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Grain transportation in South Dakota

C. E. Lamberton

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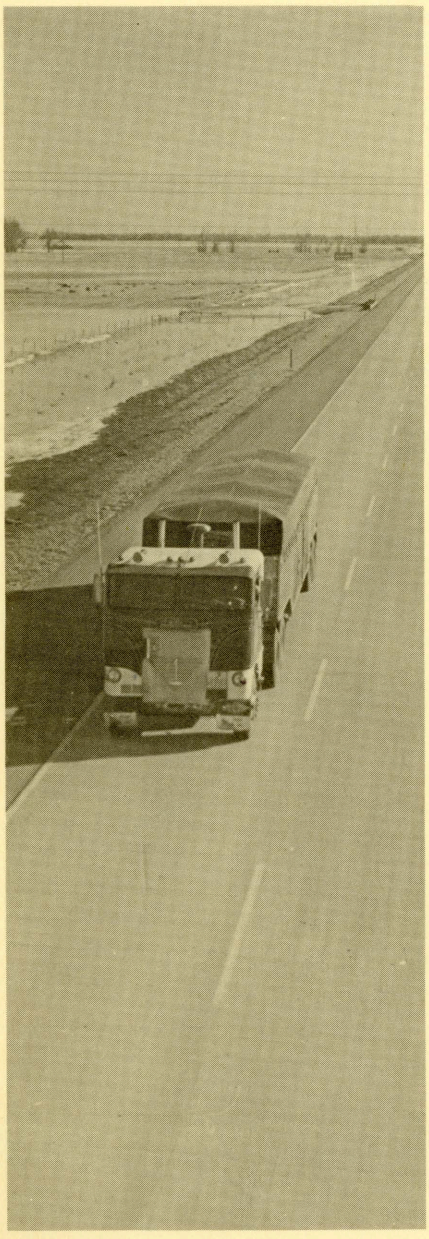

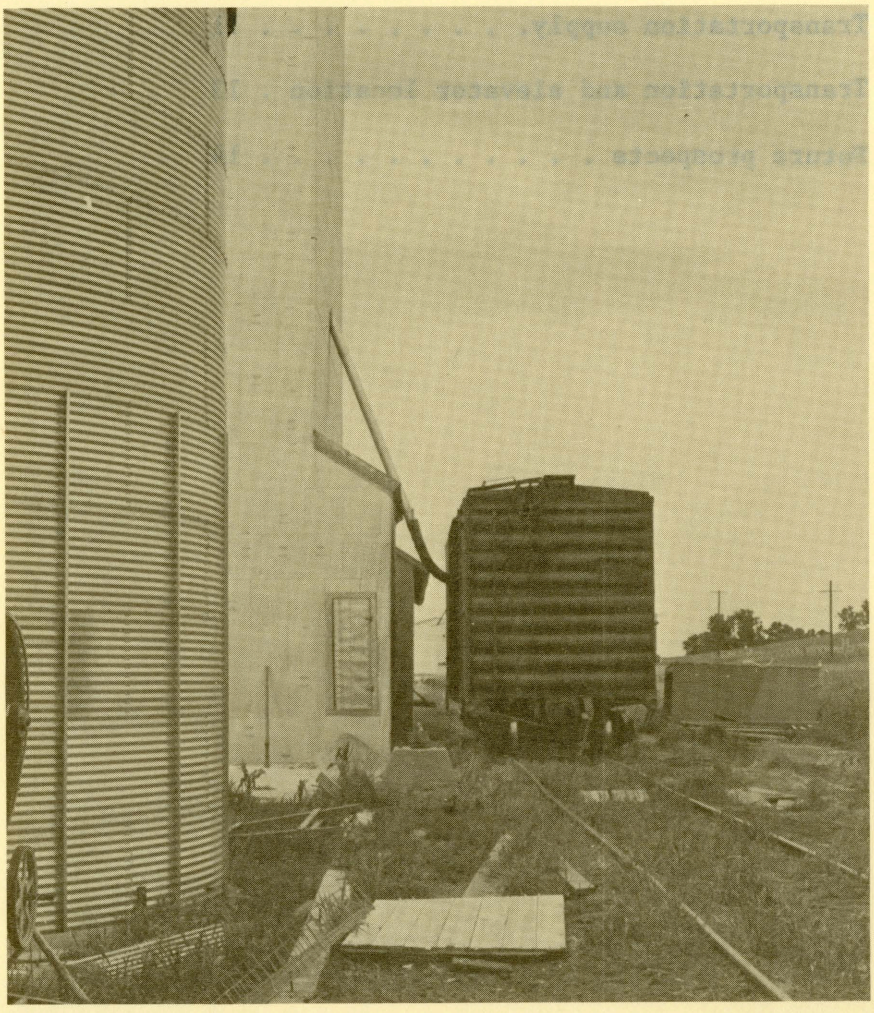

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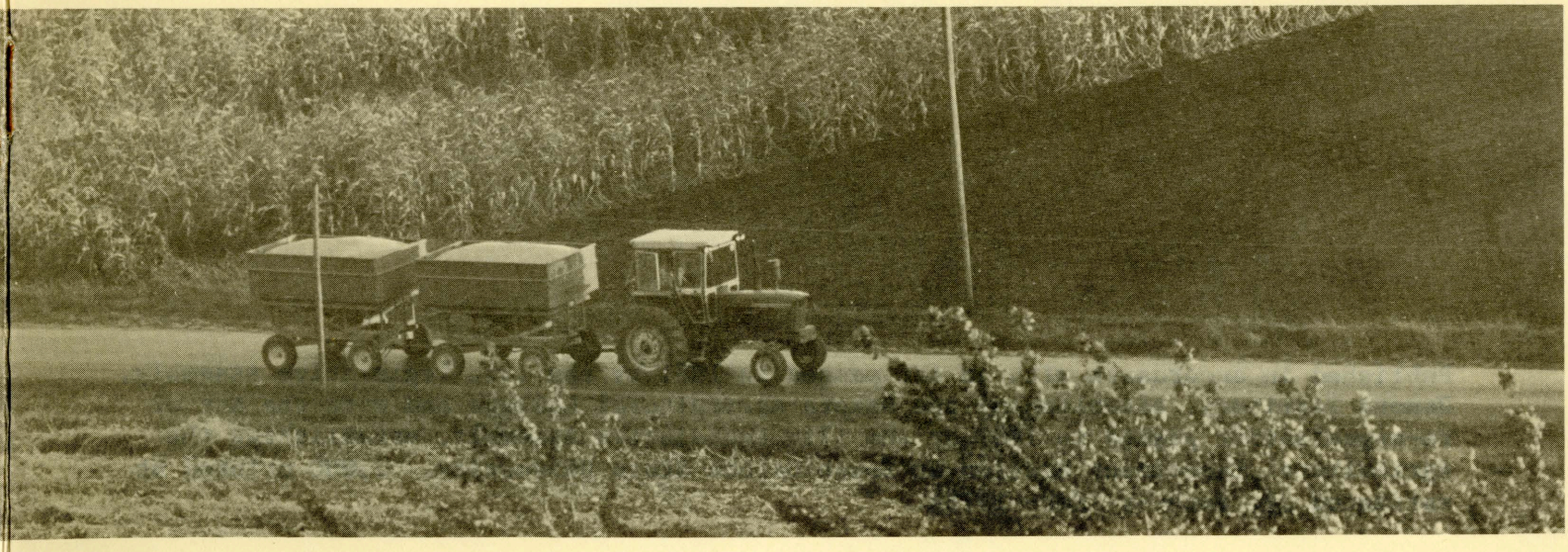

