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U.S. GRAIN HANDLING AND TRANSPORTATION SYSTEM: FACTORS CONTRIBUTING TO THE DYNAMIC CHANGES IN THE 1980S AND 1990S

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This report can also be found at this web site address: http://agecon.lib.umn.edu/ndsu.html.

Abstract

This paper describes the important changes that occurred in the U.S. grain handling and transportation system in the period following deregulation in 1980. This system has evolved and will continue to do so in response to technological and institutional changes, competitive pressures and a changed regulatory regime. The effect has been to induce investments throughout the system ultimately to improve the efficiency. Some of the important rail innovations include the use of rate discounts to induce more efficient movements from origins first, and more recently at destinations. In addition, each railroad has adopted car allocation systems comprising of several mechanisms, giving shippers logistical choices which have also facilitated more efficient allocation of cars among shippers. Finally, a number of important implications for the Canadian industry are identified as it evolves through its forthcoming changes.

Keywords: transportation, grain, logistics

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U.S. GRAIN HANDLING AND TRANSPORTATION SYSTEM: FACTORS CONTRIBUTING TO THE DYNAMIC CHANGES IN THE 1980S AND 1990S

Introduction

William W. Wilson*

The grain handling and transportation system in the upper Midwest has changed dramatically over the past two decades. There have been technological changes and productivity gains in rail operations, handling and shipping and substantial investment throughout the system. These changes were triggered in part by changes in the regulatory mechanisms that were adopted in 1980. However, other important factors have also contributed. These include underlying economies of scale in rail operations, handling and logistics management, as well as service competition. In addition, the competitive environment in the handling and railroad sectors is sufficiently strong that these cost savings have ultimately been passed on to farmers and decision makers throughout the system.

This paper describes the salient features of the U.S. grain handling and transport system, as well as its evolution over time. Several major questions are addressed: what is the current U.S. grain handling and transportation system, how did it evolve, and what are its characteristics? Section 2 describes salient elements of the system. Section 3 describes the evolution of key features of the system since 1980 including the role of changes in regulations. Sections 3 to 5 describe details of various mechanisms that have evolved to be important. Section 6 provides a summary model to depict the rationalization process in the U.S. system. The final section provides a summary and chronology of changes, and identifies some of the major features leading to greater efficiency in the U.S. grain handling sector that are relevant for review of the Canadian system.

Basic Elements of the U.S. Grain Handling and Transport System

Important elements of the U.S. grain handling and transportation system are shown in Figure 1. The U.S. system shows similarities with other systems, in terms of physical handling and commodity flows. It includes storage and handling functions throughout the system, car allocation and shipping, export handling and logistics management throughout the system. The escalation of rail shipping options is of particular relevance to this paper. Prior to deregulation rail shipping options were limited primarily to single car movements with generic service

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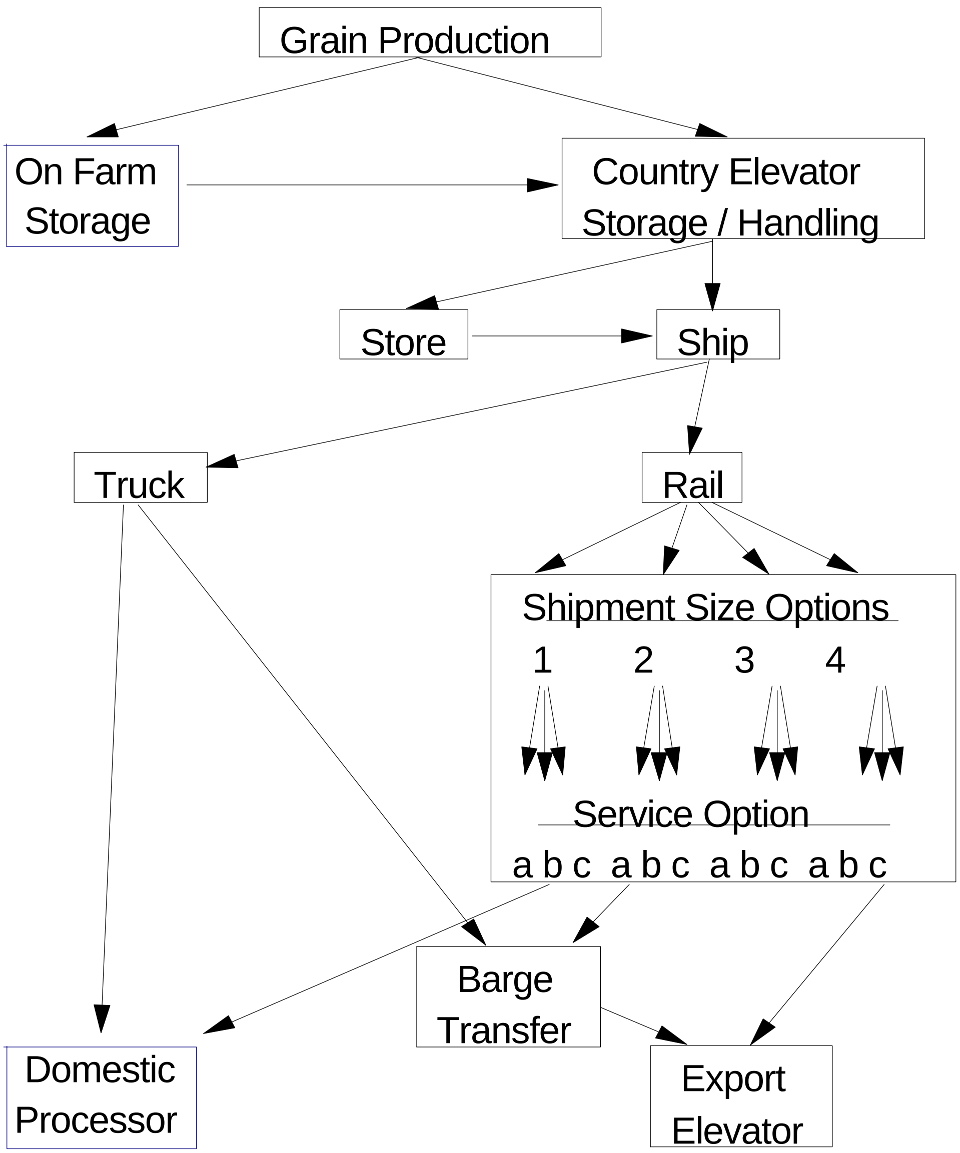

Figure 1. U.S. Grain Handling and Transport System

options. Since then there has been an increase in the number of shipment size options, as well as service options, each with associated price differentials that approximately reflect cost differences.

