IMPLICATIONS OF BREACHING LOWER COLUMBIA-SNAKE RIVER DAMS ON MODAL COMPETITION AND GRAIN FLOWS

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INTRODUCTION

Of the many policy issues confronting transportation planners and decision makers, one of the most pressing involves the trade-offs between environmental concerns and transportation efficiency. Of these, the listing of the four Snake River salmon, sockeye salmon and steelhead in the Columbia-Snake River system under the Endangered Species Act could force considerable changes in the management of the dams along the river. One possible strategy to increase the survival rates of salmon smolts migrating through the system is a river drawdown. Such an action could cool the water, eliminate smolt deaths in dam bypass and flush the juvenile salmon downstream, through the Snake River dam system, into the Columbia River, and out to the Pacific.

The National Marine Fisheries Service and the U.S. Army Corps of Engineers currently are producing an *Economic Feasibility Report/Economic Impact Statement* studying how to improve juvenile fish upstream migration on the Columbia-Snake River System (CSRS). The plan could involve breaching four existing dams on the lower Snake River portion of the CSRS. These dams provide sufficient channel depth and slack water to allow for barge transportation from the lower Columbia River up to Lewiston, Idaho, on the Snake River. Many shippers currently use this system to position commodities for export or farm inputs going up river. It is additionally perceived that other shippers benefit from the existence of the system as a result of competition to other modes that the presence of the barge system provides. The central question asked in this analysis and corresponding report is *what are the logistical impacts (rate changes and modal shifts)* of a river drawdown on grain shipments from the traditional lower Snake River origin freight territories.

Two market channels and three modes are considered in answering this question: (1) rail and (2) a truck/barge combination. Services offered by Class I railroads to Pacific Northwest (PNW) export positions are considered. The truck/barge mode is subdivided into local and long-distance. Wheat, including hard red spring and soft white varieties, are the primary commodity in this analysis because wheat constitutes the preponderance of the traffic originating by barge on the lower Snake River. Shipper preference, global grain price determination of grain, grain buyers preference, modal cost characteristics, rate setting behavior, as well as other factors, are considered.

This analysis is largely based on received theory of firm behavior. How will an individual transportation firm react to changes in the logistical system if the four dams are breached? The collective action of like firms will result in changes in the industry, which will reveal much about the potential impacts. However, the analysis is complicated by the fact that the barge industry consists of one dominant firm and the Class I railroad industry consists of two firms in the study area.

GOALS AND OBJECTIVES

The overall goals of this analysis were to:

- Estimate the short- and long-term impacts that eliminating barge transportation from Pasco to Lewiston will have on rail, truck, and barge rate structures in the selected origin territory.[1]

- Identify the potential for modal shifts.

- Discuss possible origin-destination shifts as a result of any changes in the rate structures of the three modes.

Specific objectives, listed below, were developed to facilitate the analysis.

Objective 1: Identify the commodities to be included in the analysis.

Objective 2: Delineate the area of study and identify representative points of origin.

Objective 3: Identify and evaluate Portland pricing and logistical preferences for export wheat.

Objective 4: Determine alternative rail pricing behavior and rates.

Objective 5: Determine truck pricing behavior and rates.

Objective 6: Determine alternative barge pricing behavior and rates.

Objective 7: Analyze the impact on modal rate and modal market share of eliminating barge traffic on the Snake River.

COMMODITIES CONSIDERED IN THE ANALYSIS

The Columbia River commercial navigation system supports a variety of commodities, including grain, petroleum, wood, chemical, metal, and aggregate products. The predominant commodity for major export items, in terms of volume, is wheat. It accounted for 55 percent of the total exports originated on the Columbia River between 1996 and 1998 (Research Group, 1999). Commercial navigation on the lower Snake River also is dominated by grain, with wheat and barley accounting for more than three-fourths of total tonnage moving downstream.[2] Thus, the critical consideration in breaching four federal dams on the Columbia/Snake River system is the potential impact on grain freight flows and rates; therefore, the downstream movements of wheat and barley were the only traffic considered in this analysis.

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[1] Pasco is used to label the Tri-Cities with a specific location, the two terms are used interchangeably in this report.

[2] Upstream commerce on this segment of the river is an insignificant volume, accounted for mainly by empty containers and barges and some fuel supplies.

STUDY AREA and SUB-DELINEATIONS

Based on initial findings presented in the *Lower Snake River - Juvenile Fish Mitigation Feasibility Study Technical Report-Navigation*, the grain draw area for this analysis is defined by a five-state region of Montana, North Dakota, Idaho, Oregon, and Washington (Figure 1). The grain draw area is that producing region from which the Snake River grain facilities originate grain. The primary origination area is concentrated around the lower Snake River, as counties in southeast Washington account for more than 65 percent of the annual tons delivered to Snake River elevator terminals. Whitman County, Was.., alone, accounts for 43 percent of the Washington volume. Northern Idaho also is a key draw area, providing about 17 percent of the lower Snake River grain originations (Table 1). Montana and North Dakota regions combined contribute less than 10 percent of the annual grain tonnage on the lower Snake River.

The study area was delineated into two regions: (1) North Dakota and Montana, and (2) the lower Snake River drawing territory of selected counties in Washington, Oregon, and Idaho. This delineation was made for three fundamental reasons that are discussed throughout this report: (1) rail transportation practices, (2) differences in trucking markets, and (3) proximity to barge.

Country grain elevators in the Washington and Idaho segments of the Snake River draw area primarily house facilities with track capacities under 26 cars (BNSF Grain Elevator Directory, 1998; Grain Connection, 1999). In addition, summaries developed from the U.S. Public Use Waybill data from 1993 to 1997 suggested single car shipments were the predominate rail service choice for shippers in the lower Snake River market territory (Appendix B). Number of cars per shipment for wheat ranged from 10 to 18 cars over the six-year period, averaging 13 cars per shipment. It should be noted that multiple car loading facilities, especially in 25-26 car lots, are becoming more common and are analyzed later in this

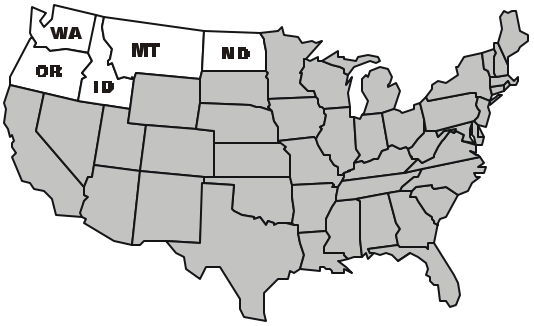

Figure 1. Snake River Grain Drawing Territory

report. These facilities now move almost 35 percent of the grain out of Washington State.[3] In contrast, grain originations in eastern Montana and western North Dakota are dominated by a population of unit-train loading facilities. Data collected from North Dakota elevators indicate that unit trains are employed to ship more than 70 percent of the wheat marketed via the PNW. Trucks have accounted for less than 5 percent of grain delivered to the PNW from ND elevators over this time period (Appendix B).[4]

For purposes of this analysis it is important to distinguish between local trucking and long-distance trucking because the competitive environment for the two markets differs significantly. The local market is characterized by lack of aggressive rail competition and limited secondary haul (backhaul) opportunities. The long-distance market, on the other hand, exists only because of the primary haul of manufactured and building inputs from the PNW. Furthermore, there is active, aggressive competition for grain moving long-distances from the northern plains to the PNW ports by rail, making the truck movements face an elastic demand curve.

[3]Newkirk, Erikson and Casavant, 1995.

[4] Benson and Domine, 1999.

Table 1. Selected Representative Origins by County in Local Draw Area[5]

	County	Origin Country Elevator	Existing Major River Elevator Destination	Alternate Major River Elevator Destination
Washington				
1	Adams	Ritzville	Windust	Tri-Cities
2	Asotin	Anantone	Wilma	Tri-Cities
3	Columbia	Dayton	Lyons Ferry	Tri-Cities
4	Franklin	Mesa	Burbank	Burbank
5	Garfield	Pomeroy	Garfield	Tri-Cities
6	Grant	Ephrata	Kennewick	Kennewick
7	Lincoln	Davenport	Burbank	Burbank
8	Spokane	Cheney	Central Ferry	Tri-Cities
9	Walla Walla	Walla Walla	Sheffler	Tri-Cities
10	Whitman	Colfax	Central Ferry	Tri-Cities
Idaho				
1	Bennewah	St. Maries	Central Ferry	Tri-Cities
2	Boundary	Bonners Ferry	Central Ferry	Tri-Cities
3	Idaho	Grangeville	Lewiston	Tri-Cities
4	Canyon	Caldwell	Hague Warner	Hague Warner
5	Kootenai	Hayden	Central Ferry	Tri-Cities
6	Latah	Deary	Lewiston	Tri-Cities
7	Lewis	Culdesac	Lewiston	Tri-Cities
8	Nez Perce	Sweetwater	Lewiston	Tri-Cities
Oregon				
1	Wallowa	Enterprise	Lewiston	Tri-Cities

Local trucking is the service provided to grain shippers in the immediate grain-gathering territory of the

[5]Given the 250-mile truck competitive threshold, Montana counties are not listed in this table as all the truck traffic would shift to Tri-Cities.

CSRS river elevators. A minimum of a 250-mile threshold is the distance that Class I railroads think, and cost analysis supports, rail can profitability compete with truck. Although this varies by Class I carrier, it is a rule of thumb for examining pricing behavior. This local analysis area includes the counties in Washington, Oregon, and Idaho identified in Figure 2.[6]

Trucks are more competitive than rails in short hauls because truck terminal costs are low, compared to rail. Alternatively, rails exhibit lower line haul costs and thus, at some longer distance, become quite competitive with truck (the 250 mile indifference point). The long-distance market for this study consists

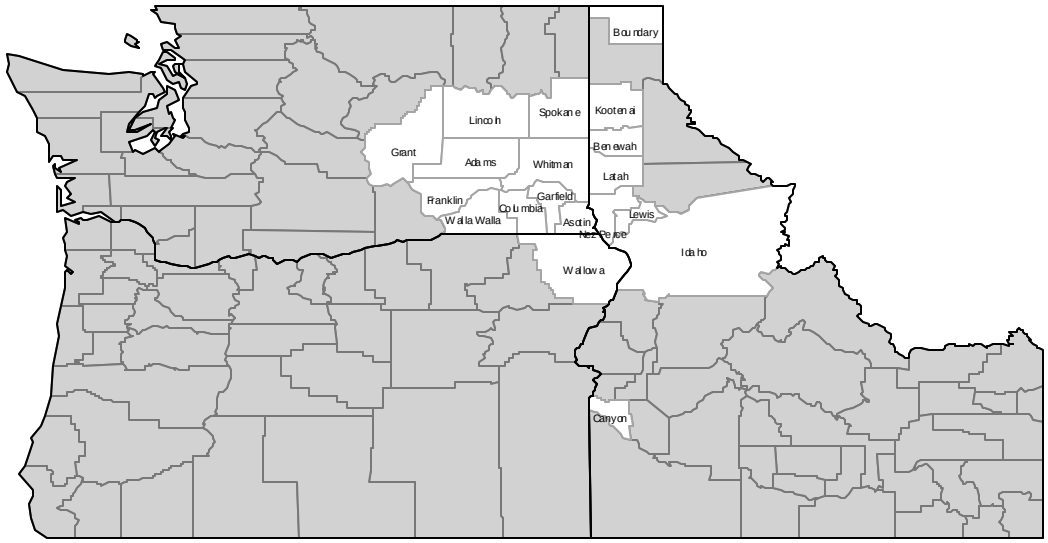

Figure 2. Counties in Local Snake River Grain Drawing Analysis.

of grain moving by truckload from Montana and North Dakota into river elevators for movement by barge on the CSRS.