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GRAIN TRANSPORTATION IN SOUTH DAKOTA

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The movement of people and products in and out of the state is of particular importance for people who export much of their own production and import much of what they consume, as South Dakotans do. The primary exports from South Dakota are agricultural products of which grain is one of the most important. Consequently, the grain transportation needs of the state have been a primary determinant of the structure of the state's transportation system. The transportation system, in turn, has influenced the character of South Dakota's economic development.

In looking at the grain transportation system, it is useful to examine the system's historical development. This development has been shaped by both economic forces and the institutional constraints provided by the important role of government regulation in the transportation industry. The effects of these two forces on the historical development of South Dakota's grain transportation system are considered in the first section of this paper. Some of the economic characteristics of the transportation system are discussed in subsequent sections. Future prospects are presented in the final section.

Historical Perspective[1]

Rail service began in this area in 1872. By 1887 when the Interstate Commerce Act was passed, there were over 2400 miles of track and by 1891 17 railroad companies were operating. As residents of a predominantly agricultural territory, Dakotans supported railroad regulation when it was first introduced in 1887. They saw regulation as a means of limiting the economic power of the railroads over rates, routes, and depot locations. They also expected that regulation would ensure relatively low freight rates on agricultural exports and encourage settlement. Regulation would institutionalize and legalize the practice of value-of-service pricing. This is a pricing system whereby low-value agricultural products and raw materials are shipped at rates lower than high-value manufactured goods. The relatively low rates on exports would allow local products to compete in the large eastern markets, thereby

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[1]More detailed discussion of the topics presented in this section can be found in any of a number of texts on transportation and government regulation of business such as:

Fair, Marvin L. and Ernest W. Williams, Economics of transportation and logistics, Business Publications, Inc., Dallas, TX, 1975.

Locklin, D. Philip. Economics of transportation, Richard D. Irwin, Inc., Homewood, IL, 1972.

Friedlaender, Ann F. The dilemma of freight transportation regulation, Brookings Institution, Washington, DC, 1969.

Wilcox, Clair. Public policies toward business, Richard D. Irwin, Inc., Homewood, IL, 1971.

Information on rural and South Dakota transportation in particular can be found in:

"Prelude to legislation to solve the growing crisis in rural transportation" Senate Committee on Agriculture and Forestry, February 1975.

"Report on the South Dakota railroad industry yesterday and today," SD Public Utilities Commission, September 1974.

supporting farm incomes in the territory.

While value-of-service transportation rates did support farm and shipper incomes and assisted agricultural development, this same rate structure hindered the state's industrial development. Relatively high rates on manufactured products provided an incentive to locate industrial projects near major markets, not in South Dakota which was isolated from those markets. Thus, the dominance of agricultural interests in the state and at the national level obtained favorable treatment for agriculture but also contributed to an imbalance in the state's economic development.

To some degree value-of-service pricing evolved out of transportation market conditions which were not representative of South Dakota. In much of the eastern part of the country railroads faced a relatively elastic demand for the transportation of bulk commodities. This meant that there were large responses in the quantities of bulk commodities shipped to small changes in the rates charged. This high elasticity was due in part to the large contribution which freight costs made to the cost of the final goods (which was also true for South Dakota's commodities) and also to the availability of water transportation and alternative sources of supply of agricultural products (which were not available to South Dakotans). Thus, the institutionalization of value-of-service rates tied South Dakota's commodity shipping rates to the relatively low rates charged on such commodities nationally, even though South Dakota's demand for rail transportation was much less elastic (quantities shipped by rail did not change as much as prices for the service changed).

There was another related advantage of regulation to South Dakotans. Prior to regulation, eastern railroads had engaged in rate wars where two or more lines faced each other in direct competition for traffic. Rates could be reduced as low as the level of variable costs for short periods. Since railroads incur heavy fixed costs relative to variable costs, these rate wars resulted in large rate reductions and heavy losses on competitive lines. To survive, each railroad was forced to charge much higher rates where demand was inelastic, where the quantities to be shipped were determined by the goods produced and were not responsive to changes in shipping rates. On these noncompetitive lines rates charged had to be sufficient to cover the traffic's variable costs on these lines plus all of the railroad's heavy fixed costs. South Dakota was potentially one of those areas with few or no alternatives to rail service. Such high rates on South Dakota's products would place South Dakota producers at a competitive disadvantage in national markets. Regulation, by tying rates on South Dakota farm products to those elsewhere, allowed South Dakota agriculture to develop and to compete in national markets.

The Interstate Commerce Act of 1887 prohibited several discriminatory railroad practices: granting undue preference based on persons, companies, or localities; charging higher rates for short hauls than for long hauls along a common line; and pooling of revenues. The Act did not prohibit commodity price discrimination (charging different rates for the movement of different commodities over the same line). In its early reports the Interstate Commerce Commission not only approved of this form of discrimination but also encouraged it through value-of-service pricing. This was done because trade and national development were encouraged by charging high value commodities more than their share of costs and low value commodities less. South Dakota, as an agricultural state, was one of the beneficiaries of that encouragement.

