days. Even though new regulations have been added over the years, few have been removed. Tariffs have been modified to fit a number of needs, not all of them economic.

The objective of this research (Task II) was to examine the effects of government regulation on the energy efficiency of railroad operations. In this report, we examine the development of railroad regulation in this country and briefly describe the governmental legislation, policies, and procedures that make up the regulatory environment within which the railroads must operate. We also examine the relationship among regulations, energy usage, and costs in three specific areas of regulation: long-haul rates, empty car distribution, and rates on low-density rail traffic.

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II SUMMARY

The regulation of U.S. railroads by government agencies has developed over more than a hundred years of legislative, judicial, and administrative activity. At present, the railroad industry is one of the most heavily regulated industries in the country. It is subject to federal, state, and local regulations, principally in the areas of rates, service and operations, accounting, financial practices, safety, and environmental protection. It is widely accepted that these regulatory controls have significantly influenced both day-to-day railroad operating procedures and long-range rail planning activities, including the development and implementation of rail technology.

Our examination of the impact of regulation on the railroads' use of energy focuses on three primary areas: (1) relationships within the current rate structure, (2) empty car mileage, and (3) rates on low-density traffic routes. The examination of historic data and the output of SRI's Long Run Average Cost (LRAC) Model indicate that government regulatory policies and practices can indeed influence the level of energy consumption by the railroads.

Regulatory policies and practices have caused the railroad rate structure to be developed in a way that seems to favor long hauls of many commodities. For certain commodities, rates do not vary at all over a span of more than 2,000 miles, although the output of the LRAC Model shows that length of haul is a major determinant of costs and energy involved in rail transportation. The analysis indicates that some long-haul rates are disproportionately low in relation to distance and appear to have risen less in relation to the cost and energy consumption levels than the average of rail rates. In many cases such rate relationships involve cross subsidy, which tends to obscure the true costs associated with the production of specific commodities. In effect, the regulated rate structure has been designed to encourage producers distant from markets and to create a greater demand for transportation and in turn a greater demand for energy.

The result of such a rate structure is a breakdown of the natural locational advantages of regional producers and a freer movement of goods between regions, as was intended by Congress. Although such a policy may have been appropriate at the time of its inception, and still may be, it clearly encourages the substitution of transportation outlays for other production outlays. To the extent that greater energy usage results, the policy probably ought to be reviewed.

Our examination shows that the transportation of empty freight cars by U.S. railroads requires a significant expenditure of energy. To a large extent movements of empty freight cars are an inevitable consequence of directional imbalances of traffic. Low rates on back hauls could in some measure lessen empty car mileage. Other factors that contribute to empty car mileage include specialization of equipment, patterns of freight car ownership, and the rules related to the disposition of empty freight cars. The ICC has influence over empty car mileage through its promulgation and enforcement of car service rules. Often, during periods of car shortages, the ICC has deliberately increased empty car miles in order to spread the adverse impact of the shortages. This practice, although it has "spread the poverty," has also increased the shortages. Recent emergency orders (1973) actually had the effect of shifting shortages from the West to the East. Another regulatory policy that tends to lessen efficiency in the use of freight cars is the ICC's reluctance to allow non-railroad car owners to contribute to the freight car fleet.

The present ratemaking policies have not allowed rail carriers to selectively raise or reduce the rates charged for the transportation of various commodities along low-density branch lines. Thus railroads are often forced to carry traffic that, from an economic and/or energy standpoint, should be transported by some other mode or not at all. In the long run, the capability to raise rates for branch-line service or to abandon low-density collection and distribution lines would tend to result in a centralization of industrial activity, thus substantially reducing the economic and energy costs associated with these services. In the short run, however, such changes could actually increase energy consumption because traffic movements may be diverted to a more energy-intensive mode.

III REGULATION OF U.S. RAILROADS

Regulation of U.S. railroads by various federal, state, and local government agencies has made the railroad industry one of the most heavily regulated industries in this country. It is generally conceded that government regulation of railroads has significantly influenced railroad operating procedures. It has also been suggested that government regulation has had a significant effect on the development and implementation of railroad technology.[1,2,3] Railroad operating procedures and technology, in turn, are major factors influencing railroad costs and fuel usage. In this section we present an overview of the government regulatory environment within which the U.S. freight railroads must operate. However, because the present regulatory policies and practices have developed over more than 100 years of legislative, judicial, and administrative action, it is impossible within the scope of this narrative to identify and describe each regulatory policy or practice. For this reason, we refer the interested reader to the cited sources for more detailed explanations.

A Historical Perspective

The development of this country's railroads represented a major advance in transportation technology. The construction and operation of the U.S. railroad system has been performed primarily by private companies. Federal, state, and local governments fostered these efforts through various incentives and offers of assistance, which were generally associated with certain restrictions or requirements. The railroad's acceptance of government incentives and assistance and the attendant stipulations and requirements probably represents the beginning of railroad regulation in this country.

Certainly the most notable of the government's incentives and assistance efforts was the federal land grant program that was active from 1850 to 1871. Under this program the federal government transferred the title

of certain defined portions of public lands to various railroad companies. At first the land was transferred indirectly through a state government, but after 1862 it was transferred directly to the individual railroad corporations. These land grants consisted of a strip of land for the railroads' right-of-way (generally 200-400 feet wide) as well as alternate sections of land for some distance on either side of the right-of-way (generally 6 to 20 miles on each side of the right-of-way). In total, 72 federal land grants were completed, which involved the transfer of 132 million acres of public land.[4] (An additional 17 land grants were forfeited because of failure to complete construction.)[5*]

The acceptance of government land grants was linked to the requirement that the receiving railroads were obliged to transport mail at 80 percent and government troops and property at 50 percent of the normal rate.[6†] These rate reductions also applied to non-land-grant railroads that desired to carry mail, government troops, or property; they remained in effect, with certain modifications, until 1945.

Other types of federal, state, or local government assistance to railroads included loans, bond guarantees and subsidies, tax exemptions, and stock subscriptions. State and local government assistance even included outright contributions of money, labor, materials, equipment, and securities. The acceptance of such government assistance often was tied to agreements stipulating such factors as railroad line location and frequency or level of service.

The early regulation of railroads also was incorporated into the various charters that granted authority for the organization of railroad corporations within the individual states. The structure of these charters was a form of regulation because they generally specified the railroad's construction schedule and the locations of both main-line routes and branch

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*Reference 5 indicates that the land grants involved 183 million acres valued at $178 million at the time the grants occurred.

†These rates varied because of different judicial interpretations of the land grant agreements (see Reference 5).

lines, junctions, or extensions. In addition, the early state charters often regulated the railroad's financial activities by stipulating such items as the amount of capital stock that could be issued, the price per share, the distribution of dividends, the liability of stockholders, the issuance of annual reports, and the railroad's money-borrowing limits. Some state charters even attempted to regulate railroad rates by specifying maximum rates for passengers and freight and by attempting to limit railroad earnings to a percentage of capitalization.[6] However, most early attempts to regulate railroads through charter provisions were ineffective for a number of reasons, such as the nonuniformity of the various charters issued by the states, the difficulty in modifying charter provisions to account for changing circumstances, and the general lack of adequate supervision or enforcement.[7]

Some states attempted to regulate railroads through the passage of general laws or statutes dealing with the safety of rail travel, railroad taxes, and the issuance or transfer of secutities, and through the establishment of state regulatory commissions. In the late 1830s and 1840s, railroad commissions were established in some New England states.[7] These commissions were charged with enforcing railroad safety laws and investigating compliance with railroad charters. However, these early commissions had little or no power over rates and very little actual control over railroad operations.

By and large, most attempts by state and local governments to regulate rail commerce before 1870 were ineffective, primarily because of the lack of overall regulatory policy direction, scope, and enforcement. The granger laws passed by various states in the Middle West between 1871 and 1874 probably represent the first major attempt to enact a comprehensive system of railroad regulation. These laws established state regulatory commissions that subsequently served as models for the development of the Interstate Commerce Commission (ICC). In addition, the various granger laws established maximum rate limits, dealt with location and short- and long-haul rate discrimination, and forbade the consolidation of competing railroads. The granger laws also established nontrivial penalties for extortion and unjust rate discrimination.

The granger laws and other state regulation of railroads were subsequently challenged in the courts, and the decisions in a number of cases upheld the government's right to regulate commerce that affected the public interest (see Munn v. Illinois, 1876). However, in the case of the Wabach, St. Louis and Pacific Railroad Company v. Illinois (1886), the Supreme Court ruled that interstate commerce could be regulated only by the federal government. The granger laws and other state regulatory efforts, in conjunction with their subsequent judicial review, forced Congress to increase its role in the regulation of railroads. Prior to 1887 the federal government played a fairly minor role in regulating railroads. However, in that year, Congress passed the Act to Regulate Commerce, which established the ICC and regulated such railroad practices as rate establishment, personal discrimination, undue preference or prejudice, pooling, and rate publication.

The 1887 Act to Regulate Commerce was a foundation piece of legislation that has been modified numerous times by such acts and amendments as the Elkins Act of 1903, the Hepburn Act of 1906, the Mann-Elkins Act of 1910, the Panama Canal Act of 1912, the Valuation Act of 1913, the Emergency Transportation Act of 1933, and the Transportation Acts of 1920, 1940, and 1958. The development of new legislation, the changing membership of the ICC, changes in public policy, the country's economic environment, the development of new transportation technology, and the judicial review of the ICC's administrative activities have been major factors in the evolution of the regulatory structure to its present form.

The ICC and the enabling legislation were originally structured to prevent railroad rate discrimination against the more settled regions of the country, particularly in the Midwest. This direction in regulatory practice was a compensating measure to protect older regions against the too rapid growth of new regions stimulated by federal support. Public sentiment against big business monopolies also manifested itself in the "trust-busting" activities of the early 1900s and, in particular, the passage of the Sherman and Clayton Acts.)

This direction in railroad regulation prevailed until 1920. However, for the first 10 to 15 years after the passage of the original 1887 Act to Regulate Commerce, ICC's capability to implement and enforce such regulation

was severely inhibited by the Supreme Court's interpretation of the legislation. Prior to 1906, the ICC generally acted as an investigative body, and, although it was moderately successful in controlling discrimination and pooling, it was unable to control effectively railroad rate increases and the massive financial manipulation and organizational restructuring that occurred at that time. The passage of the Elkins Act of 1903 and the Hepburn Act of 1906 strengthened the ICC's regulatory control by giving it authority to monitor and enforce regulation in such areas as rate discrimination, maximum rates, accounting procedures, and the transportation of commodities produced and owned by the railroads.

The ICC's authority was further strengthened by the passage of the Mann-Elkins Act of 1910, which allowed more control over rate making. From 1906 to 1917 the ICC was able to restrict more effectively rates and discriminatory practices.

The passage of the Transportation Act of 1920 marked a dramatic modification of the basic philosophy of railroad regulations. This act was the first major piece of legislation designed to regulate the U.S. railroads as a system rather than as separate and competing corporate entities. The act recognized that the economic reality that enforced competition between railroads could be "ruinous," and that, in the long run, the public interest would suffer from such regulatory policies. From 1920 on, railroad regulation was patterned, to a great degree, after public utility regulation, with a greater sensitivity to the railroads need for a fair rate of return. This general philosophy of railroad regulation was reinforced by provisions of the Emergency Transportation Act of 1933 and the Transportation Act of 1940. The 1940 act, however, went further in that Congress, for the first time, recognized the intermodal nature of the U.S. transportation system and, based on this recognition, declared a national transportation policy that acknowledged that regulatory practices and procedures had to consider the special characteristics of the individual modes and the competition between them. The most important legislation related to railroad freight regulation since 1940 has been the Transportation Act of 1958 and the 4R Act of 1976. Both acts amended the ratemaking policy stated in Section 15a of the Interstate Commerce Act.

The Present Regulatory Environment

The regulatory environment within which the railroads operate has developed or evolved over a century of legislative, judicial, and administrative activities. In general, regulations that directly affect railroads are promulgated and administered by a number of government agencies attempting to implement legislative transportation policies and programs and are subject to judicial review. The ICC presently administers the major portion of significant railroad regulation. However, railroads are also directly regulated by the Federal Railroad Administration (FRA), state regulatory commissions in 47 states, and regional and local agencies. In addition, railroads, like other businesses, are subject to regulation by such government agencies as the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA), which are not solely concerned with transportation regulation. Thus railroads probably make up the most comprehensively regulated industry in the country.

Railroad regulations affect the following major aspects of rail transportation:

- Rates
- Service and operations
- Accounting procedures
- Finances
- Safety
- Environment.

These areas of regulation often overlap, and regulatory action in one area often requires the modification of regulations in another area. For example, the regulation of railroad rates fostered the regulation of railroad financial and accounting practices. In addition, the regulation of railroad rates is inexorably intertwined with the regulation of railroad services. We briefly describe below the extent of railroad regulation in these major areas.

Rate Regulation

The regulation of railroad rates and charges is primarily handled by the ICC.* This regulatory activity has probably required more of the ICC's time and effort than any other phase of regulation. A major portion of the Interstate Commerce Act is concerned with rate regulation. The ICC has been directed by Congress to prescribe just and reasonable rates and to ensure that rates are not discriminatory or preferential and that overall rate levels provide sufficient earnings to the carriers. Before 1920, the ICC's regulatory practices were generally intended to prevent monopoly practices by the railroads in setting rates. Since that time, however, the general policy of rate regulation has been oriented toward developing and maintaining carrier stability.

The mechanism of ICC rate regulation generally takes the following form: A railroad, group of railroads, or rate bureau must file a proposed rate at least 30 days before it becomes effective. The proposed rate may be reviewed by the ICC. If it is not, which is the case over 90 percent of the time, the rate goes into effect as filed. The ICC examines proposed rates at the request of shippers or other carriers, as well as on its own volition. It may disapprove a rate if it is judged unreasonable or unlawful, or it may suspend a rate for up to seven months.

Rail carrier rate proposals are either (1) general or across-the-board rate increases or (2) rates on individual commodities or specific transportation services. General or across-the-board rate proposals normally are used to raise the general level of rates in order to increase the carriers' overall earnings. Since 1950 most general rate proposals have been in response to rising costs, inflation, and depressed earnings. The ICC evaluates such proposals on the basis of whether or not rate levels are "reasonable" and whether the carriers need the revenues. Although no specific definition of what constitutes a reasonable level of rates has yet been developed+ the ICC will generally consider the

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*Various state commissions regulate certain intrastate rates.

+It has been the subject of a recent ICC investigation--Ex Parte No. 271.

economic condition of the railroads requesting the general increases, how the increase will affect the competing carriers, and the effects of the rate increases on particular industries, geographic areas, or the national economy. Thus, even if the requesting railroads are in very poor financial shape, a request for a general rate increase may be denied because of its potentially adverse effects on other elements of society or the economy. Recently, however, most requests for general rate increases have been approved by the ICC (although such requests are often reduced or modified).

In recent years, railroads have tended to increase the general level of rates and to decrease the rates on specific commodities or commodity groups, although individual rate increases also occur. The ICC is empowered to specify minimum rates, maximum rates, or exact rates. The ICC's review and control or rates are based on the outlays involved in supplying service, the demand for service, and public policy. The Rule of Rate Making (Section 15a of the Interstate Commerce Act) was significantly amended by the 1976 4R Act. The amended section establishes a policy of setting rates that are adequate to produce revenue levels that cover total operating costs and that do not protect the traffic of other modes or carriers:

> With respect to common carriers by railroad, the Commission shall, within 24 months after the date of enactment of this paragraph, after notice and an opportunity for a hearing, develop and promulgate (and thereafter revise and maintain) reasonable standards and procedures for the establishment of revenue levels adequate under honest, economical, and efficient management to cover total operating expenses, including depreciation and obsolescence, plus a fair, reasonable, and economic profit or return (or both) on capital employed in the business. Such revenue levels should (a) provide a flow of net income plus depreciation adequate to support prudent capital outlays, assure the repayment of a reasonable level of debt, permit the raising of needed equity capital, and cover the effects of inflation and (b) insure retention and attraction of capital in amounts adequate to provide a sound transportation system in the United States. The Commission shall make an adequate and continuing effort to assist such carriers in attaining such revenue levels. No rate of a common carrier by railroad shall be held up to a particular level to protect the traffic of any other carrier or mode of transportation, unless the Commission finds that such rate reduces or would reduce the going concern value of the carrier charging the rate. [1976 4R Act, Sec. 205]

The actual expenses of carrying any individual commodity depends on many factors such as weight, loading characteristics, susceptibility to loss and damage, value of the commodity, volume and regularity of movement, special services and equipment required for the commodity, and the distance of haul.

Besides the out-of-pocket expenses associated with carrying a given commodity, the fixed expenses of the railroad must be distributed among railroad traffic. Congress has fostered the distribution of fixed expenses based on the value of service or the demand for service. Thus a greater percentage of rates on commodities for which demand tends to be inelastic are generally attributed to fixed expenses than are the rates for low-valued commodities.

The ICC also considers public policies such as military policy, foreign trade, natural resource utilization, and industrial location when examining rate proposals. In fact, one of the major reasons for regulating rates is to develop and maintain a set of rate relationships which are as a matter of public policy acceptable. In order to regulate these relationships in the public interest, the ICC has been given power to control differences between rates. These differences may be based on the commodity, the places between which the rates apply, the "person" paying the rates, and distances on the same line. When the ICC finds that these differences are unduly large or small, they declare them to be discriminatory and unlawful.

Place or geographic discrimination results from undue rate differentials between places. This may result from differences in the expenses of handling traffic, or from lack of competition on one route as compared with another.

Commodity discrimination is where differences in rates between commodities are held to be undue. It should be noted that value-of-service pricing results in rate differences that may not reflect differences in operating expenses. To the extent that the ICC has approved value-of-service pricing, rate differences will not be held to be unlawful and indeed may be preserved by the ICC.

Personal discrimination involves charging different rates to different shippers in like circumstances. Such differences in rates have been narrowly defined, but rigorously prohibited by regulation.

