5-1-1980

Public Provision of Transportation Equipment: Some Long Term Economic Impacts

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PUBLIC PROVISION OF TRANSPORTATION EQUIPMENT: SOME LONG TERM ECONOMIC IMPACTS

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May 1981

Research Report 81-1

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Introduction

Periodic shortages of rail equipment have freqnetly imposed marketing problems and costs upon the grain industry. For example, one study estimated the total cost due to the lack of transportation equipment was $2.36 million dollars for Iowa elevators in 1969.[1] In spite of efforts to resolve the equipment problem through the private sector, these costs have persisted and led to attempts to seek relief through government intervention.

During the 1980 legislative session, the South Dakota Governor suggested a new approach; the purchase of rail cars by the State to supplement railroad and elevator fleets. South Dakota is not alone in examining the purchase of rail cars. The Highway and Transportation Department in Michigan has made a similar proposal. North Dakota recently concluded a feasibility study which explored the same alternative. And during October, 1979, the Province of Saskatchewan ordered 1000 covered hopper rail cars.

The purchase of rail cars by a State to relieve equipment shortages is a new approach. But when past attempts to resolve a problem have failed, public officials may be forced to venture into uncharted waters. This report is an attempt to assist decision makers in evaluating the probable success of this policy alternative.

First, the history and causes of rail car shortages will be addressed followed by an evaluation of the profitability of rail car ownership. Thirdly, the problems of managing a public rail car fleet will be explored. The fourth section includes a discussion of the long-term impacts that State provision of rail cars would have upon the supply of equipment available to move grain. This will be achieved by analyzing the economic incentives which motivate railroad and shipper investment in rolling stock. The long-term involves a period long enough for the railroads and shippers to make major changes in investment and disinvestment policies. This paper concludes with an explanation of some alternatives available to public officials that could effectively relieve the shortage by modifying supply and demand for rail cars. An appendix is included which briefly applies public good theory to the provision of rail cars.

History and Causes of the Rail Car Shortages

While the "investigation of the reasons for seasonal rail car shortages" is often included in current lists of critical transportation issues to be addressed, the problem is not of recent origin. The very first case heard before the Interstate Commerce Commission (ICC) "involved a complaint by the North Dakota Board of Railroad Commissioners against the Northern Pacific Railway for failing to provide adequate car service to North Dakota shippers."[2] Again, "as early as 1907 the Commission held extensive hearings on freight car shortages, receiving testimony from shippers of grain, coal, and lumber on their inability to obtain freight cars in sufficient numbers at the time requested."[3] In the fall of 1921, the Joint Commission of Agricultural Inquiry, created by a Senate Resolution, found that "the supply of box cars, coal cars, stock cars, and refrigerator cars is inadequate to meet the demand during normal periods of activity

and should be rapidly augmented."[4] In 1953, William Hudson found that a tight boxcar situation with periodic shortages, particularly of the better class of equipment required for grain and grain products, will probably continue over the next several years."[5] In spite of this attention, the carrier car shortage problem continues and elevators have started acquiring private fleets in order to reach rail based markets.

No single factor can be identified as the primary contributor to this continuing shortage of railcars. Rather, it has resulted from the interaction of numerous economic and non-economic incentives over time. Following are nine factors which have and continue to contribute to the shortage:

First, the railroads have failed to share in general periods of economic prosperity. They have earned an average of about 2¼ percent return on investment between 1964 and 1979, and during the last 5 years the return has averaged 1.6 percent.[6] Railroad earnings are not sufficient to meet all their capital requirement. The low rate of return discourages reinvesting railroad earnings back into the railroad and also fails to attract outside capital.

A second factor contributing to the rail car shortage is the seasonal production pattern of grain combined with year-to-year variation in foreign demand. This creates shortages and surpluses of rail equipment over time. The result is that "carriers may invest in capacity that is under-utilized during off-peak periods or use existing capacity so intensively that costs increase in greater proportion than output."[7] These changes in demand over time can be compounded by agricultural production practices. For example, the technological development and adaptation of the picker sheller and corn dryer increased, from 29 to 59 percent, the amount of corn moving

directly to the Iowa elevator during harvest.[8] Increases in farm storage capacity also provided farmers with the ability to alter historical marketing patterns. This creates surges in grain movements in response to changes in grain demand rather than the predictable pattern of grain production.

