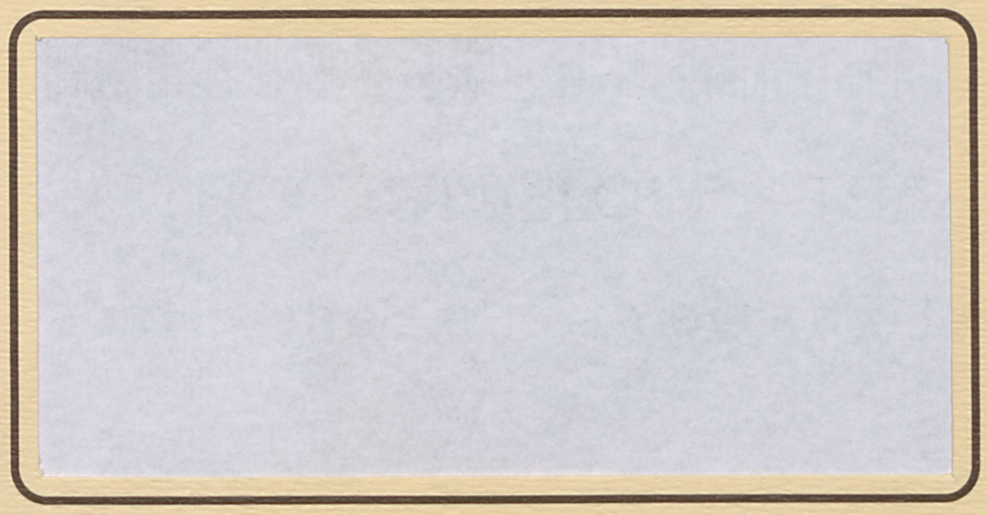
RURAL ECONOMY



PROJECT REPORT

FARMING FOR THE FUTURE

Alberta AGRICULTURE

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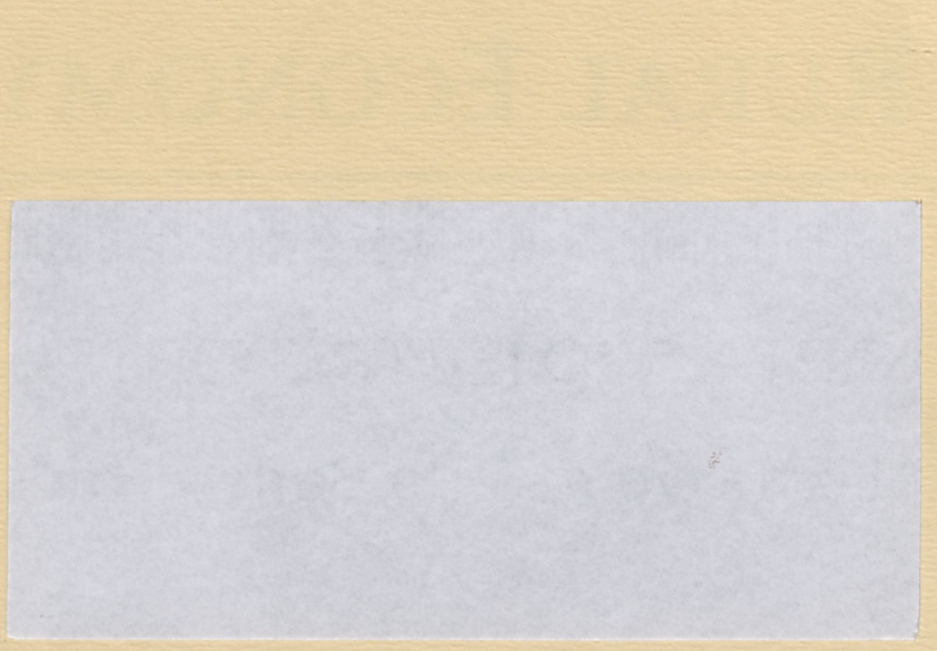

Alternative Alberta Barley Trade Scenarios With the Northwest United States

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Project Report 92-03

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Abstract

A retrospective revised net revenue, partial equilibrium, linear programming model is developed for feedgrain trade between Alberta and eleven north west states of the United States. The model is run under six different policy scenarios over a five years period, 1984 to 1988.