Section 4 of the Interstate Commerce Act prohibits railroads from practicing long- and short-haul rate discrimination, making it unlawful for railroads to "receive any greater compensation in the aggregate for the transportation of passengers or of like kind of property, under substantially similar circumstances and conditions, for a shorter than for a longer distance over the same line or route in the same direction, the shorter being included within the longer distance." However, ICC is empowered to grant railroads relief from this "Long and Short Haul Clause," subject to the following conditions:

- The reduced through rates covered by Fourth Section Relief must be reasonably compensatory.
- Relief will not be granted to meet potential rather than actual water competition.
- When relief is granted to a circuitous route, higher charges will not be allowed at intermediate points on the circuitous line where distances are not greater than the through distance via the direct line.

The ICC can control rate discrimination through its review of railroad rates and by specifying and requiring that carriers publish rates, adhere to these rates, and collect charges in a reasonable time; give advance notice of rate changes; and open rates to public inspection. Furthermore, the ICC has declared that rebates are unlawful, and both parties are liable. The rise of intermodal competition has tended to diminish the incidence of rate differences not related to operating expenses and hence the occurrence of discrimination.

Service Regulation

The regulation of the railroads' rate structure is closely related to the regulation of the services offered to shippers. The development and specification of a shipping rate must be based on a clear definition of the type and level of service required. Therefore, the ICC regulates

service for interstate traffic and the state commissions regulate service for intrastate traffic. We briefly describe below the major areas of railroad service regulation.

Basic Railroad Service Requirements[7]

Railroads, as common carriers, are required by law to provide and furnish transportation upon reasonable request. Within the limits of their bidding out as common carriers, railroads cannot refuse to receive and transport shipments. Railroads are not required to haul circus trains, and, if they do, they may impose contract limitations on their liability. They may also refuse to transport explosives or other freight that may damage railroad equipment or other freight; valuable items, such as bank bills, coin, currency, deeds, drafts, notes, jewelry, precious stones, antiques, silverware, or goldware; and individual shipments that are improperly packaged and unsafe for shipment. In addition, railroads cannot be compelled to accept shipments that result in violations of the law, such as shipping alcoholic beverages into areas where they are prohibited, or whose safe transportation is jeopardized by strikes, floods, or other unusual conditions, such as when traffic volume exceeds the carrier's handling capability.

Supply of Cars and Equipment[7-9]

The Transportation Act of 1920 invested the ICC with the power to control the supply of railroad cars and equipment; subsequent legislation and judicial review have modified this power. The railroads are obliged to furnish an adequate supply of cars and locomotives to meet the demand for transportation services. Shippers have been able to collect damages if this condition is not met. This requirement extends to special cars and equipment, as well as boxcars, if there is sufficient demand for such equipment. For example, railroads are required to provide refrigerator cars for perishable products, car heaters or other protective equipment if a commodity needs to be protected from freezing, and grain doors for grain cars. The ICC and the courts have not held the railroads liable for their failure to provide cars when there is an unexpected demand for them.

The ICC also attempts to control car supply through the distribution of freight cars. To this end, the ICC may require the filing of car service rules. In addition, the ICC's Bureau of Service, acting through the Association of American Railroads (AAR), regularly monitors freight movement and car supply and often issues service orders in an attempt to distribute cars most effectively to meet the demand.

The establishment of per diem and demurrage rates by the ICC can have a significant effect on the supply of available freight cars. Originally the ICC could not manipulate per diem rate levels to foster improved car utilization and efficiency. Instead, the commission was supposed to establish per diem rates that compensate the car owner for the use of his equipment. The ICC's failure to establish reasonably compensatory per diem rates can significantly affect the railroads' investment in new equipment and therefore influences future railroad freight car supply. Since 1966, however, the ICC has had the authority to establish and use per diem rates as an incentive for the prompt return of cars to the owning railroad. In a similar manner, the ICC can modify demurrage rates to foster the rapid return of cars from industry to the railroads.

Pickup and Delivery[7-9]

In many cases a number of possible rail routings are available over which a shipment may be transported. In such cases, carriers are obligated to inform shippers of the reasonable routes available, and shippers have the right to select the routings. If the carriers are notified in writing of shippers' preferred routes before shipments are delivered, they are obligated to use that routing. Carriers are liable if their failure to observe specified routings results in lost or damaged shipment, or if consignors or consignees incur damages.

If shippers do not specify routes, carriers are generally obligated to transport freight by the most economical, lowest-rate routes. If carriers do not charge on the basis of lowest-rate routes, they are guilty of misrouting and are liable for excess freight charges. There

are several exceptions to this rule, however. For example, if a carrier has a higher rate than a competing railroad, it is not obligated to hand over an originating shipment to its competitor.

Diversion and Reconsignment[5-7]

Related to the shipper's control of car routing is the special service of diversion, which is offered as an additional charge to the normal transportation rate. This service, also known as reconsignment, allows a change in the destination or billing of a shipment while it is en route. This service allows the consignment of freight in transit to the most favorable market.

The ICC originally treated reconsignment as a privilege offered by the railroads to shippers on a voluntary basis. At present, however, the ICC views the denial of this service as unreasonable and requires its establishment or continuance unless the service involves a back-haul, at which time it is discouraged.

Transit Privilege[5-7]

Transit privilege is the practice of allowing a shipment to be processed while en route from the consignor to the consignee. An example of a transit privilege is the common practice of stopping grain shipments at intermediate points for cleaning, grading, milling, or mixing. Such practices are subject to little additional regulation by the ICC except to ensure that the offering of the service is not discriminatory.

Loss and Damage[7,9]

Railroads, with few exceptions, are liable for any loss or damage of a shipment, up to the full value of the shipment. If two or more carriers participate in the transportation of a shipment on a through bill of lading, both carriers are liable to the consignor or consignee.

Emergency Service Regulations[5-7]

During times of emergency, such as extreme car shortages or traffic congestion, the ICC can utilize special service regulatory powers, such as:

- Suspension of railroad car service rules
- Requirement for pooling of equipment
- Requirement for joint use of terminals
- Routing rail traffic to avoid congestion
- Establishment of embargoes and commodity priorities
- Establishment of car supply requirements.

Commodities Clause[9]

A portion of the Hepburn Act of 1906 prohibited railroads from transporting any articles (except lumber) that they produced or owned, unless such articles were being transported for the railroad's own use. This section of the Hepburn Act became known as the "commodities clause" and originally tended to keep railroads out of manufacturing, mining, and other activities that competed with similar production activities that relied on railroad transportation. Court decisions involving the relationships between railroad companies and their holding companies and subsidiaries have greatly diminished the actual effectiveness of this clause.

Joint Use of Terminals[5-10]

The ICC may order a railroad to allow another railroad to use its terminal facilities if such use is in the public interest, is practicable, and does not substantially impair the ability of the owning railroad to handle its own business. The conditions of use may include the joint use of the main-line track for a reasonable distance beyond the actual terminal facility. The railroad that owns the terminal is entitled to compensation for such joint use. If the carriers cannot agree to the terms of compensation, the ICC may determine the terms.

Pooling[6,7]

The term "pooling" refers to an agreement between railroads to divide competitive business. Regulatory policy and legislation before 1920 discouraged the pooling of traffic or money by railroads. Since 1920, however, pooling has been legal when authorized by the ICC. Pooling is generally permitted only when it does not unduly restrain competition. The ICC can use pooling agreements to stabilize rates and prevent ruinous competition between railroads. However, pooling agreements have been used primarily to eliminate wasteful duplication of services.

Entry[5-10]

The ICC must approve the entry of new firms into the railroad industry or of existing railroads into new markets through the construction of new lines. The ICC's regulation of entry is no longer a significant element of control, however. Very few railroads have applied for new certificates of public convenience and necessity since the 1920s and there has been very little new railroad construction since that time.

Abandonment[7,9]

Railroads must obtain ICC approval before abandoning all or any portion of way facilities. ICC approval is not required, however, for the abandonment of spur tracks, switching tracks, industrial sidings, or side tracks within a state.

Combination and Control[9]

The acquisition, merger, or control of a railroad or a portion thereof by another railroad is subject to ICC approval. In deciding whether to approve such actions the ICC considers (1) the effect on adequate service to the public; (2) the effect on the public interest of the inclusion of, or failure to include, other railroads in the territory; (3) the total fixed charges resulting from such action; and (4) the interest of the railroad employees affected, so that for a period of four years from the effective date of authorization, the employees will not be in a worse position with respect to their employment.

A new administrative process has recently been developed to control and plan railroad merger and consolidation activities more effectively.

Intermodal Ownership and Control[8,9]

Several legislative barriers to intermodal ownership and operation have been developed to prevent monopolistic or oligopolistic control of the nation's transportation system. Perhaps the earliest barrier was a result of the Panama Canal Act of 1912, which prohibited railroad control of common water carriers operating through the Panama Canal. The act also prohibited railroads from owning or leasing any other water carriers unless such action did not prevent the water carrier or carriers from being operated in the public interest, to the advantage of commerce and the convenience of the public, and did not exclude, prevent, or reduce competition on the water route under consideration.

The ICC also regulates the acquisition and control of motor carriers by railroads. Such intermodal ownership and operation is allowed only if it is consistent with the public interest, enables the railroad to use motor vehicle service to the advantage of the public, and does not unduly restrain competition. In interpreting the enabling legislation, the ICC has developed several types of restrictions for railroad-controlled motor carrier operations.* Such operations must be of an auxiliary and supplemental nature to the railroad's own operations and limited to points that are rail stations. In addition, the ICC can limit these operations by prohibiting service between certain locations called "key points."

All contractual agreements between the railroad and the motor carrier must be reported to the ICC. These agreements are subject to revision by the ICC to ensure that they are fair and equitable to both parties. The ICC can also reverse or modify past approvals, as necessary, to ensure the auxiliary and supplemental nature of the service even under changing conditions.

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*These restrictions do not apply to many railroad-controlled motor carrier operations established before the passage of the Motor Carrier Act of 1935.

Compulsory Construction

The ICC has the authority to require railroads to construct and operate switch connections to shippers' private sidings. The railroads, however, cannot be required to construct the private sidings themselves, and the construction of the switch connection must be reasonably practicable and located where it can be safely constructed and operated, and it must furnish sufficient business to justify its construction and maintenance. The ICC can determine the appropriate compensation for railroads that are required to construct and operate such switch connections.

The ICC can also require the construction of track facilities to facilitate interchange operations. However, such construction can be required only if the volume of interchange traffic warrants the expenditure and the resulting interchange facilities do not divert competitive traffic from one railroad to another.

The Transportation Act of 1920 theoretically gave the ICC the power to require railroad line extensions. Such extensions must be in the interest of public convenience and necessity, and the expense of such extensions must not impair the ability of the carrier to perform its duty to the public. The ICC has required such a line extension only once, and this action was set aside by the courts. The court decision in this case drastically limited the ICC's authority to require line extensions by stating that the ICC cannot require railroad line extensions into new territory.

Accounting Procedures Regulation[7]

The regulation of railroad rates and operating procedures presupposes a thorough knowledge and understanding of the economic and financial state of the industry. Thus the establishment and control of railroad accounting procedures is an important aspect of government regulation. In fact the structure of the railroad's accounting system (and the information available from it) can significantly affect the development and implementation of other regulatory practices.

This fact was recognized to a certain extent by the 1887 Act to Regulate Commerce, which authorized the ICC to require annual financial reports from the carriers and to establish a uniform system of accounts. However, the ICC did not establish a uniform system of accounts, and the enforcement provisions of the original act were so weak that any such attempt would probably have ended in failure. The Hepburn Act of 1906 changed this situation by establishing penalties for failing to make reports or for falsifying them. The Hepburn Act also empowered the ICC to require carriers to submit monthly and special reports and to keep accounts in a format specified by the ICC. In 1907 the ICC, in conjunction with the Association of American Railway Accountants, established a standard railway accounting system. This system was revised extensively in 1914 and has been modified a number of times since then.

The primary reason for the regulation of railroad accounting procedures is to insure that accurate records of operating expenses, depreciation expenses, taxes, plant and equipment investments, and the like are available for use as the basis for railroad rates and financial regulation. By specifying the accounting system, the ICC has some control over the type and reliability of the financial information it receives.

Regulation of railroad accounting procedures also allows the ICC to establish a uniform system of accounts to be used by all railroads. Before regulation, railroads used various accounting procedures based on their own preferences and/or various state regulations. A uniform accounting system enables the ICC to compare the financial performance of two or more individual railroads and to examine railroads as a whole or in groups, as is necessary since rate regulation is often instituted on an industry level. If railroad accounts were not kept in a uniform format, such aggregation would be more difficult.

Regulation of railroad accounting procedures is useful for several other reasons. It enables the ICC to distinguish between operating and capital expenditures and to control valuation of railroad property. It also enables the ICC to distinguish between carrier and noncarrier business. Regulatory policy is to some degree based on the premise that

regulated industries are entitled to a fair rate of return on investment. For regulatory evaluation purposes, therefore, it is imperative that a company's investments, expenses, and revenues be segregated on the basis of whether or not they are associated with regulated business operations.

Financial Regulation[7-10]

Many complaints about railroad operations in the late nineteenth and early twentieth centuries were concerned with such financial practices as watered stock, excessive payment of dividends, overcapitalization, and inflated construction costs. The financial activities of the railroads were first subject to regulation with the passage of Section 20a of the Transportation Act of 1920. Section 20a has been subsequently amended, and the passage of Section 20b in 1948 has further revised the regulation of railroad financial practices. Most state regulatory commissions can influence railroad financial activities, although their powers are certainly less influential than those of the ICC.

The regulation of railroad financial practices is primarily concerned with controlling the capitalization and capital structure of the railroads. The term "capitalization" refers to the amount of stock and long-term debt outstanding; the term "capital structure" refers to the composition of a company's capitalization, that is, the proportion between debt and equity that make up the capitalization.

Both the level and structure of railroad capitalization can affect railroad rates and service quality. For these reasons they are areas of concern for both the ICC and state regulatory agencies.

Although this narrative primarily describes the regulatory powers of the ICC as it has primary jurisdiction in the area of regulating interstate railroad financial activities, the states generally are given an opportunity to intervene on behalf of the state or its citizens. For example, whenever a railroad files an application with the ICC to issue securities, a copy of the application is sent to the govenor of each state where the railroad operates. In addition, state securities commissions usually regulate the financial activities of intrastate railroads.

The ICC has significant control over the level of capitalization of the railroads subject to the Interstate Commerce Act. No securities may be issued by these railroads unless the issue is approved by the ICC. The commission has great latitude in evaluating the railroads' applications to issue securities and has the power to attach terms and conditions to its approval. In order to allow railroads the freedom to meet current financial requirements quickly, the ICC allows railroads to issue short-term notes (notes maturing in two years or less) without commission review and approval unless such notes, along with all other outstanding notes maturing within two years, account for more than 5 percent of the par value of all of the railroad's outstanding securities.

In the past, the ICC often denied or limited the issuance of securities to prevent overcapitalization. However, if new securities are to be issued to raise funds for needed improvements, the issuance cannot be denied solely because it would result in overcapitalization. The ICC can deny an application to issue new securities if the funds are to be used to reimburse the railroad's treasury for previous capital expenditures. This action tends to reduce the level of capitalization, although the regulation of security issues is less effective at reducing overcapitalization than at preventing its occurrence.

The ICC uses its regulatory powers to prevent not only overcapitalization but also stock watering or the issuance of securities without a more-or-less equivalent increase in assets. In the area of new construction or improvements, the ICC has prevented the capitalization of expenditures that were not properly chargeable to the investment in road or equipment accounts. The ICC has also denied the issuance of new securities to pay for construction work when it judged the charges for that work excessive. The commission also attempts to prevent overcapitalization and stock watering during consolidations or acquisitions. The sale of securities below par also causes stock watering, and this practice is prohibited by the laws of many states. The issuance of stock dividends also can be considered stock watering. The commission regulates such issuance only when the dividends represent a reinvestment of earnings in capitalized

assets and a substantial uncapitalized surplus exists. The regulation of dividend payments can be used to reduce overcapitalization as well as to control stock watering.

The ICC requires that new securities be sold through competitive bidding, but it will make exceptions to this practice depending on market conditions. Besides controlling the issuance of securities, the ICC regulates railroad indebtedness. This is an important power because funded debt is a major element of the railroads' total capitalization. The regulation of both securities and indebtedness allows the ICC some control over the level and structure of the railroads' capitalization. However, except in the extreme case of reorganization, regulators have often had little control over railroad indebtedness. Several states have established a ratio of bonds to stock that may not be exceeded by railroads. The ICC can restrict the amount of bonds issued by a railroad and can rule that securities should be issued instead of stock, although this is not a realistic approach at present and has run into significant opposition from the railroads. When approving bond issues, the ICC can require certain conditions, such as the redemption of bonds prior to maturity or the use of sinking funds.

The regulation of stock and bond issues has generally had diminishing effectiveness on railroad finances since the 1930s. Since that time, the regulation of railroad reorganizations has had much greater impact on railroad financial activities. Financial reorganization of a railroad is the most drastic and generally the most effective way of changing the level and structure of a company's capitalization. The 1933 passage of Section 77 of the Bankruptcy Act has caused the heavy involvement of the ICC in such reorganizations. The railroad must file a plan of reorganization with both the court and the ICC within six months after court approval of a petition for reorganization. Trustees, stockholders, creditors, and other interested parties may also file reorganization plans. The ICC reviews the submitted reorganization plans (a process that includes public hearings) and approves a reorganization plan that may or may not be one of the submitted plans. The plan approved by the ICC must be compatible with the public interest and be fair and equitable, and the fixed charges of the plan must be within the earning capacity of the reorganized railroad.