A third factor contributing to the equipment shortage is the decrease in car utilization over time.[9] Railroads and shippers are constantly striving to reduce labor requirements while providing greater protection for cargo. The result has been the demise of the plain, 40 foot, narrow door boxcar. It has been replaced by cars specifically designed and equipped to meet the requirements of individual commodities. However, this has resulted in an inflexible car fleet which cannot serve multiple uses as transportation demands change. Therefore the percent of loaded miles has decreased from 67 percent of total miles in 1946 to 57.9 percent in 1979.

Fourth, rail rates remain stable throughout the year, failing to reflect the seasonality of grain production or to allocate demand over time. While the Railroad Revitalization and Regulatory Reform Act of 1976 (RRRR Act) addressed this issue by instructing the Interstate Commerce Commission "to provide sufficient incentive to shippers to reduce peak-period shipments,"[10] seasonal rates were not widely adopted and the provision was repealed in 1980.

Fifth, the "Economics of Forced Compensation" is the title Tosterud and Nelson[11] have applied to the negative incentive provided by existing per diem rates. Per diem rates are the fees paid by one railroad to another for using rail cars and are established by the American Association of Railroad (AAR) and the ICC. Historically they have been maintained at

a level which is below cost to the railroad owning the car. The low level of per diem fees continues primarily through the efforts of those railroads whose total car usage is greater than their ownership. These carriers are located within territories which terminate more interregional carloads than are originated. Historically, these have been the eastern roads. The western roads, including those serving South Dakota, are forced to interline carloads of traffic with eastern carriers, and rather than invest in cars to meet their needs, the deficit carriers simply keep the cars and use them as long as they are needed. During periods of car surpluses, cars are returned to the owning carrier empty, while westbound loads are loaded in the cars owned by the deficit carriers. In addition to an increase in empty miles, which use additional resources, this practice also places a disproportionate share of the cost of the car surplus upon railroads having an adequate car supply.

Grunfield summarized the impact of the per diem incentive,[12]

> (a) a per diem rate which was less than prospective daily ownership costs of a new freight car would lead to an overall deficiency in freight car ownership; (b) a single per diem rate would discourage the purchase of the more expensive freight cars with their greater annual depreciation expense[13]; and (c) a seasonally inflexible per diem rate would fail to equate freight car demand with opportunity costs during peak and off-peak periods.

The sixth factor is that the existing demurrage charges make rail cars economical storage alternatives during periods of storage stress. Demurrage is the fee shippers and receivers pay for holding a rail car beyond the normal time necessary for loading or unloading. While the daily demurrage rate increases with time, elevators which are filled because of heavy grain movement still find rail cars an economical storage alternative. Unfortunately, this inefficient use of grain cars normally occurs during harvest periods when car shortages often are greatest.

Another factor is that the ICC is charged with the responsibility of protecting the public interest and must decide between the interests of large and small shippers. Large elevators, capable of shipping unit trains, use rail cars much more efficently than smaller elevators. According to an Iowa study, the movement of grain in unit trains requires only 28 percent of the number of cars that would be needed to transport the grain in single car movements.[14] Thus the ICC is charged with choosing between efficiency and equity. A recent policy limited the percentage of cars used in unit trains, protecting the interests of the smaller and branchline elevators while reducing the total amount of grain which is moved. In August 1980 the responsibility for car service was shifted to the AAR. Renewed emphasis on efficiency will likely lead to policies improving car utilization to the detriment of smaller shippers.

An eighth factor is the limited capacity of American rail car builders. Over the past decade, purchasers have faced order backlogs which have delayed delivery of grain cars for many months. This backlog limits the ability of railroads or elevators to respond quickly to changes in demand and it also means public purchases will delay private purchases.

