The University of Manitoba

The Economic Potential of U.S. Routes for the Movement of Grain from Western Canada to Export Destinations

A Thesis Submitted to the Faculty of Graduate Studies

in Partial Fulfillment of the Requirements for the

Degree of Master of Science

Department of Agricultural Economics and Farm Management

by

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Any error or omissions contained in this thesis are solely the responsibility of the author.

ABSTRACT

Recently, considerable attention has been paid to the economics of the existing Canadian routes for grain transportation but little consideration has been given to possible U.S. alternatives. This study attempts to put the economics of the various routes in Canada and in the U.S. into perspective for the crop year 1984/85. In addition, a number of institutional constraints, which may prevent movements of Canadian grain through the U.S. for export, are identified and discussed.

Four basic rate combinations were analyzed using a linear programming transportation-transshipment model. These combinations incorporated different levels of Canadian and U.S. rail rates. Several scenarios which reflected different barge rate levels for the Mississippi River were analyzed for each basic rate combination.

Several conclusions were drawn from the analysis of the various results. Under the current *Western Grain Transportation Act* rates, in which producers pay only a small proportion of the total cost of moving the grain to export position, none of the U.S. alternatives would be used for Canadian grain.

If WGTA rates were modified so producers paid the full cost of transporting grain, the U.S. routes would become attractive alternatives to existing Canadian routes. The amount of grain which would utilize the U.S. system depends on the U.S. rail rate levels used. Two methods of estimating the U.S. rail rates were developed in this study. The first method was based on rates provided by the major railroads which were based on published tariffs while the second method involved calculating the distance

to each U.S. port from each prairie origin and using the *WGTA* distance formula to calculate representative rates.

Results from the first method indicate that at 1985 barge rates less than 5% of Canadian grain would move down the Mississippi while at lower barge rates (100% of tariff) more than 20% would be more economically moved by this route. U.S. rail rates calculated by the second method result in considerably more grain moving through the U.S. At 1985 barge rates, approximately 130% of tariff, over 40% of Canadian should move via the Mississippi while an additional 6% would move through Portland, Oregon in the Pacific Northwest. Even at 170% of tariff barge rates, over 25% of Canadian grain would be economically moved down the Mississippi River. The present rail rate hierarchy established under the *Western Grain Transportation Act* is therefore seen to render uneconomic movement of Canadian grain by U.S. routes from the standpoint of the user of the system. If the users were to pay the full cost rate, routes though the U.S. would be rendered economic. The economic distortion arising from rates to users which do not reflect real cost becomes evident in this analysis.

The degree of regulation built into the Canadian grain transportation system is seen to prevent movements of Canadian grain through the U.S. system. However, each of the institutional constraints identified in this study can be overcome if the need to develop alternative export routes for Canadian grain becomes apparent.

Please note:

- All freight rates are in Canadian dollars with 1.00 U.S. dollar equivalent to 1.3652 Canadian dollars, the average exchange rate for 1985.
- All units of weight are cited in metric tonnes; 1 metric tonne equals 2,204.62 lbs.
- The Canadian crop year, for which all information was gathered, runs from August 01 to July 31.
- Rapeseed is equivalent to Canola in Canada.

CHAPTER I

INTRODUCTION

In recent years there has been little interest, on the part of many in the grains industry, in exploring the potential for moving grain by routes other than Canada's current principal distribution channels. Such an attitude could be explained by the surplus capacity available on existing routes and the effect this lack of capacity utilization was having on the economics of grain movement. However, the recent strike and lockout at the terminal elevators in Thunder Bay and similar labour difficulties in Vancouver have stimulated interest in researching alternative routes for getting grain into export position to fulfill sales commitments. Grain producers, in particular, are interested in avoiding exploitation by other participants in the system at a time when returns from grain sales in international markets are low. Therefore, the availability of a low cost route for exporting Canadian grain is of vital importance to all Canadians. In this study, an attempt will be made to put the economics of the various alternative routes for grain transportation into perspective.