The ICC can exercise a great deal of discretion in the development and approval of a plan for reorganization. (Such plans must also be approved by the court and by creditors and stockholders representing two-thirds of the company's capitalization.) The plans approved by the ICC are based on limiting the reorganized company's capitalization in relation to conservative estimates of future earnings, not property valuations. The ICC has little control over the priority ranking of claim settlements. Under the Boyd Rule, the creditors' claims must be settled in order of priority and before giving any compensation to the stockholders.

Safety Regulation

One of the major objectives of any transportation system is the achievement and maintenance of a fairly high level of safety. To ensure that an acceptably high level of safety is maintained, various government agencies have been given the responsibility of regulating the safety of the different transportation modes. Railroad safety is regulated principally by the FRA, which exercises jurisdiction over such areas of railway safety as track maintenance, inspection and equipment standards, locomotives, signals, safety appliances, and power brakes.

One of the major roles of the FRA is the investigation and summarization of train accidents and accident trends. To support this task railroads are required to file monthly accident and incident reports with the FRA. The FRA reviews new equipment designs and inspects prototype equipment to ensure that the purpose, intent, and requirements of the Safety Appliance Act are met and to uncover potential hazards that might exist in new and untried designs. The FRA has the authority to require that railroads install and utilize specified equipment designed to increase or enhance safety and has established equipment safety standards that affect the use and maintenance of railroad equipment.

The FRA can also require that railroad operating procedures that are judged unsafe or hazardous be modified or eliminated. The FRA is also responsible for the enforcement of the Hours of Service Law, which limits the allowable hours of work performed by train and engine employees, as well as operators, train dispatchers, and other railroad employees.

The FRA promotes and enforces regulations related to the railroads transportation of explosives, chemicals, and radioactive materials.

Other federal agencies, such as OSHA, as well as state and local agencies regulate rail safety in various ways. The regulation of railroad safety by state and local governmental agencies has caused a proliferation of regulations that the railroads must be cognizant of and adhere to. The lack of coordination between the regulatory efforts of these state and local governments can result in a nonuniform code of regulations that can significantly affect the economic and energy efficiency of railroad operations. For example, one railroad moving through 62 municipalities was subject to 13 different speed limits, some as low as 5, 8, and 11 miles per hour, for reasons other than track condition.[12]

Environmental Regulation

Public concern over environmental quality has caused the development of a considerable body of regulation in this area. The principal regulatory agency is the EPA. However, other federal, state, regional, and local regulatory bodies are involved in regulating railroad activities that affect the environment. The interstate nature of railroad operations causes a railroad to be subject to a multitude of different environmental standards and regulations, some of which may be effective only in a small region.* The railroad industry spent about $92 million in 1972 to meet various environmental standards and regulations.

The form of environmental protection regulations generally differs from the FRA railroad safety regulations in that individual hardware items and operating procedures often are not specified. Instead, environmental

*In the past, many state, regional, and local government agencies developed environmental standards that were more stringent than EPA standards. Such regulations often varied between locations, depending on the specialized needs perceived by the individual communities. The EPA recently attempted to foster a certain degree of uniformity in the regulation of railroad noise emissions, but exceptions are permitted if necessitated by special local conditions.

regulations specify an acceptable standard level of performance that must be achieved; the means for achieving this standard is often the responsibility of the regulated firm or industry.

The areas of environmental regulation that most affect the railroads are air pollution, noise intrusion, and waste disposal. Air pollution regulations primarily influence the rail industry in the control of locomotive exhaust emissions. Technology is already available that will allow the railroads to meet most of the current standards.

The reduction of the noise level of diesel-electric locomotive operations may require new technology to meet existing and projected standards. In addition, the regulation of noise associated with fixed facilities (e.g., coupling noises and retarder squeal in yards) may force either the development of new noise-suppressant technology or the abandonment or reduced usage of some facilities.

Waste disposal regulations have increased the disposal costs of crossties, engine-crew wastes, railcars, and liquid wastes.

Environmental regulations have also affected railroad operations and costs in less direct ways. For example, the requirements for detailed environmental impact reports for construction projects can significantly affect the cost and time schedule of such projects.

IV ENERGY AND COST IMPLICATIONS OF SPECIFIC REGULATORY PRACTICES

In this section we describe specific regulatory practices related to the establishment of long-haul rates, the distribution of empty freight cars, and the rates on low-density rail traffic and examine the energy and cost implications of these practices. Mr. Robert A. Nelson performed the major portion of our analyses through the examination of ICC data and records. The energy and cost implications associated with these regulatory practices were analyzed at SRI using the Long Run Average Cost Model.

Distance-Based Rate Structure and the Length of Haul

Over the years the ICC has frequently structured rates based on mileage or distance scales. In fact, all railroad class rates except transcontinental are based on distance scales in effect over most of the country. In addition, the rates on many basic commodities and commodity groups, again excepting transcontinental, are based on distance scales. The use of a distance-based scale means that shippers everywhere within the area of application of the scale pay the same rates for the transportation of equal weights of the same commodity for a given distance. In 1952, the ICC ordered that rail class rates be made uniform across all rate territories except Mountain Pacific.

There are a number of reasons for constructing a rate structure on a distance scale. Distance-based rates are relatively simple, easy to understand, and are less likely than other rates to be considered discriminatory. In general, distance-based rates are more likely to be related to the actual economic costs of providing transportation service than rates that are not distance related. If all other conditions are similar, the effort and costs involved in transporting a given shipment between two points will be closely related to the distance between those points. Thus, the length of haul is an important element in determining

the amount of transportation service provided, the cost of providing that service, and, ultimately, what rate the user of that service should be charged. Distance-based rates also are more stable than rates based solely on competitive market conditions. A distance-based rate structure acknowledges the natural, competitive characteristics of individual locations and tends to discourage hauls and cross subsidy of producers distant from markets by producers near to markets.

The shortcomings of distance-based rates are that they may bear scant relation to railroad operating expenses, or, in a larger sense, the opportunity costs of rail operations. Moreover, they do not permit the normal responses of sellers to different demand conditions in different places.

Regulatory Policies Related to the Distance-Based Rate Structure

The application of distance-based rates has been influenced by various ratemaking policies explicitly or implicitly adopted by Congress and the ICC. We briefly describe the evolution of ICC regulatory practices related to distance-based rates in Appendix A.

The Tapering Principle

Almost all distance-based rate scales for railroads are constructed to reflect the tapering principle. This means that the distance rate scale (i.e., the relationship between the length of haul and the rate) is structured so that the distance intervals become larger, or the rate increments become smaller, or both, as the length of the short-route haul increases. The result is that the slope of the scale tends to become increasingly less than proportionate to distance. Therefore, while the total shipper charge increases with distance, the rate of the increase of the total shipper charge is less than the rate of increase in length of haul. An example of a tapered distance-based rate structure is shown in Figure 1. Ostensibly, the rationale for "tapering" a mileage-based rate structure is based primarily on considerations of the cost of service. The terminal costs are included in the general freight rate even though such costs are not directly related to the length of

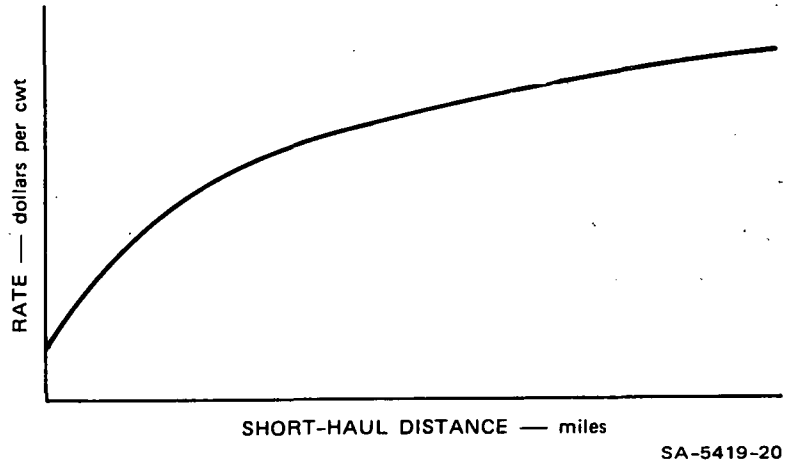

FIGURE 1 A TAPERED DISTANCE-BASED RATE SCALE

haul. It has been implied that tapering results from spreading the constant terminal costs over an increasing length of haul. Another postulated reason for relying on the tapering principle when setting rates is that relatively short hauls (less than 75 miles) generally are moved by local or way freight trains whose associated costs are greater than the costs associated with through freight trains typically used for longer hauls. These considerations, however, do not explain the increasingly smaller increases in rates in comparison with constant increments of distance. Much of the taper must be attributed to value-of-service considerations.

The following cases are indicative of some of the ICC's views on mileage scales and its reliance on the tapering principle in the construction of such scales:

> Only a uniform mileage scale would preclude claims of relative maladjustment between the rival markets of Minneapolis, Milwaukee, and Chicago, and while no market desires this system to be here applied generally, eventual resort to this basis may possibly be the only outcome of reiterated complaint over a complex situation which the Commission has repeatedly tried to adjust. [46 ICC 685, 692]

> A mileage scale ordinarily yields a much higher rate in proportion for a short haul than for the long one. [26 ICC 638, 649]
>
> Distance scales are constructed so that the rate of progression decreases as the distance increases. [144 ICC 731]

The tradition in ICC ratemaking of lower per-mile rates for longer hauls is found in both mileage scales and the transcontinental rate structure. Transcontinental rates historically have reflected value of service, market competition, and water competition. As a result they may bear little relation to distance and in fact may ignore distance for literally hundreds of miles. It is common for transcontinental rates to "blanket" long distances. The effect of this for those distances is to put a zero rate of progression into the relationship of rates with distance.

Holddowns

In addition to the cost-of-service factors described above, the ICC uses the tapering principle to establish rates that do not restrict the movement of traffic over long distances. If the rate scale were based on a uniform progression of rates in direct proportion to distance, the long-distance rates would be so high that the movement of certain commodities would be greatly inhibited. The same is true when a general percentage increase in freight rates is approved. Although such a rate increase causes all existing rates to be increased by the same percentage, it also causes the absolute rate increases to be greater for the long-distance shippers than for shorter-distance shippers. Such across-the-board percentage rate increases can thus effectively change the relative competitive position of different producers in the same market because it increases the transportation costs of the distant producers more than those of the nearby producers.

In many recent rate level cases, the ICC, while approving general percentage rate increases, has imposed limits to the absolute increase in rates on certain commodities. Such limitations to a percentage rate increase are generally referred to as "holddowns," and

their application often causes a cross subsidization of traffic analogous to that caused by value-of-service ratemaking procedures. The imposition of holddowns has the effect of increasing the tapering effect for the rates of certain commodities at the middle to upper ranges of the distance scale.

The following cases represent the ICC's philosophy on distance-based rates and holddowns.

> While the substitution of commodity rates based on mileage for a group adjustment must necessarily result in many instances in different rates to points formerly grouped together and accorded the same rates, there is no sound reason why, as a general rule, commodity rates constructed on a distance basis should not be graded according to distance in substantially the same manner as class rates. [77 ICC 473, 497]

> If the policy of carriers is to afford the widest possible latitude to competition, which is consistent with any return short of actual loss, the proponents of a distance scale will favor a low rate of increase for unit progressions, and this will result in relatively low rates for long distances. Thus a distance scale directly reflects the purpose of its maker. [48 ICC 201, 234]

> Making rates on an arbitrary mileage system may finally be reached, but the industries and commerce of the country are now established on a different basis. [29 ICC 376, 379-380]

> It might be feasible to reflect costs more accurately in a scale with a constant rate of progression if costs on class rate traffic were as certainable with a fair degree of accuracy. But such a scale properly would require an initial rate for 5 miles burdened with all the terminal expenses. One likely effect of a scale of this character would be to discourage the movement by rail of much class-rate traffic in contravention of the Hoch-Smith Resolution which specifically provides that freight rates shall be so adjusted that the traffic may freely move. [164 ICC 1, 190]

> The effect of a uniform rate of progression is to make short-haul rates lower and long-haul rates higher than under a graded progression. While the rate for each haul should include both cost and profit in practical ratemaking it is frequently necessary to make rates which will yield less profit for some than for other hauls. As the importance of the freight charge to the shipper increases in proportion as its relation to the value of the load increases, if there is to be some variation in the amount of profit under the rates for hauls of different length, the shorter hauls can better pay the higher rate of return. [176 ICC 1, 68]

> While a progression of 3 cents for each 100 miles in a rate scale is low for distances over 800 miles, it may be more than offset by a high progression for distances less than 800 miles; and, when viewed as a whole, not to produce low rates for the long hauls. [263 ICC 9, 59]

In a succession of general rate increase cases following World War II to the present, the ICC has imposed holddowns on commodities that account for a rather large share of rail traffic. For some of these commodities long hauls were not involved but rather reflected competitive producing points located at varying distances from markets. (Competitive producers tend to resist changes in input costs that affect them unequally.) Table 1 lists the commodities that received holddowns in Ex Parte No. 148, the first general rate increase case following World War II.

Table 1

COMMODITIES RECEIVING HOLDDOWNS IN EX PARTE NO. 148

Commodity	Increase per CWT (¢)	Commodity	Increase per CWT (¢)
Cotton in bales	10	Clay	6
Fruits and vegetables	13	Saltcake	6
Wool	20	Dolomite per ton	30
Coal per ton	30	Bituminous rock per ton	30
Iron ore per ton	12	Logs pulpwood	8
Alumina per ton	12	Posts and ties	10
Gravel and sand per ton	15	Building woodwork	10
Fluxing stone per ton	15	Wood and pulp	10
Stone per ton	15	Petroleum	6
Furnace slag per ton	15	Vegetable oils	12
Limestone per ton	15	Sugar	10
Cinders per ton	15	Iron and pig per ton	200
Petroleum tank cars	6	Aluminum and pig per ton	200
Asphalt	6	Aluminum bars per ton	240
Tar	6	Cement per ton	120
Salt	6	Brick per ton	120
Phosphate rock per ton	30	Fertilizers per ton	120
Sulphur per ton	40	Canned foods	13
Industrial sand per ton	30		

Source: Ex Parte No. 148.

In several general rate increase cases in the fifties and sixties, the ICC turned away from percentage increases to flat increases per hundredweight or per ton on a long list of commodities. These flat increases, which favored long-distance shippers, were intended to mitigate the effects of past percentage increases. After these cases, the ICC returned to the practice of imposing holddowns on percentage increases. Tables 2 and 3 list commodities receiving holddowns on percentage increases in two recent general rate increase cases.

Table 2

COMMODITIES RECEIVING HOLDDOWNS IN EX PARTE NO. 281

Commodity	Price per CWT (¢)
Beet and cane sugar	3
Coal per ton	15
Fruits and vegetables, fresh	4
Fruits and vegetables, processsed	4
Lumber and hardwood flooring, plywood	2
Malt liquors	4
Millwork	4
Soda ash per ton	40
Walnuts	3
Wine	4

Source: Ex Parte No. 281.

Table 3

COMMODITIES RECEIVING HOLDDOWNS IN EX PARTE NO. 295

Commodity	Price per CWT (¢)
Coal per ton	15
Foodstuffs, canned, frozen	6
Fruits, vegetables, edible nuts	6
Iron ore per ton	22
Lignite per ton	15
Petroleum, coke, briquets per ton	15

Source: Ex Parte No. 295.

Effects of Regulatory Policies on Distance-Based Rates

We briefly examine below two cases where regulatory practices have markedly influenced the basic distance-based rate structure. In the first case we have selected three commodity groups from among those that have been primarily affected by holddowns during the period of price level and general rate increases since World War II. Table 4 shows the commodity groups, the increases on long hauls from 1950 to 1974, and the average of all rate increases for all commodities and distances. Table 5 shows the importance of these commodities to the railroads. The data seem to support the assertion that holddowns limit increases on long-haul rates. The smaller percentage increases and the preference for long hauls already built into the rate structure suggest that an increasing advantage to long-haul traffic has been provided, at least for the commodities shown. Admittedly some of the increases were lower as a result of higher volume minimums and incentives for loading. It is not possible, however, with the information presently available, to separate out the respective effects of holddowns and higher minimums. The rate changes shown in Table 4 indicate what would have been paid for the highest minimum weight in 1950 and 1974. The effects of the holddowns on rates probably exceed considerably the effects of higher minimums, although this can only be surmized.

The importance of the movement of these three commodity groups to U.S. rail traffic is considerable. As shown in Table 5 the tonnages of these commodity groups constitute a relatively small proportion (0.56 percent) of total rail tonnage. Revenues from their transport bulk are somewhat larger (2.72 percent) in the total rail revenue picture. Their share of total ton-miles is even larger. A large part of the tonnages of these three commodity groups transported by rail is derived from hauls of over 2,000 miles. A comparison of the shares of tonnages and revenues of these commodity groups for hauls of 2,000 miles or more of total U.S. rail tonnages and revenues for hauls of 2,000 miles or more shows that the three commodity groups account for almost 19 percent of total tonnages moving 2,000 plus miles but for only 2.7 percent of revenues--that is, the proportion of tonnages accounted for by the three commodity groups is

Table 4

RAIL RATE CHANGES FOR SELECTED COMMODITIES
ON HAULS OF 2,000 MILES OR MORE (1950-1974)

Commodity	1950-1974 Rate Increase (%)	1974 Total Tonnage (Thousands)	1974 Total Revenue (Thousands)
Fresh fruits and vegetables		2,196.6	129,976.6
Apples	57.9		
Oranges	59.9		
Lettuce	61.6		
Canned fruits and vegetables	83.1	594.2	25,281
Lumber	95.8	4,364.5	182,112.3
Totals		7,155.3	337,369.9

Note: Authorized increases for 1950 through 1974 totaled 129%. The simple average of actual increases is 109.7%. The index of railroad freight rates maintained by the Bureau of Labor Statistics since 1969 stood at 158.3 at the end of 1974. (1969 = 100.)

nearly seven times greater than the proportion of revenues. Obviously, these commodity groups are being transported at rates much lower than average for hauls of 2,000 miles or more. This is not surprising considering the special treatment given to them by such legislation as the Hoch-Smith resolution of 1925 (see Appendix A) and by holddowns.