Alberta is divided into three regions (north, central and south), while the eleven states are divided into two regions (U.S. north and south). Feedgrain requirements and production are calculated for each region using grain consuming animal units and barley equivalents. Each region is able to both import and export feedgrain. As well as the five regions, two export points (Vancouver, British Columbia and Portland, Oregon) are defined. These points can import unlimited volumes of grain but are not permitted to export to any of the regions.

A baseline version of the model is developed, which incorporates Alberta producer payments for rail transportation as set out in the Western Grain Transportation Act, border costs as they existed during the time of the study, and estimates of trucking rates. The baseline scenario is compared to five other scenarios which reflect the following policy changes: i) a closed Canada - U.S. border; ii) Alberta producers paying the full published cost of rail transportation; iii) the removal of all priced border costs; iv) Alberta producers paying the full rail rate as well as the removal of all priced border costs; and v) producers paying the full rail rate, the removal of priced border costs, as well as trucking rates set equal on a per tonne per mile basis to full cost rail rates.

The results suggest that the possibility for increased feedgrain trade between Alberta and the U.S. exists. When the trade flows developed are valued using feedgrain prices based on full cost rail rates, net revenue gains above the no trade scenario are indicated for all models. The increases are at the expense of shipments to Vancouver, are variable among years, and depend upon transportation rates.

I INTRODUCTION

A. Background

1. Importance of feedgrains in Alberta

During the ten year period 1979 to 1988, Alberta produced an annual average of 5,825 thousand tonnes of barley, 49 percent of Canadian production. During this period, barley accounted for nine percent of Alberta's farm cash receipts, an average of $328 million annually (Canada Grains Council, 1989).

In many areas of Canada, a substantial portion of barley production is domestically consumed by the local livestock industry. Groenewegen (1983) estimates that 83 percent of feedgrains are consumed by livestock within the region in which they are produced. In Alberta, however, producers rely on barley exports to market a substantial portion of barley production and generate a major portion of barley value. While approximately two thirds of Alberta's barley is fed domestically, the remaining one third is exported. Over the years, the eastern Canadian market, once a major market for western feedgrains, has shrunk as Ontario and Quebec have become increasingly self-sufficient in feedgrains. The remaining deficit areas in Canada, especially those in Atlantic Canada, increasingly use corn from the United States as the subsidy declines for western grains moving to the east. While national barley markets shrink, international feedgrain markets are expanding. However, moving into this arena increases Alberta producers' exposure to the volatility of world markets. Table 1 indicates how variable exports and receipts from exports have been.

Table 1: Barley production and out-of-country exports, Alberta and Canada, 1984 to 1988.

Year	Production		Exports			
			Alberta		Canada	
	Alberta '000 T	Canada '000 T	'000 T	$ '000	'000 T	$ '000
1984	4,638	10,279	1,745	284,153	3,905	636,118
1985	4,768	12,287	861	123,228	2,231	319,245
1986	7,185	14,569	2,609	247,698	5,986	568,378
1987	6,586	13,957	2,372	195,329	5,444	448,208
1988	5,813	10,212	1,421	143,602	2,796	282,708

Source: Canada Grains Council. *Canadian Grains Industry Statistical Handbook*.. Canada Grains Council: Winnipeg. Various years.
Alberta Agriculture, Statistics Branch, a. *Alberta's Agricultural Exports*. Alberta Agriculture: Edmonton.

2. Northwest United States feedgrain market

The northwest United States, as defined in this study[1], is a likely place to target Alberta feedgrains. Distances between this region and the corn producing center of the United States are similar to distances from the region to Alberta. Although generally a feed deficit region, there is high variability among the states in both grain production and livestock numbers.

One of the largest problems faced when considering the United States as a market for feedgrain is the current importance of corn. There is the risk that this preferenced may take the form of a producer bias against other feedgrains, although such a possible bias is ignored throughout this study. It is assumed that if a grain such as sorghum is accepted on the basis of price and nutrient value (Roy and Ireland, 1975), so too could other feedgrains such as barley.