South Dakota's rail system was virtually complete before the First World War. In fact, the state's first track abandonment occurred as early as 1909. Following the nationalization of railroads during the war, Congress

attempted to revise the regulatory environment in 1920. The Transportation Act of 1920 established "fair return on fair value" as the rule to be followed by the ICC in its rate making decisions.[2] Under such a rule railroads would have raised the rates charged on commodities moving out of South Dakota and lowered rates on incoming manufactured goods. This shift would have occurred because of a post war imbalance in freight movements with a shortage of cars for east-bound agricultural commodities and a surplus of cars for west-bound manufactured goods. Thus, the railroads, if allowed, would have used the new rate-making rule to abandon value-of-service pricing. The ICC, however, continued to enforce value-of-service pricing and was supported by the Hoch-Smith Resolution of Congress in 1925. This resolution was intended to retain low rates on agricultural commodities, giving an advantage to agricultural shippers which was reflected in ICC rate-making decisions well into the 1950's. South Dakota agriculture was a beneficiary of the continued policy which simultaneously discouraged the state's industrial development.

In the post war period railroads faced new competition from trucks. Trucks had the advantages of speed, quick point-to-point service, and the ability to carry smaller lots, enabling them to capture a significant share of the eastern transportation market for high-value manufactured goods. In response to this traffic loss the railroads tried to raise rates on agricultural commodities where rail still maintained a decided technological advantage over trucks. This response was further motivated by the depression of the 1930's which resulted in substantial excess capacity of both railroads and trucks.

Competition from trucks, intensified by the depression, led to intermodal rate wars where the two modes competed directly and to efforts to raise rates on agricultural products where the railroad still exercised monopoly power. With a combination of an inelastic short-run supply of agricultural commodities and railroads' technological advantage, any increased rates on agricultural commodities would benefit railroad profits. Shippers would pass the higher rates back to producers. The ICC opposed these efforts of the railroads, and the Transportation Act of 1933 supported the ICC by requiring the "lowest charges consistent with the cost of providing service." This clause allowed the ICC to retain its policy of value-of-service pricing to the advantage of South Dakota's agricultural products.

Traffic losses due to truck competition, drought, and the depression, coupled with the inability to raise rates on their remaining traffic, brought many railroads close to bankruptcy. In an attempt to stabilize the transportation system and rail and truck profit levels, Congress passed the Transportation Act of 1935. This brought trucks under the regulatory umbrella and preserved the excess capacity of the transportation industry by preventing rate wars. Thus, shippers were to pay rates above market determined rates. Once again, however, South Dakota shippers were protected; the

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[2]Under the Act a fair rate of return was established by the ICC at 6% in 1920 and lowered to 5.75% in 1922. The ICC has not specified an appropriate rate of return since then. Such specification has not been necessary since the railroads' rate of return has been lower than that in other sectors. The ICC has recognized a rate of return of 4% as "substandard" and less than 4% as "inadequate." Fair return has been interpreted by the ICC to mean the original cost less recorded depreciation of railroad investment plus an allowance for working capital. Thus, fair value is not based upon current or replacement value of railroad assets.

framers of the 1935 Act, in an effort to retain low rates on agricultural commodities, exempted truck movement of these commodities from the regulations. This allowed the excess capacity in trucks and railroads to exert downward pressure on agricultural commodity rates and retained the principle of value-of-service pricing. This result was reinforced by the Transportation Act of 1940 which brought water carriers under the regulatory scheme but largely exempted agricultural commodities by exempting bulk movements with less than four commodities to a tow.

Up until World War II South Dakota's agricultural sector had consistently benefited from the rulings of the ICC and the transportation laws passed by Congress. Value-of-service pricing was retained by rule and law on the low-value bulk commodities shipped from South Dakota. Where competition would provide greater benefit to South Dakota shippers than would regulation, competition was allowed to prevail. At the same time, value-of-service pricing restrained South Dakota's industrial development by imposing high rates on manufactured products.

The agricultural benefits and the cost advantages of rail over truck transportation for the long hauls from South Dakota to eastern markets meant that sufficient traffic used the rail system to avoid abandonments before World War II, even though there was a general excess capacity in transportation. Less than 190 miles of track were abandoned before 1940, only about half of which occurred in the 1930's.

After World War II the situation changed. The railroads sought rate reductions to meet the competition of truck and water carriers. The ICC allowed such reductions to meet water competition but did not generally allow the railroads to use price competition to retain the traffic being lost to trucks. With no interior water transportation, South Dakota shippers received only part of these rate advantages - that part reflecting the commodity movement which paralleled the river routes beginning at the Twin Cities on the Mississippi and Sioux City on the Missouri. There were no rate advantages on the movement from South Dakota to these river terminals. Thus, while South Dakota shippers gained in an absolute sense, they lost in a relative sense and their competitive position with respect to producers elsewhere was eroded.

Since South Dakota developed as an agricultural state, early transportation policy redistributed income in favor of South Dakotans. This favoritism lasted well into the post-war period. However, the redistribution of population, the subsequent reapportionment of political power, and the increasing number and severity of urban problems caused a fundamental shift in the nation's policy toward income distribution, beginning in the late 1950's and 1960's. This shift gained momentum in the 1970's and one result has been a change in the national transportation policy. The new policy is reflected in institutional changes such as new track safety standards, the 34-car rule,[3] and government participation in rail operations.

Such institutional changes have prompted various groups to seek adjustments which would recognize the new technology. Trucking companies have supported construction of a nationwide system of free access interstate highways. Eastern and midwestern railroads which tie together larger centers of population have sought federal and state loans and subsidies while abandoning light density rural branchlines representing excess capacity.

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[3]An ICC order of January 14, 1972, (Ex Parte No. 274, Sub-No. 1) stated that "... on the average for a 12-month period, 34 carloads of freight traffic per mile of abandonment trackage are necessary to enable a railroad to operate the trackage on a break-even basis." This "rule" has been used as one measure of the minimum standards under which a railroad must continue to operate branchline trackage.

The new institutional environment and new technology have led to changes in the relative shipping costs between rail and motor vehicles. The response of South Dakota shippers has been to increase their use of trucks to maintain their competitive position. This has been possible because the new regulatory environment allowed trucks to lower rates to compete for shippers' business but restrained railroads from meeting this price competition. The new technology is reflected in the cost structures of the two modes.