Careful examination of the geography of North American indicates several alternative routes for the movement of Prairie grain to export position in Canada (See Figure 1). The major logistical difficulty arises from the great distances and rugged terrain (e.g. the Rocky Mountains and the Canadian Shield) between grain producing and consuming regions. Current routes utilized in Canada for the movement of grain from the Prairies to our major export ports include: movement by rail to Vancouver/Prince Rupert for transfer to ocean vessels, movement by rail to Thunder Bay for

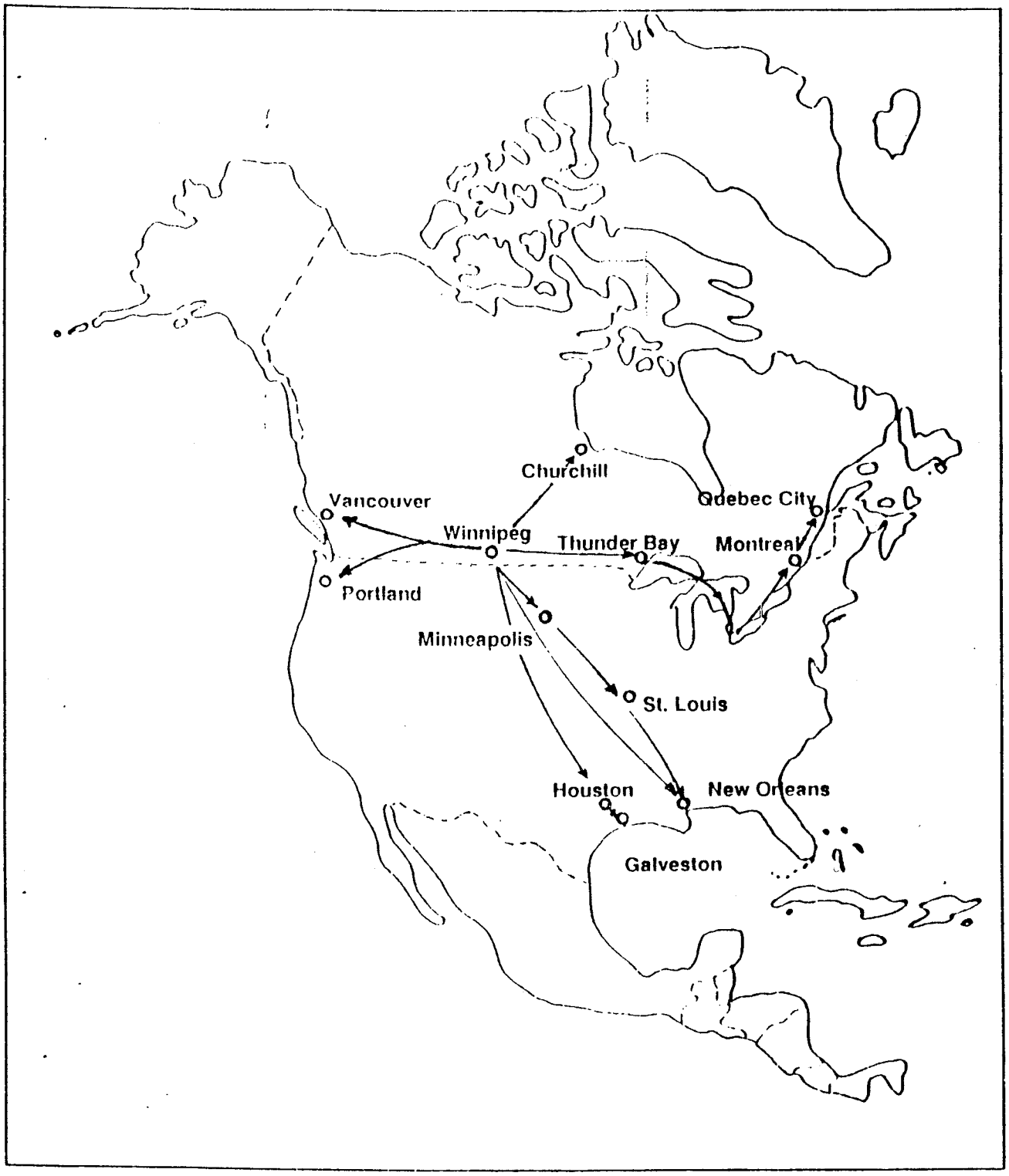

FIGURE 1
Alternative Routes for Movement of
Prairie Grain to Export Positions

direct transfer to ocean vessel or for transfer to lake vessel and ultimate transfer to ocean vessel at ports on the lower St. Lawrence River, direct rail movement to St. Lawrence terminals for transfer to ocean vessel, and movement by rail to Churchill for transfer to ocean vessel.

In addition to the existing Canadian routes, there are several possible routes for the movement of prairie grain to export through the United States. The geography of the U.S. exhibits fewer physical barriers and grain is therefore able to move via four modes: rail, truck, barge and lake vessel. Possible U.S. routes included in this study are movement by rail to Minneapolis, Minnesota, or St. Louis, Missouri for transfer to barges on the Mississippi River and later transfer to ocean vessels at Louisiana ports; direct movement of grain by rail to Gulf of Mexico ports such as New Orleans, Louisiana or Houston/Galveston, Texas for transfer to ocean vessels; or movement by rail to Pacific Northwest ports such as Portland, Oregon or Seattle, Washington. A number of other route possibilities exist in the U.S. such as movement by truck or rail to Atlantic Seaboard ports, movement via Duluth and the St. Lawrence Seaway and truck-barge movements in the Pacific Northwest involving use of the Columbia-Snake River Waterway.The routes chosen for this study, however, adequately represent the major alternatives available. Sufficient information was found to be available to enable this research to proceed.