In 1988, the United States received 114,770 tonnes of the 2,372,484 tonnes of barley Alberta exported. This made it the sixth largest barley export market in terms of mass and fifth largest in terms of value ($12,276,000 of $195,330,000). The ranking remains the same for Canadian barley exports (Alberta Agriculture 1988a). While a substantial amount of this grain is high value malting barley, it is probable that some is destined for feed.

3. Export and transportation barriers

Alberta barley destined for export out of Canada falls under the jurisdiction of the Canadian Wheat Board (CWB). As a designated grain from a designated region, all legislation set out in the CWB Act applies to barley destined for the United States. Grain exported from Canada to the United States takes the form of commercial transactions between private exporters and importers, for both non-Board and Board grain purchased by export merchants. All exports of the designated grains, wheat and barley, are Board grains and take place through accredited merchants.

Transportation barriers for Canada - U.S. grain shipments also exist. These are mainly in the form of regulations concerning the trucking industry. There are few north-south railway lines between western Canada and the United States. There exist at most 12 railway entrance points to the United States in the four western provinces, with only one of those in Alberta (Mines and Resources Canada, 1974). Thus, grain moving across the Canada - U.S. border is likely to move by truck. However, regulations on backhauls, compounded by the small volumes of grain presently shipped across the border, result in grain trucking being a largely un-priced service. Most cost estimates are probably closer to "guess-timates", rather than competitive prices determined by the market.

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1 The eleven states covered by the definition of northwest United States include: California, Colorado, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming.

4. Problem statement

The purpose of this study is to develop a spatial model incorporating the Alberta barley market and the northwest United States feedgrain market with a view to testing the impact of possible changes to the existing regulations and pricing patterns.

B. Objectives

The objectives of this research are:

1) To develop a spatial partial equilibrium model for the Alberta barley market that reflects the current priced regulatory practices in terms of feedgrain exports and the present shipping costs under the Western Grain Transportation Act (baseline study).
2) To illustrate changes in trade flow patterns resulting from regulatory changes in the baseline model to reflect:
   a) a total closure of the border between Canada and the United States.
   b) a continuation of tariff barriers, with a change to full cost shipping for Alberta export grains.
   c) a tariff free Canada - U.S. border, with a continuation of shipping costs under the WGTA
   d) a tariff free Canada - U.S. border, with full cost shipping of export grain.
   e) a tariff free Canada - U.S. border, with full cost shipping of grain, as well as rail competitive trucking costs.
3) To determine the economic feasibility of barley exports from Alberta to the northwest United States under the above scenarios.

C. Sources of Data

The majority of the information used in the Alberta portion of the study was obtained from Alberta Agriculture, with special assistance from various individuals within the Economic Services Division. The majority of data regarding the United States is secondary data from USDA publications, compiled by Peter Gamache. All are from secondary sources.

D. Plan of Study

A baseline model is developed initially which incorporates appropriate policy and transportation costs with regard to the movement of feedgrain between Alberta and the United States. This model is then altered to permit a comparison of the potential gains and losses in the past five years as a result of border barriers to trade. Differences in prices between regions that exceed transportation costs can be viewed as the cost imposed on producers by institutional barriers to trade.

II MODEL DESCRIPTION

Linear programming models (LP) assume a linear objective function and linear constraints. The quantity of a commodity demanded in a consuming region and the amount available in producing regions are fixed. The objective of the transportation model, a typical LP model, is to minimize total transportation costs. The outcome is a system of commodity flows from the producing to the consuming regions. As each region has supply and demand constraints the spatial equilibrium condition is satisfied. Linear programming models are simple to use, easy to understand and are computer efficient, but they do have limitations. The main limitation is that the assumption of fixed supply and demand can not be recognized. As a result the solutions of LP models must be considered conditional, rather than global, optimal solutions.

Quadratic programming models, a subset of non-linear programming models, overcome this limitation by using demand and supply functions for each region. In the past quadratic programs were considered large and unwieldy; the development of computer algorithms changed that. However, quadratic models have large data requirements which make larger models difficult to formulate and use due to a lack of available information.