There are some critical features of the U.S. system that have evolved to a fairly high degree of sophistication. One is the role of price signals and service competition throughout the system to coordinate the vertical marketing functions and to guide marketing and investment decisions. This occurs throughout all elements of the marketing system. Price signals have always played an important role in fundamental storage decisions (i.e., timing of marketing decisions are influenced by intermonth price spreads). In addition, on and off-farm storage decisions are affected by competition. Off-farm storage occurs if it is more efficient than on-farm storage, and to accommodate logistical requirements (i.e., accumulating grain for larger scale shipment). These competitive pressures prevail throughout the system and assure efficiencies.

The system of price signals determining storage decisions has always been a salient feature of the marketing system. In the past two decades other forms of price signals have emerged specifically related to transport decisions. Through competitive pressures price discounts have induced development of larger scale elevators and shipments, and have provided incentives for farmers to deliver to further distant origins. More recently, other signals have begun to emerge in the rail sector, notably price differentials reflected in the rail car market, which are transmitted back to grain handlers, shippers and farmers. In Figure 1, these affect the choice of shipment size, as well as the service option (a,b,c...) chosen. Indeed, these signals influence storage decisions, the timing of shipping decisions, as well as investment decisions in rail cars and infrastructure.

A second important distinction is the definition of the shipper. Prior to deregulation, whether the originator or receiver (in both cases being grain companies) was the shipper was not a very important issue. The reason for this was that shipping and service options were nonexistent. making the distinction unimportant. However, with the increase in the number of service and shipping options, which are pursued differently by market participants as part of their longer-term strategies, who (originator, receiver, or intermediary) is the shipper to a transaction is critical. Fundamentally, the firm that assumes the risks associated with logistics management is the shipper and held accountable to the railroads and other parties to the transaction.

Staggers Rail Act: Critical Provisions

Many of the changes that occurred in the U.S. grain marketing system were concurrent with the Staggers Rail Act (SRA) of 1980. The SRA also introduced important changes in the regulatory regime regarding overall rate levels. A number of these have had important effects on the grain shipping and handling industry. Each is discussed below along with, where appropriate, the pre-SRA institutional environment.

Rate Regulation: Captive Shippers, Market Dominance and the SRA Prior to the mid 1970's rates were regulated under the Interstate Commerce Act. Beginning with the 4R Act of 1976 an evolution began toward greater rate flexibility, and less rigid regulation, but providing a mechanism for protection for shippers.

The SRA imposes two tests that must be met before the ICC and now the STB[1] would have jurisdiction to regulate rate levels. The first is the revenue to variable cost ratio (R/VC)

[1]These roles and functions have since been replaced by the Surface Transportation Board (STB).

threshold.[2] Specifically, if the R/VC is less than the threshold the ICC would not have jurisdiction to regulate rates in that movement. If R/VC exceeds the threshold, the ICC may have jurisdiction. However, simply because the R/VC exceeds the threshold does not necessarily mean the shipper is captive.

The second test is a finding of *market dominance* in the relevant market. This is defined by the ICC as "an absence of effective competition from other carriers or modes of transportation for the transportation to which a rate applies" (49 § U.S.Gc. 10701a(b))1) (Supp.IV 1980) and is intended to be a test or screening device for rate reasonableness. Guidelines have evolved to allow for evidence of direct competition including inter and intramodal, as well as two forms of indirect competition, product and geographic.[3] Based on these, if the carrier is found to be market dominant, the shippers could be defined as "captive"[4] and then the STB would have jurisdiction to regulate the rate. It is important that these are more than administrative criteria and are now evaluated in the context of competitive markets considering inter and intra modal, as well as product and geographic effects. The SRA also transferred the burden of proof for maximum rates to shippers. Before the 4R Act, carriers had to prove only that a rate was below the ICC's prescribed percentage of R/VC, in order to justify an increase.[5]

Rate reasonableness cases are evaluated on a case by case basis. There have been few cases in which rate levels have been appealed under these criteria. Most notable and relevant here is the McCarty Farms shipping case.[6] Briefly, that case has had several rulings since it was originally filed in 1978. In 1987, the ICC ruled that the Burlington Northern was dominant in wheat and barley shipments to the Pacific Northwest and that the shippers were captive. However, the most recent ruling (August 14, 1997) indicated these contested rates were not unreasonable and did not exceed the maximum reasonable level. This decision was based on the constrained market approach and standalone costing procedures.

While rate increases have been a major concern for shippers, most of these concerns have been unfounded. In fact, several studies have indicated that as a result of deregulation, cost savings have accrued and rail rates have fallen in real terms. Wilson (1997, p. 23) found that "the effects of deregulation on costs and productivity gains are tremendous, with costs in 1989 estimated to be 40 percent lower under partial deregulation than they would be under a regulated regime." In a related study focused on rail pricing, (Wilson 1994, p. 20) found that though there

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[2]In 1984 that threshold was 1.80 but now depends on the extent the railroad is earning an adequate return.

[3]See Tye for an economic interpretation of these concepts.

[4] See *Market Dominance Determinations*, 365 ICC 118 (1981).

[5]Currently, there is an STB proceeding considering elimination of geographic and product competition from market dominance determination.

[6]See Surface Transportation Board Decision No. 37809, August 14, 1997: *McCarthy Farms v. Burlington N.R.R.*

were some initial increases in rates following deregulation (1980), by 1988 "deregulation produced lower prices in most commodity classifications and did not increase prices in other classifications, suggesting that advances on productivity have dominated any adverse market power effects."

Rate Changes Were Liberalized Prior to 1980 rate changes required a 90 day notice for increases and there were fairly liberal procedures to challenge proposed changes. The net effect was that rates were largely rigid and changes were introduced only infrequently. Proposed changes were typically subject to a very long notice about the rate increase. As a result shippers had little risk related to rate changes.

The SRA changed the dynamics of rate changes. Specifically, rate increases (decreases) required a 20(1) day notice. The effect was to allow greater flexibility for railroads to respond to market conditions, but the exposure of shippers to increases in rail rates also increased.

Contracts Contract shipments were an important feature of the service environment during the 1980s. In addition, some of the evolving contract terms likely influenced the pricing and car allocation practices that subsequently evolved.

Contract rates were widely used in the Untied Sates in the first years following the SRA. The SRA explicitly encouraged carriers and shippers to enter into confidential contracts for grain shipments subject to informational disclosure.[7] Shippers could challenge contract rates on grounds of competitive harm or impairment of common carrier obligation. In addition, the SRA allowed agricultural shippers to challenge contract rates on grounds of the carrier's refusal to offer similar terms to them (which would constitute unreasonable discrimination). The legal process to intervene required that the complainant must first demonstrate their case and that the dispute cannot be resolved otherwise.