A representative origin was selected for each chosen county in the analysis (Table 1). The counties were selected based on the Snake River grain facilities drawing data, as depicted in the initial Corp survey of elevators. The Washington and Idaho counties account for 91 percent of the bushels shipped via the Snake River (Research Group, pg. 56). These origin points were used in developing existing and alternative truck/barge costs for comparison with rail rates.

[6] Some counties were not included in the analysis because they did not ship significant amounts of grain to the river elevators.

The origins were selected on the basis of central location with a further consideration of grain production density characteristics. A major river elevator destination then was selected for each county and associated country elevator origin for the existing logistical system, as well as for the scenario involving the breaching of the four dams. The existing major river elevator destinations in Table 1 were based on summaries provided by an earlier Corp of Engineers grain elevator survey. This survey defined origin-destination pairs for the Snake River grain shipment data. The alternative elevator destination, for the Tri-Cites area, is the farthest upriver feasible barging location on the Columbia River. It was selected as per initial Corp of Engineers grain movement analysis.

PORTLAND EXPORT PRICING AND LOGISTICAL PREFERENCES

Wheat pricing and export elevator logistical preferences underlying this analysis with three specific issues being addressed: (1) the manner in which wheat prices are determined at the Portland market, (2) how wheat prices are set in the interior grain gathering territories, and (3) what logistical preferences are for receiving grain among the export elevators. These factors, in combination with the underlying rate structure, provide the base for understanding current terminal marketing patterns and potential market reactions given changes in the existing logistical framework.

The Snake River system acts as a conduit to the PNW export terminals, the primary market for the soft white wheat varieties grown in the northwestern United States (U.S. Public Use Waybill; USDA Grain & Feed Marketing News). Additionally, the PNW serves as an important export market for hard red wheat. Although wheat and barley are considered, analysis is conducted specifically for wheat, as it accounts for about 90 percent of the wheat/barley annual tonnage (Research Group, 1999).

The manner in which these wheats are priced at Portland is important in understanding the potential impacts of breaching the four dams on the Lower Snake River. Essentially, wheat competes in a global market that is extremely competitive. Wheat prices are based on world demand and supply conditions and determined in major commodity exchanges such as Minneapolis, Chicago, Kansas City, and Portland. The result is that wheat is base-point priced from some combination of major market points where price is determined by global competition. The wheat cross-price elasticities are elastic for different classes and from different producing regions, domestic and international. The essence of this cross-price elasticity is that it makes it nearly impossible for anyone in the supply chain to shift price increases forward into the world market. The end result is that the price of wheat is set for all participants in the supply chain.

The inability of the country elevator, or any other agent in the supply chain, to shift costs and/or risk beyond the point of export is an important consideration. Price in the country, and within the supply chain, is determined by subtracting the logistical costs from the relevant port price. This determination is presented in Figure 3. A North Dakota country elevator evaluating selling wheat into the different destinations of Portland, Duluth, and Houston will have a choice of all three at some centrally located point in the state. The price they receive will be determined by the port price less the logistical costs incurred to position the grain for export. These pricing characteristics, global and base-point pricing, result in a very competitive environment within the supply chain with each economic agent striving to shift costs and risk to other agents within the chain.

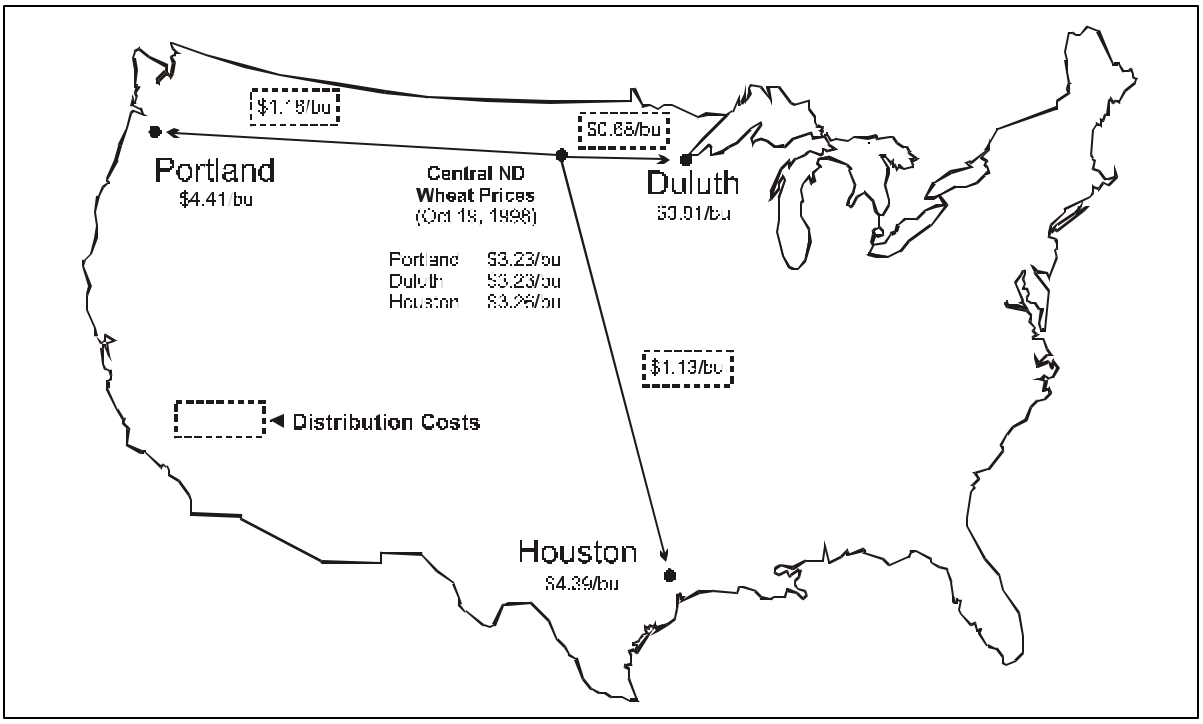

Figure 3. Central North Dakota Wheat Prices Based on Port Prices Determined by Global Supply and Demand Factors.

As depicted in Figure 3, the hypothetical prices offered for hard red spring wheat delivered to Duluth, Houston and Portland are quoted at $3.91, $4.39 and $4.41 per bushel. To make the decision which market is the best option for a sale made that day, an elevator manager in central North Dakota must calculate the net price per bushel for wheat delivered to each market. Thus, rail rates of $.68, $1.13 and $1.18 per bushel are subtracted from the export bids at Duluth, Houston and Portland, respectively, to identify the highest net price per bushel. In this case, the hard red spring wheat would be sold to the Houston market, as its net price of $3.26 per bushel is a 3 cent premium above the net values at either Duluth or Portland. These pricing relationships are dynamic, with pricing relationships among these markets, as well as local markets in constant change. This base-point pricing also holds for elevators in the local drawing area of the PNW.

A final factor to be considered in this section is the preferences by export elevators for receiving grain. Direct delivery by truck to PNW export facilities is not considered a viable mode in this analysis for three reasons: (1) Truck share of deliveries continues to decline;[7] (2) Industry sources who own/operate facilities at the PNW have stated that labor requirements, testing, and payment for truck unloads make the option relatively unattractive compared to barge and rail alternatives; (3) Some facilities have abandoned truck delivery facilities; and (4) Truck costs cannot compete with rail costs in this area. However, this does not mean that trucks do not play an important role in the supply chain for hard red spring and white wheat for export from the PNW. Trucks are critical to the local haul of white wheat from the Oregon,

[7] Truck deliveries accounted for less than 5 percent of PNW export facility receipts between 1992 and 1997 (Casavant, et al).

Washington, and Idaho producing regions. Additionally, trucks play a minor role in moving hard red spring wheat from North Dakota and Montana to river elevators on the CSRS. Truck rates are included in the rate schedule as a part of the truck/barge market alternative. Rail rates for movement directly to export locations also are included.

RAIL PRICING BEHAVIOR AND RATES

Only Class I railroads were considered in the analysis. It was determined that short lines did not play the defining role in any changes that might take place if the dams were breached.[8] Railroads operating in the gathering region have a great deal of market power in the rail and truck-barge marketing channels.[9] They are the price leader in the distance markets of North Dakota and Montana. Both railroads serving the local gathering region in Washington, Idaho, and Oregon also have significant market power given the nature of their network. The rail network in the region does not provide for a great deal of head-to-head competition at specific points. However, there is the possibility of truck-served, cross-country competition with elevators on the other rail lines. The market power is tempered by the threat of cross-country competition and truck-barge competition, but still is viewed as significant by the definition stated above.

The proposed navigation alternative, which would end commercial navigation on the Snake River, has a potential for impacting grain flows in the draw territory and would likely impact the rate structure for shipping grain by rail and barge-truck in the region. The Corps findings suggest the extent of the changes would be determined by market competition and, over the long-run, would settle at a pricing equilibrium where marginal revenue is equal to marginal cost (Research Group, 1999). This simplistic alternative may provide a means for estimating rate impacts in a perfectly competitive market environment. However, many of the transportation industries do not function in a purely competitive environment.[10] This is particularly true of railroads, one of the first major industries to implement demand pricing on a national scale through the mechanism of tariffs. Another consideration is that railroads are exempt from most antitrust laws, thus further disturbing the perfectly competitive market assumption.

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[8] There are two reasons for this. First, a review of the rail unload capacity at river ports indicated that there is presently little unload capacity at the river ports (Grain Connection, 1999). However, this could change over time. Second, in terms of impacts, short lines and trucks are good local substitutes for gathering grain, and thus, do not figure into the larger picture of delivery to PNW export facilities. A concern with short lines is oriented toward car capacity and track condition as they perform their 'collector' role for the Class I railroads.

[9] Market power, as defined for purposes of this analysis, is the ability of an individual firm to raise prices to a level that results in high profit margins significantly above costs without a corresponding shift of the traffic to a competitor or to reduce prices below costs in an effort to capture market share and the corresponding ability to absorb those losses without jeopardizing the overall economic health of the firm.

[10] Even then they are adept at developing pricing strategies that allow them to practice third degree price discrimination resulting in increased margins in specific markets; e.g., airline ticket prices for business versus leisure travel, railroad service auctions (COTs), etc.

In the Staggers Act,[11] 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."[12] Under this legislation railroads are better able to differentiate markets, setting rates that will allow them to be revenue adequate as a system, while the rate/cost relationship may be quite different for alternative routes, commodities, regions, etc. The market's ability to influence rail rates generally is considered within the context of the competitive environment. Rates generally are determined by four primary market influences or competition: (1) geographic, (2) product, (3) intramodal and (4) intermodal. Because white wheat grown in the region is usually treated as a specialty commodity for export from the PNW to Asia for noodle production, no reasonable competition from geographic or product substitutes can be identified. Thus, the crux of the rail rate scenario will be based on potential intramodal and intermodal competitor reactions and their abilities to absorb or pass along increased costs/profits.

The nature of a rail network also impacts pricing behavior. Railroads with large networks, such as the BNSF and UP, are necessarily cognizant of two broad economic realities when considering strategic pricing actions.[13] One is the impact rate changes will have on competitors. This involves the structure of oligopolistic game theory and gauging what the reaction of a competitor will be. A second and equally important area is the impact rate changes will have on the economics of their system. A rail rate structure has been likened to a blanket in that all points on the network are interconnected. A tug on one corner of this blanket sends ripples through the entire system. Railroads seldom make a rate change without considering what impact it will have on maximizing network revenue.