The sharp decline in U.S. grain exports in recent years has resulted in a large amount of excess capacity in U.S. water routes and very low barge rates have prevailed on the Mississippi River. The bulk commodity barge industry in the U.S. is highly competitive and free of government rate regulation, i.e. barge rates are free to fluctuate to reflect current market conditions. Barge rates for grain and other bulk commodities were quite

low in 1984 and 1985 due to the large excess supply of covered hopper barges, arising from the over-expansion of industry capacity in the 1970's. This over-expansion was induced by the very high barge rates prevailing during that period stimulated by tax incentives caused by transportation capacity shortages. A speculative binge of barge building by outside investors lured by the available investment tax credits and guaranteed loans, resulted in 30 to 40% excess capacity prevailing within the industry in 1983 and 1984.[1]

Export demand, on the other hand, did not increase at the rate projected while rail deregulation under the *Staggers Rail Act* of 1980 led to the transfer of traffic from the barge mode to the rail mode which further aggravated the supply-demand imbalance. As a result, grain barge rates have fluctuated around the lowest possible short run level - i.e. variable cost of operation. Some barge companies apparently operated below variable cost for certain periods in order to maintain a "going concern" value for their firm by maintaining qualified crews and operating contracts.[2]

The decline in U.S. grain exports severely affected the Gulf and Pacific Northwest ports in terms of capacity utilization in 1984 and 1985. The Gulf and lower Mississippi ports recorded a 53% decline in traffic in 1984 as well as experiencing a decline in the market share of wheat exports from 20% to 17% while Houston/Galveston declined to 15.5% of total U.S. wheat exports. In addition, corn export centres located on the Pacific coast recorded a combined 40% decline in exports in 1985.[3]

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[1]Dan Halbach, Jerry Fruin, and Scott Wulff, "1984 Barge Rates for Upper Mississippi River Commodities," (Staff Paper P85-13, University of Minnesota, 1985), p.2.

[2]*Ibid.*, p.3.

[3]"U.S. Gulf - Increasingly Dominant Market Share in Bulk Traffic," *International Bulk Journal*, August 1986, p.9.