Railroads were restricted in the portion of capacity allocated to contract carriage. In general, a carrier could allocate no more than 40% of its own fleet (for a particular car type) to service under contracts. However, the restriction was more specific for large agricultural shippers (i.e., those originating more than 1000 cars per year). A railroad could allocate no more than 40% of the average annual number of rail-owned and private cars supplied to the shipper during the previous three years.

Contracts were generally opposed by small shippers, grain brokers, and farm groups. Reasons for this opposition included: their feeling they had little bargaining power; feelings that contract rates created price uncertainty by obscuring traditional basis pricing system tied to tariff rates; and that contract summaries were vague and provided little useful information. In response

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[7]Summary information about contract terms were filed by the carrier with the ICC. This information was fairly general and was publicly disseminated including information about railroad, commodity, general origins and destinations, number of cars, type of movement, base tariff rate, any special features and the minimum annual volume.

to public pressure, Congress called for more liberal discovery provisions and added several additional disclosure requirements.[8] In addition, the ICC added some specific disclosure requirements for agricultural traffic including shipper identity, specific origins and destinations, and actual volumes. The ICC also eliminated the injury and need-to-know criteria for the second phase of discovery.

Railroads approached contracting differently. An important distinction evolved among two important grain originating carriers in the upper Midwest. In the early 1980s the BN's customer focus for contracting was on the receiver or intermediary (i.e., traders), while the Soo Line's was primarily on country elevators and processors. Grain contracting peaked for the BN in 1986 and for the Soo Line in 1985, and declined rapidly thereafter due in part to the more liberal discovery rules and disclosure requirements. By the late 1980s, both railroads stated their intention not to enter into new grain contracts. Essentially, the contracting process was replaced by more comprehensive systems of service and car allocation (described below). It is important that these observations, though generally consistent, are not as pervasive for grain terminating railroads or for grain product shipments.

Premium Rates for Premium Service One of the important features of the SRA was a clause to allow railroads to charge premium rates for premium service. Specifically, Congress stated that "rail carriers shall be permitted to establish tariffs containing premium charges for special services for specific levels of services not provided in any tariff otherwise applicable to the movement" (Section 10734 of Title 49, United States Code). As a result of this provision, railroads actively pursued market-driven allocation mechanisms, in addition to addressing shippers' complaints of car availability and to foster productively gains. This eventually proved to be important because it is one of the clauses that facilitated development of more elaborate guaranteed forward shipping mechanisms and service competition (see below).

Branch Line Abandonment The Staggers Rail Act created liberalized procedures for branch line abandonment. As a result of this process branch line abandonment was expedited beginning in 1980. In the period since 1980, 19.9% of the rail lines were abandoned in Region 3, the region including the upper Midwestern states. In Montana, 29% of the Class I and II rail lines were abandoned. Only 13.5% were abandoned in North Dakota, likely due to the geographic scope of railroad competition in key regions of branch line concentrations. In addition, a portion of the rail lines were converted to short line railroads and operated independently of the Class I carriers (see Section 5).

This escalation of track abandonment is merely an extension of longer-term trends. Since the early 1900's, the Class I railroad network in the United States has been shrinking, while the overall traffic base has remained relatively constant.[9] Concentration of traffic on fewer miles of

[8]Conrail privatization Act of 1986.

[9] In 1929, major U.S. railroads originated 1.339 billion tons of freight with 229,530 miles of road. In 1992, Class I carriers originated approximately the same tonnage (1.339 billion tons of freight) with only 113,056

road, in conjunction with longer hauls, greater car capacity, and other gains in operational efficiency has had a profound effect on railroad productivity. Net ton-miles per train hour (a single-factor measure of productivity) increased by 519 percent during this period.

Rail Incentive Mechanisms

The evolution of the rail incentive mechanisms has been crucial to the changes that have occurred in the grain handling and transportation industry. Differentials implied in these mechanisms reflect economies of rail operations and are passed on in the form of rate discounts. In the process these rate discounts provide incentives to induce more efficient grain handling and shipping practices.

The grain rate structure has evolved to include trainload, single and multiple-origin rates, as well as programs to enhance efficiencies in the total movement --commonly called origin-destination efficiency programs. Each of these are very important features that affect rate spreads, providing differentiation and incentives among rail service levels. These are not necessarily an outgrowth of the SRA, and in fact could have been and in some cases were introduced prior to the SRA. These are described in this section and the most important features of the BN and CP/Soo rate structures are highlighted. These include: 1) origin efficiency, or, trainload rates; 2) origin-destination efficiency programs; 3) per car rates; and 4) rates and requirements for shipments in higher-cube (286,000 lb) covered hopper cars.[10]

Origin-Efficiency Incentives[11] In the 1970's, the BN and UP introduced trainload rates from Kansas and Nebraska to the Pacific Northwest (PNW). At the request of northern plain shippers, the BN introduced similar rates in North Dakota and Montana in late 1979. Over time there has been an evolution in these rate differentials from allowing both multiple and single origin incentives, to now only providing incentives for single-origin movements. This evolution is described below.

Multiple Origin Unit Train Rates: BN’s early rate structure included four elements: a 52-car“unit train” rate, a 26-car single-origin rate, a 26-car multiple-origin rate and a single-car rate. The purpose of the multiple-origin rate was to allow branch-line shippers with smaller facilities and limited siding to gain part of the benefits of multiple-car rates, and at the same time, provide an

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miles of road. Over the same period, the traffic density of the Class I railroad network (as measured in revenue ton-miles per mile) increased from 1.95 million to 9.436 million, while the average length of haul increased from 334 to 762 miles.

[10]Numerous forms of rate discounts have evolved in the U.S. rail system. It is critical that any comparison of rates over time, as well as between U.S. and Canadian regions account for the cumulative effects of these discounts.

[11]The terminology is distinguished from innovations explicitly introduced in the summer of 1997 referred to as Origin-Efficiency and Destination-Efficiency programs on the BNSF. These are clarified in a later section.

incentive for branch-line shippers to upgrade their facilities and become single-origin multi-car stations. Initially, the BN allowed as many as four elevators to pool a 26-car shipment. However, the 26-car multiple-origin rates were abandoned from BN's rate structure around 1985.[12]

Multiple-origin rates seemed to have fallen into disfavor with the BN for two primary reasons: (1) efficiency and (2) the mitigating effect on rate spread incentives. Simply, multiple-origination of grain movements is less efficient than single-origin from an operational perspective (a fact exemplified by the Soo Line surcharge of $150 per car). Multiple-origin shipments require the switching of several small blocks of cars at 2, 3, or 4 stations as opposed to the switching of one large block of cars at a single station. Switching inefficiencies are compounded when both the loaded and empty switches are considered. In addition, several waybills must be prepared and processed for a multiple-origin shipment (instead of just one).