Two Class I rail carriers serving the Snake River draw area, the Burlington Northern Santa Fe (BNSF) and the Union Pacific (UP), have developed several alternatives for service to their customers, pricing each accordingly. The BNSF and its short-line affiliates offer shippers in various parts of the country a range of transportation services for moving grain: single car (1 to 25 cars), multi-car (26 to 51 cars), unit train (52 to 103 cars), 104-car train, and shuttle train (four trips of 104-cars) service/rates. The UP and its affiliates also offer an array of service/rates ranging from single car units (1 to 24 cars) to shuttle train programs (three trips of 100 cars). The operative rate is determined when the shipper orders the rail service that fulfills both the shipper's and buyer's infrastructure and product requirements. The effective rail rate from each origin region to the PNW export region, based on shipment characteristics and capabilities of the grain facilities, is presented in Table 2. The operative rate structures provide useful information, but are less than a complete picture of the pricing environment experienced by railroads.

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[11] In 1980 Congress adopted the Staggers Rail Act for oversight of rail rate/service issues. With this legislation, Congress restricted ICC juristiction over maximum rates to markets where railroads have market dominance. The *ICC Termination Act of 1995* preserved price discrimination and maximum rate provisions, transferring oversight to the Surface Transportation Board (United States General Accounting Office, 1999).

[12] Section 10734 or Title 49, United States Code.

[13] This also is true of smaller railroads, however, the problem may not be as complex.

Table 2. Rail Rates from Origin Stations of the Lower Snake River Draw Area to PNW Export Facilities[1]

State and County	Rail Rates to PNW Export Sites ($/ton)	State and County	Rail Rates to PNW Export Sites ($/ton)	State and Region	Rail Rates to PNW Export Sites ($/ton)	State and Region	Rail Rates to PNW Export Sites ($/ton)
Idaho		**Washington**		**Montana**		**North Dakota**	
Bennewah [2]	$14.65	Adams	$13.52	Central*	$31.26	Central*	$40.68
Boundary	$16.36	Asotin [2]	$10.81	Northeast*	$37.06	East central*	$40.68
Canyon	n.a.	Columbia [2]	$9.95	North*	$32.27	North central*	$40.68
Idaho	$14.57	Franklin	$11.38	South central*	$30.63	Northeast*	$40.68
Kootenai [2]	$13.82	Garfield [2]	$12.34	Southeast*	$34.44	Northwest*	$38.49
Latah	$13.21	Grant	$12.58	West	$28.17	South central*	$40.68
Lewis [2]	$13.99	Lincoln [2]	$15.86			Southwest*	$38.00
Nez Perce	$13.44	Spokane	$13.52	**Oregon**		West central*	$38.95
		Walla Walla	$9.48	Wallowa	$14.31		
		Whitman	$10.64				

[1] rail = 99 tons/car

[2] Estimated

Single Car Rates, except * reflect Unit Train Rates

Beyond the current rate structure, costs are an important component of potential rail reaction to competitive market changes. Uniform Rail Costing System (URCS) estimates of rail costs for the local Snake River draw territory to the Pacific Northwest export terminals are provided in Table 3.[14] In addition, wheat rates, from Texas elevators to the Gulf, and from Montana and North Dakota elevators to the PNW, are provided so that comparisons might be made among regions.

[14] URCS estimates are average variable costs based on long-term railroad accounting data and are the accepted institutional/regulatory estimation technique.

Table 3. Rail Revenue/Cost Ratios for Selected Snake River Market Origins - Single Car Shipments

Route	County	Rail Carrier	Rail Miles	Rail Rate or Revenue ($/Car)	Fully Allocated Costs[1] ($/Car)	Variable Costs[1] ($/Car)	R/VC Ratio	R/FAC Ratio
Idaho to Portland, Ore. - Single Car								
	Nez Perce	UP	386	$1,331	$1,714	$1,260	106%	78%
	Latah	BNSF	458	$1,331	$1,855	$1,359	98%	72%
	Idaho	BNSF	463	$1,442	$1,865	$1,367	105%	77%
	Boundary	BNSF	483	$1,620	$1,906	$1,396	116%	85%
	Boundary	UP	483	$1,325	$1,908	$1,402	95%	69%
Washington to Portland, Ore. - Single Car								
	Franklin	BNSF	234	$1,127	$1,399	$1,025	110%	81%
	Lincoln	BNSF	424	$1,507	$1,786	$1,308	115%	84%
	Spokane	BNSF	364	$1,338	$1,664	$1,219	110%	80%
	Chelan	BNSF	364	$1,464	$1,664	$1,219	120%	88%
	Spokane	BNSF	424	$1,457	$1,786	$1,308	111%	82%
Texas to Houston, Tex. - Single Car								
	Ellis	BNSF	206	$1,100	$1,342	$984	112%	82%
	Coleman	BNSF	336	$1,450	$1,607	$1,177	123%	90%
Montana to Portland, Ore. - Single Car								
	Hill	BNSF	890	$3,610	$2,735	$2,003	180%	132%
	Lewis&Clark	BNSF	757	$2,789	$2,464	$1,805	155%	113%
ND to Portland, Ore. - Single Car								
	Stark	BNSF	1324	$4,246	$3,619	$2,649	160%	117%
	Pierce	BNSF	1366	$4,442	$3,705	$2,712	164%	120%
	Williams	BNSF	1191	$4,276	$3,348	$2,451	174%	128%
ND to Portland, Ore. - Unit Train (Typical Shipment configuration is Unit Train)								
	Stark	BNSF	1324	$3,831	$2,207	$1,616	237%	174%
	Pierce	BNSF	1366	$4,027	$2,270	$1,662	242%	177%
	Williams	BNSF	1191	$3,861	$2,006	$1,469	263%	192%

1Fully allocated costs (FAC) includes the variable cost (VC) component attributed to a specific shipment and a 'system' cost component that is shared among shipments originated by a carrier.

A review of the rail-revenue-cost table reveals several interesting points germane to this analysis. First, as reflected by the revenue-to-cost ratio, it is quite evident that rails enjoy more market power in the movement of wheat to the PNW as the distance from the origin increases. This is evidenced by the increase in the revenue-to-variable cost ratio as a result of several factors. Rails are subject to greater

truck/barge competition closer to the destination due to the cost-structure of the two modes. At some distance the cost for each mode is equal, and as mentioned earlier, this point is assumed to be approximately 250 miles. This characteristic is not unique to the lower Snake River gathering territory. The same phenomenon is exhibited in the Texas-Houston market, as evidenced by the comparison of the above revenue-to-cost ratios.

The second point of interest is the lack of a profit margin on movements from the local drawing region (Idaho, Washington and Oregon). Revenue-to-variable cost ratios hover around the 100 to 115 percent range. This is relatively low-return compared to high-return traffic such as wheat from North Dakota and Montana.

The ratio of revenue to fully allocated costs provides some additional insights. These revenue/cost ratios suggest that the BNSF and the UP lose money in the long-run on traffic from Washington and Idaho counties included in the analysis. This is further evidence that the truck/barge combination does provide some intermodal competition in the movement of wheat.

Finally, R/VC ratios for moving North Dakota unit train shipments to the PNW are high relative to the movements of grain from the local drawing territory. The average R/VC ratio for shipments to the PNW from North Dakota regions is double the ratios for the Idaho-Washington origins, 247 percent compared to 109 percent (Table 3). The ratios for the local market do fall short of the Surface Transportation Board 180 percent R/VC ratio, which is recognized as the initial test for determining rates as reasonable. These cost estimates further buttress the argument that there is more intermodal competition in the local region than in the long-distance markets. This does not imply that rates are cost based. The current returns do suggest that railroads probably will not be aggressive, through lower rates or capital investments, to capture a majority of the traffic under the current scenario. Although breaching the dams will change this competitive relationship, it is not clear whether it will be enough to shift the traffic from truck/barge to rail. That question is addressed in the *Impacts on Rates and Modal Shifts* section.

TRUCK PRICING BEHAVIOR AND RATES

Trucks are an integral part in the potential modal rates and market shifts, and the possible origin-destination shifts resulting from changes in the lower Snake River navigation system. How a trucking firm, or most firms for that matter, determines what prices to charge in a free enterprise market-based economy depends on many factors including economic, social, and personal. However, for purposes of this analysis, the assumption is made that the objective function for individual trucking firms servicing the demand for moving grain from origin territories to the CSRS river grain elevators, and thence by barge to Columbia River export facilities, is to maximize profits in the long-run. An additional assumption is that long-distance truckload carriers will price below full costs, but always cover variable or incremental costs, for specific movements, in the short-run as well as the long-run.[15]

The organization and structure of the truckload industry is useful in explaining pricing behavior, for

[15] Incremental costs are defined as those additional costs specific to the movement compared to the costs that a firm would incur if no backhaul was available and the truck had to deadhead back to the original origin.

structure often dictates prices. Competitively speaking, the trucking industry is characterized by several structural elements.

1. Easy entry subjects the industry to the continual threat of new or existing firms moving into an existing market.

2. Good substitutes exist in the form of rail and intermodal transportation alternatives.
3. The large number of small firms and the relative size and position of shipper firms result in a negotiating advantage for shippers.

4. Competitive rivalry among the firms in the industry is intense.

The cumulative effect of these elements is a cost- and service-competitive trucking industry. However, as will be explained later, this does not imply that each firm will always price according to its costs. What it does imply is that normal or below normal rates-of-return on capital can be expected. Additionally, it also suggests that returns to labor and management are probably marginal at best. These characteristics are taken into account by truckload managers when pricing a specific movement, whether it is an owner-operator or a company-owned fleet truck. The economic environment detailed above does not allow trucking firms to have a great deal of market power in setting prices. Therefore, trucking firms, whether owner-operator or company fleet, tend to be price takers.

Although actual trucking costs are not the predominant factor in determining truck pricing, they will have a significant impact in pricing behavior. The rates will be determined by the competitive environment of the demand for transportation services. However, truck costs do determine if truck is a viable alternative mode of transportation and also which firms will survive. Truck costs set a floor in the aggregate for truck rates and corresponding revenue in the general sense. In an extremely competitive environment, truck rates will tend toward the full cost of delivering truck service in the long term. If they did not, individual firms would continue to lose money and eventually go out of business. Nevertheless, short-run truck rates, or rates for specific markets on a continuing basis, may not reflect the long-run costs of providing the service.

Cross subsidization among different hauls is not unusual in the trucking industry. The need for it arises when there is not sufficient secondary traffic to balance the primary haul, resulting in empty return, deadhead mileage. The secondary haul could be too competitive to allow a rate that captures the full roundtrip cost of delivering the service. Furthermore, interaction with substitute services, such as rail, also is a major influence on pricing behavior in the secondary haul market. This is typical of export grain moving from the northern plains region to the PNW. The cost of deadhead mileage must be covered by someone other than the trucking firm or the firm will not survive in the long run.

Actual truck costs were adapted from a 1997 study conducted at the Upper Great Plains Transportation Institute, North Dakota State University.[16] The study identified costs for a dry-van owner-operator providing basic truckload transportation service, the type of trucker of importance for the types of movements in this study. Several cost parameters were identified and quantified as follows: (1) 80,000 lb.

[16] Mark Berwick and Frank Dooley, Upper Great Plains Transportation Institute, North Dakota State University, MPC Report 97-81, October 1997, 53 pp.

Gross Vehicle Weight, (2) 53,200 lb. net payload weight, (3) a utilization factor of 100,000 miles per year, (4) time loaded - 71 percent, (5) driver costs - $0.29 per mile, (6) waiting time - $10 per hour, (7) fuel price of $1.25 per gallon, and (8) average speed of 45 MPH.[17] Actual total costs are $1.04 per mile, and variable costs constituted 60 percent of total costs at $0.62 per mile.