The Mississippi River offers some of the most modern and sophisticated elevator facilities in the U.S. with 10 elevators having total storage capacity of over 1 million metric tonnes. With much of this capacity lying idle, the Mississippi River appears to warrant examination as a possible low cost alternative to existing Canadian export routes.

Another area of interest is the location of the east-west dividing line for grain shipments from the Prairies. This relates to how much grain should move by the St. Lawrence Seaway relative to Vancouver/Prince Rupert. A recent proposal by the Canadian Wheat Board indicates their interest in directing more grain to Canada's west coast ports.[4] Currently, grain is priced on a Thunder Bay - Vancouver equivalence basis even though the Board contends net market returns are lower at Thunder Bay than at the west coast. This is due to the freight and elevator charges of approximately $23 Canadian per tonne attached to moving grain from Thunder Bay to the St. Lawrence ports. The Board contends the division line does not lie within the Prairies on grain shipments because current producer rail rates are always less than $12 per tonne while the Thunder Bay - St. Lawrence route cost is greater than $20 per tonne. Therefore, market returns are always higher on west coast shipments from any Prairie point. However, there is a constraint on the total tonnage which can be exported through the west coast. The Board proposed changing the export pricing points to the St. Lawrence ports and Vancouver to satisfy a natural price equilibrium between these two export areas. They feel that the shifting nature of demand from Europe to the Pacific Rim and the low mar-

[4]John R. Groenewegen, "Canadian Wheat Board Price Pooling and West Coast Capacity," *Proceeding of a Workshop on Grain Transportation Research*, ed. A. G. Wilson (November, 1986), p.101.

ginal cost of ocean shipping will ensure that the current east-west pricing relationship will continue over the forseeable future. The proposal would shift the borderline for the westerly flow of grain further east than Scott, Saskatchewan, the traditionally identified cut-off point.[5]

The present configuration of the grain handling and transportation system in Canada reflects, in addition to need, the various subsidy and regulatory practices which apply in the industry. These institutional constraints will have a great deal of impact on the possible movement of Canadian grain through the U.S. system and must be considered in addition to determining the minimum cost route. Modifications are being made in the Canadian system on a continual basis in response to changing economic forces. The speed at which these modifications are occurring reflects, in large part, the existing social and institutional constraints to obtaining the potential cost savings arising from a rationalized system (i.e. closure of high cost, low volume rail branchlines and elevators). Such a rationalized system would give greater flexibility in the use of alternative routes for the movement of Canadian grain to export position in the event of a major disruption in the Canadian system, such as labour disputes or equipment failures, since clean grain could be moved quickly onto rail mainlines and rerouted through the U.S. as necessary.

Movement of Canadian grain through the United States would not be a new development as Canadian grain has moved through the U.S. system in significant volumes in the past. In general, these movements have occurred more in response to limitations in the Canadian system than from the competitiveness of the U.S. system. Substantial volumes of Canadian

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[5]*Ibid.*, p. 101.

grain moved through U.S. ports in the early years of this century. This movement peaked in the early 1920's when up to 50% of Canadian grain exports moved through Portland, Maine and Buffalo, New York (see Table 1). U.S. facilities were used as they provided an economic outlet for large volumes of grain when the Canadian system was not as well developed.

During the period 1946/47 to 1952/53, significant volumes of wheat moved through U.S. ports, Duluth in particular (Table 2). At that time, Canadian terminal elevators at Thunder Bay had insufficient available storage capacity to facilitate shipment; this problem was intensified in the 1951/52 crop year by a low grade wheat crop, 40% of which was harvested tough or damp. During this period, Canadian grain moved in rail cars in bond to Duluth where it was cleaned and stored in sealed bins leased by the Canadian government. Canadian Grain Commission inspectors were stationed at Duluth to ensure grain was graded according to Canadian export standards.