It was the large data requirement, especially for demand equations, that lead to the adoption of a revised linear programming transportation model in the form of a net revenue maximization model. When dealing with a primary input such as feedgrains, a truly price responsive quadratic programming model would require information regarding the demand for the final good, livestock products, as suggested by Fox (1955). Such information on demand is beyond the scope of the present study.

A. An Overview of the Model

The objective of this study is to develop a model for the feedgrain market of Alberta and eleven northwest states in the United States that is sufficiently detailed to suggest trade flows under several scenarios. The model is retrospective and is not a forecasting model. Thus, past policies and physical relationships among variables are employed.

The basic plan of the model is as follows. Five regions are defined. Each of these regions produces a known quantity of feedgrain in each of the years studied. Within the United States, feedgrain consists of both corn and barley production. In Alberta, feedgrain is defined as barley, due to differences in feeding patterns between barley and oats. During the same period each region had a pre-determined feedgrain requirement. This quantity is calculated based on the number of livestock in the region during the year in question. As well as the five regions, two export ports are defined. These ports can accept grain from the other five regions but are unable to act as suppliers within the model.

The objective function is to maximize the net revenue to the whole of the five producing regions. Net revenue is calculated using the barley market price within each region minus transportation costs and any direct border costs (tariffs and customs fees) for international movements of grain. As this calculation does not include cost of production, it was not a true net revenue value. It was assumed however, that cost of production, being a sunk cost, is not relevant to producers after the crop had been produced.

B. Definition of regions

A total of five supply and demand regions, as well as two export ports, were defined within the model. Within Alberta three regions were demarcated as illustrated in figure 1: Alberta North, Alberta Central, and Alberta South. These regions were largely determined by geography and the census division breakdowns by which statistical information was made available. The choice of a regional center was based on a centralized location within the region, and the importance of the site as a center for grain movement and/or livestock production. The dispersed nature of agriculture in northern Alberta lead to a choice based largely on the size of the center. Grande Prairie was the largest center in the agricultural region of northern Alberta. Red Deer was selected as the regional point for central Alberta due to its role as an agricultural center. In southern Alberta, Calgary was chosen as the regional point due to the levels of livestock feeding in the vicinity.

Figure 1 also shows how the eleven northwest states of the United States were divided into two regions: U.S. North[2] and U.S. South[3]. The eleven states are divided into two regions based on an average feedgrain surplus or deficit position over the five years the model examined. The five states defined as surplus continually had high levels of excess feedgrain production. Wyoming, while on average a surplus state, had a variable level of excess production. For three of the five years it was in a surplus position, but for two of the five years it was in a feedgrain deficit position. On the basis of this observation it was decided Wyoming did not fit well with the other U.S. north states and was included in the U.S. south region.

Due to the vast area encompassed by each U.S. region and the large differences in agricultural production patterns between states the choice of regional points within the two regions is more difficult than in Alberta. The choice of Great Falls, Montana for the northern surplus region is partly due to availability of a consistent barley price series. The choice of Stockton, California for the U.S. south region is also partly due to availability of a price series, but also because California has the largest feedgrain requirement of any of the eleven states examined.

The choice of the export ports is based on location, and relative size compared to other potential choices. This results in the choice of Vancouver, British Columbia for Alberta export movement and Portland, Oregon for export movement out of the U.S. north region.