Cost Structures

Estimation of costs is a difficult process for both railroad and truck transportation because of the diverse nature of their output. Both produce transportation services which differ as the products being transported or routes being traveled are changed. In producing the various services many joint and common costs are incurred.[4] Any allocation of these costs to specific products or routes must be arbitrary. Thus, the long-run costs of carrying specific products cannot be determined except in an arbitrary accounting sense. In South Dakota grain is the principal product shipped by rail. The cost determination problems can be reduced drastically by assuming that there is a single homogeneous product, grain, being transported. This simplifying assumption distorts the rail cost structure in the state less than it distorts the cost structure in the trucking industry. This is because both livestock and grain are exported by truck, whereas livestock is not moved by rail. Also, most consumption and intermediate goods are imported by truck.

Transportation costs can be divided into two components: terminal costs and line-haul costs. Terminal costs are those costs incurred at traffic origin and destination points. Line-haul costs are the costs of moving freight between the origin and destination points. Railroads have higher terminal costs than trucks. Rail cars are weighed, classified and switched at both origin and destination, while trucks are not. This is due, of course, to the technology involved where each truck carries a homogeneous load with its own power source while a train includes many unpowered cars headed for various destinations. These same technological characteristics make truck line-haul costs higher than rail line-haul costs. Both rail and truck line-haul costs diminish as larger cars and trailers are used.

One part of the new technology is the jumbo covered hopper cars which have made boxcars obsolete for many rail movements of grain. The jumbo covered hoppers carry 3,200 to 3,500 bushels of corn or wheat compared to boxcars which carry only 1,800 to 2,000 bushels. Covered hoppers are also much more efficient than boxcars in the loading and unloading stages of grain hauling. In 1960 the U.S. railroad fleet included 637,829 boxcars and only 64,255 covered hoppers. By 1974 the number of boxcars was down to 326,435 and the number of covered hoppers had been increased to 153,092.[5]

This change in rail technology has had a negative impact on South Dakota's rail service. The state's rail system, completed before World I, consists almost exclusively of branchlines designed to handle the lighter boxcars. These lines cannot carry fully loaded covered

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[4]Common costs are costs incurred due to a multiplicity of services; e.g., the cost of railroad right-of-way maintenance is common to all products moved over the right-of-way.

Joint costs occur when two products or services are necessarily produced together in fixed proportions; e.g., the movement of goods from X to Y by truck necessarily imposes the costs of the backhaul from Y to X whether goods are carried or not. Any assignment of these costs to the services is necessarily arbitrary.

[5]Statistics of Class I railroads of the United States, Association of American Railroads, 1975.

hopper cars. The reduction in the inventory of boxcars has also increased the difficulty in obtaining them. The railroads have preferred to use the covered hoppers in other states where they can travel fully loaded. Thus, the economies of larger carloads have not been available to South Dakotans.

Railroads have allowed much of the right-of-way in South Dakota to deteriorate through failure to upgrade and maintain rights-of-way. This restricts South Dakota service to boxcars and partially loaded covered hoppers operating under slow orders. The use of older boxcars imposes additional costs on grain shippers. These include costs of repairing the cars to minimize losses in transit and higher costs of loading and unloading the cars. Trucks traveling on an improved highway system (including Interstate highways 90 and 29), have been able to increase both the size of shipment carried and the speed traveled. These changes in technology have cut into the railroads' line-haul cost advantages by increasing the railroads' relative transit time and by decreasing their relative shipment size. Thus, the relative inventory costs of shipping by rail have increased.

Railroads are substantially more fuel efficient than trucks for line-haul point-to-point movement of commodities. Recent increases in fuel costs would then be expected to raise the cost of truck shipments relative to rail movements. The case for railroads' high fuel efficiency, however, is based on trainload line-haul movements. Since the overwhelming majority of rail traffic in South Dakota involves less-than-trainload lots moving on branchlines to collection points, the fuel efficiency advantages of railroads are largely unavailable for the movement of South Dakota products. Fully-loaded trucks traveling directly from the loading point are generating the greatest number of bushel-miles of transportation per unit of fuel possible from their power source. A locomotive picking up from one to ten boxcars of grain from each of several elevators located miles apart along a long branchline is rarely, if ever, used to its capacity. Consequently, it is not using fuel as efficiently as it was built to perform. Thus, three 800-bushel trucks might incur a lower fuel cost than a locomotive moving a single boxcar carrying 2,400 bushels.

Although terminal costs are lower for trucks than for railroads, a significant portion of truck costs for shorter movements is incurred in loading and unloading. In the study of 1974 grain transportation in South Dakota, a truck rate function representing the cost per bushel-mile of moving a composite of South Dakota grains was estimated.[6] This function was $R = \$0.11339 + \$0.00043 \cdot M$ where R is the truck rate and M is the distance traveled in miles. This estimated function suggests that the combined fixed costs and terminal costs were approximately 11.3¢ per bushel, while the marginal cost of carrying a bushel an additional mile once the truck is moving is about .04¢. A loaded 800-bushel truck could drive an additional mile for only 34.4¢. Since all grain must be moved from the farm by truck, these numbers imply that a farmer would be willing to bypass his local elevator and deliver the grain to an elevator 10 miles farther from the farm if the price at the more distant elevator is only one-half cent per bushel higher than at the closer elevator. This, in fact, has happened. Low marginal truck costs have induced farmers to bypass their local branchline elevator. This, in turn, has raised the average cost of rail shipments from that branchline elevator. Attempting to cover their average costs, railroads have raised their rates and consequently induced further use of trucks.

For South Dakota these technological changes might still have a net advantage

[6]"A pilot study to investigate efficient grain transportation and marketing systems for South Dakota," Department of Transportation DOT-OS-50229, SDSU, 1976.

to rail shipment of grain in homogeneous trainload lots headed to distant terminals. In some rural areas of the United States where necessary conditions are met, the rail advantage has been recognized by lower multicar and unit-train rates. In South Dakota, however, such rates have not generally been available because the necessary conditions are not satisfied. The relatively lower productivity of South Dakota's agricultural land means that there are few locations in the state at which grain could be assembled in trainload lots destined for a single terminal. The state's elevator industry was developed in coordination with the railroads' boxcar technology. Thus, even in areas where production is sufficient to justify the new rail technology and multicar or unit-train rail rates, a new elevator technology is required. This would be in the form of larger receiving and loading facilities plus longer, heavier siding and upgraded trackage. Furthermore, the primary terminal destinations for South Dakota grain have been Sioux City, Minneapolis, and Duluth. All of these destinations are within 200 to 400 miles of much of the eastern half of the state where the line-haul cost advantage of railroads is relatively small.