The effects of regulatory policies and the original tilt toward long hauls also can be seen from an examination of the present profiles of rates. The Special Projects Staff (SPS) of the ICC has carried out studies of relative rate levels for various investigations under Ex Parte No. 271. In the SPS studies, rates over distance on particular commodities were charted and compared with costs as determined by ICC cost-finding formulas. The first series of SPS charts is for lumber moving to various parts of the United States. In Figure 2 the rates from Mountain Pacific to official territory are precisely the same for distances between 1,400 and 3,800 miles. This reflects the practice of

Table 5

PERCENTAGE OF TOTAL U.S. RAIL TONNAGES AND REVENUES
FOR SELECTED COMMODITIES ON HAULS OF 2,000 MILES OR MORE
(1974)

Selected Commodities	Percentage of U.S. Tonnage of Each Commodity	Percentage of Total U.S. Tonnage Over 2,000 Miles	Percentage of U.S. Revenues Each Commodity	Percentage of U.S. Revenues Over 2,000 Miles
Fresh fruits	65.33	2.062	83.9	.38
Fresh vegetables	65.27	3.67	82.6	.67
Canned fruits and vegetables	22.89	1.55	40.6	.20
Lumber	32.74	11.389	54.4	1.47
		18.671		2.72

Note: Total U.S. rail tonnage over 2,000 miles to total U.S. rail tonnage is 3 percent. Total U.S. rail revenue derived from hauls over 2,000 miles to total U.S. rail revenues is 16 percent.

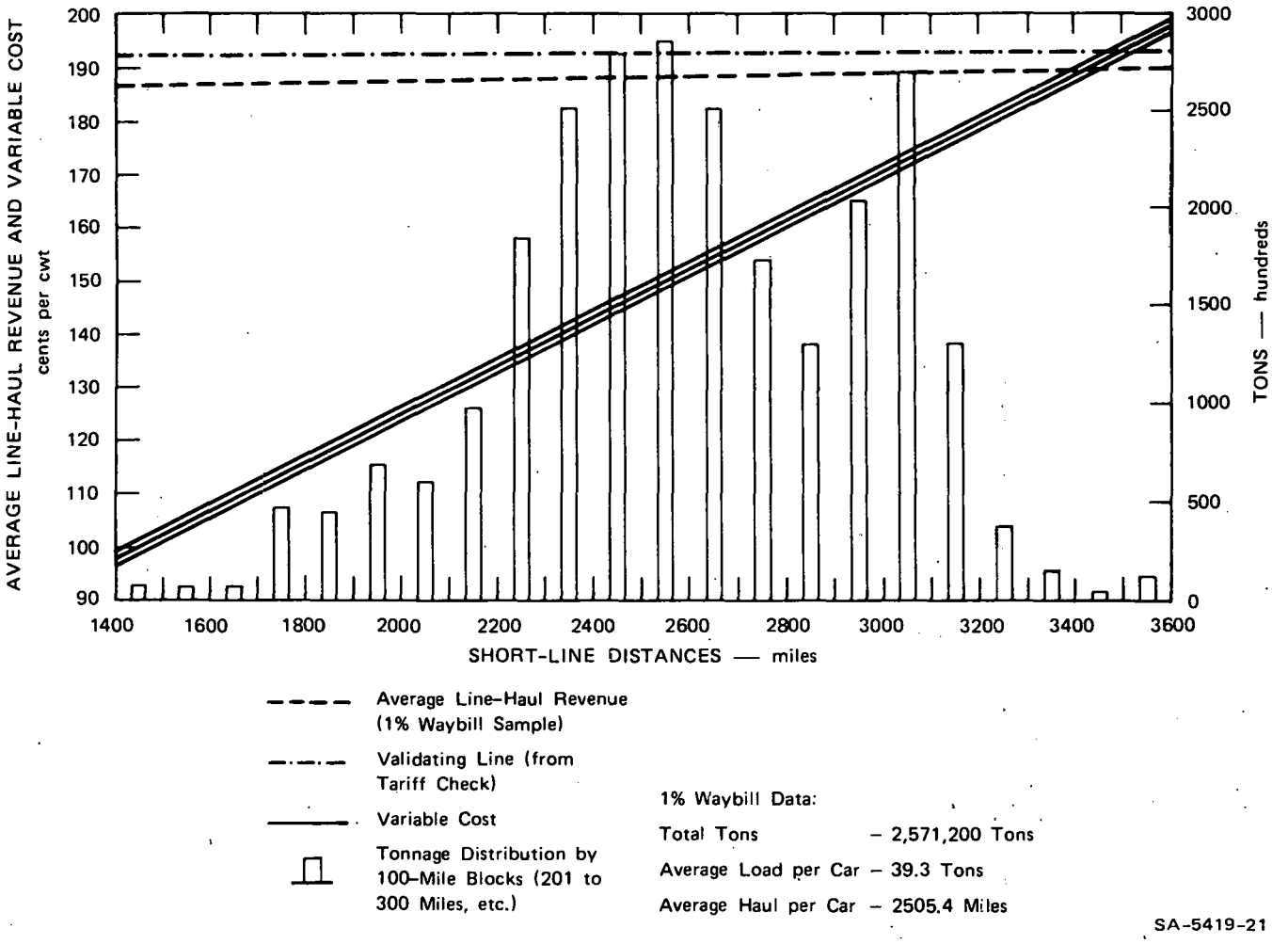

FIGURE 2 RATES FOR TRANSPORTATION OF LUMBER FROM MOUNTAIN PACIFIC TO OFFICIAL: 1972

blanketing transcontinental rates eastbound over extended areas in the Northeast. For some commodities the rate is the same to all points east of the Mississippi River. Thus eastern railroads receive for the transport of those commodities the same amount whether a shipment moves 100 or 1,500 miles on their lines.* By contrast, Figure 3, which shows rates from Mountain Pacific to Mountain Pacific, indicates a pattern of rates increasing with distance more rapidly than costs. Figure 4 shows rates from Mountain Pacific to southern territory that reflect the blanketing effect.

Generally the charts on lumber prepared by the SPS show that rates from Mountain Pacific to official and southern territories largely ignore distances between 1,400 and 3,800 miles. On the other hand, rates on shipments moving within the territories tend to rise with distance more rapidly than costs.

Figures 2 through 4 also show the variable costs and traffic volumes associated with different lengths of haul. It is important to exercise caution in the analysis of this cost information because the costs shown are formula costs based on average conditions and rather arbitrary assumptions about cost-distance relationships. Because of the potentially enormous variations in costs from one rail line to another and one situation to another, this cost information says little about any single flow of traffic. However, it is interesting to note that the rates for the transportation of lumber between the Mountain Pacific and official territories do not even cover the average variable costs as calculated by the ICC for some long hauls.

Effects of Regulatory Policies on Costs

As previously stated, one of the major reasons for using a distance-based rate scale is the general correspondence between the length of haul

*The SPS has not made such studies for fresh fruits and vegetables and canned goods. Blanket rates resulted from a combination of water competition through the Panama Canal and enforcement of the prohibition of higher rates for shorter hauls than for longer.

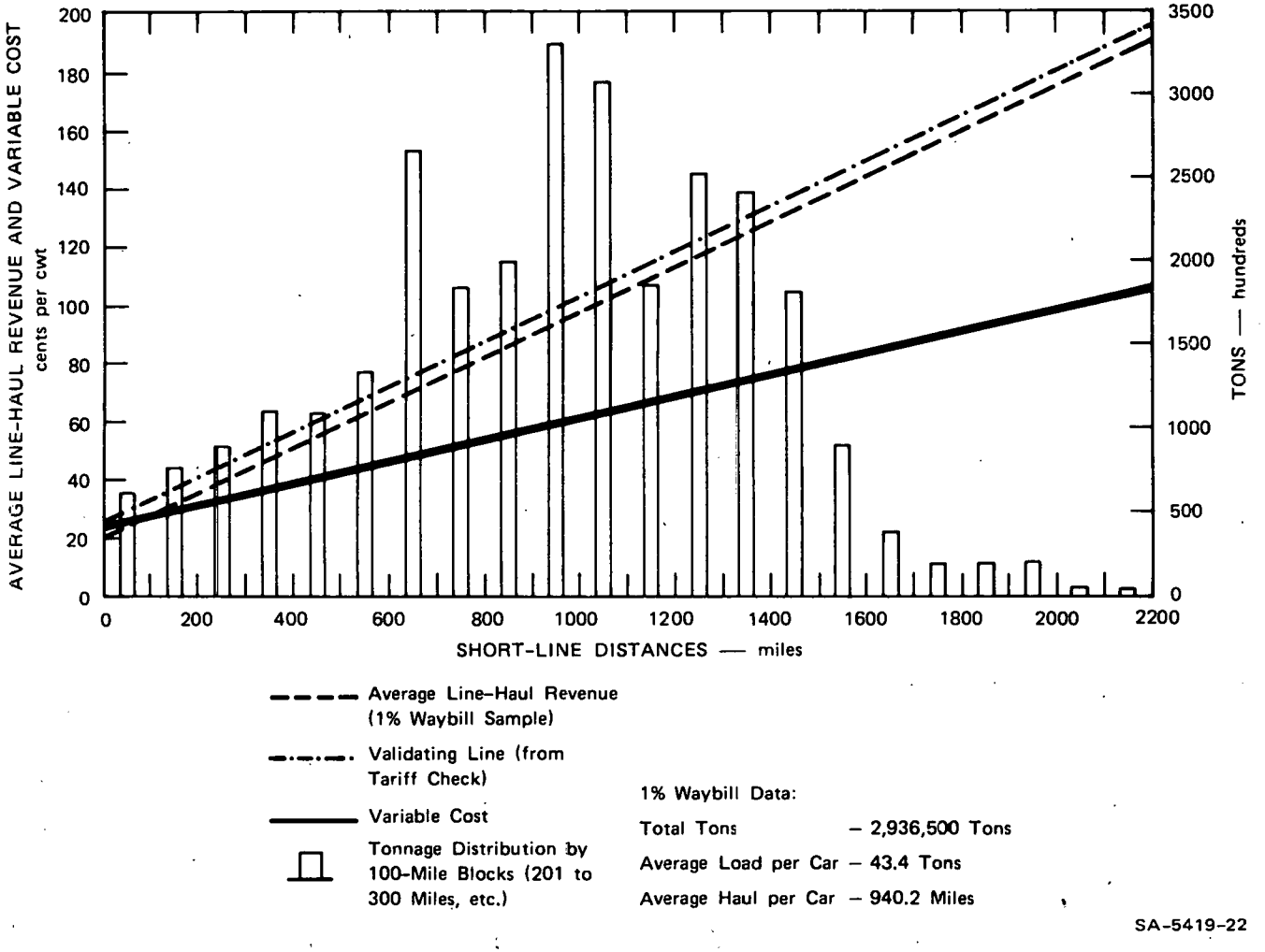

FIGURE 3 RATES FOR TRANSPORTATION OF LUMBER FROM MOUNTAIN PACIFIC TO MOUNTAIN PACIFIC: 1972

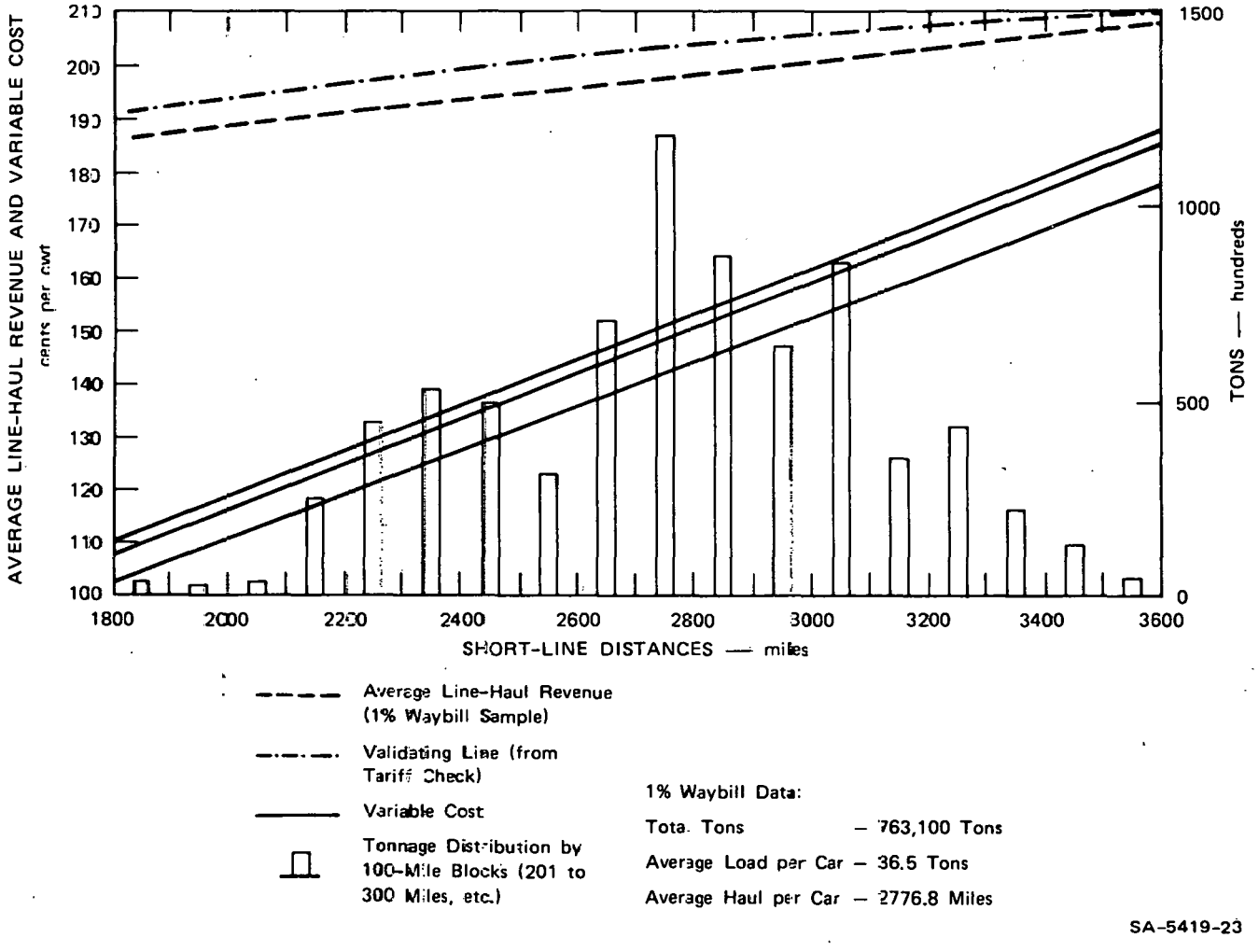

FIGURE 4 RATES FOR TRANSPORTATION OF LUMBER FROM MOUNTAIN PACIFIC TO SOUTH: 1972

and the cost of service. Indeed many of the ICC's ratemaking policies are based, to some degree, on its cost-estimating procedures. For example, to some extent tapered distance-based rate scales are based on the assumption that actual railroad costs are tapered in a similar fashion. If, in fact, costs are not related to length of haul in this manner, the use of the tapering principle in setting rates may result in cross subsidy of some traffic and more outlays on transportation than otherwise would be the case.

It therefore seems appropriate to examine briefly some aspects of the relationship between the length of haul, economic costs, and energy usage. In this examination we used SRI's Long Run Average Cost (LRAC) Model to determine general cost patterns and relationships. There are many drawbacks to the use of long run average costs in such an examination, particularly in the estimation of the costs including prorations of joint or common costs associated with a particular service. In addition, the analysis of costs alone does not account for the interdependence of costs, rates, demand, and rail plant capacity. Nevertheless, these disadvantages are present to some extent in most railroad cost description schemes, which may in fact have even further disadvantages.*

The LRAC Model was used to develop graphs of the relationships between costs and length of haul for four different commodities: coal, farm products, lumber and wood products, and transportation equipment (see Figures 5 and 6). In each case a traffic corridor was nominally defined in such terms as traffic volume, density, track gradients and curvatures, and the like to represent typical conditions as closely as possible. (The assumptions used in constructing the input data for the LRAC Model are described more fully in Appendix B.)

The graphs in Figure 5 relate the long-run average cost per ton originated to the length of haul for distances between 200 and 2,500

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*For a more complete description of the use of long-run average costs, long-run marginal costs, and other cost description schemes we refer the reader to Reference 1.