The Economics of Public Car Ownership

The ninth and most important factor contributing to the rail car shortage is the fact that owning or leasing railcars is unprofitable for either elevators or railroads. Both need cars to operate, but neither want to own their own. Rather, they prefer that someone else own the required equipment and allow them to use it. If owning rail cars were profitable, railroads would be buying cars, rather than reducing investment as they have in the past. During the last ten years, for

example, class one railroads reduced their car capacity ownership by over 20,000 cars per year.[15] The argument can also be extended to shippers who would gladly purchase cars if they were a good investment, but shippers have also been reluctant investors. While shipper-owned or leased cars increased by over 6,400 units per year between 1969 and 1979[16] they were not purchased as an investment but rather as a necessary cost of doing business. Rail markets often pay more than truck markets and elevators need rail cars to receive the higher bid. Since railroads do not provide enough rail cars the elevators have had to acquire their own. They lose money on their private fleets but the higher price received for the grain offsets the loss and their total income is increased.

The specific profitability of owning rail cars is developed in Table 1. The major variables are turnaround time, car cost, and mileage credits. Turnaround is the number of trips a car makes each month and is usually higher if the car is in a unit train. Car costs can be estimated either through a lease or purchase price. Since both methods are used extensively by shippers and an active lease market exists, theory suggests that either lease prices or purchase prices would provide adequate estimates for car costs. Mileage credits are the fees paid by railroads to shippers when shippers use their own car. The early 1980 rate was 24 cents per loaded mile for covered hopper cars. Table 1 reveals that car lease payments exceed mileage earnings for <u>all</u> reasonable assumptions. Historically, rail car investments have not been profitable for carriers or shippers. All figures in Table 1 represent actual turnaround experienced by private shippers.

It must be stressed that State-owned or leased cars would also incur a deficit. Thus, not only would the State incur the initial cost but the rail fleet would require continuing operating support.

These nine factors have interacted with others not identified to create an environment which has discoraged the railroads and elevators from purchasing grain cars. In fact, between 1960 and 1979 the railroads have actually reduced their ownership of cars capable of carrying grain.[17]

Table 1. Cost of Monthly Rail Car Ownership

Assume: (1) A 15 year lease signed during the first quarter of 1980. A likely lease rate would include a monthly payment $570 and an annual charge of $0.02 for each mile over 30,000. This rate is subject to increases as maintenance costs increase.
(2) Railroads pay $0.24 per loaded mile for privately leased or owned covered hoppers during early 1980.
(3) These figures represent 100 percent utilization, 12 months per year. Costs increase rapidly if the cars are idle.

Cost of Lease per Month	Number of Loads Per Month	Monthly Mileage Credit Earned	Profit or (Loss) Per Car Per Month
	300 Mile One Way Trip		
$570	1	$ 72	$(498)
570	2*	144	(426)
570	3	216	(354)
	700 Mile One Way Trip		
570	1*	168	(402)
576	2**	336	(240)
604	3	504	(100)
	1500 Mile One Way Trip		
580	1	360	(220)
640	1.66***	600	(40)
640	2****	525*****	(115)

*Probable turnaround for single car movement - Current turnaround for Burlington Northern (BN)
**Probable turnaround for unit train
***Turnaround achieved by unit train shippers in Nebraska using Burlington Northern
****Turnaround achieved by unit train shippers in Nebraska using Union Pacific
*****The Union Pacific has a lower rate rather than a mileage credit which works out to about $0.175 per loaded mile

The volume of grain carried depends upon factors other than capacity, such as turnaround and the number of cars in serviceable condition. Therefore, the total car capacity may be increasing but failing to match increases in grain production.

Turnaround and Public Ownership of Rail Cars

A major factor contributing to grain car availability is the efficiency with which rail cars are used; i.e., turnaround. If the State owned cars do not match railroad and elevator turnaround, public provision of rail cars will decrease the total grain carrying capacity. Following are some problems which will affect turnaround of State controlled cars.