Railroads in South Dakota have had to recognize some of the social costs of their operations by paying property taxes. The tax is levied on the value of each railroad's entire system rather than the value of the line in South Dakota. Since much of the railroad operation in South Dakota earns a lower rate of return than the overall railroad system, the railroad is paying more in taxes relative to earnings in South Dakota than elsewhere. That is, if property taxes are roughly proportional to the market value of property, then the railroads, being taxed in South Dakota on the basis of the market value of their property in all states, are paying a higher tax relative to the value of their South Dakota property than are other South Dakota property owners. This is likely to be true because the market value of railroad property is higher in other states than it is in South Dakota. This appears to be unfair from the railroads' point of view. From society's viewpoint, the value of the right-of-way should be measured as its value in its best alternative use - usually agriculture. This value may be greater or less than the value actually used to levy taxes. Thus, it is not possible to say more than that railroads pay property taxes in recognition of social costs.

Trucks use publicly provided rights-of-way for which they pay taxes indirectly through license fees and fuel taxes. The rights-of-way provide joint services to both passenger cars and trucks so that allocation of construction and maintenance costs is arbitrary. It would seem appropriate to charge trucks for the incremental costs of building highways to meet the incremental design standards needed for trucks but not necessary for cars and for highway maintenance costs in proportion to the highway wear and tear for which they are responsible. Whether trucks contribute to the social costs in accordance with these standards has not been resolved in general. For any particular highway segment these standards may or may not be met. Again, it is only possible to conclude that trucks do contribute to the social costs.

The pattern of rail and truck transportation systems emerging in South Dakota in response to changes in relative shipping costs reflects the abilities of the two modes to adopt the new technology. Technological change in transportation occurs in both vehicles and rights-of-way. Trucks require a much smaller initial investment than railroads in both of these complementary components. The public sector has provided an improved highway system for use by larger, faster trucks. The adoption of new truck equipment requires only a relatively small investment in equipment and a sharing of highway construction costs over a long period of time for highways presently available for use.

Railroads, to implement new vehicle technology, must first invest large sums in improved rights-of-way. They have not usually been aided by public sector and

have been unable to share costs with other users. When roadbeds have been improved the railroad must make another large investment in new vehicles in order to take advantage of new technology.

The advantages of trucks in adopting new technology, in addition to the greater freedom to compete allowed by the regulatory environment, have resulted in a relative cost advantage to shipping by truck. This relative cost advantage has induced substantial substitution of truck use for rail use in marketing South Dakota grain.

Railroads, by abandoning light density branchlines with their attendant high unit costs of moving small numbers of boxcars and by upgrading higher density lines over which they move larger trains of covered hoppers, are recognizing their line-haul cost advantage over trucks. The beginning of the adjustment appears to be well under way, with nearly 500 miles of railroad abandoned since 1968 and nearly 350 miles pending abandonment. Another indication of the adjustment process is the recent construction of larger capacity, rapid turnover elevators.

One form of change in grain trucking has been the shift to larger, faster farm trucks hauling large loads longer distances. The farm-to-elevator distance will increase as elevators on abandoned lines are bypassed for delivery to elevators on better rail lines. The other change in grain trucking has been the substitution of truck for rail delivery to terminals. This trend may continue, especially in those areas of the state which are relatively close to the Sioux City and Minneapolis terminals. These trips are often too short for railroads' line-haul cost advantage to offset the speed, convenience, and back-haul advantages of trucks. In areas more distant from terminals or where large loading facilities are constructed, railroads may maintain or increase their share of South Dakota grain traffic. The balance between truck and rail will eventually be struck where the marginal cost of shipping by the two modes is equated.

Transportation Demand

Demand for transportation services is derived from the locational patterns of buyers and sellers of the product being transported. Transportation is therefore a factor of production; and the elasticity of demand for transportation is directly related to the elasticity of demand for the final product, the importance of transportation costs in the total production cost, and the availability of substitutes for transportation.

The demand for transportation to move South Dakota grain has varying elasticity, depending upon the time period being considered. In a short-run period the elasticity will be greater when the capacity of elevator and on-farm storage facilities and the availability of credit are greater. The availability of storage and credit capacity are reflected in the costs of holding a grain inventory for later sale and shipment. Storage costs (including charges made, risk of commodity deterioration due to storing in less desirable facilities, opportunity costs due to foregone interest earned, interest rates paid on loans, and risk of market price decline) all tend to increase as the volume of grain stored increases. As these costs increase relative to the grain market price, grain sales and the demand for transportation increase. Thus, the elasticity provided by available storage capacity and credit complements the elasticity derived from the demand elasticity for final grain products. Up to the limit of available storage capacity and farm credit, the quantity of transportation demanded can vary significantly with small changes in grain market prices. Over an intermediate run period or in the short run if storage capacity or credit is fully utilized, the demand for transportation is quite inelastic, reflecting the need to move the entire crop to market over this period due to high relative storage costs.

The combination of these characteristics implies that the short-run demand may be reasonably elastic for that part of the calendar year when there

are unused storage and credit capacities and low relative storage costs. The months during and after the harvest season may see an inelastic demand as the storage capacity constraint is binding and costs increase. The months during the planting and growing season are likely to see the credit constraint become effective and interest cost increase. Therefore, both the short- and intermediate-run periods are likely to display relatively inelastic demand for transportation. The demand may become more elastic during the few winter months after much of the previous crop has been moved and before the next crop has been planted.

Over a long-run period the ability to turn to substitutes for transportation means that the demand for transportation will be more elastic than for shorter time periods. Such substitutes can take several forms. Additions to storage and credit availability provide direct substitutes for transportation in marketing grain. Diversion of agricultural production factors to other uses, such as converting cropland to pasture, causes a substitution of livestock transportation demand for grain transportation demand. Increased processing of grain in South Dakota, either directly into consumer goods or indirectly through livestock to consumer goods, also leads to a substitution of demand for other forms of transportation for grain transportation demand. The willingness to make these substitutions depends upon the relative prices of the alternative products. The ability to make the substitutions depends upon the costs of implementing them. In particular, interest rates will affect the ability to add storage capacity, to build livestock herds, to invest in grain processing facilities, and to expand either truck or rail capacity.