U.S. grain continues to flow through Canadian facilities on the lower St. Lawrence River where U.S. grain is allowed to occupy up to 40% of the space in the transfer elevators located at these ports. In order to ensure the American grain meets export standards, an office of the U.S. Federal Grain Inspection Service is maintained in Montreal. The experience gained from these precedents could well be beneficial to any future movements of Canadian grain through U.S. ports.

Hypotheses

From the above discussion it is possible to put forward the following hypotheses. Grain transportation rates on the prairies, which do not reflect real costs of movement, have resulted in a pattern of grain movements

TABLE 1

Comparative Exports of Canadian Grain via Domestic and United States Ports by Crop Year, 1918 to 1937[1]

CROP YEAR	Volume of Exports		Proportion of Exports	
	Domestic Ports	U.S. Ports	Domestic Ports	U.S. Ports
	thousand tonnes		*percent*	
1918/19	960.5	519.9	64.9	35.1
1919/20	1315.7	354.3	78.7	21.2
1920/21	891.8	1474.9	37.7	62.3
1921/22	1158.6	2721.8	29.9	70.1
1922/23	2364.3	3534.5	40.1	59.5
1923/24	3450.6	3839.5	47.3	52.7
1924/25	1870.1	2043.1	47.8	52.2
1925/26	3345.3	3869.3	46.4	53.6
1926/27	2922.9	3707.9	44.1	55.9
1927/28	3924.6	3699.4	51.5	48.5
1928/29	5179.9	4192.1	55.3	44.7
1929/30	2147.4	1893.0	53.1	46.9
1930/31	3557.7	2441.9	59.3	40.7
1931/32	3528.2	1325.2	72.7	27.3
1932/33	5035.7	1491.4	77.1	22.9
1933/34	3411.0	1216.0	73.7	26.3
1934/35	2465.2	1053.7	70.1	29.9
1935/36	3524.3	1998.8	63.8	36.2
1936/37	3287.1	1067.0	75.5	24.5
1937/38	1713.5	325.2	84.0	16.0

[1]Export data was not reported during World War II.

SOURCE: Processed from *Grain Trade of Canada*, Crop Years 1918/19 to 1937/38 inclusive.

TABLE 2
Overseas Clearance of Canadian Grains Via United States Ports by Crop Year, 1946 to 1956[1]

Crop Year	Volume of Exports				Proportion of Exports			
	Wheat	Oats	Barley	Rye	Wheat	Oats	Barley	Rye
	Thousand Tonnes				*Percent*			
1946/47	325.1	19.6	61.9	18.4	7.3	5.8	41.2	13.8
1947/48	428.0	0.4	4.1	33.4	11.8	0.5	7.0	12.8
1948/49	266.5	-	20.0	-	5.3	-	4.2	-
1949/50	3.9	-	-	-	0.1	-	-	-
1950/51	43.1	-	-	77.3	0.8	-	-	32.5
1951/52	108.5	22.1	15.6	21.7	1.3	2.1	1.0	12.5
1952/53	102.0	-	-	2.4	1.1	-	-	1.1
1953/54	3.5	-	-	-	0.1	-	-	-
1954/55	1.0	-	-	29.5	[2]/	-	-	12.5
1955/56	6.4	-	-	-	0.1	-	-	-
1956/57	13.4	-	-	-	0.2	-	-	-

[1]/ No significant movements through U.S. ports after this Crop Year.

[2]/ Less than 0.05

SOURCE: Processed from *Canadian Grain Exports*, Crop Years 1946/47 to 1955/56 inclusive.

which does not reflect the least cost routing. Institutional constraints currently in place in Canada have prevented the most economical (least cost) pattern of grain movements to export position from developing. These hypotheses will be tested in this research.