The approach of the CP/Soo was somewhat different. Initially, more alternatives were allowed to shippers. As recently as 1995, the Soo Line published multiple-origin wheat rates to Washington and Oregon. That rate allowed as many as four shippers to pool the consignment; but they must be located in the same tariff pooling group in order to quality. The Soo Line also had a 52-car rate which allowed two adjacent shippers to pool a consignment. In either case, shippers incurred a $150/car charge in addition to the regular 26-car or 52-car rate.

The effect of these rates was to collapse the incentive implied in the rate spread. As example, in 1995, the spreads among the 1- and 25-car rates and the 25- and 50-car rates without multiple-origin rates were approximately $307 per car. Under multiple-origin service, the rate spreads were effectively reduced to $150 per car. If a smaller Soo Line elevator could load 25 cars with one switch (but cannot handle 50 cars), the elevator would be at a 9 cent per bushel rate disadvantage relative to a single-origin trainload shipper. Alternatively, if the same elevator can pool a 50-car consignment with an adjacent facility, then its rate disadvantage drops to 4.5 cents per bushel.

Single Origin Unit Train Rates: Multi-car/single origin rates were adopted later and proliferated to include 1-,3-,5-,10-,26- and 52-car incentives in the case of wheat. However, the most recent tariffs have reduced the categories to 3 as shown in Table 1.

There are several important addendums to these rate differentials[13].

- The rate spreads shown are for the portion of the movement to Minneapolis. In addition, to some destinations (but not all) beyond, additional rate discounts exist for larger trains--though these are very market specific and responsive to market and competitive conditions.

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[12]In some instances, the 26-car multiple-origin rates were replaced by 3-, 5-, or 10-car rates to Minneapolis and Duluth.

[13]Similar concepts and spread were introduced for other small grains.

Table 1. Rail Rate Discounts for Single Origin Movements from North Dakota

	Number of Cars Originated		
	26-51 versus 1	***52-110 versus 1***	
BN to Minneapolis/Duluth	$255/car (8c/b)	$425/car (13c/b)	
BN to Pacific Northwest	$207/car(6.3c/b)	$415/car(13c/b)	
	25 versus 1	***50 versus 1***	***75 versus 1***
CP/Soo* to Minneapolis/Duluth	$256/car (8c/b)	$426/car (13c/b)	NA
CP/Soo to PNW	$208/car (6c/b)	$415/car (13c/b)	$565/car (17c/b)

*Spreads apply to the movement in standard hopper cars. Comparable spreads exist for shipment in higher capacity (e.g., hi-cube, 286,000 lb) cars.

- Differences among these, as well as the absolute value, are largely reflective of the railroad's marginal cost differences. The fact that they differ among corridors and railroads reflect that their operating economies vary in these dimensions.

- As recently as 1995, the westbound Soo Line wheat rate structure consisted of five elements: a single-car rate, a 25-car multiple-origin rate, a 25-car single-origin rate, a 50-car two-origin rate, and a 50-car single-origin rate.

- The Soo Line rates to Minneapolis, Duluth and Glenwood, MN included a five-car rate. However, these have since been abandoned.

The trend is currently toward adoption of larger scale incentives for shipments up to 108 cars.[14] However, it appears this is selectively being combined with a broader class of incentives called origin-destination efficiency programs which are discussed below.

[14] Both the UP and BN are "tweaking incentive policies to encourage efficiency"... in the form of larger scale movements. In Kansas and Oklahoma where these incentives already exist, discounts relative to 1-car movements are $400/car, an additional $100/car relative to 52-car trains. There is debate in industry as to whether these types of movements will come to dominate the trade (*AgWeek* p. 2A, Sept., 8, 1997).

Cycles, Shuttles and Origin-Destination Efficiency (ODE) Programs

Origin-Destination Efficiency (ODE) types of programs were introduced for grain in 1993[15] to "promote efficient car utilization, customer logistics, and quality accounting." At that time the BN introduced two programs: a West Coast item applicable to export corn, sorghum and soybean movements and a St. Louis program applicable on spring wheat, durum and barley. Important requirements of that west coast program were:

- Shipment unit was for 108 cars (consisting of two 54-car units) loaded at two stations, both of which are included in the same operating group.
- All 108 cars must terminate at a single destination (elevator).
- Each unit must be loaded and unloaded within 16 hours of constructive placement.
- Only guaranteed freight cars can be used.
- Only elevators served directly by BN at Tacoma, Seattle, Kalama, Portland or Vancouver, WA, are eligible as destinations.
- $200 discount per car.

The St. Louis program was primarily targeted at encouraging efficiency in the movement of northern grains to the Mississippi River for barge transfer. It allowed adjacent stations to pool two 52- or 55-car consignments to form a 104- or 110-car train. Again, shippers received a $200 per car discount.

Since their inception, wide-scale adoption of these mechanisms has been hampered by market conditions. Following their initial offering these programs vacillated and in 1997 evolved in the form of contract programs (e.g., commonly called the XLP program on the BN).[16] Given that these are under contract the exact terms are not transparent, but industry contacts suggest they were similar in format to the above:

- 100+ cars loaded at 1 or 2 stations within 24 hours;
- Power remains attached for the complete movement;
- All cars unloaded at a single destination (consignee) in 24 hours;
- Some form of a guaranteed shipping mechanism (COTS, SWAPS) is required.
- Rate discount is $300/car ($200/car) for single (2) origin shipments respectively relative to the 52-car tariff rate.

The CP/Soo offered a complementary program for part of this period, but it has since been suspended. The UP has a similar program called the Contracted Shuttle Train Program which it operates as a component of its broader set of service options.

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[15]However shuttle types of trains have been used for coal since the 1960s.

[16]The tariff version of the ODE (Item 12167) was canceled in September 1995.

Railroads have continued to expand and offer these incentive programs. In September 1997 the BNSF introduced 104 ODE type train shipments on wheat from the upper Midwest. This movement would be under contract and require 104 cars loaded at one origin station with a single placement and unloaded at a single destination elevator. The offering prescribed the origin and destination elevators at which the program could apply (presumably specifying those with the technical capabilities of meeting the shipment requirements). The rate discount for this movement is $150/car off the 52-car rate.[17]

The BNSF also introduced a variant of these programs for corn, soybeans and milo under tariff to induce efficiencies in origination and termination during the summer of 1997.[18] These provided $100 discount each at origin and destination if certain requirements were achieved, including electronic data interchange (EDI) and certified weights at origin. More recently (September 1997, Item 12230) the BNSF indicated that to qualify for 52-car or more unit train discounts, the shipment would only be allowed one initial placement at the destination industry (Item 12230)--thus encouraging more efficient movements from single origins to single destinations (i.e., industry plant at the destination market).[19] Further refinements to the program were introduced during the summer of 1998.