Again, it is important to distinguish between local trucking and long-distance trucking. Local trucking is the service provided to grain shippers in the immediate grain gathering territory within about 250 miles from the CSRS river elevators. This includes counties in Washington, Oregon, and Idaho identified in Figure 2. The long-distance market for this study consists of grain moving from Montana and North Dakota by truckload into river elevators on the CSRS.

The reason for the distinction between local and long-distance markets, as referenced earlier, is that the competitive environment for the two markets is significantly different. The local market is characterized by a lack of aggressive intra-rail competition and limited secondary haul or backhaul opportunities. The long-distance truck market, on the other hand, exists because of the primary haul of building materials from the PNW, hence empty mileage is quite low. Another factor is the competition of grain trucked from the northern prairie to the PNW. Railroads have developed several service packages concentrating on efficiency to move grain to the PNW over the past 18 years. The impact of these rates has been to lower rail rates below one-way truck costs, thereby making truck movements subject to incremental cost pricing. A rationale for the long-distance market is described first and will be followed by an explanation of local trucking costs.

Long-distance Markets

The Pacific Northwest export facilities handled an average of 3,190 million bushels of wheat, corn and soybeans annually, between 1991 and 1997. Corn accounted for the largest share of the bushels with 56 percent, or approximately 1,777 million bushels. About 763 million bushels, or 24 percent, of the average handle was soybeans, with wheat constituting the remainder. The wheat, by class, was 10 percent hard red spring wheat,7 percent white and 3 percent hard red winter.[18]

The long-distance market for truckload grain consists of grain shipments from country elevators in eastern Montana and western North Dakota, primarily of hard red spring wheat from country elevator origins to river elevators on the CSRS. This market is serviced primarily by owner-operators and company fleets whose primary haul is lumber and other building materials from the Pacific Northwest to the north-central United States. The primary haul could include destinations as far away as Chicago. Evidence of prices charged by trucking firms suggests that there is an imbalance of traffic moving back to the PNW (*Annual ND Transportation and Rail Service Survey*). Given this imbalance of return traffic, truck firms seek out any backhaul that will increase their gross revenue, even though it may not cover full operating costs. Grain from the northern prairies is one such backhaul. Even with some backhaul, trucks likely will have to deadhead part of the way. The trucks are forced to take whatever they can get because of the competitive conditions and nature of grain pricing.

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[17] Ibid. p 35.

[18] USDA, *Grain and Feed Weekly Summary and Statistics*.

Rail is the predominate mode used for shipping wheat to Portland export facilities from Montana and North Dakota. It is also the preferred mode of shipment for most of the grain moving to this market. The net effect of this environment is that truckload carriers constitute a small portion of the total market of wheat moving to the PNW from North Dakota (less than 5 percent). Thus, trucks contribute a marginal capacity to the overall movement. These elements make it even more difficult to price above truck costs.

Current truck rates from North Dakota country elevators are approximately $0.90 per mile.[19] This is well below their full cost of $1.04 per mile. The reason for this lower rate is the preference for rail which allows for larger shipment sizes, multi car and unit trains, which are much easier to manage and market from the perspective of a country elevator manager. Thus, rail rates set the maximum that the combined costs of trucking to the river elevator, one additional handle, and barge rates, can equal. Since rail is preferred, the truck/barge rate will most likely have to be lower in combination with the handling cost to effectively break into the market. Conversely, rail rates at this distance will be largely unaffected by changes in the truck/barge supply chain for the reasons just cited. Rails will determine prices based on the global price of wheat and the alternative channels that bread wheat can be marketed. Truck rates will be determined by rail rates and the level of competition for a backhaul. Since little of the truck-barge trip to the PNW can be attributed to barges, the ability of barges to influence grain traffic flows from Montana and North Dakota is limited.

Therefore, little or no impact on the modal split and total distribution costs for moving grain into position for export at Portland should be expected from a river drawdown. This premise is based on the underlying assumption that the building material will continue to move to the north central United States regardless of the proposed changes on the CSRS. Because country elevators generally have a rail alternative, the price they pay producers will not change as a result of changes in the supply chain waterway infrastructure. Additionally, these changes will not influence the price at Portland, which is determined by world supply and demand factors. The two economic agents left in the supply chain,the primary haul contractor and barge companies, will be left to absorb any increase in distribution costs. Each of these agents will do whatever is possible to shift any increase in costs to one another. The ability to do so will depend on the elasticity of demand for their services, their overall market power, and the long-run strategy of the river elevators and the barge interests.

Local Markets

The local trucking market is quite different from the long-distance market. It is expected that truck rates will more closely approximate truck costs in this market, especially in the long-run. This is based on the relatively easy entry into the local trucking business, by shippers if necessary, in combination with other factors such as the primary haul being grain, from the origin counties to the river elevators. Although the rates for grain primarily will be based on costs, the actual cost to the shipper will likely vary by the degree of backhaul traffic generated and the revenue it provides. It is assumed that revenue for any backhaul would be similar to trucking costs. Although there is a small possibility of some fertilizer backhaul, it is

[19] *Annual Transportation and Rail Service Survey*, Upper Great Plains Transportation Institute. Parameters used for the calculation: (1) 976 miles from Bismarck to Lewiston, (2) 27.5 net tons, and (3) a rate of $1.60 per ton.

assumed that much of the return mileage to the origin country elevator will be empty. Thus the focus of the analysis is on a zero backhaul scenario.

Points considered for analysis of rate impacts were determined by the criteria cited earlier. As already noted, one representative origin was selected for each county considered in the analysis. Highway distances were calculated from the one selected representative county origin to the existing river elevator locations for each county (Table 4).[20] Existing river elevator destinations were taken from information provided by the Corp of Engineers. The alternative river elevator locations considered were any location at or below the Tri-Cities and nearby Burbank slightly above the confluence of the Snake River with the Columbia River. Highway distances also were calculated from each representative origin to the alternate river destinations. Changes in distances cause a change in trucking costs for the breaching of the dams. Thus their accuracy is critical to the analysis. Note: for those counties (Table 4) that have the same major river port defined as existing and alternate, further analysis is not conducted because the existing traffic patterns are assumed to prevail when the existing port is located below the Tri-Cities.

Table 4. Selected Representative County Origins, Corresponding River Destinations and Associated Highway Distances

County	Existing Major River Elevator Destination	Existing Highway Distance to River (miles)	Alternate Major River Elevator Destination	Alternate Highway Distance to River (miles)
Washington				
Adams	Windust	55	Tri-Cities	79
Asotin	Wilma	24	Tri-Cities	136
Columbia	Lyons Ferry	31	Tri-Cities	61
Franklin	Burbank	25	Pasco	25
Garfield	Garfield	24	Tri-Cities	85
Grant	Kennewick	93	Kennewick	93
Lincoln	Burbank	124	Burbank	124
Spokane	Central Ferry	76	Tri-Cities	123
Walla Walla	Sheffler	13	Tri-Cities	34
Whitman	Central Ferry	31	Tri-Cities	117
Idaho				
Bennewah	Central Ferry	96	Tri-Cities	193
Boundary	Central Ferry	203	Tri-Cities	244
Idaho	Lewiston	76	Tri-Cities	201
Canyon	Hague Warner	245	Hague Warner	245
Kootenai	Central Ferry	126	Tri-Cities	173
Latah	Lewiston	45	Tri-Cities	167
Lewis	Lewiston	24	Tri-Cities	151

[20] Highway distances were based on several sources of information including a combination of software-based mileage programs and Rand McNally Motor Carriers-Atlas, in conjunction with the Corp data.

	Nezperce	Lewiston	17	Tri-Cities	144
Oregon					
	Wallowa	Lewiston	85	Tri-Cities	154

The cost of trucking grain to the existing river elevator destination was based on the previously cited truck cost of $1.04 per running mile (Table 5). The net weight was assumed to be 27.5 tons, 55,000 pounds.[21] As stated earlier, fertilizer appears to be the only viable backhaul of any degree of significant volume. Thus a range of costs were developed using 0, 20, and 40 percent rates of backhaul. Without any backhaul it is assumed that the shipper will have to pay for the round trip mileage between origin and destination. A 20 percent rate of backhaul means that the primary haul is responsible for the entire distance to the destination and, on average, 80 percent of the empty return mileage. As would be expected, a 20 percent backhaul rate reduces the cost of the total movement by 10 percent, and a 40 percent backhaul rate reduces cost of the total movement by 20 percent. This assumes that the shipper paying for the backhaul is paying the full cost of operating the truck for the distance required for the backhaul.

Table 5. Truck Costs to Existing River Destinations from Representative County Origins for Three Levels of Backhaul

	County	Existing Major River Elevator Destination	Existing One-Way Highway Distance to River	Existing Truck Costs to River Elevator		
			(miles)	0% BH	20% BH	40% BH
Washington				($ per ton)		
1	Adams	Windust	55	4.16	3.74	3.33
2	Asotin	Wilma	6	0.45	0.41	0.36
2	Columbia	Lyons Ferry	31	2.34	2.11	1.88
4	Franklin	Burbank	25	1.89	1.70	1.51
5	Garfield	Garfield	24	1.82	1.63	1.45
6	Grant	Kennewick	93	7.03	6.33	5.63
7	Lincoln	Burbank	124	9.38	8.44	7.50
8	Spokane	Central Ferry	76	5.75	5.17	4.60
9	Walla Walla	Sheffler	13	0.98	0.88	0.79
10	Whitman	Central Ferry	31	2.34	2.11	1.88
Idaho						
1	Bennewah	Central Ferry	96	7.26	6.53	5.81
2	Boundary	Central Ferry	203	15.35	13.82	12.28
3	Idaho	Lewiston	76	5.75	5.17	4.60
4	Canyon	Hague Warner	245	18.53	16.68	14.82
5	Kootenai	Central Ferry	126	9.53	8.58	7.62
6	Latah	Lewiston	45	3.40	3.06	2.72
7	Lewis	Lewiston	24	1.82	1.63	1.45

[21] Based on an average of 25 and 30 tons cited in information provided by the Corp and 53,800 lbs. identified in the Berwick, et al. study.

8	Nezperce	Lewiston	17	1.29	1.16	1.03
Oregon						
1	Wallowa	Umatilla	85	6.42	5.78	

As one would expect, the costs from the various counties varied in direct proportion to the distance, ranging from a low of $0.98 per ton from Walla Walla County, Washington to a high of $18.53 per ton from Canyon County in Idaho.

Table 6. Truck Costs to Alternative River Destinations from Selected Representative Origins by County for Three Levels of Backhaul

County	Origin Country Elevator	Alternate Major River Elevator Destination	Alternate One Way Highway Distance to River	Alternate Truck Costs to River Elevator		
				0% BH	20% BH	40% BH
Washington			(miles)		($ per ton)	
1 Adams	Ritzville	Tri-Cities	79	5.98	5.38	4.78
2 Asotin	Asotin	Tri-Cities	136	10.29	9.26	8.23
2 Columbia	Dayton	Tri-Cities	61	4.61	4.15	3.69
4 Franklin	Mesa	Pasco	25	1.89	1.70	1.51
5 Garfield	Pomeroy	Tri-Cities	85	6.43	5.79	5.14
6 Grant	Ephrata	Kennewick	93	7.03	6.33	5.63
7 Lincoln	Davenport	Burbank	124	9.38	8.44	7.50
8 Spokane	Cheney	Tri-Cities	123	9.30	8.37	7.44
9 Walla Walla	Walla Walla	Tri-Cities	34	2.57	2.31	2.06
10 Whitman	Colfax	Tri-Cities	117	8.85	7.96	7.08
Idaho						
1 Bennewah	St. Maries	Tri-Cities	193	14.60	13.14	11.68
2 Boundary	Bonners Ferry	Tri-Cities	244	18.46	16.61	14.76
3 Idaho	Grangeville	Tri-Cities	201	15.20	13.68	12.16
4 Canyon	Caldwell	Hague Warner	245	18.53	16.68	14.82
5 Kootenai	Hayden	Tri-Cities	173	13.09	11.78	10.47
6 Latah	Deary	Tri-Cities	167	12.63	11.37	10.11
7 Lewis	Culdesac	Tri-Cities	151	11.42	10.28	9.14
8 Nezperce	Sweetwater	Tri-Cities	144	10.89	9.80	8.71
Oregon						
1 Morrow		Boardman	42	3.18	2.86	2.54
2 Umatilla		Umatilla	36	2.72	2.45	2.18

Truck costs also were calculated for the alternative river elevator destination of the Tri-Cities using the same procedure (Table 6). Obviously, costs increase in proportion to the increase in distance. However, the change in distance can not be predicted simply based on current distances because the new routing to new river (alternative) elevator destinations is unique to each origin. Some origins will experience a considerable increase in distance while others will remain nearly or the same.