Efficienty and Equity

Throughout their history, railroads have been charged with discrimination against some shippers in the allocation of cars. Through the purchase of rail equipment the State could attempt to alleviate this. The State will find, however, as the railroads have, that efficiency and equity are often mutually exclusive goals. The elevators which are experiencing the greatest shortage are also the most expensive to serve, i.e., the small or branchline elevators. Through serving these elevators, the State will reduce turnaround and increase the net cost per bushel. Thus the State would have to choose between efficiency and equity, between moving the greater volume of grain for each dollar invested and serving all the elevators in South Dakota. And this would be an extremely difficult decision for any public employee.

Assignment Problems

The State could assign cars permanently to individual shippers, but this would result in a fleet which would be inflexible and unresponsive

to changes in demand. And further, a permanent assignment is difficult to justify based upon shipper needs. If a shipper would benefit enough to merit a permanently assigned State car, he should invest in a private fleet. The State could also assign the cars to the railroad's fleet, but this would mean the carriers would allocate the cars. And if the cars ever returned to South Dakota, the same allocation problems created by the railroads in the past would continue. Empty cars could also be assigned after each trip but this requires extra handling by the railroads and takes extra time, which increases costs.

Management

The elevators which have used their fleets the most efficiently have hired full time traffic managers. This would also be a requirement for the State. A fleet of 1,000 cars would take a minimum staff of three people and a high speed computer compatible with the railroads' computers.

Periods of Surplus Equipment

The seasonality of grain marketing creates fluctuations in the derived demand for transportation services. Some firms have achieved a higher level of utilization by co-leasing with shippers with different seasonal demand patterns. For example, grain dealers and fertilizer dealers occasionally co-lease equipment, and each shipper uses the cars during their period of greatest need. Occasionally, a shipper will find the seasonal patterns have fluctuated, creating the need for the cars when they are assigned to the co-lessee. A private business recognizes that to maximize long term profits, an occasional short-term loss may be incurred. But considering the political problems that could result if State owned rail cars were moving fertilizer during a grain car shortage; it is unlikely any public official could advocate a co-lease.

Under existing tariff regulations[18] railroads need not accept private (State owned) cars during periods of car surpluses. And the significant variation in the volume of grain marketed within and between crop years can turn car shortages into surpluses. For example, weekly shortages of 8,000 covered hoppers during October 1976 evaporated into surpluses of nearly 5,000 cars per week by the end of 1976. Surpluses also existed during most of May through September 1977 (see Table 2). During time of surplus equipment, the State would encounter the same dilemma as the other non-rail owners. That is, how do they capitalize on an investment which is continuing to incur costs but which cannot be used? In addition, cars not in use incur a storage charge if they are stored on a railroad-owned siding, and many elevators in South Dakota do not own their sidings. The problem of surplus equipment could be resolved in the short run by requiring that publicly owned rail cars be utilized before carrier or shipper-supplied equipment. This would minimize the net public cost, but as the railroads and elevators became the residual car supplier, utilization of their equipment would decrease, making ownership more expensive and encouraging an even faster disinvestment for railroads and the reduction of shipper investment. Therefore, this would be counter-productive to the long run objective that State provision of rail cars was designed to achieve.

Table 2. Surplus and (Shortage) of the U.S. Rail Car Supply for a Seventy Week Period.[a]