Each of these programs was developed as a further step in the process of trying to improve rail efficiency. An important underlying impetus is that the cycle time for grain cars is far greater than for other types of movements. The BNSF cited the average cycle time of coal trains at 5.3 days, versus wheat trains at 19 days.[20] In reference to the UP approach to these mechanisms, Collier noted it "... is part of our ongoing strategy to reward the productivity of individual facilities through our rate structures"[21] The mechanisms provide incentives for improving the total movement including origination, termination and thus rail cycle time. Other major railroads have since implemented similar programs, though in many cases the terms remain under contract. However, railroad and receiver logistics have an important impact on the commercial viability of these mechanisms, resulting in their being used only in selective corridors.

Per Car Rates An important innovation in administration of rail shipments and providing additional incentives was the adoption of per car rates. Prior to the late 1980's virtually all rail grain rates in the Upper Midwest were on a per unit of volume basis (e.g., per bushel or cwt.).

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[17]At least in the offering the BNSF did not indicate whether the movement required the shipper to have guaranteed cars to effectuate the shipment.

[18]These were introduced in tariff (Items 12604 and 12605)

[19] In 1995 the BN westbound 52-car rates allowed the shipment to be broken into two 26-car blocks at destination (with a single switch) and delivered to two consignees, provided both blocks are consigned under one waybill. The second 52-car rate is the traditional single-origin, single-destination rate--shippers get a $100 per car reduction by consigning the entire shipment to one consignee

[20]*Milling and Baking News*, Sept. 30, 1997, p. 19.

[21]*Milling and Baking News*, Sept. 19, 1997 p. 15.

The effect of this was neutral with respect to fully-loading rail cars and at least a portion of the grain cars were less than fully loaded.

The effect of per car rates was to fully encourage handlers to load cars to their (either car or track) capacity--or vice versa, provide them disincentives for under loading of cars. In addition, accounting and billing were simplified.

111 ton Cars Since 1990, railroads have begun acquiring larger C6X covered hopper cars which have a 286,000 lb. gross weight limit. On average, shippers can load approximately 11 more tons in a C6X than in a regular C6 covered hopper car. The CP/Soo also has procured a large volume of high-cube cars, and apparently comprises up to 50 percent of their fleet. These cars are handled under different tariff provisions, and incur a different rate. Rate differences between C6 and C6X cars are normally simply a multiple of each other (i.e., 1.07 times the C6 rate). The unit train differentials are similar.

Because of the efficiencies associated with using these cars, each railroad controls their allocation, ultimately to make them fully utilized and retained as units. The BN has specific procedures for requesting C6X cars. In order to participate in the Soo Line program, shippers must request authorization for a maximum of 100 cars two months in advance. At least 15 days before the want date, the shipper must place an order for delivery of the cars, at which time authorization becomes official. The Soo Line reserves the right to restrict authorization to lines capable of handling the heavier cars.[22]

Car Allocation Systems: The Evolution of Service Competition

One of the important areas of competition that has evolved since 1987 is that of car allocation and service options. These have changed radically during the past few years and have had important implications for the grain handling and shipping industries. These are described briefly.

Background Traditionally, rail car allocation was generally on a "first-order-first-serve" basis. Uncertainties in rail car availability and lack of penalties for car cancellations facilitated persistent over ordering and a phenomenon known as "phantom orders"--car demands inflated in the form of orders, and subsequently canceled. An important result was that both shippers and railroads were confronted with uncertainties--shippers with respect to timely receipt of cars, and railroads with respect to certainty of future demand. Due to a multitude of market and competitive pressures, the BN railroad, an innovator in this area, developed explicit car allocation and service mechanisms. These have evolved to encompass a system of mechanisms including

[22]The Soo Line envisions upgrading most or all of its system to a minimum of 90-lb continuous welded rail (the minimum desirable standard for at least 25 mph operations with heavy cars). In the interim, heavy car speeds may be restricted on very light rail.

shorter term guarantees, longer-term guarantees and more refined procedures for allocation of general car orders.

Similar mechanisms have been developed and adopted by virtually all the other major Class I railroads in the grain industry. For purposes of illustration, the following describes the BNSF system.[23]

BNSF Car Allocation System The car allocation mechanisms on the BNSF comprise a system of logistical choices for shippers. General tariff, Certificate of Transport (COTs), and SWAPS[24] offer shippers a continuum of logistical choices from which to develop rail shipping and grain merchandising strategies. Various degrees of forward commitment, transferability, rate uncertainty, and performance incentives exist in this car allocation system. It is incumbent on shippers to select the best option, or combination of options, that best meets their needs. Salient features of these programs and how they relate under current offerings are shown in Table 2.

Each of the major Class I railroads have adopted systems with similar mechanisms. These result in more choices for shippers and a more logically consistent and efficient system of car allocation. Most grain car allocation systems comprise three mechanisms to allocate cars: 1) general tariff shipments; 2) shipments subject to short-term guarantees (e.g., COTS, PERX); and 3) longer-term guarantees (e.g., SWAPS, GEEPS). The development of these programs represents an effort to promote efficiency and improve service in the grain sector of rail transportation.

Allocation methods for general tariff service have been redesigned to discourage persistent over ordering and eliminate the need for shippers to be first in line. Carriers have approached this in varying ways. In general these have resulted in improved efficiency and fairness of car allocation for general tariff shipments. Common features of shorter term guarantee programs include: forward order period and carrier performance guarantees, a bidding process, transferability and shipper cancellation penalties. Programs differ among carriers on these features. However, all major programs generally permit the grain shipper to secure rail capacity for short-term shipping periods--at a premium charge during some periods.

Longer-term guarantee programs promote greater efficiency and provide a mechanism of risk sharing between shippers and carriers. An important motive for these programs is that management of private railcar fleets by rail carriers, normally in the form of a pool, results in efficiency gains. In addition, carriers are able to expand fleet size while offering logistically differentiated services to shipping customers. Longer-term guarantee programs provide incentives to level out shipping patterns and extreme seasonal swings in grain movements (Priewe and

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[23]See Wilson and Priewe for a detailed description of these mechanisms for each of the Class I railroads in the United States. Priewe and Wilson analyze the economics of shipping strategies using these mechanisms.