The existing and alternative truck costs are presented in Table 7. One pronounced finding is the sharp impact potential backhauls have on the cost of trucking grain from local counties to river elevators. Taking Whitman County, Was., as an example, a 20 percent backhaul rate reduces the new rate from $8.85/ton to $7.96/ton, a difference of over 2 1/2 cents per bushel.[22] The impact increases another 100 percent with a 40 percent backhaul rate. Although the difference is not overwhelming it does demonstrate that

[22] This calculation assumes there is little or no possibility for a backhaul under existing conditions. the distances are too short to justify development of backhaul markets. If they do exist it is most likely the result of a unique specialized arrangement.

success in obtaining backhaul can have a positive impact on the cost of moving grain. It is possible that the Tri-Cities area may have more potential backhaul opportunity than the smaller original river elevator locations.

Changes in truck costs for moving grain to alternative river ports varied widely, ranging from no change in five origins to more than 700 percent in the case of Nez Perce County, Idaho (Table 8). However, percentage increases can be misleading because it can reflect extremely low existing truck costs due to the proximity to the river. In absolute terms, there were four other origins in Idaho that had increases around $9 per ton.

Table 7. Comparison of Existing and Alternative Truck Costs from Selected Representative Origins by County for Three Different Levels of Backhaul (BH)

	County	Existing Major River Elevator Destination	Existing Truck Costs to River Elevator			Alternate Major River Elevator Destination	Alternate Truck Costs to River Elevator		
			Backhaul Level				Backhaul Level		
			0%	20%	40%		0%	20%	40%
			(dollars per ton)				(dollars per ton)		
Washington									
1	Adams	Windust	4.16	3.74	3.33	Tri-Cities	5.98	5.38	4.78
2	Asotin	Wilma	1.81	1.63	1.45	Tri-Cities	10.29	9.26	8.23
3	Columbia	Lyons Ferry	2.34	2.11	1.88	Tri-Cities	4.61	4.15	3.69
4	Franklin	Burbank	1.89	1.70	1.51	Pasco	1.89	1.70	1.51
5	Garfield	Garfield	1.82	1.63	1.45	Tri-Cities	6.43	5.79	5.14
6	Grant	Kennewick	7.03	6.33	5.63	Kennewick	7.03	6.33	5.63
7	Lincoln	Burbank	9.38	8.44	7.50	Burbank	9.38	8.44	7.50
8	Spokane	Central Ferry	5.75	5.17	4.60	Tri-Cities	9.30	8.37	7.44
9	Walla Walla	Sheffler	0.98	0.88	0.79	Tri-Cities	2.57	2.31	.206
10	Whitman	Central Ferry	2.34	2.11	1.88	Tri-Cities	8.85	7.96	7.08
Idaho									
1	Bennewah	Central Ferry	7.26	6.53	5.81	Tri-Cities	14.60	13.14	11.68
2	Boundary	Central Ferry	15.35	13.82	12.28	Tri-Cities	18.46	16.61	14.76
3	Idaho	Lewiston	5.75	5.17	4.60	Tri-Cities	15.20	13.68	12.16
4	Canyon	Hague Warner	18.53	16.68	14.82	Hague Warner	18.53	16.68	14.82
5	Kootenai	Central Ferry	9.53	8.58	7.62	Tri-Cities	13.09	11.78	10.47
6	Latah	Lewiston	3.40	3.06	2.72	Tri-Cities	12.63	11.37	10.11
7	Lewis	Lewiston	1.82	1.63	.145	Tri-Cities	11.42	10.28	9.14
8	Nez Perce	Lewiston	1.29	1.16	1.03	Tri-Cities	10.89	9.80	8.71
Oregon									

1	Wallowa	Lewiston	6.42	5.78	5.13	Tri-Cities	11.64	10.47	9.30

Table 8. Existing and Alternative Truck Costs from Representative County Origins, 0% Backhaul

	County	Major River Elevator Destination	Alternate Major River Elevator Destination	Existing Truck Costs to River Elevator	Alternate Truck Costs to River Elevator	Difference Between Existing and Alternate	Percent Change from Existing
				(dollars per ton)			(%)
Washington							
1	Adams	Windust	Tri-Cities	4.16	5.98	1.82	44%
2	Asotin	Wilma	Tri-Cities	0.45	10.29	9.83	2167%
2	Columbia	Lyons Ferry	Tri-Cities	2.34	4.61	2.27	97%
4	Franklin	Burbank	Pasco	1.89	1.89	0.00	0%
5	Garfield	Garfield	Tri-Cities	1.82	6.43	4.61	254%
6	Grant	Kennewick	Kennewick	7.03	7.03	0.00	0%
7	Lincoln	Burbank	Burbank	9.38	9.38	0.00	0%
8	Spokane	Central Ferry	Tri-Cities	5.75	9.30	3.55	62%
9	Walla	Sheffler	Tri-Cities	0.98	2.57	1.59	162%
10	Whitman	Central Ferry	Tri-Cities	2.34	8.85	6.50	277%
Idaho							
1	Bennewah	Central Ferry	Tri-Cities	7.26	14.60	7.34	101%
2	Boundary	Central Ferry	Tri-Cities	15.35	18.46	3.10	20%
3	Idaho	Lewiston	Tri-Cities	5.75	15.20	9.45	165%
4	Canyon	Hague Warner	Hague Warner	18.53	18.53	0.00	0%
5	Kootenai	Central Ferry	Tri-Cities	9.53	13.09	3.55	37%
6	Latah	Lewiston	Tri-Cities	3.40	12.63	9.23	271%
7	Lewis	Lewiston	Tri-Cities	1.82	11.42	9.61	529%
8	Nezperce	Lewiston	Tri-Cities	1.29	10.89	9.61	747%
Oregon							
1	Wallowa	Lewiston	Tri-Cities	6.42	11.64	5.22	81%

It should be recognized that the costs used in this section are linear in nature and therefore do not reflect any types of economies associated with distance, volume, market, scope, or scale. For purposes of this analysis, such economies would probably have little or no impact on the general findings.

Truck costs are considered a per-mile constant in this analysis varying by scenario, but trucks must recover full costs in the long run to continue to operate.[23] Over time this will result in a fairly constant cost between origin and destination pairs. Thus, rail and truck-barge modes become much more important in the business strategy of reacting to the potential breaching of the four dams on the Lower Snake River.

BARGE PRICING BEHAVIOR AND RATES

[23] This will hold true even if a country elevator chooses to provide its own transportation capacity by owning and operating its own trucks.

The pricing behavior of the barge industry is straightforward in one respect; the industry is dominated by one firm for grain movements on the CSRS. This characteristic eliminates any consideration of intra-industry competition. Thus, the pricing behavior is conditioned by at least five considerations:
(1) shipper and receiver preferences; (2) the economics of moving grain by two competing networks;
(3) competition from the railroad industry; (4) the nature of grain commodity pricing; and
(5) alternatives for utilizing company capital assets.

Any reference to truck is conspicuously missing from the list of factors that influence how and what prices will be charged to barge customers. Truck costs do limit the competitiveness of barges to the extent that the truck-barge combination can compete with the rail alternatives. The reason for this is that trucking costs are considered a given constant for any specific origin-destination pair, with no room for price adjustment in the long run, and little flexibility in the short run. The role trucks play in this supply chain is determined by the prevailing competitiveness in and about the trucking industry, in combination with a lack of any distinguishing transportation element that would provide tucking interests with any degree of market power over the other two modes in the network. The trucking industry is quite competitive and its prices essentially are driven by costs influenced by the availability of backhauls. Since backhauls largely are beyond the control of trucking industry participants, truck prices are considered as a given and relatively constant over time, changing in proportion to distance changes.

The first factor relates to preferences of shippers and receivers of grain from origin territory. In this case it is assumed that there is no preference on the part of either and that they are indifferent to the manner in which grain is originated and terminated. Thus, a country elevator manager is detached from the decision to select a mode of transport from the country origin with the exception of the net price they receive. The result of this is the absence of any modal market power due to logistical preferences from the country elevator industry. This is not true of river and export elevators. As cited earlier, river elevators do not have a great deal of rail unload capacity. Thus, they have revealed a preference for truck delivery. Export elevators, on the other hand, have little truck unload capacity and discourage truck deliveries. Export elevators are assumed to be indifferent to barge and rail, with the exception of instances of periodic logistical congestion.[24] This indifference is exemplified by the manner in which they price grain. Currently, exporters do not differentiate between barge delivery versus rail. Thus, they have revealed a preference for a modal choice. (One terminal operator pointed out that their preference is barge, due to lower unloading costs and larger shipment lot size. This preference, however, is not revealed in the market by a price difference between the two modes of delivery.[25])

The second factor, the economics (cost economies and system revenue needs) of the two competing networks for moving grain into export position in the Portland region also is critical. It provides the basis for comparing the two alternatives and is understood by all the economic agents involved in assessing possible pricing strategies. In this analysis, the railroad industry is considered to be a price leader. Railroads have the luxury of determining how much traffic they want and will set their prices and corresponding service levels to achieve company goals. They also can absorb losses to the extent they are covering at least variable costs due to the overall size of their network and the huge business volume of

[24] *USDA, Grain & Feed Market News*.

[25] Ibid.

the Class I's operating in the region.[26] Thus, railroads are formidable competitors to barge transportation on the CSRS. An additional factor to be considered is that barges currently dominate the market, with approximately 62 percent out of Washington and 63 percent out of Idaho shipments (Casavant and Jessep, Newkirk, et al.). Given the existing profitability of barges (to be presented later), their dominance in the market, and rail market power it is likely that barges will wait for railroads to make adjustments before reacting to any changes in the logistical system.

The global pricing of grain also will influence how barges will price. As stated earlier, the price at Portland is fixed for the inland logistical network. All logistical cost must be absorbed by some economic agent in the supply chain. Given that truck costs essentially are fixed for any move, barge and rail become the only transportation agents to have the management prerogative to adjust prices. If rails are price leaders and have substantial system-wide market power, barges will react to the railroads as opposed to rails reacting to barge.

The final factor is alternatives for utilizing company assets. If the assets are mobile, such as truck, they will move to the best alternative use in the short run. In the long run they will be consumed and not replaced if the business is not sufficiently profitable. For the rail industry, where resources are rather immobile, with the exception of rolling stock, decisions regarding plant and equipment investments and distribution of finite resources are made within a system context. The barge industry has plant and assets which are largely immobile, thus limiting any asset movements in adapting to market changes.

[26] For example, BNSF had gross freight revenues of $8.92 billion in 1998 and a net income of $1.15 billion. Ag commodities produced gross revenues of $1.07 billion and was the third largest contributor to revenue for the railroad.