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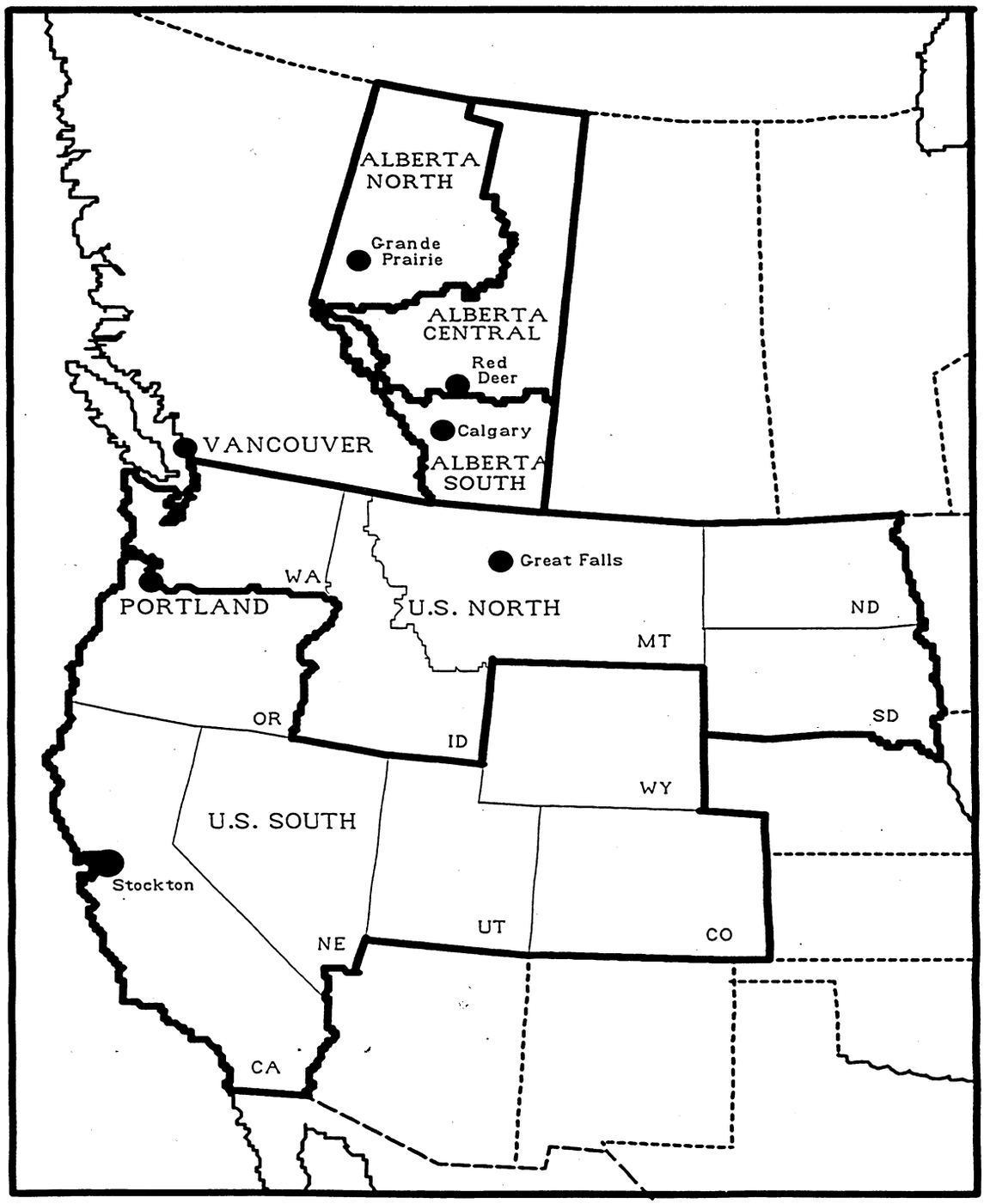
2 U.S. North consisted of five states: Idaho, Montana, North Dakota, South Dakota and Washington.

3 U.S. South consisted of six states: California, Colorado, Nevada, Oregon, Utah and Wyoming.

Figure 1: The regions and regional trade points as defined in the study.



Within each region the annual production of feedgrains is determined. For Alberta, Census Division data for barley is used as reported in the Agriculture Statistical Yearbook (Alberta Agriculture, Statistics Branch). This information is consolidated into values for the three regions earlier defined.

Calculations for the two U.S. regions are more complex. In order to make the values comparable between regions a common basis is required; for this study corn is converted to a barley equivalent. The conversion is based on a factor of 90 percent, the estimated feeding value of barley compared to corn on a unit weight basis. The feedgrain values for each state, as published by the USDA, are then consolidated into two regional sets of values.