[24]These were originally commonly referred to as SWAPS and are now referred to as Guarantees.

Table 2. Allocation System: Key Elements

Item	General Tariff	COT	SWAPS
Fleet Allocation (Estimates)	35 - 40 percent	30 - 35 percent	30 - 35 percent
Corridor/District Allocation	3-year moving average	Strategically determined	Strategically determined
Instrument	Tariff	Tariff	Private Contract
Type of Guarantee	None	Short-term	Long-term
Allocation to Individual Shippers	Each unit train origin assured one train per month upon order; if orders exceed supply, trains allocated randomly.*	Bidding	Negotiation
Forward Order Period	1 month	Up to 6 months	Monthly shipments for varying periods forward
Window	30 days	15 days	30 days
RR Guarantees to Shipper	N/A	$400	$400
Cancellation Penalties	$200/car	Prepayment - $300 per car plus premium	$250
Rate Level	Tariff at time of shipment.	Option of shipper. Bid or effective tariff at time of shipment.	Tariff at time of shipment.
Transferability	Intra-firm, intra-district only.	Allowed	Allowed

* This is critical because it has been incorrectly described in numerous explanations of the mechanism. Cars are allocated to each geographic district based on historical shipments. Each unit train origin is allocated one train per month and is effectuated by an order. Only in the case that the number of orders exceeds cars available for that month is the random process used for allocation.

Wilson 1997). Shippers receive guaranteed services and rail carriers benefit from more predictable movements. Transferability is also important and facilitates secondary market transactions.

Implications for Shippers These mechanisms have a number of important implications for grain firms. Most important is that it becomes critical to integrate logistics, grain merchandising and handling decisions. Firms with greater control over inventories and/or forward sales (processing demand) will have a greater ability to utilize these mechanisms, the effect being to minimize the summation of car cancellations, and inventory and storage costs and demurrage.

As a result of these changes, most grain handling firms have re-organized and integrated their trading and logistics functions for purposes of enhancing logistical efficiency. For purposes here, logistical efficiency refers to having the right grain in the right place at the right time, and in the process, minimizing inventory and storage costs, and penalties associated with car cancellation and late shipments. Some of the important implications to grain firms associated with adopting of these mechanics include:

- Coordination of logistic and merchandising becomes critical

- Firms that have advantages with these programs are multi-plant firms (so long as origin transferability is allowed), processors, or any firm with certainty about forward needs. But potential bargaining power of large firms is mitigated.

- Strategic implications of forward coverage becomes important: Prior to the advent of these mechanisms, if a shortage emerged it was perceived that all were treated equally.

- Information emanating from primary and secondary transactions in these mechanisms improves forward decision making of both carriers (in equipment planning and allocation) and shippers (regarding the timing of forward marketing decisions).

- Mechanism operations have become highly transparent

- Identification of the shipper in grain transactions becomes critical (i.e., who is the shipper)--generally the shipper is the party to the transaction, (either the originator, receiver, or intermediary), having the prerogative to manage risks and car strategies. In the U.S. this has become an important negotiable term in grain transactions.

- Accountability between carrier and shipper become critical--the carrier offering guarantees about a portion of their forward car allocations, and shippers about the obligation of fulfilling orders with actual shipments.

Factors Contributing to Rationalization and Efficiency of the U.S. Grain Handling and Transportation System

The U.S. grain handling and transportation industry has already experienced a fairly radical rationalization process which continues to evolve. Numerous pressures were exerted on this system over the past two decades, which has resulted in improved efficiency in the overall system. A model of that rationalization process is depicted in Figure 2.

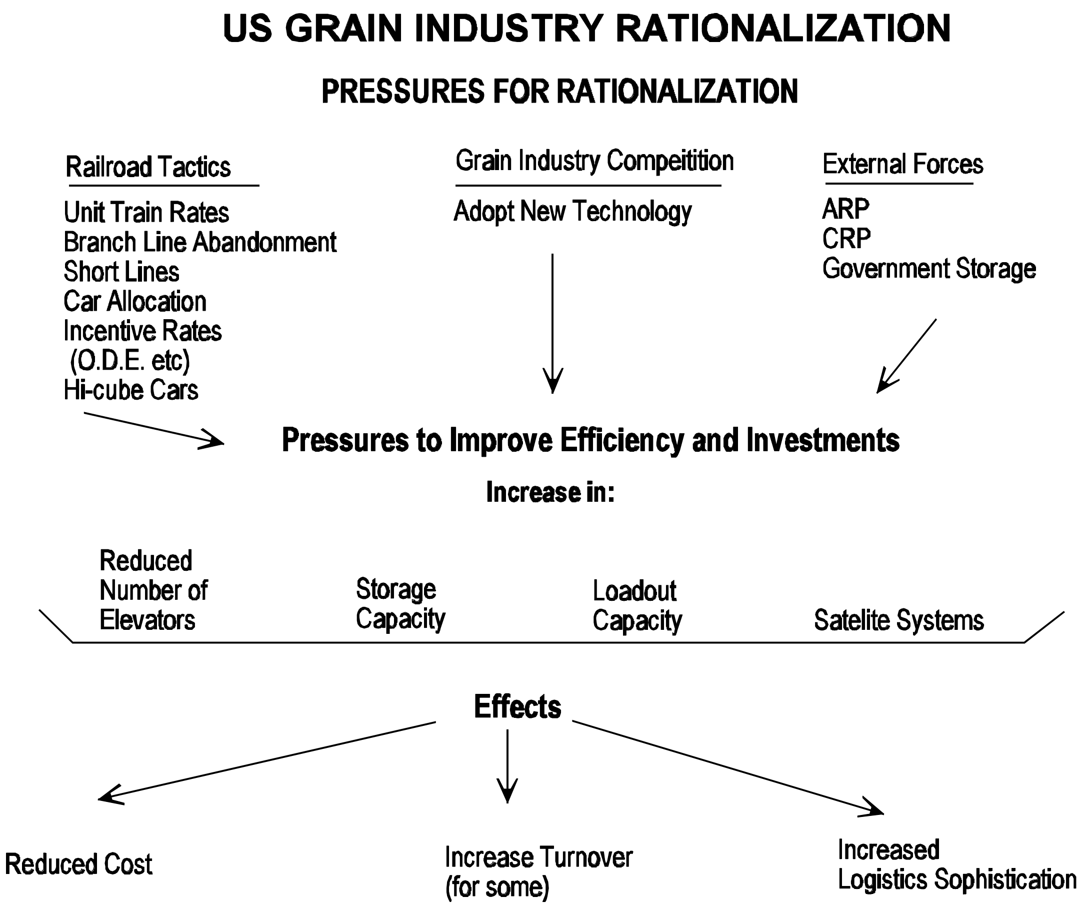

Figure 2. U.S. Grain Industry Rationalization

Numerous pressures have given rise to the rationalization process. These include various railroad tactics, competition in the grain handling sector and external factors. Each of the railroad tactics shown in Figure 2 was discussed previously with exception of Short Lines (see below). It is important that the rationalization process is more complex than simply the unit train rates that provide incentives for larger scale movements. Each of the other railroad tactics have also contributed to a more rationalized system.