The current barge, rail and truck rate relationships for the Columbia/Snake River draw area are illustrated in Figure 4. Barge rates reflect the published Tidewater Barge, Inc. rate schedule for wheat originating at river terminals, destined for Portland export facilities.[27] Barge rates, on solely a line-haul basis, currently provide the least cost alternative for delivering grain from the local Columbia/Snake River draw area to the PNW export facilities, as illustrated in Figure 4. Of course, these aren't directly comparable because no barge investments occur without some truck costs as well. The truck/barge combination that is illustrated includes no backhaul, with one-third of the trip mileage attributed to truck and two-thirds of the trip attributed to barge. When compared to the single car rate, truck/barge rates are approximately equal at the 250-mile range. It should be emphasized that this relationship reflects rates and not costs, with the exception of the truck mode.

Table 9. Barge Rates and Cost Estimates to Pacific Northwest Export Terminals

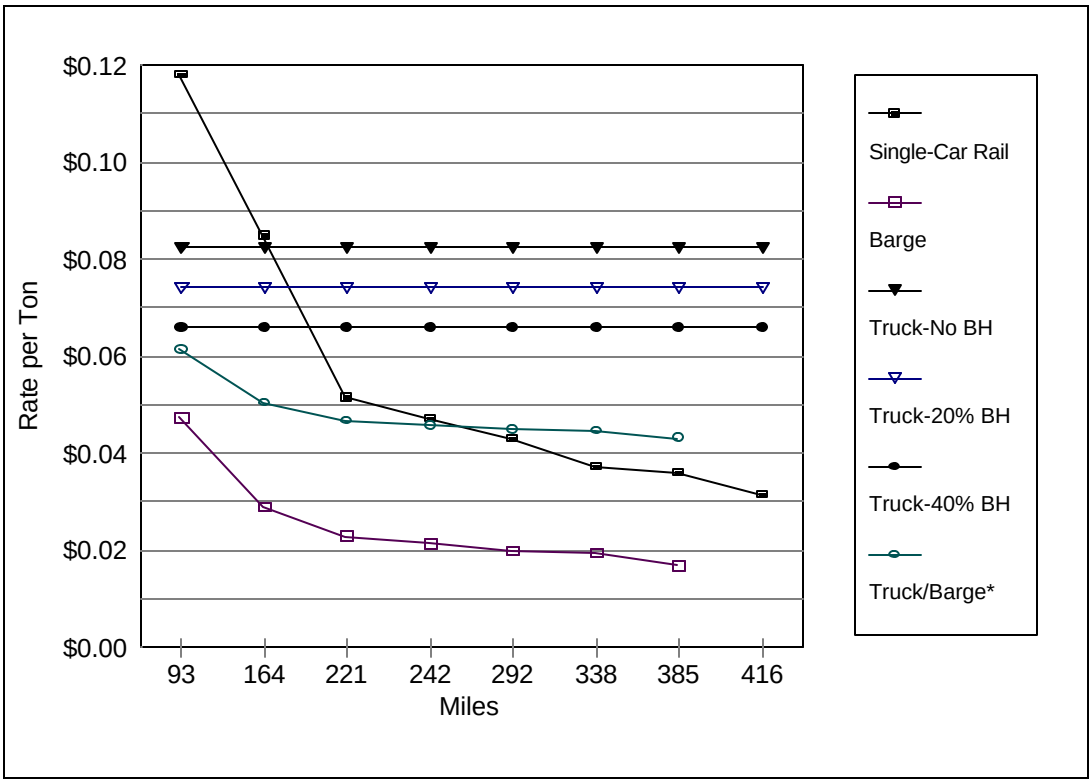


Figure 4. Current Modal Price Relationships in the Snake River Draw Area.

		Barge Rates**		Barge Cost	
Origin		Wheat	Barley	Wheat	R/FAC Ratio
	(Miles)	($/ton)	($/ton)	($/ton)	(%)

[27] Tidewater Barge Lines, Inc., is the dominant barge company operating on the Columbia/Snake River (Research Group, 1999, pg. 26).

Boardman, OR*	164	4.76	5.82		
Hogue Warner, OR*	167	4.76	5.82		
Umatilla, OR*	185	4.82	5.90		
Kennewick, WA*	212	4.91	6.02		
Pasco, WA*	215	4.92	6.02		
Burbank, WA*	221	4.92	6.02		
Sheffler, WA	231	5.32	6.51	2.12	251
Windust, WA	259	5.36	6.55	2.39	224
Monumental Dam	263	5.57	6.78	2.45	227
Lyons Ferry, WA	282	5.61	6.99	2.64	213
Central Ferry,WA	304	6.04	7.39	2.87	210
Almota, WA	325	6.07	7.42	3.07	198
Wilma - SRM 134	359	6.31	7.74	3.42	185
Lewiston, ID	361	6.31	7.74	3.44	183

* Est Miles, Costs were not estimated for these origins in the Research Group, "Lower Snake River Technical Report."
** Rates apply to Kalama, WA, and Vancouver, WA; Longview Washington is subject to additional charge of 75 cents per ton.
Source: Cost - Research Group, 1996 Reebie Estimates for $/ton, pg. 59 "Lower Snake River Technical Report."
Rates - Tidewater Barge Lines, Inc. Tariff, Jun 1999.

Barge rates for specific origins are provided in Table 9. In absolute terms, the barge companies net return on Snake River movements range from $2.87/ton (Lewiston, ID) to $3.20/ton (Sheffler, WA). In addition, the barge cost estimates provided by Reebie also were used to estimate revenue/cost ratios for several origin-destination pairs. The revenue/cost ratio for wheat shipments from Snake River origins to the PNW export terminals ranged from 176% to 251%. This level of rates provides the barge company with a significant margin. These revenue-cost ratios have several implications. First, the barge industry is not forced to price competitively (cost based) on the CSRS. Second, and more important to this analysis, the barge company has a sufficient margin to price downward if railroads become aggressive in attracting the lower Snake River grain traffic.

IMPACTS ON RATES AND MODAL SHIFTS

Consistent with the prior analysis, grain movements to the CSRS river elevators were classified into two general areas of study, long-distance, and local markets. Long-distance markets have two alternatives for shipping grain for export from Montana and North Dakota: rail direct to an export elevator on the lower Columbia, or truck/barge to the same final destination. Also, only two general logistical alternatives were considered as the local market: (1) local truck to a river elevator, transloaded to barge for Portland, and (2) rail from the origin territory direct to Portland. Truck directly to Portland was not considered because

export houses do not want to receive grain by truck as explained earlier and costs appear prohibitive. Rail, including short lines, to river elevators was not considered as well because of a lack of unloading facilities and other factors also addressed earlier.

Long-distance Markets

The long-distance hard red spring wheat market is analyzed first because of its simplicity. Breaching of the four dams on the lower Snake River should have little or no impact on the modal choices made by shippers and no impact on origin-destination pairs, attributable to several factors. The most determining is the pricing strategy of railroads to maximize profitability over their entire network. Railroads do not determine prices based on local economic phenomena, when that market is influenced on a national or global basis, such as hard red spring wheat. The wheat rates to the PNW from Montana and North Dakota have been set to optimize profitability within the entire BNSF network for grain and grain products. Adjustments in the level of rates and service to the PNW could have a negative impact on the overall network rate structure and its profitability.

For instance, if BNSF chose to increase rates as a result of a perceived competitive advantage resulting from the breaching of the dams, several resulting complications would arise. First of all, some traffic would begin to shift to the east and south markets of Minneapolis/Duluth and the Gulf Ports. An increase in westbound rates will make those destinations relatively more competitive. This would result in a reduction in the supply territory for the PNW, currently a profitable haul for the railroad, as illustrated by the R/VC ratios. If the railroad raised all rates proportionately, the threat of losing market share to a competing railroad such as the Canadian Pacific or the Mississippi River barge alternative exists. Thus, it is difficult to imagine railroads would react to the breaching of the four dams by increasing their rates.

Because railroads are the overwhelming source for logistical capacity, any increase in costs within the supply chain would have to be absorbed by the two remaining economic agents, long-distance truck and barge. When the four dams are breached there will be two potential consequences for the two modes. Trucks could absorb additional costs for the increased mileage from Lewiston to Tri-Cities; or barges will lower their rates, allowing country elevators to increase the truck rate, thus, keeping the trucks whole and maintaining the status quo in terms of revenues and costs. The actual shift will largely depend on how competitive the market is for building materials and if the building materials industry will pay a higher rate on the primary haul. If it can and does, the burden will be shifted to the building materials industry. If the building industry will not absorb additional transportation costs in serving its Midwest market, the barge industry would likely absorb the rate increases attributed to the truck portion of the truck/barge alternative to retain this traffic.

The competitive outcome is that there should be little or no change in the rail rates for grain from North Dakota and Montana and only some marginal shifts in truck and/or barge rates. However, there is little probability of a modal shift in the amount of grain moving to the CSRS from Montana and North Dakota. Thus, the end result will be the status quo for long-distance markets.

Local Markets

A pricing model was developed to help analyze the prospective pricing actions of barge and rail if the dams are breached (Table 10). The model assumes that railroads are price leaders in that the barge company will wait until the railroads have made their move before initiating a pricing response. The railroad industry is assumed to have two pricing options that it could logically pursue.[28] It could continue the status quo in retaining its share of the market or it could aggressively go after a significant increase in their market share. A moderate action was not considered because it did not seem likely the industry would do something lukewarm in response to the dramatic changes proposed for the CSRS logistical system. The status quo for railroads is defined as increasing their rates by the amount of the increase in distribution cost (increase in truck cost minus any reductions in barge rates). Aggressive pricing behavior resulting from the change in the economic environment would consist of maintaining the present level of rates and possibly changing the service level associated with those rates (e.g., 26- or 52-car volume requirements in an attempt to use the increased barge/truck rates to their competitive advantage).

Table 10. Pricing Framework for Analyzing the Pricing Behavior of Rail and Barge Assuming Rail is the Price Leader

Barge Pricing Reaction to Rail	Rail Pricing Strategy	
	Aggressive	**Status Quo**
	(X Denotes Action of the Barge Reaction to Rail Pricing)	
Aggressive	**X**	
Moderate		**X**
Status Quo		**X**

Three possible reactions by the barge company have been identified for two alternative independent strategies that railroads could implement. If railroads aggressively go after the market, the barge company will have to compete by lowering its rates as much as plausible to stay as competitive as possible without becoming unprofitable. It would do this when the grain business at risk is important to the core business of the firm.

There are two expected possible reactions to a railroad status quo strategy by the barge company moderate and status quo itself. A moderate pricing strategy by barge would result if the status quo

[28] It is assumed that the two Class I railroads will, for all intents and purposes, act in concert in developing strategies. This does not mean that they will collude, but rather, there will be conscious parallelism.

strategy by the railroad began to siphon off some of the barge market share as a result of slight changes in the competitive advantage of the two modes resulting from the newly established distribution costs in the two marketing channels. The second alternative is barge pursuing a status quo of the present rate structure. This could happen where traffic is not important to the company or there is little or no diversion of traffic from truck-barge to rail. The key to this analysis is to determine the likelihood of a rail strategy and the resulting barge pricing strategy.

It appears, for several reasons, that the probability of the railroads pursuing an aggressive strategy to increase market share is relatively low. First, if the PNW traffic was strategically important to the railroads it is likely that they would have implemented more aggressive strategies in the current market structure. Second, the revenue-to-full cost ratio still is below one in Washington origins and only slightly above for the Idaho origins. In short, the business is not profitable in the long-run, even after an increase in rail rate equivalent to the net increase (higher truck costs but lower barge rates because of new, shorter downriver origin) in truck/barge rate as depicted in Table 11. Third, the barge company has a sizable margin for competitive adjustment in any pricing situations that develops.