C. The Baseline Scenario

The baseline scenario is an attempt to model the trading environment during the five years examined. However, the degree to which the model reflects the actual feedgrain movements is strongly tempered by the requirement that a five year time period be examined. It may have been possible to include cost variables that reflected non-tariff trade barriers, and make the model describe what happened in one year. This however, would not have been particularly relevant or useful.

The purpose of a baseline version of the model is to have a base series of values to compare the results from the other scenarios with. In a retrospective study, it is desirable to have the baseline series represent the actual situation during the time period examined. However, accurate depiction of a particular past period is not a necessary requirement, because the purpose of the model is to serve as a more accurate base for estimating changes due to simulated policy changes.

D. The No Trade Scenario

The no trade version of the model shows the difference in trade flows between a system with a closed border and a system where the border is open, but tariff barriers exist. This scenario uses the same net revenue, production, requirement and transportation values as the baseline scenario. However, trade is restricted to the country of origin.

E. The Full Cost Scenario

For the full cost version of the model, the changes made to the baseline version were in the rail rates between the three Alberta points and Vancouver. In this scenario, producers are required to pay the full cost of rail transportation which was taken as the published statutory rates. All other variables are as in the baseline version of the model.

F. The Tariff Free Border Scenario

In the tariff free border version of the model, it is assumed that the Western Grain Transportation Act (WGTA) remains in effect while all priced border costs were removed. This is the scenario envisioned by some under the Free Trade Agreement. All other variables remain as in the baseline version of the model.

G. The Full Cost and Tariff Free Border Scenario

The simulation in which full cost rail rates and a tariff free border occur illustrates the situation in which farmers are required to pay the full cost of rail transportation, while the Canada-United States border is free of tariffs and associated costs. Market prices, trucking rates, and regional production and requirement volumes remain as in the baseline version of the model.

H. Competitive Trucking Scenario

The final version of the model is the most far reaching simulation attempted in this study. In this simulation, Alberta producers pay the full cost of rail movement, all priced border costs are removed, and trucking rates are competitive with rail rates. Competitive means that the per tonne per mile trucking rate is set equal in each year to the average per tonne per mile rail rate. This rail rate is the average over the three Alberta to Vancouver routes under full cost rail rates. As Vancouver can handle large volumes of grain only if hauled by rail, rail rates are used between the three Alberta regions and Vancouver. As all the other points can handle grain brought in by truck, trucking rates are used for these points.

This scenario is examined to determine the potential impact on barley trade if, as sometimes alleged, trucking grain is economically competitive with rail movement. While the information available does not substantiate the view that truck and rail costs are substantially similar, there is a high probability that the trucking rates used are from the high end of the price spectrum, as opposed to being average values.

III RESULTS

The results obtained by running each of the six versions of the model for each of the five years, 1988 to 1984, are presented in this chapter. It must be remembered all are simulation results. None of the models presented are able to portray accurately the state of affairs over the years examined. The scenarios closest to reality are the baseline and no trade versions of the model.

Each of the six scenarios described in the previous chapter is applied to the five year period 1984 to 1988 using a revised net revenue maximization model. The baseline scenario incorporates i) producer rail rates as set out under the WGTA for barley movement between the three Alberta regions and Vancouver; ii) the tariff and customs fees that exist at the United States - Canada border in the years examined; and iii) trucking rates between all points based on published trucking tariff rates. The no trade scenario uses the same assumptions as the baseline model, but also a closed border to feedgrain trade between Alberta and the United States. The full cost scenario uses the final two assumptions of the baseline model but also the full published rail rates for grain movement between the three Alberta points and Vancouver. The tariff free border scenario incorporates WGTA producer share rail costs, published trucking tariff rates and the removal of tariff and customs fees for Canada - United States border crossings. The fifth scenario incorporates both full cost rail rates and the removal of tariff and customs fees from the border, but continues to use published trucking tariff rates. The final scenario relaxes all the assumptions of the baseline model: full cost rail rates are used, tariff and customs fees are removed from the border, and rail competitive trucking rates are used.