Other contributing factors include the competitive environment among handlers. Differentials (in the form of rate discounts) emerge to provide incentives for shippers to adopt more efficient shipping technologies and practices. However, the value of these to the shipper/handler lasts only until competitors adopt similar technologies. Thus, it is the highly competitive environment among handlers that results in the rapidity of adoption of more efficient shipping practices.

Finally, there were several forces external to the grain industry that had the effect of inducing a more rationalized system. Notable among these were the U.S. set aside programs (ARP and CRP) which played very crucial roles during the mid-1980s, having the effect of reducing shipping and handling demand. Decreased demand reduced margins and induced firms to adopt more efficient shipping practices and consolidation. In addition, during some of the 1980s an important component of elevator income was from storing government-owned grain. Once that was liquidated through various mechanisms during the later 1980s and early 1990s, some facilities began to experience financial difficulties and the rate of plant closures accelerated.

Short Line Railroads An important feature of railroad cost savings was the adoption of short-line shipping technology. Since 1980, over 250 new short line or regional railroads have been formed in the U.S., most as a result of Class I carrier sales. Much of these efficiencies[25] relate to fewer employees per mile and per carload. However, lower wage scales with profit-sharing plans, smaller train crews, few, if any, work rules, and employee flexibility are all important factors in operational efficiency. An early study reported that labor costs decreased by 75% versus Class I railroads on comparable movements (Thoms, Dooley and Tolliver). Furthermore, short line railroads are able to purchase and more effectively utilize older power. Two operational characteristics of short line railroads facilitate their use of older power units. First, they operate at slower speeds than Class I carriers (frequently at 10 miles per hour). Second, short line railroads do not continuously utilize their power, frequently shutting units off at night.

Lower train speeds help to reduce costs in other ways. Low train speeds reduce the probability of derailment. In fact, lower train speeds allow short lines to perform minimal track maintenance without incurring heavy casualty and insurance costs that would result from frequent derailments. Short line carriers could not make this trade-off without crew flexibility and lower labor costs. In essence, short lines can trade-off higher crew costs, resulting from lower speeds and layovers, against lower track maintenance and power costs. Class I carriers cannot make these tradeoffs; they must operate at higher speeds.

[25]Several studies of short line railroads in the northern plains region have found significant economies of branch line operations. In particular, three case studies conducted in ND in the late 1980's illustrated the relative economics of the two modes of branch line operation. The first case represents a stand-alone branch line operation; i.e. a short line railroad operating a single branch line and interlining with the existing Class I railroad. Logic suggests that because of the start-up (threshold) costs of running a business, stand-alone short line systems consisting of a single branch line may not be profitable. The results of the case study (which simulated operation of an 81-mile line with nine cars per mile) support this conclusion showing a 20 percent increase in cost from short line operations (assuming the short line practices normal maintenance). The other two case studies were of a regional network consisting of 667 miles of road (with an average density of 20 cars per mile) and a short line network of 211 miles (with 36 cars per mile). Both simulations yielded positive efficiencies. Cost savings of 36 percent and 31 percent were projected for the regional and short line networks, respectively. A more generalized study found that (on average) short line operations reduced on-branch costs by 24 percent per car. See Thoms, Dooley and Tolliver for a summary.

The expanded use of C6X cars may pose problems for short line railroads in the future. If branch lines or short line tracks have to be upgraded for C6X cars, or special permits cannot be given to some shippers, then some shippers will achieve competitive advantage over others.

Efficiency and Rationalization The effect of these pressures has been an increase in investment in the grain handling and transportation sector and a corresponding improvement in efficiency. This is characterized by a reduction in the number of elevators, and investments in larger elevators in terms of storage, rail siding and load-out capacity. In addition, there has been an escalated rate of investment in grain rail cars.

Throughout the grain marketing system there are important economies resulting in lower unit costs associated with larger scale shipment. Costs have been reduced throughout the system in part due to these economies, and in part due to increased logistical efficiency.

Time Paths of the Rationalization Process The U.S. experience leads to the conclusion that the time path of the rationalization process is affected by several important factors. These are summarized in Figure 3. Early in the rationalization process the mechanisms and competitive and market pressures resulted in fairly wide-scale adoption of more efficient shipping and handling practices. Later, due to competitive pressures there has been an escalation in mergers and consolidation. However, each firm, being larger, is better capable of exploiting economies resulting in cost savings.

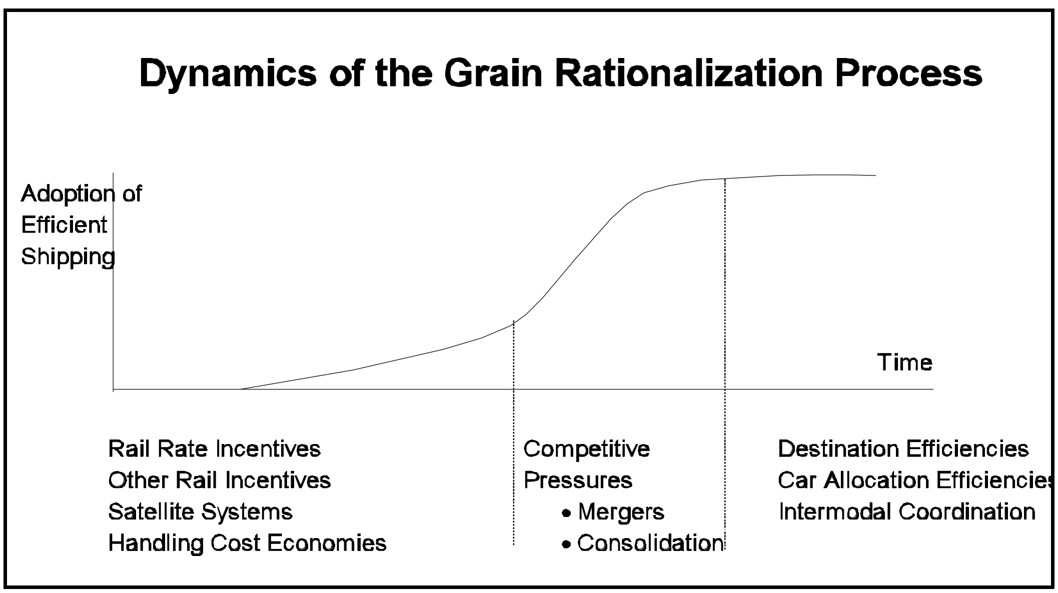

Figure 3. Dynamics of the Grain Rationalization Process

The rationalization of the U.S. grain handling system continues to evolve and in recent years is being further dominated by mechanisms to induce greater logistical efficiency. These include destination types of efficiency mechanisms to further induce greater efficiency of the total system. A second is to induce more efficient car allocation mechanisms.[26]