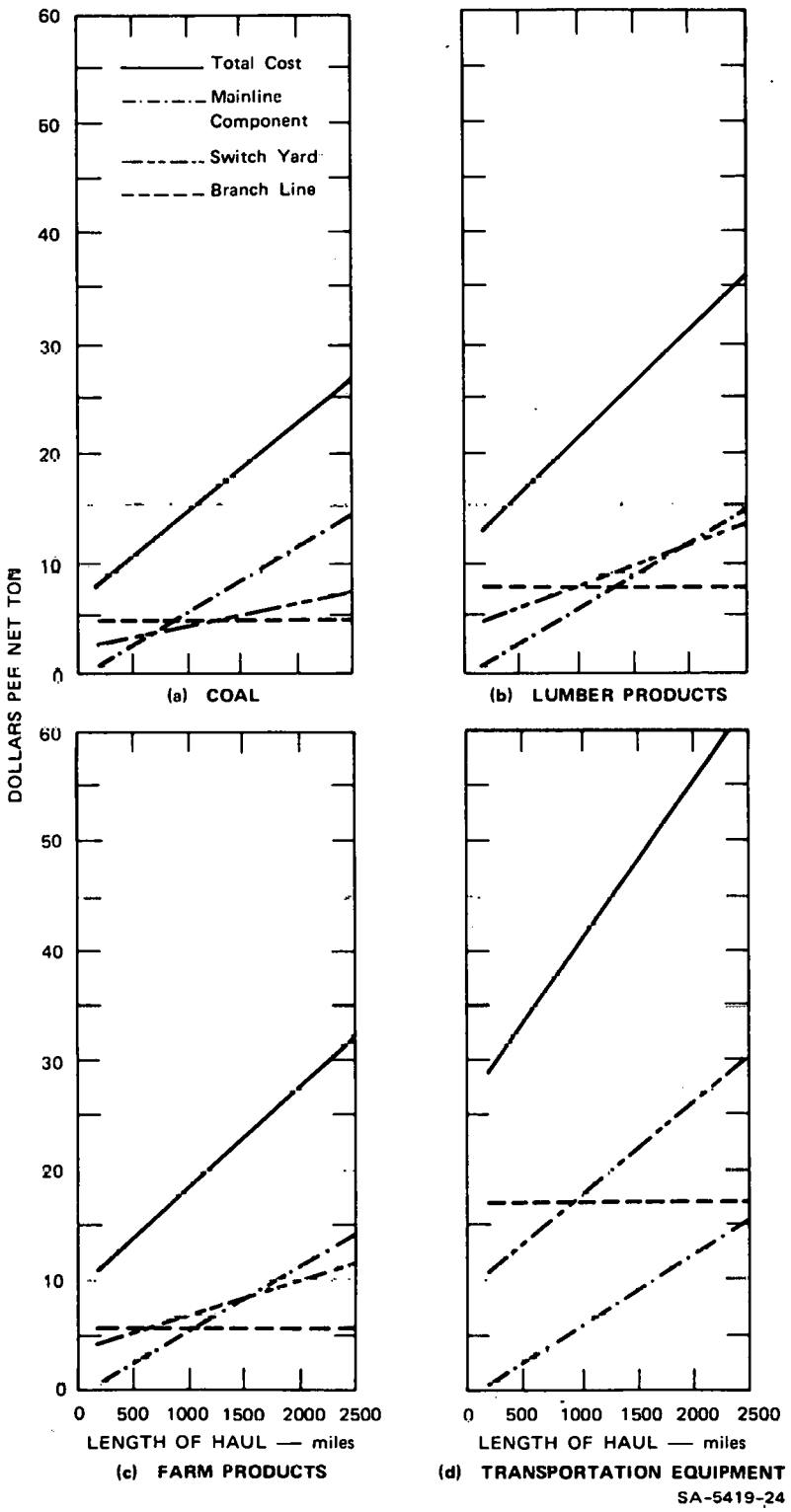

FIGURE 5 LONG-RUN COSTS FOR SELECTED COMMODITIES

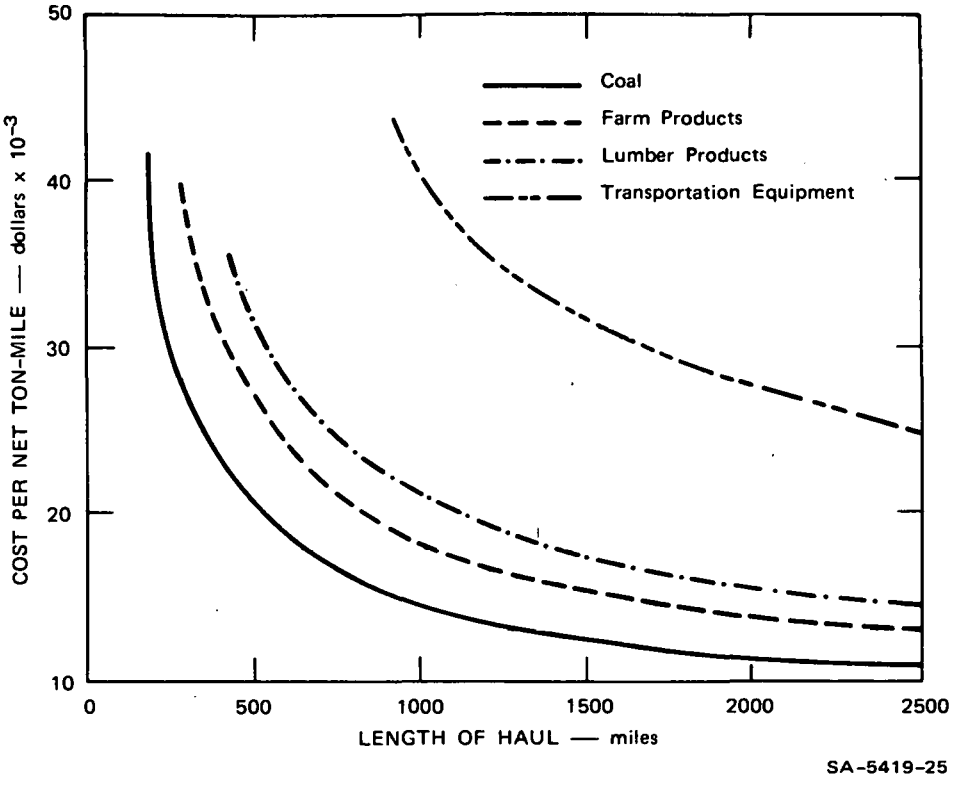

FIGURE 6 COMPARISON OF LONG-RUN AVERAGE COSTS FOR SELECTED COMMODITIES

miles. Because of the assumptions used as input to the LRAC model for these analyses, it is dangerous to attach much significance to the absolute values of the costs. Although the project team attempted to define a nominal rail corridor that generally represented typical rail operations, it must be remembered that significant variations exist between transportation operations between regions and even between individual routes that are roughly parallel. Costs, too, are sensitive to the operational changes that exist between different regions and routes. Therefore, although these model outputs are typical of the costs involved in handling the selected commodities, they should be viewed as only general indications of the relative relationships of the cost components and of the general pattern of the relationship between costs and the length of haul.

The total cost is further broken down in Figure 5 into main-line costs, branch-line costs, and terminal and switching costs. The graphs in Figure 5 show a number of interesting differences among the four commodities. For example, switchyard costs are relatively more important in determining the total cost of transporting transportation equipment than coal.

Although many similar comparisons can be made, the major point of interest is the general makeup and shape of the costs as related to the length of haul. For each of the four commodities the overall average cost function is linear between 200 miles and 2,500 miles. To some extent this is a result of the initial assumptions used to structure the model's input. In defining the rail operations within the corridor, we assumed that the branch-line activity related to collecting and distributing freight cars (irrespective of the commodity) involves nearly 27 miles of local or way train operation at both ends of the main-line movement. Such a branch-line operation is generally prerequisite to the movement of the freight cars on the main line. For this reason, and because branch-line movements are operationally distinct from main-line movements, branch-line costs are modeled independently of main-line costs and are completely accounted for before considering the cost of even the first mile of main-line transit. Thus, for our nominally defined rail corridor operation, the costs associated with branch-line operations will increase for lengths of haul up to 53 miles (all of it on branch lines). Thereafter, branch-line costs will remain constant while main-line costs, which are zero for lengths of haul less than 53 miles, will increase linearly with distance. Thus, as modeled by SRI's LRAC Model, a significant break occurs in the slope of the total cost curve at 53 miles because of the large differences in cost characteristics between branch-line and main-line operations. This represents the only "tapering" or lessening of the rate of cost increase in relation to length of haul. Of course, it may be correctly argued that in numerous cases branch-line operations account for more than 53 miles of the total length of haul. However, the previously postulated principle that branch-line costs are independent of and prerequisite to main-line costs remains the same even

in those few individual hauls where branch-line operations are much greater (e.g., 300 miles). Thus, when solely considering the effects of branch-line costs on total costs, it is difficult to justify tapering distance-based rate scales beyond the length of haul that occurs on way or local trains serving branch lines (generally well under 300 miles).

The relationship between railroad operations on branch lines and main lines is fairly well defined and understood, at least on an aggregate basis. Therefore, we were able to develop the structure and input of the LRAC Model with a fair degree of confidence in the validity of its output. The assumptions we have made concerning branch-line and main-line operations are realistic and do not deviate significantly from those assumptions made during the course of other related research. However, the relationship of switchyard volumes and operations to the length of haul are less well understood. Based on national averages, we can roughly estimate the number of times a freight car is yarded and switched per trip or car cycle. We have even been able to break down these estimates by commodity type. However, at this time, we are unsure of the exact shape of the curve relating switching requirements and costs to the length of haul. For the purposes of this analysis, and based on reasonable engineering judgment, we have assumed that this relationship is linear with a nonzero intercept of the cost axis. (This intercept may be thought of as representing the initial terminal costs associated with a traffic movement.) The result of this assumption is that the cost of yard operations does not cause any tapering of the total cost function, which is linear throughout most of its range.

If we had assumed that the number of switchings per carload increased proportionately less than the length of haul because of increased blocking flexibility, the result would have been a cost function with a concave downward or "tapered" shape. Conversely, the recognition that increases in the length of haul cause more interchanges of the freight car between railroads would result in a concave upward cost function. Because of the offsetting effects of these two factors, our assumption that the number of switchings, and hence the switching costs, increase

proportionately with the length of haul is probably the most reasonable. In any event, the fact that there is no reliable information or even strong opinion on the subject leads one to suspect that, on the average, any deviation from our assumption is probably minor and will not significantly affect the overall shape of the cost curve.

Effects of Regulatory Policies on Energy Consumption

Additional output of the LRAC Model includes information about the energy consumption associated with the different elements of railroad operations (i.e., main-line, branch-line and switchyard operations). The relationships between total fuel consumption and the length of haul for coal, lumber products, farm products, and transportation equipment are shown in Figure 7. Figure 8 shows the average fuel consumption for these four commodities as related to the length of haul. An important point to note in the analysis of these graphs is the relative importance of the various components of fuel consumption as compared to costs. For fuel consumption, main-line operations become the dominant component for length of hauls greater than 500 to 700 miles. However, main-line costs per net ton do not become the major component of total costs until the length of haul increases beyond 900 miles for coal, 1,500 miles for farm products, and 2,000 miles for lumber products. For transportation equipment the main-line costs are the least important component of the total costs up to 2,500 miles.

The difference between the behavior of costs and energy consumption as related to length of haul is further demonstrated by comparing the average cost per net ton-mile (Figure 6) with the average fuel consumption per net ton-mile (Figure 8). The average fuel consumption per net ton-mile decreases rapidly between length of hauls of 200 and 1,000 miles. As the length of haul increases beyond 1,500 miles, however, the average fuel consumption per net ton-mile remains almost constant. In contrast, the average cost per net ton-mile for the three bulk commodities (coal, farm products, and lumber products) do not approach an equivalent level of constancy until well beyond 2,000 miles, and the average cost per net ton-mile for transportation equipment is still rapidly decreasing at 2,500 miles.

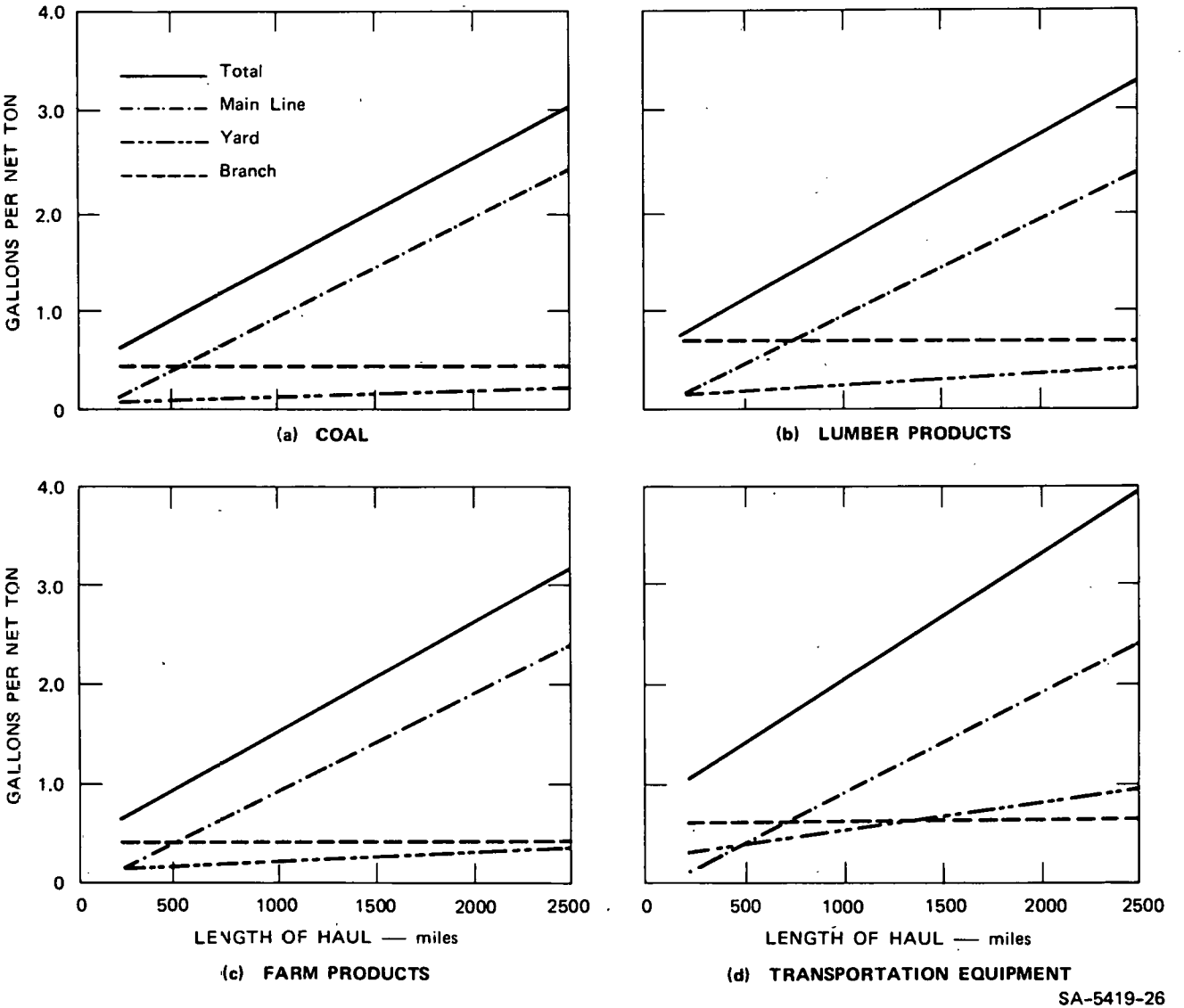

FIGURE 7 COMPONENTS OF ENERGY CONSUMPTION FOR SELECTED COMMODITIES

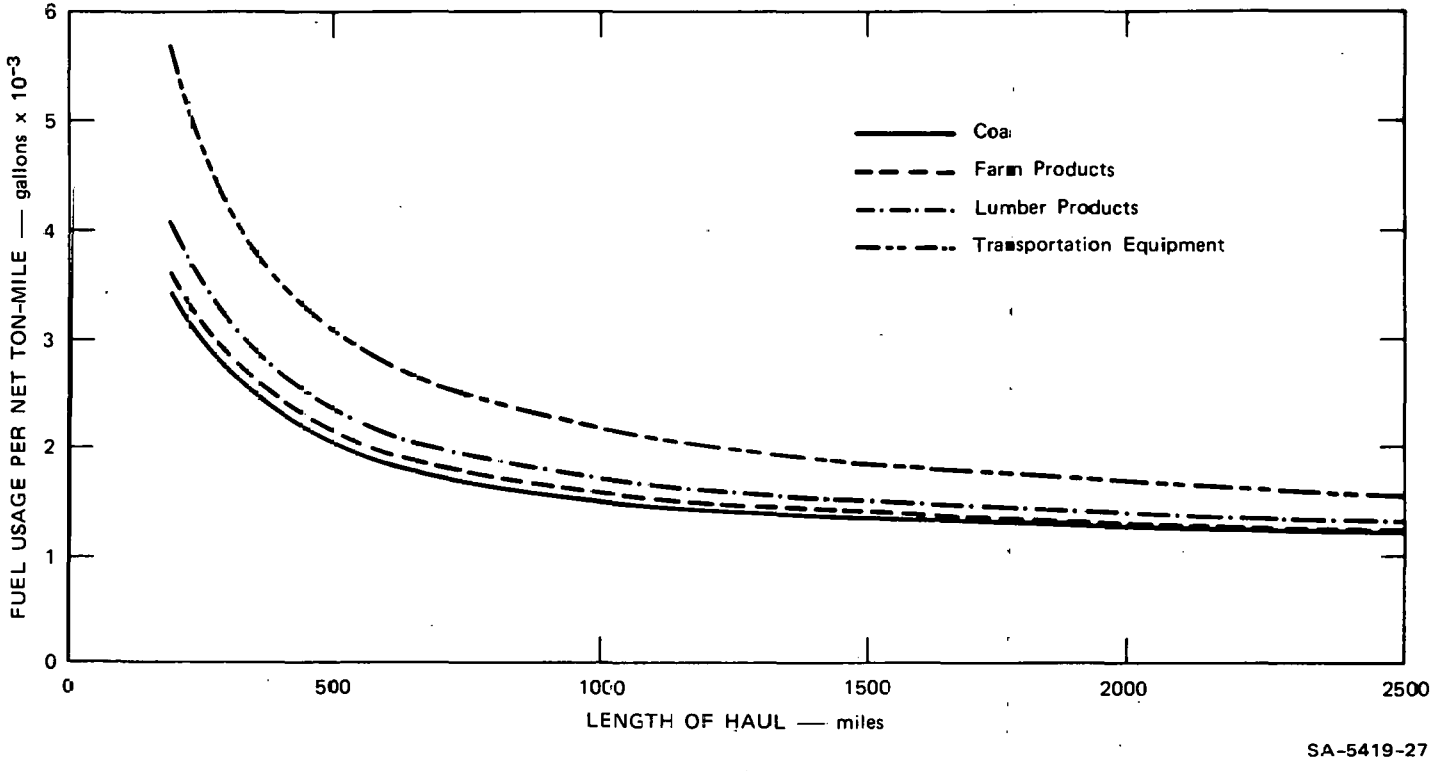

FIGURE 8 AVERAGE ENERGY CONSUMPTION FOR SELECTED COMMODITIES

Implications for Future Regulatory Policies

The evidence suggests that railroad rates and rate relationships are structured to favor long hauls of a number of commodities.* For some commodities the rates do not vary at all over a span of 2,400 miles. It is obvious that the economic costs of service and energy consumption do not remain constant over such distances. An examination of the economic and energy costs using the LRAC Model confirms that this rate bias in favor of long hauls is probably not justified on the basis of the costs of service or the direct energy consumption characteristics of railroad operations. In fact, the output of the LRAC Model indicates that the basic concept of using a tapered rate scale and holddowns may be inappropriate when viewed in terms of costs for distances beyond the length of the branch-line operations.