The more likely strategy that rails will pursue is the status quo. As mentioned before, this would mean increasing rates by the net change in the truck/barge rate. The barge company's reaction to this would likely be a moderate reaction of lowering rates sufficiently to retain market share, but not reduce the margin more than necessary.

A review of a simple comparative analysis of the distribution cost for the two distinct marketing channels reveals some points of interest (Table 12). Railroads still are not competitive with the truck/barge combination in all but one of the Washington counties. The results of the comparison are nearly the same for the Idaho counties.

Based on the current truck/barge and rail rate relationships, shippers in Grant county, Was. and Boundary and Kootenai counties, Idaho have existing competitive rail alternatives for reaching the PNW port system (Table 11). These three counties comprise eight percent, or approximately 8.6 million bushels of the grain movements on the Lower Snake River. Beyond these counties, it appears that little diversion of traffic will result from breaching of the four dams on the lower Snake River, for the same reasons delineated above. First, this traffic, even at increased rates, is not that profitable when compared to other alternatives for railroads (Table 7). Furthermore, the R/VC ratios continue to fall below 100 percent in the breaching scenario for all counties. Second, railroads would have to price aggressively to be competitive, and because of the former reasons cited, would likely choose not to. The barge company has a sizable margin, an average of $3.02/ton, that would be useful in competitive response to any move by railroads to capture a large share of the market. And finally, the truck/barge combination is still the lower cost alternative compared to the rail marketing channel for most of the territory in question.

Table 11. Change in Rail Wheat Rates Resulting from Increase in Trucking Costs and a Reduction in Barge Rates

	County	Existing Truck Costs (A)	Alternate Truck Costs (B)	Existing Barge Rates (C)	Alternate Barge Rates (D)	Truck/Barge Rates from Existing River Port (E)	Truck/Barge Rates from Alternative River Port (F)	Existing Rail Rates (G)	Breaching* Rail Rates (H)	Existing Rail Revenue Cost Ratio (I)	New Rail Revenue Cost Ratio (J)
Washington											
1	Adams	4.16	5.98	5.36	4.92	10.85	12.23	13.52	14.90	0.86	0.95
2	Asotin[2]	1.81	10.29	6.31	4.92	9.45	16.54	13.71	20.80	0.87	1.32
3	Columbia[2]	2.34	4.61	5.61	4.92	9.28	10.86	13.10	14.68	1.10	1.23
4	Franklin[1]	1.89	1.89	4.92	4.92	8.14	8.14	11.38	11.38	0.81	0.81
5	Garfield[1,2]	1.82	6.43	6.04	4.92	9.19	12.68	12.34	15.83	0.87	1.12
6	Grant[1]	7.03	7.03	4.91	4.91	13.27	13.27	12.58	12.58	0.78	0.78
7	Lincoln[1,2]	9.38	9.38	4.92	4.92	15.63	15.63	15.86	15.86	0.84	0.84
8	Spokane	5.75	9.30	6.04	4.92	13.12	15.55	13.52	15.95	0.80	0.94
9	Walla Walla	0.98	2.57	5.32	4.92	7.63	8.82	9.48	10.67	0.66	0.74
10	Whitman	2.34	8.85	6.04	4.92	9.71	15.10	10.64	16.03	0.65	0.98
Idaho											
1	Bennewah[2]	7.26	14.60	6.04	4.92	14.63	20.85	14.65	20.87	0.78	1.11
2	Boundary	15.35	18.46	6.04	4.92	22.72	24.71	16.36	18.35	0.85	0.95
3	Idaho	5.75	15.20	6.31	4.92	13.39	21.45	14.57	22.63	0.77	1.20
4	Canyon	18.53	18.53	4.76	4.76	24.62.	24.62	N.A.	N.A	N.A.	N.A.
5	Kootenai[2]	9.53	13.09	6.04	4.92	16.90	19.34	13.82	16.26	0.82	0.96
6	Latah	3.40	12.63	6.31	4.92	11.04	18.88	13.21	21.05	0.72	1.15
7	Lewis[2]	1.82	11.42	6.31	4.92	9.46	17.67	13.99	22.20	0.81	1.29
8	Nezperce	1.29	10.89	6.31	4.92	8.93	17.14	13.44	21.65	0.72	1.16
Oregon											
1	Wallowa[2]	6.42	11.64	6.31	4.92	14.06	17.89	14.31	18.14	0.72	0.91

*Railroads increase rates by the amount of the increase in truck costs, less the decrease in barge rates; i.e., the status quo. Then,*H = (B-A) + (D-C) + G.

[1]Barge Cost Estimated.
[2]Rail Rates and Costs Estimated.
[3]Handling Costs of $1.33 for truck-barge movement.
[4]Franklin, Grant, Lincoln, and Canyon counties experience no change so original truck-barge rates and river destinations are used.

Table 12. Comparison of Alternative Truck-Barge Costs (Rates) and Alternative Rail Rates from Representative County Origins, 0 Percent Backhaul

	County	Alternate Major River Elevator Destination	Percent of Draw Area Volume**	Alternate Truck Costs to River Elevator	Alternate Barge Rates	Breaching* Truck/ Barge Distribution Costs	Breaching Rail Rates	Alternate Truck/Barge vs. Alternate Rail Difference
Washington								
1	Adams	Tri-Cities	7	5.98	4.92	12.23	14.90	-2.67
2	Asotin	Tri-Cities	2	10.29	4.92	16.54	20.80	-4.26
3	Columbia	Tri-Cities	4	4.61	4.92	10.86	14.68	-3.82
4	Franklin	Burbank	1	1.89	4.92	8.14	11.38	-3.24
5	Garfield	Tri-Cities	11	6.43	4.92	12.68	15.83	-3.15
6	Grant	Kennewick	0	7.03	4.91	13.27	12.58	0.69
7	Lincoln	Burbank	2	9.38	4.92	15.63	15.86	-0.23
8	Spokane	Tri-Cities	8	9.30	4.92	15.55	15.95	-0.40
9	Walla	Tri-Cities	7	2.57	4.92	8.82	10.67	-1.85
10	Whitman	Tri-Cities	28	8.85	4.92	15.1	16.03	-0.93
Idaho								
1	Bennewah	Tri-Cities	1	14.60	4.92	20.85	20.87	-0.02
2	Boundary	Tri-Cities	3	18.46	4.92	24.71	18.35	6.36
3	Idaho	Tri-Cities	5	15.20	4.92	21.45	22.63	-1.18
4	Canyon	Hague	1	18.53	4.76	24.62		
5	Kootenai	Tri-Cities	5	13.09	4.92	19.34	16.26	3.08
6	Latah	Tri-Cities	1	12.63	4.92	18.88	21.05	-2.17
7	Lewis	Tri-Cities	0	11.42	4.92	17.67	22.20	-4.53
8	Nez Perce	Tri-Cities	1	10.89	4.92	17.14	21.65	-4.51
Oregon								
1	Wallowa	Tri-Cities	1	11.64	4.92	17.89	18.14	-0.14

* Includes a handling charge of $1.33/ton for the extra handle at the river elevator.

** Source: *Snake River-Navigation*, pp. 56-58.

This previous analysis assumed no backhaul. The development of any significant backhaul market would support the pricing behavior predicted in a positive manner, effectively reducing the amount rails could increase their rates or the amount the barge industry would have to lower theirs. Market shares and traffic patterns are expected to remain the same.

The previous analysis was based on the relationship between single car rail rates and truck/barge marketing alternatives. One expected scenario that should be considered as a range for sensitivity in the rate and modal relationships is continuing further development, by local marketers, of multicar shipments. Using current published rate spreads for Washington elevators the 26-car option is priced 1.66/ton or 4.5 cents per bushel below the single car rate, on average (BNSF Tariff). Under this pricing scenario the revenue/cost ratios are more attractive, although they still fall short of the ratios offered by hauls from eastern Montana and North Dakota to PNW (Table 13).

Table 13. Changes in 26-Car Rail Wheat Rates Resulting From Increase in Trucking Costs and a Reduction in Barge Rates

	County	Truck/Barge* Costs from Existing River Port	Breaching* Truck/Barge Distribution Rates	Existing[1] Rail Rates	Breaching[2] Rail Rates	New Rail Revenue/Cost Ratio
Washington						
1	Adams	10.85	12.23	11.86	13.24	147%
2	Asotin[2]	9.45	16.54	12.05	18.95	336%
3	Columbia[2]	9.28	10.86	11.44	13.02	223%
4	Franklin[1]	8.14	8.14	9.72	9.72	134%
5	Garfield[1, 2]	9.19	12.68	10.68	14.17	192%
6	Grant[1]	13.27	13.27	10.92	10.92	116%
7	Lincoln[1,2]	15.63	15.63	14.20	14.20	125%
8	Spokane	13.12	15.55	11.86	14.29	141%
9	Walla Walla	7.63	8.82	7.82	9.01	113%
10	Whitman	9.71	15.1	8.98	14.37	147%
Idaho						
1	Bennewah[2]	14.63	20.85	12.99	19.21	158%
2	Boundary	22.72	24.71	14.70	16.69	132%
3	Idaho	13.39	21.45	12.91	20.97	173%
4	Canyon	n.a.	24.62			
5	Kootenai[2]	16.90	19.34	12.16	14.60	143%
6	Latah	11.04	18.88	11.55	19.39	166%
7	Lewis[2]	9.46	17.67	12.33	20.54	172%
8	Nezperce	8.93	17.14	11.78	19.99	186%
Oregon						
1	Wallowa[2]	14.71	17.89	12.65	16.48	143%

[1]Single car to Multicar Rate=$1.66/ton, 4.5 cents/bushel based on published tariff spreads.

[2]Railroads increase their rates by the amount of the increase in truck costs, less the decrease in barge rates; i.e., the status quo.

*Includes $1.33/ton for additional handle.

Note: [1]Barge Rate Estimated, [2]Rail Rate Estimated

Potential does exist for additional traffic shifts from truck/barge to rail with the employment of 26-car rates (Table 14). Substantial traffic shifts are possible if railroads choose to respond to the dam breaching with aggressive rate posture, by offering better terms on 26-car rates. Net increases in the truck/barge rate would shift bushels from barge to rail for all counties in the Snake River draw area except Columbia and Franklin Counties in Washington. This effectively shifts 95 percent of the current barge traffic to the rails.

The potential for modal shifts diminishes assuming railroads opt for status quo, increasing rail rates to maintain current modal rate spreads by increasing their 26-car rates to reflect any net increases in the truck/barge rate. Results indicate that under the 26-car rate and no rate increase scenario, Lincoln, Spokane, and Whitman Counties in Washington, Idaho County in Idaho; and Wallowa County in Oregon shift from barge to rail, in addition to the counties that shifted under the existing and single-car rate scenarios. These five counties contribute 44 percent, or 54.3 million bushels, of the annual Snake River grain volume.

As mentioned previously, railroad pricing and capacity reactions to changes in the barge infrastructure are critical components in assessing potential impacts on market flows and rate structures. These market shifts require a commitment on the part of the railroads for some shift of car capacity to this PNW market or additional investment in capital equipment by the Class I railroads.