The U.S. grain handling system has evolved and will continue to do so in response to technological and institutional changes, competitive pressures and a changed regulatory regime. The effect has been to induce investments throughout the system (for example, in rail siding, loading/unloading capacities, rail car ownership, electronic interchange of data and information, etc.) and innovations, and to improve efficiencies throughout the system. In virtually all cases this response has resulted in some form of cost reduction and efficiency gain.

This section provides a summary of the evolution of changes and identifies some important lessons that have been learned for the evolution of the Canadian grain handling and transportation system. Critical changes in the U.S. marketing system are identified first, followed by a discussion of implications for the Canadian marketing system.

Critical Rail Initiatives: There have been a multitude of changes in the U.S. system, particularly with respect to rail initiatives. For summary purposes, Table 3 describes the approximate evolution of these mechanisms, and their effect on the industry.

A number of points are important to the above evolution. First, rate discounts have played an important role, though not exclusive, in the evolution of the system. U.S. railroads developed rate structures that are increasingly differentiated in numerous dimensions. In nearly all cases these are characterized as follows: 1) identification of rail operating efficiencies, 2) rate discounts are developed to reflect operating cost differentials; and 3) rate discounts are conveyed to decision makers. These ultimately provide incentives to shippers about making capital expenditures, and/or marketing decisions. These discounts have evolved system wide and even in regions with only one or two serving carriers.

Second, the particular form in which the rate discounts and clauses have evolved is suggestive of the type of efficiencies achievable by railroads. It is critically important and very clear that the U.S. has evolved from fairly disjointed movements characterized by multi-station origination to multiple customers at one or more destination. It is evolving rapidly toward a system of single station origination to single placements at destinations, combined to reduce switching costs and improve car cycle times. Not all movements will conform to these

[26]For here it is important that there are two elements of efficiency: pricing efficiency and distributional efficiency. Wilson analyzes the efficiency of car allocation mechanisms.

Table 3. Stage of Rail Initiatives

Approximate Timing	*Initiative*	*Effect*
1976 & 1980	Changes in Regulatory Regime	Part of subsequent changes were triggered by selected features of the regulatory regime
mid-1970's⇨mid-1980's	Unit train discounts introduced at origins; single and multiple origin rates; and many different sized movements	Induced beginning of multicar origination
late 1980's	Per car rates replaced per grain volume rates	Induced fully loaded (i.e., to equipment capacity) cars
1990's	Convergence toward single origin and single destination unit train incentives; and standardization of unit size	Further improvements in rail and handling efficiency
1990's	Adoption of higher-capacity cars	Reduced costs per unit and incentives conveyed to handlers
1993 to current	Cycle, shuttles, ODEs and destination incentives being developed	Induce efficiency on the total movement including destination efficiencies
1990's⇨Current	Refinement of car allocation systems with multiple mechanisms	Greater efficiency and reduced risks for both shippers and carriers

requirements, however, those that can will receive incentives to do so, and if they offset the cost differentials, these would ultimately prevail. In all cases these at least offer shippers the option to induce efficient rail movements.

Third, issues related to car allocation and service competition evolved to the point that each of the major railroads have adopted systems comprising several mechanisms, giving shippers logistical choices. This has evolved so that identification of the shipper is essential. Generally, the shipper should be the bearer of risk in grain shipping and beneficiary of efficient logistical management. This is because of the bilateral nature of accountability that emerges between the shipper and carrier as a result of these mechanisms.

Implications for Canada: As Canada seeks to understand issues related to the evolution of its grain handling and transportation system, several issues emerge from the experience of rationalization in the upper Midwest of the United States. These can be grouped into three major areas.

Regulatory Framework and Rate Flexibility: To accomplish what has been adopted in the United States requires a regulatory framework which allows for some form of flexibility. This requires moving away from cost-based regulation. Flexibility in rate-making is important for at least four reasons. One is that temporal demand conditions are inevitably uncertain. Second, numerous shipping configurations can evolve which allow railroads to exploit economies that can and should be reflected in rate discounts. Third, there are several other dimensions of service competition that can evolve but necessarily requires some form of more flexible rates. Fourth, the financial viability of Canadian railroads in a competitive environment depends on a more rational distribution of costs among shipments. If railroad costs are fixed at some arbitrary rate cap (e.g., fully allocated costs) railroads will inevitably be less responsive to changes in demand (both random and seasonal) and shippers will be under served due to capacity restrictions.

In the United States, the regulatory framework facilitates flexibility to respond to demand conditions, efficiencies and service competition. Protective mechanisms exist for shippers in a multitude of forms of direct (intermodal and intramodal) as well as indirect (product and geographic) competitive pressures. In addition, there are explicit mechanisms within the regulatory framework that provide protection for shippers.

System Efficiency, Integration and Coordination: The United States system evolved from a highly vertically disintegrated industry structure. Grain flows in that system were largely uncoordinated and resulted in frequent and random rationing and embargos at selected elevators. The system is evolving toward a system which is more structurally vertically integrated and coordinated through more explicitly shipping tariff and contractual relationships. In contrast, the Canadian industry has the elements of being a highly vertically integrated system, but does not necessarily function as a vertically coordinated and integrated system.

Numerous mechanisms exist and can be developed to exploit vertical system efficiencies. In general these involve use of rate differentials for different movement configurations, as well as car allocation and service options. Each of these is a natural area of service competition among carriers and would likely be adopted system wide. However, as became apparent in the United States, use of these mechanisms requires more explicit designation of the shipper, as well as accountability between shipper and carrier.

Benefits to Farmers: Many of the changes were induced in the United States because of the railroad's ability to identify and exploit operating efficiencies. These resulted in increased rail productivity and the reduced rail operating costs ultimately were passed on to shippers in the form of rate discounts. Combined with more efficient lower cost handling, the total marketing costs for farmers are reduced. In addition it is notable in the United States there is nearly always adequate handling and shipping capacity, farmers are not restricted as to the timing of their sales, and there has been private investment in rail cars which are generally available as needed.

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