The structure of current railroad mileage-based rates does not totally reflect the actual cost or energy consumption patterns as related to the length of haul. The main reason for the development of these rate scales is the intention of Congress and the ICC to encourage maximum freedom of movement of goods. This objective has been spelled out in legislation and policy statements, and the ICC has attempted to achieve this objective through such regulatory policies as holddowns and blanket ratemaking, which tend to impose artifical constraints on the rate structure. The results of such regulatory policies are that long-haul rates are disproportionately low in relation to distance and appear to have risen less in relation to the price level than the average of rail rates. Such a rate structure tends to obscure the true costs of production associated with specific commodities and may result in cross subsidy of long-haul traffic by short-haul traffic. This fact raises the question as to whether in light of higher energy costs the time has come to remove the preference toward long hauls built into the rate structure. As discussed in Appendix A, tradeoffs continuously take place between production and transportation costs. For example, transportation costs already make up a substantial portion of the production

*This conclusion is in general agreement with the results of several similar studies. See, for example, Reference 13.

costs for many of the commodities that have been affected by holddowns of general rate increases (see Table 6). If long-haul rail transportation rates (costs to users) were to go up, sooner or later there would be a shift to production points more local to markets. More citrus fruits would move from Florida to the Northeast and fewer from Southern California; more lumber would flow from the South and less from the Pacific Northwest. The result would be savings in energy consumption. Two important questions cannot be answered in this report. The first is whether the change in production locations would involve increases in energy consumption that would neutralize the savings in energy consumption resulting from lesser transportation. The second is what the impact of production location changes would be on the communities losing the jobs to the new producing areas. During a transition period, the social and welfare costs may be high, and the persons affected may resist such changes.

Empty Freight Car Mileage

Railroads, shippers, and the government are examining with increasing frequency the problem of empty freight car mileage. Certain undesirable economic costs, such as the basic operational economic and energy costs of transporting a nontrivial element of a train's gross weight, are associated with the transportation of empty cars. Other undesirable costs include the operational costs of handling empty cars (e.g., switching, connecting brake hoses), and the investment costs involved in not fully utilizing a major capital resource. Despite the economic penalties connected with the haulage of empty freight cars, the total nationwide empty car mileage, as a percentage of total car mileage, has increased from 33 percent in 1946 to 45 percent in 1975. This increase is largely a result of the current car distribution policies and practices of the U.S. railroad system.

Table 6

DIRECT AND INDIRECT FREIGHT COSTS PER DOLLAR OF FINAL OUTPUT

Department of Transportation Sector	Railway (¢)	Total (¢)
Agriculture	2.0¢	9.5¢
Iron ore mining	15.3	27.4
Nonferrous mining	6.2	16.3
Coal mining	20.8	30.2
Miscellaneous mining	12.4	76.7
Construction	2.2	7.1
Ordnance	1.4	4.7
Food and drugs	2.4	8.5
Textiles and apparel	0.9	5.4
Lumber and products	7.5	13.5
Furniture	2.3	6.7
Paper and paper products	5.1	10.5
Printing	1.4	4.4
Chemicals	3.8	10.8
Plastics, paints, and rubber	2.0	6.7
Petroleum and products	1.0	9.4
Stone, clay, glass products	3.8	12.8
Iron and steel	3.9	8.3
Nonferrous metals	2.7	6.3
Fabricated metals	1.8	5.2
Farm and construction machinery	2.7	6.9
Industrial machinery	1.7	5.5
Electrical machinery	1.1	3.9
Motor vehicles	2.9	6.8
Aircraft	0.9	2.8
Other transportation equipment	2.2	6.1
Scientific and optical instruments	0.6	5.4
Communications	0.3	1.1
Utilities	2.7	6.1
Services	0.5	4.3
Auto repairs	1.0	3.4
Government enterprises	4.4	9.1
Business travel and gifts	2.2	8.6
Miscellaneous manufacturing	2.7	12.7
Scrap sales	14.5	16.7

Source: Reference 14.

Note: Total (direct and indirect) freight generated per dollar of final demand, including both the direct and indirect freight on the inputs to the final product and the freight services needed to ship the final product to the ultimate customer.

Factors Contributing to Empty Freight Car Mileage

We discuss below the factors that contribute to empty car mileage.

The Imbalance of Traffic

Imbalances of traffic between various regions of the United States are responsible for much empty car movement. A good deal of this imbalance is inevitable because of the concentration of sources of supply of some basic raw materials.

Since World War I the balance of rail traffic in the United States has been northbound and eastbound. Basic raw materials and agricultural commodities tend to originate in the South and West; finished goods move in the opposite direction. An imbalance results because finished goods experience weight and cube loss in the process of manufacture. Moreover, more finished goods than raw materials move by truck. In New England, the rail traffic imbalance has reached the proportion of five loaded freight cars in to every two out. Elsewhere in the Northeast the imbalance is high, but not as high as in New England.

So-called back-haul rates could encourage a more balanced movement. It is not clear, however, that rate reductions would draw traffic back from truck or stimulate a response in the way of industry relocation. It is possible, however, that a combination of higher rates on eastbound movements and lower rates on westbound movements would have some results, but such a change in rate policy would run counter to the practice of having high-value westbound commodities pay part of the transportation costs of low-value eastbound shipments. Of course, this policy evolved in the days when resources of fossil energy seemed boundless. In the light of energy implications today, a different policy might be appropriate.

Specialization of Equipment and Service

Since the mid-1950s, an increasing percentage of the freight cars ordered by U.S. railroad companies has been designed for more specialized service. Specialized cars include equipped boxcars,

covered hoppers, refrigerator cars, stock cars, tank cars, drop-center cars, and auto-rack cars. Special car types accounted for about 9 percent of all freight cars owned by U.S. Class I railroads in 1955, for nearly 20 percent in 1965, and for over 30 percent in 1975. During the same period the railroads developed special services, such as unit trains and run-through freight trains.

These special freight cars and services were developed to improve the level of service offered to the shipper. For example, some specially designed cars, such as bottom- or side-dumping hopper cars for coal, have greatly reduced the time and costs associated with loading or unloading the car's lading. Other cars, such as refrigerator cars and shielded auto-rack cars, have been designed to decrease the occurrence of damage to lading. Specialized services, such as unit trains, have been developed to improve service in transit time and transit time reliability. Although the railroads' introduction and use of specialized equipment and services has improved the level of service offered to shippers, it has also been a major reason for increases in empty car mileage during the past two decades. These cars are designed to transport a limited number of commodity types and, in a number of cases, only one type of commodity. For this reason it is often difficult to find a commodity that is suitable for the back haul of these specially designed cars, and their typical duty cycle tends to be loaded in one direction and empty for the return trip. Cars used for such special freight services as unit train operations are often dedicated to the transportation of a single commodity between a given origin and destination and thus generally travel empty during the return trip. In addition, cars used in special service are required to be returned to the originator immediately, which also reduces the potential for finding a return load. Table 7 shows the ratio of empty to loaded car-miles for different types of equipment and services. Special-purpose cars, such as refrigerator and tank cars, travel empty more frequently than general-purpose cars, such as boxcars. In addition, for each type of car, the range of the ratios of empty to loaded car-miles is usually greater for cars in special service than for those in general service.

Table 7

RATIO OF EMPTY TO LOADED CAR-MILES

Car Type	General Service (range)	Special Service (range)
Box	0.65-0.76	0.96-1.01
Flat	0.88-0.89	Not reported
Gondola	0.78-0.83	1.00-1.01
Hopper, open	0.86-1.04	0.99-1.02
Hopper, covered	Not reported	1.01-1.20
Tank	1.08-1.10	Not reported
Refrigerated	0.70-1.30	Not reported

Source: Reference 15.

Note: A ratio of 1.00 indicates an exact 50-50 split between empty and loaded car-miles. A ratio greater than 1.00 indicates more empty car-miles than loaded car-miles and a ratio less than 1.00 indicates the converse. Thus, lower values of this ratio are generally more desirable.

The ratio for special service cars does not vary significantly from 1.00, which supports the contention that their duty cycle is usually composed of a loaded forward haul and an empty back haul.

The fact that the dramatic increase in empty car-miles during the past two decades coincides with a similarly dramatic shift to special-purpose cars and freight services over the same period strongly suggests that this shift has been a major influence in the increase in empty car mileage.* The continuance of this shift to specialized equipment and services will cause empty car mileage to increase, probably approaching a limiting value around 50 percent of the total car mileage. However, the continued implementation of special equipment and services will constrain the flexibility to distribute freight cars to meet demand

*Reference 16 shows that there is a strong statistical correlation between the ratio of special cars to other cars and the ratio of loaded to total car-miles.

peaks because unassigned, general-purpose equipment has greater interchangeability between commodities and routes.

Freight Car Ownership

Railroad freight cars are owned by railroad operating companies, car leasing companies, private shippers, and such specialized companies as the Trailer Train Company, which is owned by a group of railroads and supplies flatcars for trailers on flatcars (TOFC) and automobile transport. The division of freight car ownership among these various parties has changed significantly during the last 50 years, partly in response to changing government regulations and the judicial interpretation of these regulations (see Appendix C). The general trend in car ownership has been for a greater percentage of the freight car fleet to be owned by companies other than railroads. In 1929 railroads owned 89 percent of all freight cars; in 1975 they owned 80 percent of all freight cars (see Table 8).

Table 8

PATTERNS OF FREIGHT CAR OWNERSHIP

Type	Total	Class I Railroads	Other Railroads	Car Companies and Shippers
Box cars				
Plain	321,480	304,910	9,068	7,502
Equipped	173,679	170,179	2,621	879
Covered hoppers	228,265	156,850	1,386	70,029
Flat cars	141,316	98,320	778	42,218
Refrigerator cars	100,815	70,434	2,618	27,763
Stock cars	4,423	4,341	--	82
Gondola cars	186,773	176,408	4,923	5,442
Hopper cars	363,186	346,413	6,720	10,053
Tank cars	170,876	2,951	18	167,907
Other freight cars	32,792	28,653	1,275	2,864
Total	1,723,605	1,359,459	29,407	334,739

Source: Reference 17.

The ownership of railroad freight cars can significantly affect the distribution of cars and the amount of empty car mileage. For example, cars owned by private shippers are seldom loaded for the return trip. The ownership of freight cars by individual railroads has also tended to influence the car distribution process. Some individual carriers have actually owned very few cars and have relied on the freight cars of other railroads to supply their own shippers' needs. Other carriers have found it necessary to own a substantial fleet of cars. The difference between the two kinds of ownership hinges on whether a carrier has a net of inward-bound or outward-bound traffic. Carriers with a net of inward-bound traffic tend to accumulate empty "foreign" cars on line and therefore find it easy to provide their shippers with cars without having to ship cars in from distant points. Carriers with a net of outward-bound traffic are often short of cars and hence under pressure from their shippers to get them. This situation has led to conflicts among the carriers and to the establishment of car service rules to govern car distribution and return. One of the purposes of car service rules is to protect the owning carriers from more or less permanent loss of their freight cars. Thus the rules provide that cars unloaded off the owner's lines must be started back toward the owner whether they are loaded or not. When there have been car shortages, the ICC has put into effect emergency requirements that cars be on their way back to their owners within 48 hours. Enforcement of this rule has tended to increase empty car mileage and, presumably, energy costs.

Government Regulation

Government regulation perhaps has the most pervasive influence on the generation and control of empty car mileage. The ICC can regulate to some extent the factors of car ownership and use and the makeup of the railroads' freight car fleets. It can also influence the geographic imbalance of freight car demand through its ability to set low rates for traditional back-haul movements. The ICC is also empowered to set per diem rates, the charges that owning railroads impose for the use of their freight cars by other railroads. Through its power to promulgate and

enforce the normal car service rules and emergency orders that govern the interchange of equipment, the ICC can also affect the supply and utilization of freight cars.

Thus the ICC can be a major influence in the distribution of rail freight cars and the control of empty car mileage. However, given the magnitude and complexity of the car distribution process and the existence of competing and not completely compatible objectives, it is not at all clear that regulation has allowed the best use of the freight car fleet. During the late 1960s and early 1970s, for example, car shortages were a persistent problem for shippers, railroads, and the ICC.

In requiring all shippers to "share in the poverty" of freight cars, the ICC has sometimes issued emergency car service orders that required cars to be on their way to the home road, loaded or not, 48 hours after being reported empty by shippers. As a result, the number of empty car-miles has increased significantly. To some extent the ICC's order reflected the conflict between eastern roads and southern and western roads. The ICC's stringent enforcement of its order resulted from complaints by the western roads and their shippers that they were being forced to provide the car fleets for the whole rail system. In a time of rapidly rising costs of capital funds and resistance on the part of the ICC to cost-matching increases in the per diem rate, the western carriers found themselves in a very adverse situation, that is, buying cars and having them go off line for long periods of time when they, the western carriers, were plagued with inabilities to deliver cars to their own shippers.

Recent enforcement of the 48-hour rule almost immediately shifted the car shortages from the West to the Northeast.

Prior to the prescription of emergency car service rules in 1973 car shortages were primarily in the West. Subsequently, according to Appendix C of the ICC's show cause order of June 10, 1974, reported shortages were 58,500 cars in the Eastern District and 28,000 in the Western District. By forcing cars to move empty toward the West, the ICC created shortages in the East. This was at a time when six railroads

in the Northeast were bankrupt and could ill afford the cost of moving empty cars or the loss of business because of car shortages.

The Cost of Empty Freight Car Mileage

Even if the number of empty car-miles is reduced, the question of how much would be saved remains. On the average, an empty car adds about 40 percent of the trailing tonnage of a loaded car. Thus the transportation of empty cars can be a major portion of the total tonnage hauled by the railroads. In 1975 the transportation of empty cars accounted for a little over 45 percent of the total freight car-miles and nearly 25 percent of the gross ton-miles. The reduction in fuel usage due to decreasing the transportation of empty freight cars will not, however, be in direct proportion to the reductions in trailing weight (i.e., halving trailing weight will not result in halving fuel consumption and costs). A certain amount of energy is expended simply for the operation of the locomotive. Beyond this intercept level, however, incremental increases in trailing tonnage probably produce approximately equal increases in energy consumption. On the average, the energy saved in the reduction of one empty car-mile would be about 0.135 gallons of diesel fuel. In the United States in 1975 the number of empty car miles was about 12,521,373,000, and the amount of fuel used for empty car transportation was about 1,690,385,355 gallons. Thus a 25 percent reduction in empty car mileage would save about 422,596,339 gallons of fuel per year.

The LRAC Model was used to examine the relationship between long-run average costs, fuel consumption, and the ratio of empty to loaded cars. Figure 9 depicts the sensitivities of main-line fuel consumption to the ratio of empty to loaded cars (0.83 nationwide in 1975) for a 500-mile line where trains operate at an average speed of 30 mph. As would be expected, the lower the ratio of empty cars to loaded cars is, the better the fuel consumption. Figure 9 also shows the cost per main-line net ton-mile for different ratios of empty to loaded cars.