Week	40-Foot Narrow Door Box Cars	Covered Hopper	Week	40-Foot Narrow Door Box Cars	Covered Hopper
9/ 4/76	9,311	(3,621)	5/ 7/77	3,946	(996)
9/11/76	9,220	(2,623)	5/14/77	5,284	627
9/25/76	9,185	(3,980	5/21/77	5,940	1,955
10/ 2/76	8,242	(4,017)	6/ 4/77	7,811	2,577
10/ 9/76	7,346	(3,919)	6/11/77	8,238	2,020
10/16/76	3,673	(8,130)	6/18/77	8,595	386
10/23/76	3,072	(9,142)	6/25/77	8,302	705
10/30/76	3,209	(8,056)	7/ 2/77	7,912	1,486
11/ 6/76	2,740	(7,261)	7/ 9/77	6,318	(32)
11/13/76	6,329	(5,671)	7/16/77	5,140	(62)
11/20/76	7,509	(3,848)	7/23/77	3,773	(1,415)
11/27/76	9,500	(1,104)	7/30/77	3,024	(1,035)
12/ 4/76	10,923	1,463	8/ 6/77	2,656	(1,050)
12/11/76	11,129	2,800	8/13/77	2,251	(543)
12/18/76	11,805	4,884	8/20/77	3,121	41
12/25/76	12,996	5,216	8/27/77	3,129	1,098
1/ 1/77	12,734	5,279	9/ 3/77	3,706	1,935
1/ 8/77	11,695	2,641	9/10/77	3,542	949
1/15/77	10,700	(835)	9/17/77	3,030	(897)
1/22/77	7,980	(3,624)	9/24/77	2,202	(2,052)
1/29/77	3,714	(7,291)	10/ 1/77	1,246	(4,111)
2/ 5/77	1,433	(9,666)	10/ 8/77	462	(4,647)
2/12/77	(1,053)	(12,140)	10/15/77	175	(3,753)
2/19/77	(1,722)	(11,957)	10/22/77	(269)	(6,836)
2/26/77	(2,213)	(10,050)	10/29/77	(837)	(8,145)
3/ 5/77	(2,924	(11,433)	11/ 5/77	(1,157)	(9,796)
3/12/77	(2,479)	(11,381)	11/12/77	(1,226)	(9,100)
3/19/77	(1,550)	(10,839)	11/19/77	(1,255)	(9,215)
3/26/77	(1,042)	(9,246)	11/26/77	(1,202)	(7,464)
4/ 2/77	(1,028)	(8,321)	12/ 3/77	(1,851)	(7,186)
4/ 9/77	(817)	(7,396)	12/10/77	(1,655)	(6,947)
4/16/77	(301)	(6,994)	12/17/77	(1,512)	(7,068)
4/23/77	(1,018)	(5,921)	12/24/77	(1,353)	(7,182)
4/30/77	1,445	(4,378	12/31/77	(1,273)	(6,865)

[a]Source: North Dakota Public Service Commission, "Preliminary Report on Feasibility of State of North Dakota Acquiring a Covered Hopper Rail Fleet," Bismarck, North Dakota, November 1978.

Impact of Public Provision Upon Car Supply

In spite of potential management difficulties or operating costs, the critical issue in determining if the State should purchase rail cars, is the long-run impact. Will public provision increase the total supply of rail cars available for South Dakota grain shippers, or could the supply actually be decreased over time? The answer is dependent upon the expected behavior or response of existing car owners including railroads and elevators.

If one assumes that public investment will have no impact upon either private investment or car allocation, the additional investor would increase the total car supply and relieve a portion of the cost imposed by shortages. Unfortunately, this is an unlikely outcome for several reasons. First, limited capacity exists for building rail cars, and delivery usually varies from between one and two years. Therefore, the total number of cars which can be manufactured will not increase with State purchase, and an investment would simply delay delivery to private purchasers. And secondly, it does not consider the economic incentives for either the railroad or elevators which own or lease cars.

If, on the other hand, one assumes that the railroads and shippers will adopt strategic behavior in response to the newly created economic institution and incentives, the effective increase in the total supply of rail cars will be far less than the State's total purchase. In fact, it is possible that if the State purchases rail cars, the long term impact will be to reduce the number of cars available to move grain. This scenario, which assumes a strategic response by current car owners to the perceived economic and political incentive, is moreover, the probable outcome.

Railroads have existed in a highly regulated environment for many years and have learned to make calculated decisions based upon the response they expect from the public sector. In fact, railroads are often accused of strategic manipulation in other decision making processes such as branchline abandonment cases.[19] These allegations, however, are simply charges that the railroads are attempting to maximize profits within the existing institutional parameter, and there is little reason to expect them to alter their profit-maximizing behavior when planning car investment. The continuing low rate of return to car ownership provides no incentive for the railroads to purchase additional cars or even to maintain the existing fleet. Presently the opportunity cost of capital dictates that railroads disinvest in rail cars and utilize the capital for other purposes, very likely non-rail investment.