The results from the six simulations tend to confirm informed opinion regarding likely consequences under various policy scenarios. Under the baseline version of the model, which depicts a scenario close to the actual during the period, the Alberta and United States markets remain relatively separate. While there are occasional movements of barley from Alberta to the United States, the volumes are small. The difference between the baseline and no trade scenarios are minor.

When the situation is changed so that tariff barriers remain but Alberta producers are required to pay the full published cost of rail movement, there is a slight shift in trade flows. A smaller amount of the extra barley produced in Alberta is shipped to Vancouver. Instead, much of the production is shipped to the northern United States which in turn increases shipments to Portland.

When tariff barriers are removed while Alberta barley producers pay the producers' share of rail rates as set out in the WGTA, trade flows remain similar to those in the baseline scenario.

When tariff barriers are removed and producers pay the full cost of rail shipments, the results are similar to the full cost scenario. In most years, the impact of full cost rail rates overpowers any shifts in trade flows due to the removal of tariff barriers.

The final simulation, which is the same as the fifth except trucking rates are equalized with full cost rail rates, shows the largest changes in trade flows from the baseline scenario. In this simulation, all Alberta barley that was once headed for Vancouver would move through Portland.

A. The Baseline Scenario

An average of 16 percent of northern Alberta barley production is required to satisfy local requirements, which leaves an average of 84 percent of production for shipment out of the region. In four of the five years, the full amount is shipped to Vancouver for export. In 1984, the baseline scenario shows similar volumes shipped to both central and southern Alberta, with no shipments to Vancouver.

In central Alberta, an average of 56 percent of regional production is required to meet local feedgrain requirements. In two of the five years all extra barley moves to Vancouver. In 1984, all the extra barley produced is shipped to Great Falls, Montana. In 1985, while the majority of extra barley produced is shipped to Vancouver, three percent of production is shipped to Calgary. In 1988 the majority of extra production moves to Vancouver, although six percent of annual production goes to Great Falls.

In southern Alberta, an average of 76 percent of regional production is needed to satisfy regional requirements. In 1984 and 1985 all the barley produced within the region is needed to meet a part of total regional livestock feed requirements. Increased production from 1986 through to 1988 allows for shipments outside the region. In 1986, 1987 and 1988 all the extra production is shipped to Vancouver.

The five northern states in the United States had the most varied shipping pattern. An average of 43 percent of feedgrain production is used to satisfy regional requirements; 28 percent is shipped to the U.S. south region and 30 percent is shipped to Portland for export.

The six southern states are in sharp contrast to the four other regions, being a consistently deficit feedgrain region. Every year, 100 percent of production is required to satisfy part of the regional feedgrain requirements.

Table 2: Trade flows under the baseline scenario, with tariff barriers to trade and Alberta producers paying the WGTA producers share of rail rates for 1988 to 1984, in tonnes.

Destination:		Source:					Total
		ALBERTA NORTH	ALBERTA CENTRAL	ALBERTA SOUTH	U.S. NORTH	U.S. SOUTH	Consumption
ALBERTA NORTH	1988	126,967					126,967
	1987	118,998					118,998
	1986	118,454					118,454
	1985	107,893					107,893
	1984	111,133					111,133
ALBERTA CENTRAL	1988		1,657,502				1,657,502
	1987		1,578,957				1,578,957
	1986		1,834,133				1,834,133
	1985		1,464,949				1,464,949
	1984	236,168	1,304,885				1,541,053
ALBERTA SOUTH	1988			1,267,856			1,267,856
	1987			1,196,201			1,196,201
	1986			1,160,176			1,160,176
	1985		102,498	1,065,000			1,167,498
	1984	384,699		875,000			1,259,699
U.S. NORTH	1988		199,057		4,861,257		5,060,314
	1987				5,401,750		7,273,093
	1986				7,889,482		7,889,482
	1985				8,028,677		8,028,677
	1984		1,726,115		6,250,090		7,976,205
U.S. SOUTH	1988				3,723,681	6,125,315	9,848,996
	1987				4,141,285	5,775,791	9,917,076
	1986				4,295,388	6,212,822	10,508,205
	1985				4,668,631	6,598,119	11,266,750
	1984				4,503,053	6,419,697	10,922,747
PORTLAND, OREGON	1988						
	1987				6,758,285		
	1986				5,649,500		
	1985				4,638,572		
	1984				5,232,507		
VANCOUVER, B.C.	1988	562,033	1,839,498	359,144			
	1987	674,502	1,640,441	1,146,599			
	1986	727,546	2,085,867	1,256,824			
	1985	495,107	1,532,533				
	1984						
Total Production	1988	689,000	3,497,000	1,627,000	8,584,938	6,125,315	
	1987	793,500	3,450,000	2,342,800	16,301,323	5,775,791	
	1986	846,000	3,920,000	2,417,000	17,834,370	6,212,822	
	1985	603,000	3,100,000	1,065,000	17,335,885	6,598,119	
	1984	732,000	3,031,000	875,000	15,985,648	6,419,697	