Demand for the services of a given transportation mode will be more elastic the more and better are the alternative modes available. The demand for each mode depends upon the relative prices charged by all of the other modes. Price charged includes not only the rate charged by the transportation firm but also the implicit inventory charges related to pickup, transit, and delivery times and reliability of service.

While only two modes, truck and rail, are available to South Dakota grain shippers, the demand for each of the two is fairly elastic because they are relatively close substitutes. Shippers can respond significantly to changes in the relative rail-truck transportation price within the capacity limits of the two modes. The density of grain production and the relatively significant percent of final goods price which is due to transportation cost imply that shippers can gain by using rail transportation where large shipment size is the rule. This technological advantage tends to make the demand for rail services less elastic. The technological advantage of faster, more reliable service rests with trucks, however, and increases the demand elasticity for rail services.

Transportation Supply

The technological and regulatory structure of rail and truck transportation implies that the supply of services provided by the two modes will differ. High fixed costs and regulatory constraints on the railroad services which must be provided would imply an inelastic short-run supply of their services. These same factors cause the short run to be an extended period of several years or even decades. The additional regulatory constraint on rail rates reduces the supply function to a single point at any location. That is, the frequency of service and the rate charged are constant for long periods at any elevator.

Railroads have consequently resorted to adjusting the only variable left to the firm's decision - the quality of service. On profitable lines railroads have rebuilt rights-of-way to carry larger shipments faster, thereby reducing costs and increasing profits. On light density branchlines where losses are incurred, railroads have deliberately allowed short-run losses to increase by allowing rights-of-way and equipment, and therefore service, to deteriorate and business to be lost. Thus, greater than necessary short-run losses are incurred

in order to hasten the abandonment of lines which would otherwise be permanently unprofitable. This short-term loss could then result in increased long-run profits.

Low fixed costs and freedom from regulation have resulted in an agricultural trucking industry which resembles the economist's model of perfect competition. The fixed rate and service level characteristics of rail transportation and the competitive nature of trucking mean that the supply of trucking services is quite elastic. In a short-run period when the number of trucks is fixed, truck rates respond sharply to changes in the demand for transportation. Over a longer period the number of trucks and quantity of trucking services respond to demand changes. The lack of rate regulation allows the rate responses, while the lack of financial and regulatory entry barriers provides the flexibility to enter and leave the trucking business.

The results of these demand and supply characteristics are indicated in Figure 1. The chart shows how the estimated truck rate function for wheat was shifted as crop production has varied.[7] In years of lower production (1972 and 1974), the demand for transportation was reduced. Therefore, the truck rate schedule was lower for these years than in 1973 when production was high. In terms of quantities carried, trucking also adjusted relatively more than rail to changes in production.

Transportation and Elevator Location

Country grain elevator firms deal in a variety of products and services. The number and variety of products and services have increased in recent years in response to changes in farm and elevator technology and costs. There is evidence that the rate of growth of elevator profits in South Dakota has been closely related to the ability of the elevator to offer farm supplies and services such as bulk, bagged, and anhydrous fertilizers, farm mapping, liquid feed, seed cleaning, feed grinding, customer record keeping, trucking, petroleum, hardware, and lumber.[8] While the growth rate of profits is related to an elevator's ability to supply these ancillary products and services, the primary function of the country elevator remains the storage and handling of grain. Elevator net profit is closely related to these grain services.[9] The following description of the economics of elevator location assumes that the functions of grain storage and handling are separable from the ancillary functions performed by elevators.[10]

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[7]Rudel, R.K. and W.F. Payne, "Moving grain in '75," Agricultural Experiment Station, South Dakota State University, Brookings.

[8]Raeder, Albert E. "Some factors affecting the growth of grain elevators in South Dakota," unpublished MS thesis, South Dakota State University, 1970.

[9]Ibid., pp. 35-42.

[10]Van Oppen, M. and L.D. Hill, "Grain elevators in Illinois: Factors affecting their number and location," AERR 180, Agricultural Experiment Station, University of Illinois, November 1970.

Van Ausdle, S.L. and D.L. Oldenstadt, "Costs and efficiencies of grain elevators in the Pacific Northwest," Bul. 713, Agricultural Experiment Station, Washington State University, November 1969.

Fuller, S.W. and M.L. Manuel, "Factors that affect country grain elevator efficiency," Bul. 550, Agricultural Experiment Station, Kansas State University, February 1972.

Yu, T.H., "Analysis of factors affecting the optimum size of country elevators in Indiana," Ph.D. Thesis, Purdue University, 1967.

For any elevator the price received at the terminal is determined by the grain market. The elevator receives the terminal market price less the transportation cost from the elevator to the terminal. This net price to the elevator, less the elevator's handling and storage costs, determines the maximum the elevator will pay grain producers. The maximum net price that producers can receive is this price less the assembly cost from farm to elevator. These relationships hold because each economic agent is, in effect, a perfect competitor with respect to his sales to the next agent in the grain marketing system. That is, in their role as sellers, neither individual farmers nor individual elevators can influence the price they receive. This provides an incentive for elevators to locate as close to terminals as possible to reduce their elevator to terminal transportation costs and pass most of the transportation costs backward onto producers in the form of assembly costs.

Two factors tend to offset this incentive. First, an elevator location close to a terminal would cause producers to bypass the elevator completely and deliver grain directly to the terminal. The elevator must be far enough from the terminal (and close enough to the producer) so that the additional cost to the producer of delivering directly to the terminal exceeds the charge made by the elevator for handling and shipping the producer's grain.

In addition, the threat from potential elevator competitors causes an elevator to locate close enough to producers so that potential competitors will not become actual competitors by locating between the original elevator and producers. By lowering the producer's assembly costs, a new elevator would cause producers to forsake the original elevator.