A change in the rules of the game will encourage railroads to adopt further strategic behavior. If they believe that States will purchase rail cars, they will adopt a strategy designed to create additional need to justify further public investment. This could be accomplished by: (1) continuation of railroads' disinvestment policy of the past many decades; and, (2) reassigning cars to other states not purchasing rail cars. Past rules governing allocation would encourage this because nearby states would initially have more unfilled car orders.

The other major source of grain cars is the elevators, which have become unwilling investors in response to the railroad's disinvestment. Access to rail cars is profitable for grain elevators because greater net returns can be secured in rail-based markets. But because of rail disinvestment, carrier-supplied cars are not readily available, and many elevators have responded by purchasing or leasing cars. However, mileage

credits do not offset lease costs, and consequently the rail cars themselves result in a net cost. Thus while access to rail cars is profitable for elevators, access to someone else's car is more profitable than a private fleet, and elevators prefer to eliminate their investment. This situation provides elevators with the incentive to also adopt strategic behavior and attempt to induce someone else to purchase rail equipment, in this situation, the State.

The ultimate strategy which would be adopted by elevators is, however more difficult to project. They have more to lose if rail cars are unavailable, but they also have better access to decision-making process, which encourages strategic behavior. It is likely that as long as shippers believe that a potential public investment might be forthcoming, private investment will be discouraged and delayed. Shippers will also actively encourage public investment through lobbying and news releases. This necessitates a prompt and forceful decision because as long as the decision remains unresolved or private investors perceive an irresolute decision, they will delay additional rail car purchases.

Because public investment discourages private investment, once the State has initiated a fleet, continuing pressures will exist to expand the public fleet as private owners disinvest. Of course, one can argue that the State can purchase perhaps 1,000 cars and announce that it is a one-time transaction, never to be repeated. This is simply round two of game theory. In round three, most shippers probably would believe further public pressure could force another round of State investment and then another.

The exact outcome is difficult to quantify without estimating supply and demand functions. However, there is no doubt that in the short-run, the increase in the total supply of grain cars will be significantly less than the number of cars the State purchased. This is because of the strategic behavior adopted by elevators and railroads in response to the new incentives.

A Decrease in the Supply of Rail Cars

It is possible, under some conditions, that by purchasing rail cars the State would actually decrease the supply which is available to move grain. Should private investors believe that additional public purchases are possible, the long-term impact could actually be a reduction in cars available as private interests attempt to "force" additional public investment. Elevators could reduce the number of cars they own or plan to own in a greater number than the State buys which would decrease the available supply.

Secondly, the total supply of rail car capacity is a function of the number of cars and the turnaround. Earlier, several factors were identified which suggested turnaround for State owned cars could be less than for privately owned cars. A decrease in turnaround amounts to reduced capacity available to move grain. And thirdly, railroads could shift cars to other states.

Should each of these probable outcomes occur, the long-term impact would be a net decrease in the number of cars available to move grain in the State making the car purchase.

The fact that the net increase in cars is less than the total State purchase of cars yields interesting economic results. Normal accounting practices would divide the total cost of owning the rail fleet by the bushels of grain moved to determine the State's cost per bushel and measure the effectiveness of the State investment. This would underestimate the actual additional cost per bushel. The net cost per bushel of the State car purchase should be determined by dividing the total cost of the State fleet by the number of bushels moved in excess of the grain which would have moved without the State purchase. If the net additional car capacity is significantly less than the State's total acquisition, the cost of moving the additional grain becomes rather large.

Summary: Impact of Public Provision Upon Car Supply

The agricultural citizenry of various states are seeking the assistance of the public sector to resolve the rail equipment shortage. They are proposing that State governments purchase rail cars to supplement railroad and elevator fleets. An analysis of the economic environment and the institutional incentives suggest that State acquisition of rail cars would have little positive impact upon the total supply in the long-run. And it is very likely that the incentives generated could result in a decrease in the total supply. This also results in an extremely high cost for the additional bushels of grain moved. The reasons that State ownership of rail cars would prove both costly and ineffective is that this plan addresses only the symptoms and does not treat the causes. The State does have some viable alternatives available which would address the causes and increase car supply, and stabilize demand. These are identified in the next section.