CHAPTER II

STATEMENT OF THE PROBLEM

Problem Statement

The cost of moving grain to export by current routes has been progressively increasing over time and is becoming burdensome in a period of declining grain prices. Under the *Western Grain Transportation Act* of 1983, the potential for future increases in the rail rates charged to producers and shippers is becoming ever more apparent. In addition, higher tariffs are being assessed at primary terminal and transfer elevators (up until 1987-88 when the major grain elevator companies froze tariffs at their 1986-87 levels). At the same time, the cost of moving grain through the St. Lawrence Seaway is increasing as lake vessel owners experience higher investment costs while the volume of backhaul cargo has declined.

In the U.S., generally depressed conditions in world grain markets have led to excess capacity on transportation routes, the Mississippi River waterway being a prime example. Surplus barges, constructed under tax incentives in the 1970's, line the river (approximately 3,000 of the 13,000 barges on the Mississippi sat idle in 1985). While some of these barges are now being used for storage, the barge rates for the movement of grain remain low. In addition, potential backhauls of salt, fertilizer and clay from New Orleans could further reduce the barge rates on downbound grain movements.

Deregulation of the rail industry in the United States under the *Staggers Act* of 1980 has led to significantly lower rates on volume movements of grain, particularly in areas where there is substantial intermodal com-

petition. This has made routes through the U.S. look attractive with adequate terminal and transfer elevator capacity also being available. In addition, ocean freight rates from the Gulf ports are comparable to those from the St. Lawrence ports to some overseas destinations.

Meanwhile, volume limitations on Canadian routes have been largely overcome as a result of adoption of new technology and additional construction of rail line and terminal facilities. Therefore, the relative cost of movement of grain to export position by the various routes in Canada and in the U.S. has changed and needs to be examined in greater detail. In addition, the high cost to producers arising from periodic labour disputes such as the recent strike and lockout of grain handlers at Thunder Bay and the strike by longshoremen at Vancouver, and from equipment failures such as the collapse and closure of the Welland Canal, during periods of significant grain movement, has demonstrated the need to examine alternative routes for the reliable movement of Canadian grain to export destinations.

Objectives

The objectives of this research which follow from the problem statement are to:

1. Construct an interregional, single period, multi-modal linear programming transshipment-transportation model that analyzes the 1984-85 supply, demand and transportation network of the wheat, durum wheat, barley and rapeseed transportation system in Canada.

2. Describe the optimal grain flow patterns and optimal transportation mode and port area use levels for the base model with the option of using U.S. transportation routes for Canadian grain available.
3. Analyze the effects of changing the rail freight rates in Canada, the rail freight rates in the U.S., the barge rates on the Mississippi River and the port capacity of Vancouver/Prince Rupert.
4. Discuss the policy implications of changing the grain transportation system in Canada with particular emphasis on the institutional constraints which may preclude the use of the U.S. routes for the movement of Canadian grain to export destinations.

Attainment of these objectives will either confirm or refute the hypotheses established at the outset of the study.

CHAPTER III

REVIEW OF RELATED STUDIES

Dickerson

Few comprehensive studies have been performed comparing existing and alternative routes for the transportation of Canadian grain to export position. Until recently, there has been little interest in this area as the existing Canadian routes exhibited excess capacity while high returns for Canadian grain more than covered the cost of transporting it to the importing nation. A study done at the University of Minnesota in 1985 demonstrated that at certain levels of U.S. barge and rail rates, a significant proportion of Canadian grain could be shipped more economically through the U.S. Gulf ports than Canadian ports.

This particular study, which stimulated further research, utilized a linear programming transportation/transshipment model to analyze past (1981/82 and 1982/83) and future (1990/91) Canadian export grain flows at various rate levels.[6] Due to the structure of the transportation model used, specific rate levels were required and the model was run using alternate rate levels (barge rates, rail rates and ocean freight rates). Sensitivity analysis could not be performed in order to determine the stability of the solution since this was not possible with the transportation linear programming model utilized.

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[6]Sylvia Y. Dickerson, "An Economic Analysis of the Effects of Crow's Nest Rate Rationalization on Canadian Export Grain Transportation," (Master's Dissertation, University of Minnesota, 1985), p.129.