Table 14. Comparison of Existing and Alternative Truck/Barge Costs (Rates) vs. Single and 26-Car Alternative Rail Rates

	County	County's % of Snake River Draw**	Existing* Truck/Barge Rates	Existing 1-Car Rail Rates	Existing Estimated 26-Car Rail Rates	**Existing T/B vs. Existing 26-car Difference**	Breaching* Truck/Barge Distribution Rates	**Breaching T/B* vs. Existing 26-Car Rail Difference**	Breaching 1-Car Rail Rates	Breaching 26-Car Rail Rates	**Breaching T/B* vs. Breaching Rail Difference Single-Car**	**26-Car**
Washington												
1	Adams	7%	10.85	13.52	11.86	-1.01	12.23	0.37	14.90	13.24	-2.67	-1.01
2	Asotin	2%	9.45	13.71	12.05	-2.60	16.54	4.49	20.80	18.95	-4.26	-2.41
2	Columbia[2]	4%	9.28	13.10	11.44	-2.16	10.86	-0.58	14.68	13.02	-3.82	-2.16
4	Franklin[1]	1%	8.14	11.38	9.72	-1.58	8.14	-1.58	11.38	9.72	-3.24	-1.58
5	Garfield[1,2]	11%	9.19	12.34	10.68	-1.49	12.68	2.00	15.83	14.17	-3.15	-1.49
6	Grant[1]	0%	13.27	12.58	10.92	2.35	13.27	2.35	12.58	10.92	0.69	2.35
7	Lincoln[1,2]	2%	15.63	15.86	14.20	1.43	15.63	1.43	15.86	14.20	-0.23	1.43
8	Spokane	8%	13.12	13.52	11.86	1.26	15.55	3.69	15.95	14.29	-0.40	1.26
9	Walla Walla	7%	7.63	9.48	7.82	-0.19	8.82	1.00	10.67	9.01	-1.85	-0.19
10	Whitman	28%	9.71	10.64	8.98	0.73	15.10	6.12	16.03	14.37	-0.93	0.73
Idaho												
1	Bennewah[2]	1%	14.63	14.65	12.99	1.64	20.85	7.86	20.87	19.21	-0.02	1.64
2	Boundary	3%	22.72	16.36	14.70	8.02	24.71	10.01	18.35	16.69	6.36	8.02
3	Idaho	5%	13.39	14.57	12.91	0.48	21.45	8.54	22.63	20.97	-1.18	0.48
4	Canyon	1%	n.a.									
5	Kootenai[2]	5%	16.90	13.82	12.16	4.74	19.34	7.18	16.26	14.60	3.08	4.74
6	Latah	1%	11.04	13.21	11.55	-0.51	18.88	7.33	21.05	19.39	-2.17	-0.51
7	Lewis[2]	0%	9.46	13.99	12.33	-2.87	17.67	5.34	22.20	20.54	-4.53	-2.87
8	Nezperce	1%	8.93	13.44	11.78	-2.85	17.14	5.36	21.65	19.99	-4.51	-2.85
Oregon												
1	Wallowa[2]	1%	14.06	14.31	12.65	1.41	17.89	5.24	18.14	16.48	-0.25	1.41

[1]Barge Rate Estimated
[2]Rail Rate Estimated
*Includes a handling charge of $1.33/ton - for the extra handle at the river elevator.

**Source: Snake River-Navigation, pp. 56-58.

Note: 0% Backhaul for Truck/Barge (T/B)

SUMMARY AND CONCLUSIONS

The main conclusions, stemming from this analysis vary whether in the long-distance market and local market:

Long-distance

- ✓ Prices for export grain are fixed at Portland by global competitive factors and the interior distribution costs cannot be shifted forward.
- ✓ Rail pricing in the long-distance market is determined by factors other than the truck-barge supply chain.
- ✓ Barge/truck supplies a small portion of the long-distance market.
- ✓ Increased trucking costs will likely be absorbed by other economic agents; e.g., the building products industry.
- ✓ The net impact is that little, if any, rail rate changes modal shifts in market share are expected. Furthermore, any change in increased distribution cost is expected to be born by the building materials industry and/or the barge industry.

Local Market

- ✓ Costs for trucking grain to river ports beyond the Snake River will most definitely increase in proportion to the increased distance.
- ✓ These trucking cost increases possibly could be tempered by the development of backhaul markets, although this seems unlikely in the near term.
- ✓ Rail movement in the PNW currently is unprofitable to the railroads in the long run.
- ✓ Rail rates become only marginally profitable with increases equal to net changes in the truck-barge costs.
- ✓ Railroads have better opportunities for economic return from their equipment and crews, relative to the white wheat draw territory.
- ✓ Barges have a substantial profit margin to work with in meeting any future competition from the railroads.

- ✓ A possible strategy that will allow railroads to increase their market share is the increased shipper use of more efficient and lower rate service packages such as multicar shipments (greater than 25 cars per shipment), unit trains and shuttles (Appendix C).

Rail rates from the local drawing territory will increase as a result of increased cost of trucking. However, the existing single car rate analysis presented suggests that there will be little or no diversion of traffic from barge to rail as a result of the breaching of the four dams on the lower Snake River. This would seem to hold true for the long-distance as well as the local markets. If multiple car rates become the typical movement, and rail equipment capacity is made available, significant shifts could result.

This is not to say there will not be any impacts. Distribution costs will most definitely increase. Who absorbs those increases will be worked out in the marketplace. It is true, though, that someone in the supply chain will assimilate increases.

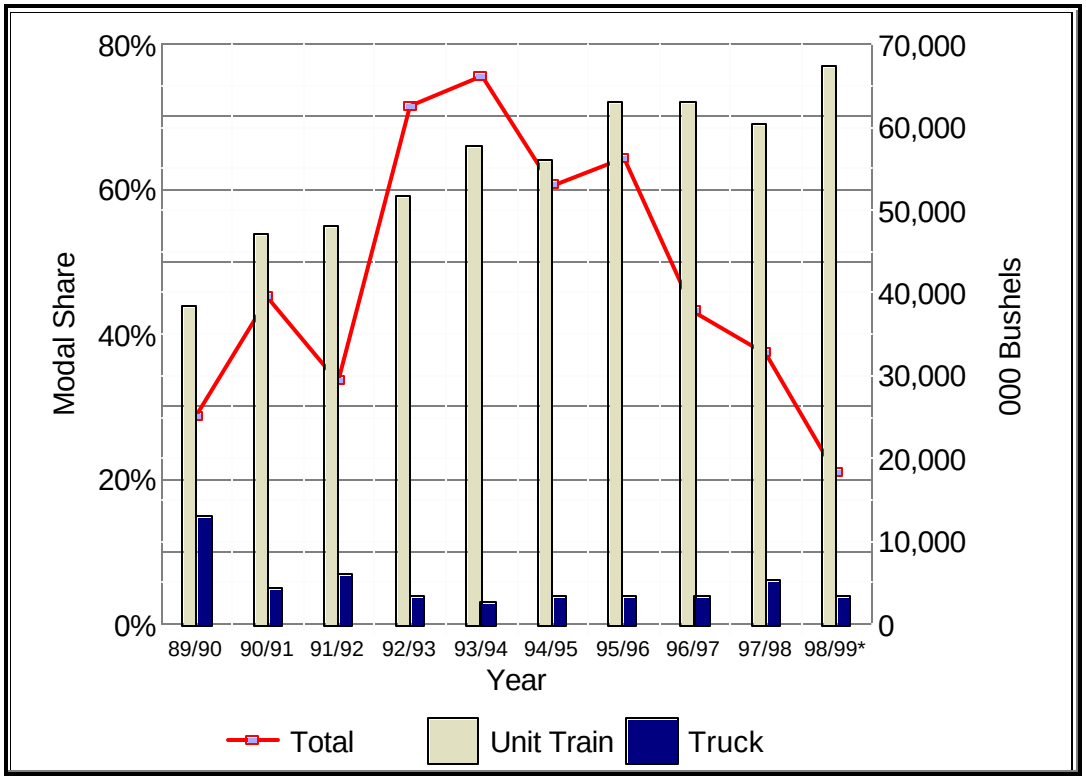
APPENDIX A. Characteristics for Wheat Originated from the Lower Snake River

	Tons	Avg Rate per Ton	Avg Cars/ Shipment	Bushels	Avg Rate per Bu.
1993	967,824	$ 10.73	14	32,228,539	$ 0.32
1994	1,188,993	$ 12.00	12	39,593,467	$ 0.36
1995	915,083	$ 13.19	10	30,472,264	$ 0.40
1996	2,042,154	$ 11.18	12	68,003,728	$ 0.34
1997	658,466	$ 14.11	18	21,926,918	$ 0.42

Avg Tons/Yr:	**1,154,531**
Avg Bu/Yr:	**38,445,878**
Avg Cars/Shipment:	**13**

Source: Public Use Waybill Data, 1993 to 1997

APPENDIX B. Wheat Shipments from North Dakota, by Mode



Source: North Dakota Grain Movement Database.

APPENDIX C. Potential Modal Shift Scenarios

Potential Modal Shift from Truck/Barge to Rail Under Alternative Rail Pricing Behavior, for Local Market

Rail Rate Scenario	*Rail Posture*	Existing Truck/Barge	Alternative* Truck/Barge
Existing 26-Car Rail	*Aggressive*	52%	95%
Existing 1-Car Rail	*Somewhat Aggressive*	8%	79%
Alternative* 1-Car Rail	*Status Quo*		8%
Alternative* 26-Car Rail	*Status Quo*		52%

*Alternative Truck/Barge rate reflects the net increase in the truck/barge rate if dams on the Snake River are breached.
As noted previously, in the base case - existing truck/barge and existing single-car rail - 8 percent of the bushels shift from barge to rail, this is included in the potential shift total for each scenario.

REFERENCES

Annual ND Transportation and Rail Service Survey. Upper Great Plains Transportation Institute, NDSU, Fargo, North Dakota. 1995-1999.

Benson, Douglas and Matt Domine. **North Dakota Grain and Oilseed Transportation Statistics, 1997-98**. Upper Great Plains Transportation Institute, NDSU, Fargo, North Dakota.

Mark Berwick and Frank Dooley. **Truck Costs for Owner/Operators**. Upper Great Plains Transportation Institute, North Dakota State University, MPC Report 97-81, October 1997, 53 pp.

Burlington Northern Santa Fe. **1999 Grain Elevator Directory**. Fort Worth, Texas.

Burlington Northern Santa Fe. Published Grain Tariff Information. July, 1999.

Casavant, Kenneth and Eric Jessup. "Transportation Characteristics of Wheat Movements in Idaho," Report to the Idaho Wheat Commission, Sep. 19, 1996.

Casavant, Kenneth and Nancy S. Lee. *Grain Receipts at Columbia River Grain Terminals, 1980-81 to 1996-97*. Department of Agricultural Economics, Eastern Washington Intermodal Transportation Study, Washington State University. Pullman, WA. January, 1998. EWITS Working Paper #9.

North Dakota Grain Movement Database, North Dakota Public Service Commission. Bismarck, ND. Various Years.

Primedia Information Inc**. The Official Railway Guide, Freight Service Edition, The Grain Connection**. Hightstown, NJ. June/July 1999.

Newkirk, Jonathan, Ken Eriksen and Kenneth Casavant. *Transportation Characteristics of Wheat and Barley Shipments on Haul Roads to and from Elevators in Eastern Washington*. EWITS Research Report #6. March, 1995.

Research Group. *Lower Snake River B Juvenile Fish Mitigation Feasibility Study Technical Report B Navigation*. Draft. June, 1999.

Section 10734 or Title 49, United States Code.

Tidewater Barge Lines, Inc. Tariff, Jun 1999.

United States Department of Agriculture. Marketing and Regulatory Programs, Agricultural Marketing Service, Livestock and Seed Programs, Livestock and Grain Market News. *Grain and Feed Weekly Summary Statistics*. Washington, DC. Various Weekly Issues.

United States General Accounting Office (GAO), *Railroad Regulation, Current Issues Associated with the Rate Relief Process*, Resources, Community, and Economic Development Division, United States General Accounting Office. February 26, 1999.

United States Public Use Waybill. Surface Transportation Board and Interstate Commerce Commission. Washington, DC. Various Years.