Viable Alternatives to Increase Railcar Availability

Supply Side Modifications

Currently rental rates in the form of per diem, demurrage, and shipping rates are administered at a level below ownership costs. A market transaction would increase the return to car ownership and would thereby encourage additional investment.

A second vehicle which has proven effective in increasing the supply of rail cars is collective action between various elevators. In some instances the purchase of rail cars has been included in an overall cooperative effort such as building a subterminal. In other cases the only collective action effort has been to acquire and manage a cooperative fleet of rail cars. But in spite of its success, collective action has not become a widely adopted strategy in South Dakota because of information limitations and organization costs. Thus a vehicle which would encourage and facilitate the various cooperative, private, and line elevators in collectively purchasing and managing a rail car fleet could reduce the equipment shortage problem. One alternative would be to establish a rail car expert within the State Department of Transportation. This individual would have the needed information regarding all aspects of car leases including cost and risk and could function as the vehicle through which organizational efforts could proceed. But this institutional arrangement would, of course, reinforce the railroads' current disinvestment strategy.

Demand Side Modifications

When grain prices are high, or during harvest season, car shortages exist, while at other times, rail cars stand idle. Thus the temporal allocation of demand is critical to effective utilization. Felton has

suggested a rail car market in which potential users could bid for railroad equipment.[20] In addition to encouraging additional investment on the supply side, this would allocate equipment more effectively and partially eliminate the problems of seasonal demand variation, non-compensatory per diem and demurrage rates, allocation among shippers, and the decrease in utilization. Other institutions which would prove effective in allocating demand temporally include flexible rail rates and seasonal rates. Should variable rates be implemented, risk will increase for elevators because as they contract grain for future delivery they cannot lock in a transportation rate. Therefore, elevator margin will widen unless a futures market in transportation service is developed to protect elevators against transportation risk. Wider margins would be borne by the farmer.

However, the volume of grain requiring transportation is too volatile to suggest that these marginal changes would be completely effective in allocating demand over time. While domestic demand for grain is relatively stable over time, export demand fluctuates greatly in response to various factors such as weather-generated shortfalls of grain in other countries, embargoes, and other foreign policy, and policies of other nations, among other factors. Each time export, and thus domestic, prices delcine, farmers react by reducing the volume they are willing to sell and increasing the amount they store. As part of its food policy, the public sector responds by making on-farm storage easier. Both construction and carrying charges are subsidized. But when prices improve, an even larger volume of grain will require transportation, which compounds car shortages and creates even larger transportation bottlenecks. And again, a public

policy designed to assist a segment of the citizenry generates behavior which yields a suboptimal performance and perhaps even a destructive performance. It should be noted that on-farm storage which allocates grain over the marketing year contributes to the orderly utilization of rail cars. On-farm storage which enables farmers to store production from more than one crop year compounds the cyclical nature of grain marketing and compounds car allocation problems.

To prevent this build-up of grain reserves at the point of production and therefore stabilize the demand for transportation services, an institutional modification is necessary which allows the deployment of grain to potential markets while the farmer retains control and ownership. Direct farmer ownership of storage facilities at ports would achieve this objective. Individual farmers, acting collectively, would build storage facilities near a port with some type of transfer to the export houses. Their grain would be shipped via the normal mode, mixed with grain of others, to this storage facility during periods of low prices. When an individual was ready to sell, he would issue instructions to the facility manger to deliver the grain to an export house. Obviously this suggestion is plagued with numerous problems, including: (1) potential managerial difficulties, (2) liability claims for transit or storage damage, (3) unwillingness of local elevators to load farmer-owned grain, (4) lack of physical control by farmers, (5) the higher construction, land, and tax costs at an urban facility. Finally, on-farm storage costs are perceived to be much less than they actually are, which perceptually make off-farm storage comparatively less favorable. While this institutional arrangement - direct farmer ownership of storage facilities - is plagued with problems, the potential benefits justify further exploration. The

public sector could play a critical role in facilitating collective action and providing information. Existing agricultural and food programs and tax laws would also need to be modified before off-farm storage could materialize. The exact impact that direct farmer ownership of storage facilities at ports would have upon the agricultural production and marketing sectors and the effective utilization of limited resources is unclear and needs further analysis. Existing agricultural policy and tax laws which encourage investment in farm storage facilities beyond one year's crop are probably going to compound the rail car shortage over time.