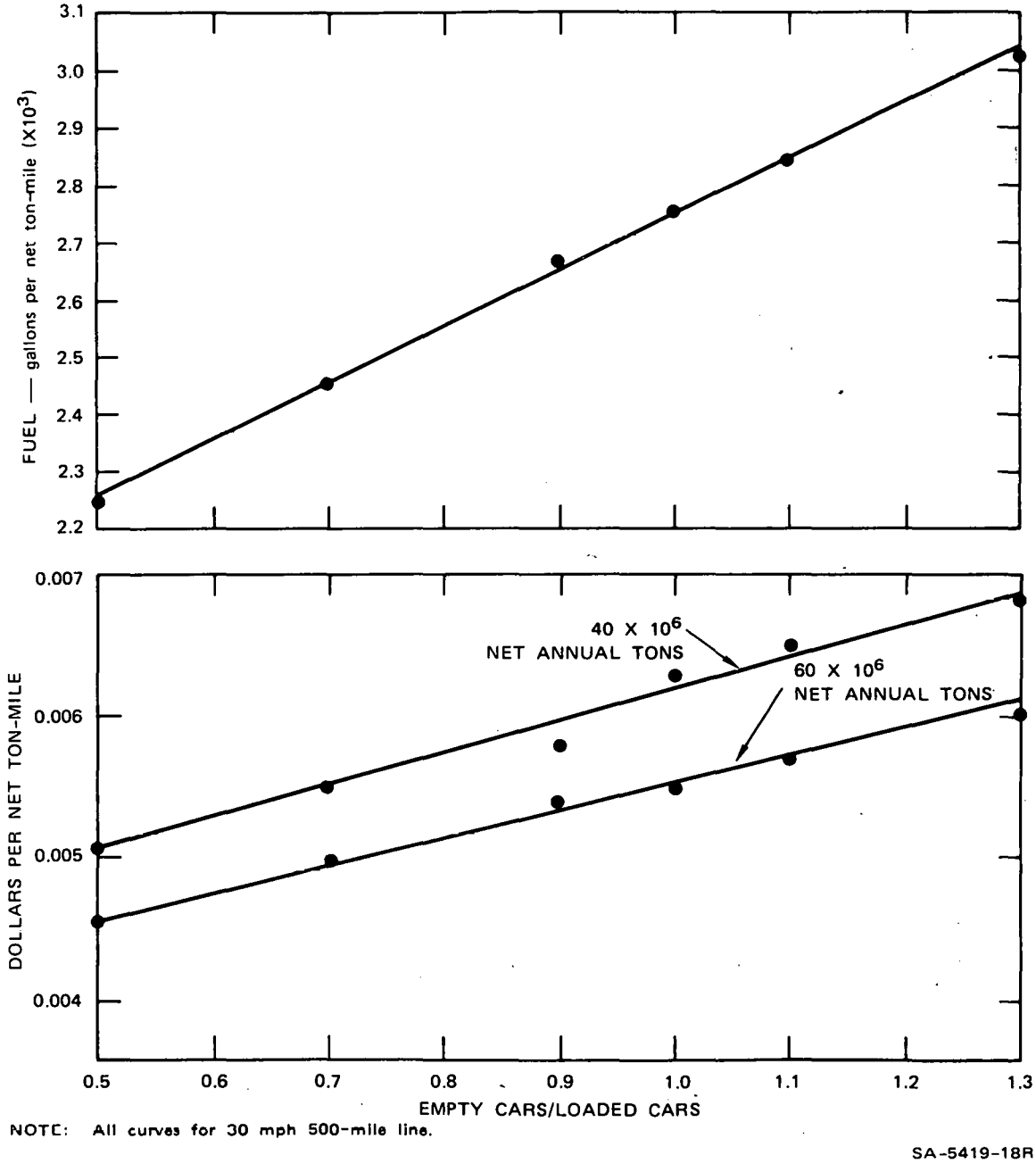

FIGURE 9 MAIN-LINE COMPONENT FUEL AND AVERAGE COST VERSUS RATIO OF EMPTY TO LOADED CARS

Implications for Future Regulatory Policies

The problem of car distribution on U.S. railroads is not a simple one. Individual railroad ownership of cars, imbalances of traffic, the right of common carriers to reject private cars, the increasing use of specialized equipment and services, and the rigid enforcement of car service rules have caused, in times of both car shortages and surpluses, the generation of empty car miles, which is inconsistent with an energy-tight economy. The simultaneous pursuit of the two seemingly incompatible but desirable goals of reducing empty car mileage and insuring an adequate supply of empty cars poses a conundrum that defies solution.

Despite this fact it must be recognized that the ICC has the power to influence significantly the magnitude of freight car shortages as well as empty car mileage. It seems, however, that a major problem is the ICC's inability to assess accurately the impact of a given regulatory practice before its implementation and to quantify the total economic and energy tradeoffs that occur because of the regulation.

The problem of imbalances of traffic, to the extent that it is created by rate policy, can be redressed by a change in rate policy. Its ramifications, however, are bound up with the basic locational structure of the American economy. The imbalance of traffic could also be mitigated, at least to some extent, if carriers were required to accept private cars for transport, which would increase the flexibility of the non-railroad-owned fleet.

Another possible course of regulatory action (although more major in scope) that might improve both empty car mileage and freight car shortages would be the establishment of a national pool of freight cars with joint ownership or lease as an alternative to individual ownership. [This situation already exists with respect to TOFC, and some boxcars and flatcars.] All cars would then be free running, that is, they would not be tied to an individual railroad or region. A central car control agency would allocate cars on the basis of some optimizing procedures. The algorithm by which allocations were made, however, would constitute a crucial question. If cars were to be distributed as now on the basis

of equalizing the shortages across regions, empty car miles might be reduced, but not by much. Empty cars would still have to flow back quickly to the net rail freight exporting regions. If minimizing empty car-miles were to be given a high value in the algorithm, then cars would tend to sit longer in net rail freight importing regions awaiting loads. Coupled with freight rate reductions that might result from the greater availability of cars, this would rebound to the benefit of the net importing regions and to the detriment of the net exporting regions. Bringing the matter down to specific regions, in general the Midwest and Northeast would benefit, while the West and parts of the South would be hurt. On the other hand, raw material and food costs might rise in the Midwest and Northeast and fall in the West. Understanding and explaining the full impact of major transportation changes on the economy is beyond the scope of this study and it is easy to exaggerate the effects of the changes we have discussed here. The important point to note is that while empty car mileage can in some measure be reduced by the pooling of all railroad-owned cars, large reductions in empty car mileage would involve major changes in freight rates and shifts in economic location. There would, in fact, be an income redistributional effect between the eastern and southern and western regions of the U.S. In that respect freight car utilization is closely related to the matter of regulatory preference given to long hauls of certain basic commodities.

Rates on Low-Density Rail Traffic

The usual approach to the so-called branch-line and main-line problem is to determine whether costs--calculated on a variety of bases--exceed revenues. If they are found to do so, the assumption is made, often implicitly, that the continuation of services will result in a decline in the going concern value of the rail carrier providing the services. If the railroad is in somewhat less than robust financial health, or if it can persuade public officials that the public interest does not require continued services, it will be allowed to abandon services on the branch line or secondary main. Or, as in the

case of northeastern railroads, the federal government may provide a subsidy to assure service continuation. Seldom is the question raised as to whether there should be higher rates for delivery on branch lines or for routing on low-density secondary mains. This is because there is a strong regulatory tradition, supported in some measure by statute, that specific rates on the same commodity on the same railroad but on different lines need not reflect specific costs of service. Put in another way, the density of traffic on a route or line should not be reflected in the rates on that route or line. As long as the revenues from some aggregate of services are sufficient to cover costs, specific rate-cost relationships cannot be at issue. Thus, the possibility that, by raising charges on the branch line, services might be continued without financial drain on the carrier providing them has been considered only occasionally, and only then when proposed by shippers located on the line up for abandonment.*

All of this reflects the pervasive condition in the rail rate structure and rail operations of a wide range of coverage of costs for similar shipments depending on the rail route or line over which they move. The coverage ranges from overwhelmingly submarginal, which provokes line abandonment cases, to very substantial. This characteristic of the rate structure has produced a variety of consequences. For example, because rail carriers have not had the option of raising some rates and reducing others, they have tended to price themselves more or less completely out of business that as a whole did not pay. This has been particularly true of manufactured commodities, which have wide distribution patterns and are particularly susceptible to truck competition. The rail carriers' inability to raise some rates and lower others on the same commodity moving similar distances has often made it worthwhile for them to give up the business completely. Another effect of geographic uniformity in the rate structure has been the lessened importance of transportation to industrial

*In this section we accept without further discussion the strong and demonstrable inverse correlation between traffic density and economic cost in railroad operations.

location. Producers not bound by raw material sources have been freer to locate in response to other factors even though the result has been to impose higher transportation costs on the economy as a whole. More heterogeneity of rates would ultimately have major locational impact, particularly in the direction of more centralization of industrial activity. While transportation costs, including energy, might be reduced, other economic and political impacts might be less acceptable.

The problem is not easy to deal with. In the short run, raising rates on branch lines and secondary mains may not change the flow of traffic. If rail rates are still lower than truck, shipments may continue to move by rail. If rail services are abandoned, the movements may be diverted to truck, which may have higher energy costs. Hence, it is probable that few branch-line and main-line savings can be made in energy in the short run. Whatever energy savings can be made will probably arise from a shift away from rail to truck. This would be resisted by shippers, however, wherever truck rates are higher than rail, such as rates on basic commodities and on shipments moving long distances. In some cases it may be justifiable in terms of energy savings to provide subsidy, not for continuation of rail services, as is now the case in the Northeast, but to make up to shippers for payments of higher truck rates. A short-run policy probably ought to be to allow, or require, abandonment of rail services wherever rail energy costs exceed those of truck. This would not deal, however, with the situation where railroads have lower energy costs than truck but where revenues do not cover resource costs as a whole. In such a case, the pressure of higher rates might well be imposed to force shippers to determine whether other locational advantages are sufficient to overcome the higher transportation resource costs of their present locations. In the longer run they might move, producing favorable effects on energy consumption.

Regulatory Obstacles

Permitting railroads to raise rates selectively on certain lines and routes would require a shift in ICC regulatory policy and changes in the Interstate Commerce Act. Over the years one of the major functions of

the ICC has been to arbitrate between the demands of shippers to be given equality of treatment by carriers regardless of cost, and the pressures of the carriers to be able to respond to supply-and-demand relationships. The resolution of these conflicts has led the ICC to establish mileage scales for rate determination that have resulted in uniformity of rates, commodity by commodity, for equal distances. In the case of class rates, this uniformity stretches over a good part of the country. Where mileage scales have been applied to commodity rates they have usually been for competitive producing regions or marketing areas such as coal from western Pennsylvania to consuming areas in the Northeast.

On the other hand, the ICC has approved various ways of increasing carrier pricing flexibility, particularly in limiting the application of reduced rates to movements where densities are relatively high. This flexibility has taken the form of unit train and trainload rates, rates under various TOFC plans, and so-called freight-all-kinds rates. The carriers have had some success in limiting the number of points to which these rates apply. This has resulted partly because the ICC has not been overly vigorous in pushing the question as to whether railroads common carrier obligations require them to install facilities and equipment everywhere for handling unit trains, TOFC, and the like. Obviously, it may not be reasonable to require financially weak carriers to install TOFC ramps to handle one or two trailer loads a week. This has permitted rate differences to be sustained even on the same commodity. Even so, the carriers face the hazard that the ICC may hold that making available a service to one shipper at one effective rate and not providing it to another may constitute illegal discrimination.

Regulatory Provisions

Sections 2, 3, and 4 of the Interstate Commerce Acts are concerned with discrimination. Section 2, which is often referred to as personal discrimination, prevents a carrier from differentiating rates (or otherwise treating unequally) between shippers in essentially similar circumstances. Although the ICC has rather stringently enforced Section 2,

its application has been largely to shippers located at the same points. It has not been relevant to the question of different rates on different routes and lines. Section 3, which aims at place discrimination, is the provision of the act that more than any other has reduced the rate-making flexibility of the carriers and has led to distance-based uniformity within the rate structure. Section 4, originally one of the most limiting provisions of the Interstate Commerce Act, prohibits higher rates for shorter hauls on the same line in the same direction when the shorter haul is within the longer. This provision does not relate very much to the branch-line problem, but it is involved with the viability of secondary mains. Some secondary mains would be viable if the carriers could concentrate on terminal-to-terminal traffic and were not required to provide service at comparable rates to intermediate points. In recent years the application of Section 4 has been softened by allowing departures (so-called Fourth Section Relief) where circuitous routes compete with direct ones, and where there is truck or water competition at end but not at intermediate points. The ICC, however, still continues to enforce Section 4 where those conditions are absent regardless of the fact that terminal-to-terminal traffic may cost but a fraction of what may be required to provide intermediate service.

Section 3 constitutes the major obstacle to relating specific rates to specific costs. It was put into the law because shippers were unwilling to permit the railroads to vary their rates depending on whether or not they were faced with competition on a route, or their traffic densities were high. Section 3 states:

> It shall be unlawful for any common carrier subject to the provisions of this part (rail) to make, give, or cause any undue or unreasonable preference or advantage to any particular person, company, firm, corporation, association, locality, port, port district, gateway, transit point, region, district, territory, or any particular description of traffic, in any respect whatsoever; or to subject any particular person, company, firm, corporation, association, locality, port, port district, gateway, transit point, region, district, territory, or any particular description of traffic to any undue or unreasonable prejudice or disadvantage in any respect whatsoever.

As the ICC and the courts have interpreted Section 3, discrimination must be participated in, at least, by one railroad--that is, unlawful discrimination does not occur unless one carrier participates in both rates, although other carriers may be involved. Also, a complainant must show that it has suffered damage in order to obtain redress. Although these legal showings have limited the scope of Section 3, it has had wide application and has greatly limited the carriers' freedom to get out of poor-paying business without also having to forego profitable business. In that regard, the ICC has not permitted the carriers to justify rate differentials on the basis of differences in traffic densities. The argument has been made by shippers confronted with high rates that a route or line could never build up enough traffic to justify rate reductions and thus would always be forced to pay high rates. There is of course some truth in this argument, although it does not follow that traffic on a route or line will necessarily increase just because rates are lowered. It may be noted that in lessening the scope of rate regulation in the Railroad Reorganization and Regulatory Reform Act of 1976, Congress took pains to make clear that it did not intend that Sections 2, 3, and 4 be weakened in any way. It is not likely that Congress will be enthusiastic about any tampering with Section 3 that would curb the protections it now affords.

Section 3 as amended clearly reflects the parochialism of the American economic and political system. Most congressmen, especially from states where railroads are characterized by relatively low-line densities, would be very loath to expose producers and buyers in their states to the possibility of having to pay higher rates than their competitors. This pressure for parity of rates has tended to override consideration of wide variations in cost of service. The argument for rate uniformity is based on the following propositions:

- It is in the interest of the whole country that each region be afforded the opportunity to exploit its economic opportunities. Rate "equality" helps to assure that.
- Communities ought not to be the victims of the particular weaknesses--financial or operating--of the railroads that serve them. The sins of railroad mismanagement ought not to be visited upon the customers.

- A less developed region of the country with low traffic densities should not be forced to pay high rates that would discourage development and reduce traffic densities with consequent higher rates. This "vicious" cycle can be broken only by rate equality.

One can be sure that any change in these rate policies, even in the interest of energy conservation, would have major economic and political ramifications and would be strongly opposed by various regional interests. This resistance to structural change in rate relationships has been apparent in recent major proceedings before the ICC.

Recent Regulatory Activity

In 1971 the ICC undertook an investigation that it characterized as one of the most important proceedings ever to come before it. In Ex Parte No. 270, the ICC began what was purported to be a thorough investigation of railroad rates and whether they are appropriate for contemporary shipper needs and reflect changes in railroad operating circumstances. Despite the fanfare at the outset, this investigation has been somewhat less than visceral. Nevertheless, it did discuss in some detail rate structures for several basic commodities.

The significant point here is that the coordinator of the Ex Parte No. 270 investigation, Commissioner Hardin, noted the existence of mileage scales in the case of three major commodity movements by rail, did not find them contrary to the public interest, and for one commodity (coal) found distance-based rates to be appropriate. In Ex Parte No. 270 (Sub No. 4) "Investigation of Railroad Freight Rate Structures: Coal," Commissioner Hardin stated:

> Figures through AA, supra, indicate that although rates have been tailored to competitive situations, particular patterns of rates have emerged in relationship to Docket No. 28300 class rate scale. [345 ICC 71, 316]
>
> The Coordinator is of the view that these, or a similar distance scale of rates can be used as a basis for the investigation and an appropriate environmental impact statement. [345 ICC 71, 317]

In Ex Parte No. 270 (Sub No. 6) "Investigation of Railroad Freight Rate Structure: Scrap Iron and Steel," the coordinator found the following:

> Interterritorial rate scales between southern origins and points in Official Territory (mostly Ohio and Pennsylvania) have fluctuated within limited ranges since the early 1930's. [345 ICC 867, 995]
>
> Within Southern Territory, information presented by the parties indicates that the majority of scrap movements are under distance commodity rates established for competitive reasons.

In Ex Parte No. 270 (Sub No. 5) Commissioner Hardin stated the following:

> First, ex-lake rate groups are primarily mileage oriented although equalization or origin ports and points within multiple-destination groups occasionally clouds the mileage-rate relationships. [345 ICC 547, 680]

Nowhere in his Ex Parte 270 reports did the coordinator suggest that distance scales lead to economic inefficiencies, or that Section 3 might be modified to permit rates to be more closely related to energy costs.

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Appendix A

HISTORICAL BACKGROUND OF LOW LONG-HAUL RATES

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Appendix A

HISTORICAL BACKGROUND OF LOW LONG-HAUL RATES

It has been a widely accepted proposition in transportation economics, at least since Von Thunen,* that production costs and transportation costs are substitutable for one another. Assuming competition at a market, this means that transportation will be a larger element in delivered price the greater distance a production point is from a market. If potential costs of production are randomly distributed with respect to distance from a market, or, as is often the case, they are lower at greater distances from a market, then improvements in transportation efficiency will result in larger production at more distant points, greater total expenditures on transportation, and smaller total expenditures on production for a given output of goods. Hence the demand for transportation will tend to be elastic to the degree that there are disparities in production costs at different distances from the market. Lower rates, or, more accurately, lower unit costs of transportation paid for by consumers, will tend to encourage production more distant from markets, and higher unit costs will tend to localize production about markets. Reductions in transportation cost will reduce total output costs of goods, and thus total output will rise (assuming a negative slope of demand). The converse is of course also true. Since transportation affects the price of nearly every good, it is understandable in light of the above-described phenomena that there have been enormous political as well as economic pressures to reduce transportation costs, or at least the outlays more distant producers have had to make. In the United States these political pressures have been vented both in regulation and public support.

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*The Isolated State.

From the early nineteenth century federal funds have been used to encourage the building of highways, railroads, waterways, and airports and thereby to reduce the amounts that transportation users have had to pay. The supposition, not always carefully specified, was that economic growth and greater intensity of use would, over time, more than make up for the "temporary" public support. During and for some time after the period of public support for railroads, railroad companies themselves with excess capacity also encouraged development by promotional pricing policies. To a considerable extent regulation was first enacted to alleviate impacts of these promotional policies on older producing regions, for example the prohibition against lower charges for longer hauls. Despite regulation, however, the railroads established and maintained rates, principally on eastbound transcontinental movements of agricultural commodities and extractives, that for similar transportation services were considerably lower than westbound rates. Westbound rates also were low compared with those on shorter, more regional, hauls. Rate structures were intended by the railroads to encourage greater utilization of large, publicly supported, capacity. Hence during these years there was a concomitance of both public and private objectives. The losers were agricultural and extractives producers in the Northeast.