These incentives to locate elevators close to producers were dominant under the earlier transportation technology with poor roads, smaller and slower trucks, and ubiquitous rail service. As a result, an elevator location pattern developed under which many small elevators were built throughout the state. There was an elevator near each group of producers whose production was large enough to supply the handling capacity of the small elevator. Technological change has induced changes in the locational pattern of elevators. Larger, faster

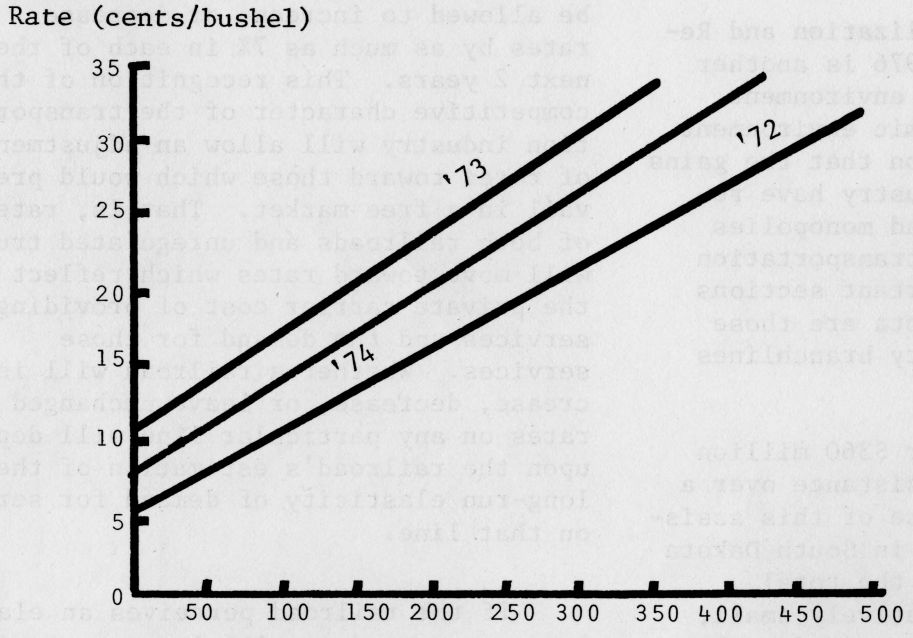


Figure 1. Truck Rates for Transporting Wheat from South Dakota Country Elevators to Primary Terminal Markets: 1972, 1973, and 1974

trucks and better roads have reduced assembly costs. Economies of scale allow lower costs of elevator storage and handling and rail transportation. Without regulation the private sector has been willing and able to take advantage of the new technology and reduce assembly, elevator, and truck distribution costs relative to rail distribution costs. The consequence has been the evolution of an elevator location pattern involving fewer and larger elevators, greater average farm to elevator distance, and increased use of trucks in distributing grain to terminals.

This evolution in the location and distribution system is not as far advanced in South Dakota as it is in other midwestern states. As it proceeds, the regulated component, railroads, are beginning to apply their new technology in South Dakota. As they abandon some of their light density branchlines, railroads are rebuilding main lines and realizing the scale economies of the larger hopper cars. The emerging pattern has fewer elevators. The larger elevators are shipping by covered hopper cars on main line track, and smaller elevators are shipping by truck.

Future Prospects

The Railroad Revitalization and Regulatory Reform Act of 1976 is another step toward a regulatory environment which reflects the economic environment. It evidences a recognition that the gains made by the trucking industry have replaced the former railroad monopolies with a more competitive transportation industry. The most important sections of the Act for South Dakota are those dealing with light density branchlines and railroad rates.

The Act provides for $360 million in local rail service assistance over a 5-year period. Little use of this assistance is likely to occur in South Dakota for two reasons. First, the total amount of funding is relatively small, averaging $72 million per year for the entire U.S. Since South Dakota has less than 2% of the line-haul railroad mileage in the nation, it is not likely that any significant amounts of assistance will be provided to lines in South Dakota as a whole. This does not mean that individual lines in the state may not receive significant aid.

Whether or not any individual lines receive assistance is tied to the second reason South Dakota is not likely to use much of this financial assistance. The Act provides that no branchline may be abandoned if subsidy assistance is offered for service continuation on the line. Since the assistance is limited to a 5-year period, subsidies will be sought by railroads and offered by the ICC only on those branchlines which are potentially profitable lines. With little foreseeable change in the volume of shipping on South Dakota lines, there is little likelihood that a currently unprofitable line will become profitable in 5 years. The exception to this would be the line which can be expected to gain substantial traffic due to the abandonment of a nearby competitive branchline or the increased production of a newly irrigated area.

The other change made by the Act which is important to South Dakota is the increased rate making flexibility granted to railroads. If the carrier does not have market dominance it will be allowed to increase or decrease rates by as much as 7% in each of the next 2 years. This recognition of the competitive character of the transportation industry will allow an adjustment of rates toward those which would prevail in a free market. That is, rates of both railroads and unregulated trucks will move toward rates which reflect the private carrier cost of providing services and the demand for those services. Whether a railroad will increase, decrease, or leave unchanged its rates on any particular line will depend upon the railroad's estimation of the long-run elasticity of demand for service on that line.

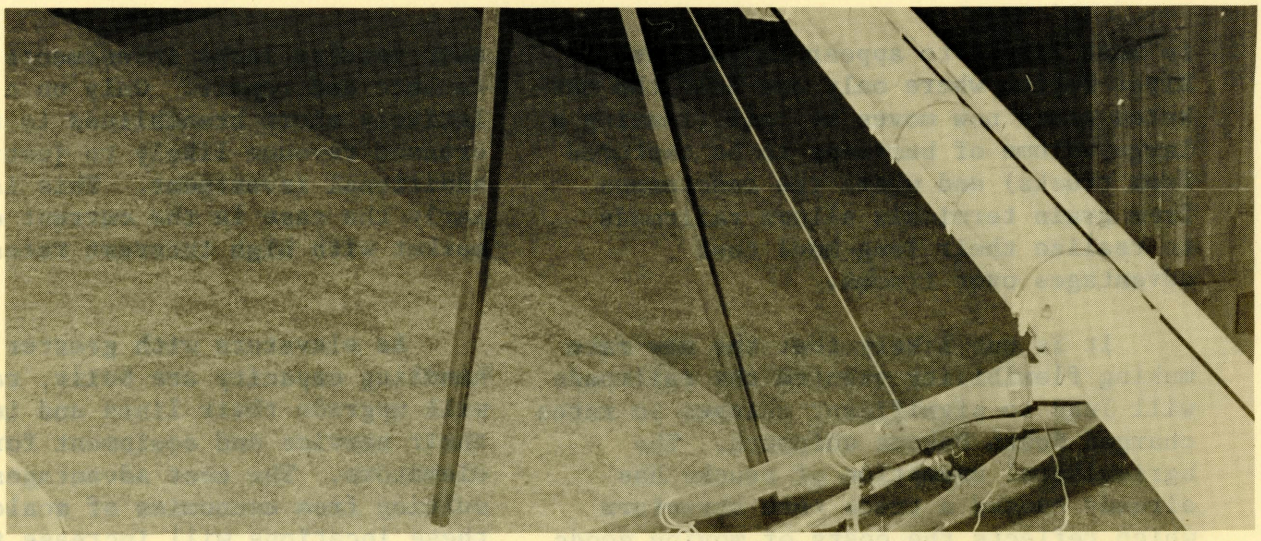
If the railroad perceives an elastic long-run demand it will lower rates in an attempt to capture more shipping business. If this occurs at all in South Dakota, it