Summary and Conclusion

The State is correct that public intervention is necessary to modify the supply and demand for rail cars. Rather than additional restrictions upon the market, however, the key is a solution based upon a minimum of administrative proceedings and a maximum of institutional incentives designed to induce investment. Because of the various economic incentives, State provision of rail cars will induce strategic behavior by railroads and shippers. Their response will be a reduced investment in rail cars, counteracting the State funding. The exact impact upon the total or the marginal supply is indeterminant, but the increase in supply will be significantly less than the total number of cars acquired by the State. And possibly, the net impact would be a decrease in the total supply of rail cars. State action which would encourage collective action among the various elevators and increase the available information would likely have a more permanent and positive effect. To resolve the problem, it is necessary to modify the institutions which have created the existing situation. Only then will an adequate fleet of cars be available to transport grain produced in South Dakota.

1. W. H. Thompson and C. P. Baumel, "Impact of Transportation Equipment Shortages on Iowa Country Elevators," Transportation Journal, Fall 1972, Volume 12, #1, p. 51.

2. Frank N. Wilner, Preliminary Report on Feasibility of State of North Dakota Acquiring a Covered Hopper Rail Fleet, North Dakota Public Service Commission, November 1974, Bismarck, North Dakota, p. 43.

3. John Richard Felton, The Utilization and Adequacy of the Freight Car Fleet, Land Economics, Vol. XLVII, #3, August 1971, p. 267.

4. Transportation, Report of the Joint Commission of Agricultural Inquiry, House of Representatives, 67th Congress, First Session, Report 408, Part 3, October 15, 1921, as reported in Robert Tosterud and David C. Nelson, A Study of the Box and Hopper Car Supply Problems in the United States, Upper Great Plains Transportation Institute, Paper #10, September 1969, Fargo, North Dakota, p. 4.

5. William J. Hudson, A Study of Conditions Affecting the Transportation of Grain by Railroad, U.S. Department of Agriculture, June 1953, p, iii, as reported in Tosterud and Nelson, p. 4.

6. Association of American Railroads: Yearbook of Railroad Facts, 1980, AAR, Washington, D.C., p. 20.

7. Erhardt O. Rupprecht, "Demand for Freight Cars in the Movements of Grains," Paper presented at the annual AAEA meeting, August 15, 1976, p. 1.

8. C. Phillip Baumel, Thomas P. Drinka, Dennis R. Lifferth and John J. Millers. An Economic Analysis of Alternative Grain Transportation Systems: A Case Study, Report No. FRA-OE-73-4 prepared for the Federal Railroad Administration, Springfield, Virginia: National Technical Information Service, 1973.

9. Roger Jones, "Another Nail in the Railroad Coffin," Transportation Research, Pergamon Press, Elmsford, N.Y., Volume 7, #4, December 1973.

10. Public Law 94-210, Railroad Revitalization and Regulatory Reform Act of 1976, 94th Congress, S2718, February 5, 1976.

11. Robert J. Tosterud and David C. Nelson, A Study of the Box and Hopper Car Supply Problems in the United States, Upper Great Plains Transportation Institute Paper No. 10, Fargo, North Dakota, September 1969.

12. Yehuda Grunfeld, "The Effect of the Per Diem Rate on the Efficiency and Size of the American Railroad Freight Car Fleet," Journal of Business, January 1959, pp. 56-57.

13. The Association of American Railroads instituted a multilevel per diem rate on January 1, 1964.

14. Baumel et al., p. 100.

15. American Association of Railroads, p. 49.

16. Ibid, p. 49.

17. Ibid, p. 50.

18. Association of American Railroads Agreement OT-5.

19. It would indeed be unfortunate for those who consider themselves victims of present railroad manipulative behavior to design new institutions which would encourage further behavior of a similar nature!

20. Felton, p. 272.