After World War I these conditions began to change as rail capacity became more fully utilized and as producers' supply curves (agricultural and extractives) began to turn inelastic. The railroads' dispositions were to raise rates, particularly on the eastbound movements, many of which were below out-of-pocket costs. Supported by the Transportation Act of 1920, which stressed railroad earnings, the carriers began to level up rates in the early 1920s. This obviously ran counter to the interests of large agricultural and extractives groups in the West. The result was that Congress in the Hock-Smith Resolution of 1925 instructed the Interstate Commerce Commission (ICC) as to a "true" rate policy which should be followed. The resolution:

> . . . declared to be the true policy in rate making to be pursued by the Interstate Commerce Commission in adjusting freight rates, that the conditions which at any given time prevail in our several industries should be considered in so far as it is legally possible to do so, to the end that commodities may freely move.

Congress went on to state in the resolution that:

> In view of the existing depression in agriculture, the Commission is hereby directed to effect with the least practicable delay such lawful changes in the rate structure of the country as will promote the freedom of movement by common carriers of the products of agriculture affected by that depression, including livestock, at the lowest possible lawful rates compatible with the maintenance of adequate transportation service. [49 USC Sec. 55]

Generally, following this resolution, the ICC proceeded through many cases over a span of years reaching to the present to hold down rates on basic commodities moving long distances.

In 1933 Congress repealed the fair earnings provision of the Transportation Act of 1920 and replaced it with language more consistent with the Hoch-Smith Resolution. The rule of ratemaking, Section 15a of the Interstate Commerce Act, was revised to read as follows:

> In the exercise of its power to prescribe just and reasonable rates the Commission shall give due consideration, among other factors, to the effect of rates on the movement of traffic by the carrier or carriers for which the rates are prescribed; to the need, in the public interest, of adequate and efficient railway transportation service at the lowest cost consistent with the furnishing of such service; and to the need of revenues sufficient to enable the carriers, under honest, economical, and efficient management to produce such service. [49 USC Sec. 15a]

By its reference to "the effect of rates on the movement of traffic" Congress intended, and the ICC has so understood, that no rate change should have the effect of discouraging the flow of traffic.

In 1940 Congress again, in its statement of "National Transportation Policy," stressed the objective of "developing, coordinating, and preserving a national transportation system by water, highways and rail, as well as other means, adequate to meet the needs of the commerce of the United States, of the Postal Service, and of the national defense" (49 USC Secs. 1, 301, 901, 1001).

More recently, in Section 205 of the Railroad Revitalization and Regulatory Reform Act of 1976, Congress repealed the provisions referred to above in Section 15a insofar as they apply to railroads and replaced them

with language that emphasizes the needs of rail carriers to retain and attract capital funds. It may be speculated that as a result of this legislation the ICC is now more free to allow the rail carriers to discourage business that they do not want.

Paralleling the legislation cited above (except the last) are ICC decisions that have carried out congressional intent to encourage freedom of flow of goods. It may be useful to review the language of some of these decisions.

Very early the ICC stated its disposition toward relatively lower rates for longer hauls, basing its consideration on both costs and the need for competition among carriers:

> That under like conditions freight can be profitably carried long distances at rates proportionately lower than short distances is as nearly settled as anything related to railroad charges can be. Equal mileage rates would often prevent legitimate competition and frequently give a monopoly in transportation to the best and shortest road. [2 ICC 375, 385]

In a much later case on coal rates, the ICC referred to the need to sustain competition among producing areas:

> The establishment of distance rates on coal would tend to localize the source of supply of consumers, destroy to a large extent existing competition, and probably have an important influence on cost of coal, [144 ICC 333, 342]

Another case on livestock made the point that rates related to distance will have an adverse impact on traffic:

> A system of rates which adheres rigidly to distance frequently resists the normal flow of traffic. [185 ICC 280, 288]

The Commission rejected the argument that rates on long-haul traffic ought to go up when short-haul rates are forced down because of truck competition:

> Rate scales constructed to provide greater rate of return for short hauls than for longer hauls are not necessarily to be reconstructed because of loss of short-haul traffic to trucks, since other considerations might outweigh or offset that factor. [190 ICC 611, 619]

In the 1920s the railroads began to push for across-the-board general rate increases to cope with price inflation and, during the depression of the 1930s, low earnings. In a case following the Emergency Transportation Act of 1933, which directed the ICC to "consider the effect of rates on the movement of traffic," the ICC raised this issue:

> Their proposals, broadly stated, increase long haul rates relatively more than short haul rates, thus adding to the disadvantage under which long haul shippers already labor, thereby tending to lessen the traffic which still largely moves by rail. [208 ICC 1, 58]

In its extended deliberations on railroad class rates throughout the country, Docket 28300, the ICC rejected costs as a controlling factor in rates:

> Costs alone do not determine the maximum limits of rates. Neither do they control the contours of rate scales or fix the relations between rates or between rate scales. [262 ICC 447, 693]

In a case just after World War II, the ICC began to deal with the problem of general percentage increases as they affected long-haul traffic:

> The railroads propose to apply a straight 7-percent increase to all rates on agricultural products without exception.
>
> They contend that the present rail rate structure is already adjusted so as to favor farm products and that a straight percentage increase will continue to favor those products.
>
> . . . start with bases of rates which were already relatively lower than the general body of rates, because they applied on agriculture products, we have tempered the application of the several general increases on agricultural commodities by permitting a less percentage than applied generally, frequently accompanied by maximum holddowns on certain products. As a result the rates on some of these agricultural commodities have been increased at a lower rate than the costs have increased. [291 ICC 279, 307, 310]

The ICC continued to be confronted with the problem of the effects of percentage increases on long-haul rates:

> The imposition of a flat increase on all traffic could not be justified from a cost standpoint, although it may be possible that the question of some form of graded increase may be explored in the permanent phase of this proceeding. [299 ICC 429, 451]

In Ex Parte No. 262 the ICC attempted to rationalize not providing holddowns on long-haul traffic:

> Another contention which invariably arises in connection with general rate increases, is that a horizontal increase is prejudicial to long-haul shippers and preferential of short-haul shippers with whom they compete. The long-haul shipper's rate is to be increased, and then use that amount, in cents per 100 pounds or per ton, as a maximum or holddown for the increase in the long-haul rate. The argument is that only in this way can disruption of competitive relationships be avoided. But such approach is valid only in a stable economy, which has not prevailed for some years. Indeed, the principal fact underlying the carriers' need for additional revenue is that the forces of inflation have pushed up their operating expenses, as measured in terms of current dollars. In this economic climate a horizontal increase applied to all rates is the fairest means of distributing the burden of providing the additional needed revenue. To hold down the increase in the long-haul rate in these circumstances means to give the long-haul shipper preferential treatment; and, to the extent this is done, the geographical advantage of the short-haul shipper is eroded. A hold-down should not be used as a device to prefer Paul at the expense of Peter. [Ex Parte 262, 337 ICC 436, 478]

In the next general rate increase cases, however, the ICC retreated to the practice of imposing holddowns:

> However, a straight percentage increase places a greater burden generally on higher rated commodities and longer-haul traffic.
>
> One of the major controversies in this area is the relative contribution of "long-haul" traffic. It is generally recognized that unit-costs decrease as the length of the haul increases. This is due, in part, that high terminal and administrative costs are spread over the greater service. It has long been the practice of the respondents to recognize these factors and, as a result, rates and charges for longer hauls have not progressed in direct proportion to the distance. For example, the competition between California and Florida producers of fresh fruits and vegetables, the rates from a representative point in the West have been held to 151 per cent of the rate from Florida, although the distance from the western point is 263 per cent greater.
>
> Notwithstanding that these principles have generally applied in the construction of rates for the longer hauls, we are of the view that the repeated application of percentage increases will tend to distort the original relationships and that recognition should be given in Ex Parte No. 267 to the cumulative effect thereof wherever competitive traffic is involved. [Ex Parte 265, 267. 339 ICC 125, 192]

The evidence herein demonstrates that there is intense competition between western origins and other areas of the country for sales of fresh fruits, vegetables, and edible nuts. It is also apparent that this traffic is subject to diversion, and that an increase of 5 percent without holddowns, could force western shippers to look to motor carriage or forgo their participation in distant markets. These shippers will benefit from our limitation of the overall increase to 3 percent; the lesser percentage increase we have authorized will have less impact upon rate differentials and competitive relationships than the increases proposed by the carriers. In determining whether a further limitation should be imposed we must consider the respondents' need for additional revenues, revenues which are essential for implementation of service improvements sought by these protestants and alleged by them to be necessary to prevent diversion. Balancing respondents' revenue needs with protestants' need for holddowns on these commodities, and based upon all the evidence in the proceeding, we conclude that the increase to be applied to fresh and processed fruits and vegetables and edible nuts shall not exceed 6 cents per hundred pounds. [Increased Freight Rates and Charges, 1973, Nationwide, Ex Parte No. 295. 344 ICC 589, 636]

Appendix B

ASSUMPTIONS USED IN THE LONG RUN AVERAGE COST MODEL

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Appendix B

ASSUMPTIONS USED IN THE LONG RUN AVERAGE COST MODEL

The analysis of costs described in Task Report No. 2 involved the application of the Long Run Average Cost (LRAC) Model.* The assumptions and details of the analysis for one of the commodities discussed in the report are summarized below.

Assumptions

To analyze the long-run average costs of hauling a commodity, we first assumed a branch-line movement to a terminal where the cars are sorted. The cars then move along a main line, pass through several intermediate yards, and arrive at a destination terminal where they are sorted again for their ultimate destination. The cars are then delivered to their destinations aboard way trains traveling along branch lines. The length of haul (or any other parameter) can be varied while other parameters are held constant to analyze the effects on costs and fuel consumption.

We made several additional assumptions and inputs regarding movement. The values used for each component of the model, where they differ from the default values, are summarized in Table B-1. The branch-line haul was taken to be the average one-way haul for a loaded car in 1963.† The value for 1973, which was not available at the time of analysis, is not

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*The model itself and the various components are covered in detail in A. E. Moon et al., "Railroad Energy Study: Description of Rail Transportation in the United States," Vol. 1, "Freight Railroading," Task Report No. 1, Contract E4-76-C-03-1176, Stanford Research Institute, Menlo Park, California (January 1977).

†"Ratios of Empty to Loaded Freight Car-Miles by Type of Car and Performance Factors for Way, Through and All Trains Combined," Interstate Commerce Commission, Washington, D.C., 1963.

significantly different (~51 mi). This 53-mile haul is split so that one-half the distance (26.5 mi) is at each end of the corridor. The average haul is assumed to be 70% of the branch-line length, giving 38 miles of line at each terminal. The branch line is assumed to be dedicated to the commodity being considered.

Table B-1

ASSUMED VALUES AND INPUTS TO THE LONG-RUN AVERAGE COST MODEL

Branch-line haul (total)	53 mi
Branch-line haul (per line	26.5 mi
Branch-line length (per line)	38 mi
Average load per car*	
Coal	80.2 T
Farm products	64.6 T
Lumber	51.3 T
Transportation equipment	23.6 T
Terminal yards	2
Nonindustrial tons dispatched per year	10,000,000 T
Industrial cars dispatched per year	15,000
Percentage of commodity dispatched on industrial trains	50%
Intermediate yards	(variable depending on haul)
Nonindustrial tons dispatched per year	10,000,000 T
Industrial cars dispatched per year	0
Main-line net tons per year	40×10^6 T

Note: The values in this table are in addition to the default values summarized in Task Report No. 1.

*Average loads were taken from "1973 Carload Waybill Statistics," Interstate Commerce Commission, Washington, D.C., 1974.

Yard assumptions in Table B-1 are summarized in two categories: the terminal and intermediate yards. We assumed that 50% of each commodity was dispatched aboard yard-associated industrial trains, which leaves 50% ot the total tonnage tor each to be dispatched on branch-line way trains. These assumptions gave costs of $20 per car for intermediate yards and $30 per car for terminal operations. The number of yarding operations

versus length of haul was estimated using the relationships in Table B-2, which was generated by first estimating the number of switches for two distances. For example, the 13 switches shown in the table represent a movement of loaded cars with 2 terminal switches, 4 intermediate yardings, and 7 intermediate switches for the returning empty car. The basic switchings were adjusted for each commodity to account for the percentage of unit and solid trains for the commodities shown. The average number of switches for all other distances were assumed to be linear interpolations of these points.

The cost of a main-line movement was estimated as the proportion of the commodity of a main-line segment having 40×10^6 net tons of traffic. The proportion for each commodity was estimated from adjusted statistics from the ICC's 1973 Carload Waybill Statistics" as the average proportion of total traffic in the United States. Costs were allocated in proportion to total tonnage.

Summary of Calculations for Coal

Table B-3 summarizes the cost and fuel calculations for coal. Length of haul, average number of switches, and switching costs have been explained above. Main-line costs come from the main-line component of the LRAC Model. Branch-line costs are the costs of hauling one-half of the assumed coal traffic on a branch line. The remainder of the traffic is assumed to be handled as industrial traffic at the terminal yard.

Table B-2

SWITCHING ESTIMATES

Length of Haul (miles)	Estimated Number of Switches per Load	Average Switching Adjustment for Unit and Solid Trains			
		Coal Products (15% unit; 15% solid)	Farm Products	Lumber Products (5% unit)	Transportation Equipment (10% solid)
516*	13 (7 back-haul empty)	10.15	13	12.35	12.40
1,000	17 (9 back-haul empty)	13.25	17	16.15	16.20

*Average U.S. haul 1973.

Table B-3

COST AND FUEL SUMMARY FOR COAL

	Length of Haul					
	200	500	1,000	1,500	2,000	2,500
Average switches per load	8.121	10.05	13.25	16.45	10.65	22.86
Total switch costs (10^6) ($/ton)	2.65	3.258	4.256	5.255	6.253	7.257
Main-line costs (10^6) ($/ton)	0.73	2.50	5.44	8.39	11.33	14.28
Branch-line costs ($/ton)	4.83	4.84	4.84	4.84	4.84	4.84
Total (10^6) ($/ton)	8.22	10.59	14.53	18.47	22.42	26.36
Dollars per net ton-mile ($\times 10^3$)	41.08	21.17	14.53	12.31	11.21	10.54
Fuel						
Gallons per net ton						
Switching ($\times 10^{-3}$)	80.45	98.45	128.4	158.4	188.4	218.4
Branch ($\times 10^{-3}$)	433.9	433.8	433.8	433.8	433.8	433.8
Main line ($\times 10^{-3}$)	123.3	421.4	918.6	1416.	1913.	2409.
Total	0.638	0.954	1.481	2.007	2.534	3.061
Average ($\times 10^{-3}$)	3.19	1.907	1.481	1.338	1.267	1.225

Appendix C

FREIGHT CAR OWNERSHIP

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Appendix C

FREIGHT CAR OWNERSHIP

In the early phase of railroad development freight cars and other rolling stock including locomotives generally belonged to shippers, car lines and express companies rather than to railroads. Following the Civil War, the provision of most equipment was taken over by the rail carriers. In the period prior to World War I, when much railroad movement was still local or regional, the precedent developed that freight cars would be owned and provided by individual railroads. After federal regulation of railroads in 1887, a number of cases arose concerning a railroad company's obligations to provide freight cars to shippers on request. In these cases, the Interstate Commerce Commission (ICC) concluded that freight cars are "instrumentalities" of transportation. From that time on there was little question about the obligation of railroads as common carriers to provide freight cars to shippers on request. Since this obligation inhered to each railroad as a common carrier, individual railroads had to acquire freight cars and make them available for shipper use. From this, the practice of individual ownership of freight cars was established. Under the law today individual railroads are still obliged to provide freight cars to shippers. It should be noted that this obligation does not extend to specialty cars such as tankers, automobile cars, and the like, which cannot be used for the general transport of freight.

When carriers were forced to take on the responsibility of supplying freight cars, they began to press the point with the ICC and the courts that they not be obliged to accept for transport cars not owned by railroads. The ICC adopted the rule that railroads could agree to transport shipper-owned or other non-railroad-owned cars but were not required to. This, of course, further rooted the practice of depending on individual railroads for cars whether or not they were in adequate supply. The following are quotes from ruling cases:

> Manifestly, the law does not impose upon defendants the obligation of hauling complainant's private cars. If used, it must be under an arrangement which is subscribed to by both, and which is stated definitely in defendants' tarriffs. [19 ICC 556, 560]
>
> Whatever transportation service or facility the law requires the carrier to supply they have the right to furnish. They can therefore use their own cars, and cannot be compelled to accept those tendered by the shipper on condition that a lower rate be charged. [232 U.S. 199, 214-15]
>
> If it be a fact that defendants have suitable refrigerator cars to carry all shipments of complainants, or will secure such cars, and furnish them on demand, they have the legal right to furnish them, and may refuse to transport shipments in privately owned cars. [52 ICC 240,246]
>
> A private-car owner, whether he be a shipper or not, has no right to have his cars used as a vehicle for the transportation of freight over the rails of any carrier without its consent. If the carriers have suitable cars and will furnish them on demand they may refuse to transport shipments in private cars. [201 ICC 323, 373-74]

The ICC has explicitly recognized that non-railroad-owned cars have a role to play in the supply of freight cars. Furthermore, the courts held in an early case (242 U.S. 208) that the carriers did not have to supply tank cars and other special cars. In 1917, the ICC was given power to set the terms of car-hire charges between non-railroad car owners and the carriers. The courts held that private cars are railroad "instrumentalities" of transport when they are on the property of a railroad. This led to the bizarre arrangements still in effect whereby shippers pay regular rates for commodity transport even in their own cars and then quite separately receive from the carriers car rental payments based on mileage. In recent years, however, some rail tariffs have provided that for certain commodities movements shippers must provide cars. In that case the published rate covers both the cars and contents. If railroads were required to haul freight cars tendered to them for shipment by shippers and other non-railroad owners, the rail car fleet would probably increase. This is because railroads tend to have considerably higher costs of capital than companies in the United States generally. The larger fleet would presumably permit greater flexibility and therefore fewer empty car miles. This might reflect an improvement in the trade-off between energy and capital costs.

*U.S. GOVERNMENT PRINTING OFFICE: 1980-640-258-2384