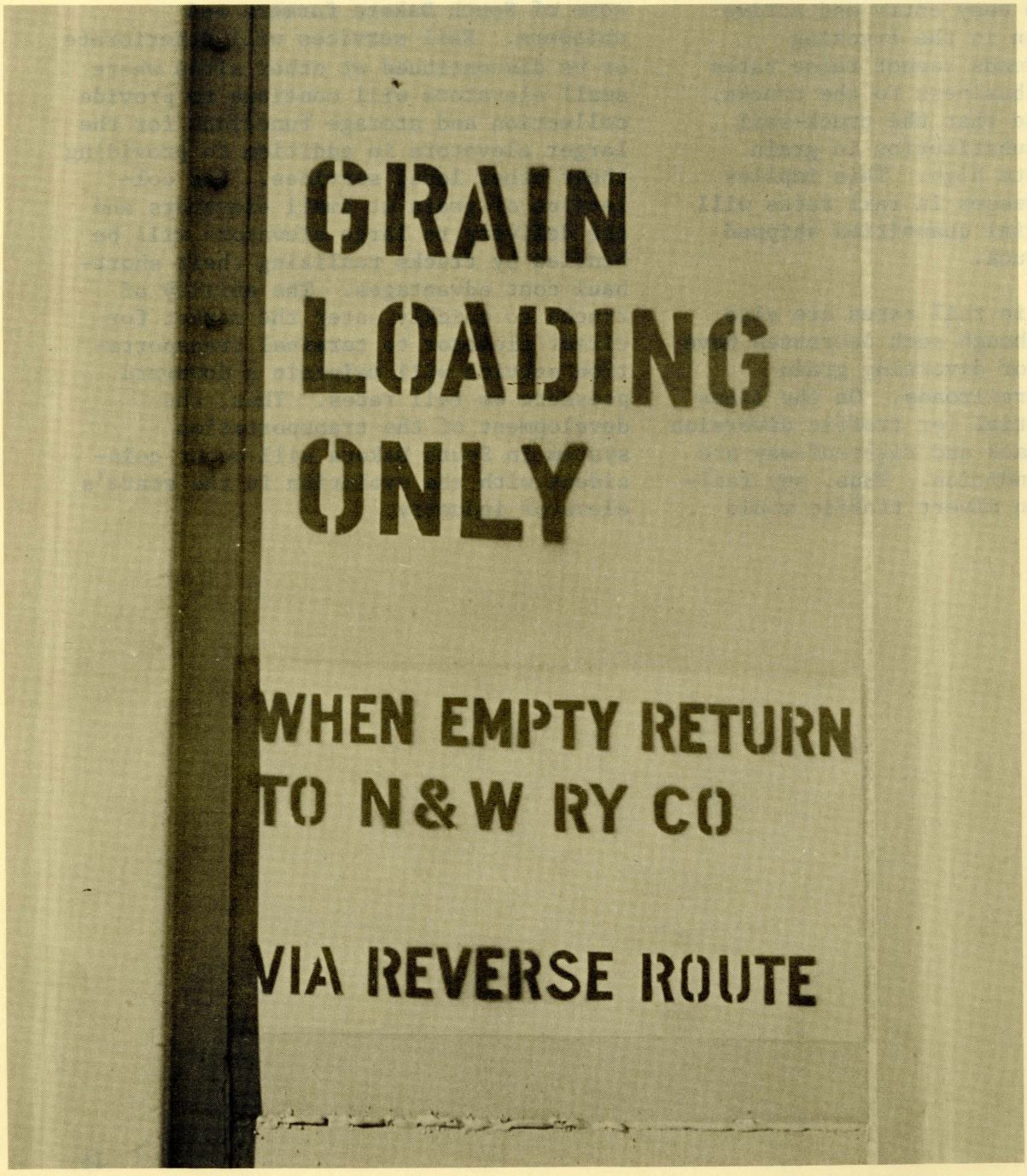
is most likely to appear in the West River region where only one-half the marketed grain now moves by rail (leaving a large volume of business to be captured from trucks) and where the remoteness from grain terminals allows railroads to realize their long-haul cost advantages over trucks.

It is not likely that the new rate making flexibility granted the railroads will lead to significant changes in rates charged South Dakota shippers. The agricultural exemption of trucks has already caused a truck rate structure which reflects the costs of moving goods by truck. With easy entry and active rate competition in the trucking industry, railroads cannot raise rates without losing business to the trucks. Studies indicate that the truck-rail elasticity of substitution in grain shipping is quite high. This implies that small increases in rail rates will divert substantial quantities shipped from rail to truck.

Decreases in rail rates are also unlikely even though such decreases have the potential for diverting grain traffic to the railroads. On the lines where the potential for traffic diversion is greatest, track and right-of-way are in the worst condition. Thus, any railroad attempts to divert traffic would also require large investments in maintenance and repair. Only on a few, relatively short branchlines is the increased revenue likely to justify the additional investment. This is particularly the case in the current capital market with high interest rates.

As elevators with greater grain handling capacity are built, railroads will upgrade their lines and improve their service and equipment for these elevators. The cost advantages resulting from economies of scale at these locations will increase the income of South Dakota farmers and shippers. Rail services will deteriorate or be discontinued at other sites where small elevators will continue to provide collection and storage functions for the larger elevators in addition to providing their other local services. The collection of grain at small elevators and the delivery to large elevators will be handled by trucks realizing their short-haul cost advantages. The ability of trucks to quickly enter the market for direct elevator to terminal transportation service will maintain a downward pressure on rail rates. Thus, the development of the transportation system in South Dakota will occur coincident with the evolution in the state's elevator industry.

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