B. The No Trade Scenario

The results from the no trade scenario are similar to that of the baseline scenario. Northern Alberta has barley requirements equivalent to 16 percent of local production. In all five years examined, 1984 to 1988, all excess production is shipped to Vancouver for export.

In central Alberta, over the five years examined, an average of 48 percent of regional production is required to satisfy regional requirements. In two years, 1984 and 1985, small volumes are shipped to southern Alberta. In those two years, the remainder of central Alberta's excess barley production is shipped to Vancouver. In the remaining three of the five years, 1986 to 1988, all excess production is shipped to Vancouver. Vancouver shipments account for an average of 50 percent of central Alberta's barley production between 1984 and 1988.

Southern Alberta needs an average of 76 percent of regional barley production to satisfy part of its regional feedgrain requirements. However, in 1984 and 1985, the region is shown to be feedgrain deficient. In the remaining years examined, 1986 to 1988, all excess production is shipped to Vancouver.

In the U.S. north region an average of 48 percent of regional feedgrain production is required to fulfill regional feedgrain requirements. Over the five years examined, an average of 28 percent of production was shipped to the U.S. south region; shipments are made to the south in all years. A further 25 percent of production is shipped to Portland for export. However, shipments to Portland occur only in four of the five years, 1984 to 1987. In 1988, the two U.S. regions (taken together) are net deficit in feedgrains. This results in all extra feedgrain production from the U.S. north region being shipped to the U.S. south region in 1988, without fully satisfying the south region's 1988 requirements. In this instance, there is no feasible linear programming solution as the scenario does not allow for feedgrain shipments from outside the two U.S. regions.

In all five years examined the U.S. south is a feedgrain deficit region. Hence, in all years 100 percent of production remains in the region to partly satisfy regional requirements.

Table 3: Trade flows under the no trade scenario, with no cross border trade and Alberta producers paying the WGTA producers share of rail rates for 1988 to 1984, in tonnes.

Destination:		Source:					Total
		ALBERTA NORTH	ALBERTA CENTRAL	ALBERTA SOUTH	U.S. NORTH	U.S. SOUTH	Consumption
ALBERTA NORTH	1988	126,967					126,967
	1987	118,998					118,998
	1986	118,454					118,454
	1985	107,893					107,893
	1984	111,133					111,133
ALBERTA CENTRAL	1988		1,657,502				1,657,502
	1987		1,578,957				1,578,957
	1986		1,834,133				1,834,133
	1985		1,464,949				1,464,949
	1984		1,541,053				1,541,053
ALBERTA SOUTH	1988			1,267,856			1,267,856
	1987			1,196,201			1,196,201
	1986			1,160,176			1,160,176
	1985		102,498	1,065,000			1,167,498
	1984		384,699	875,000			1,259,699
U.S. NORTH	1988				5,060,314		5,060,314
	1987				7,273,093		7,273,093
	1986				7,889,482		7,889,482
	1985				8,028,677		8,028,677
	1984				7,976,205		7,976,205
U.S. SOUTH	1988				3,524,624	6,125,315	9,848,996
	1987				4,141,285	5,775,791	9,917,076
	1986				4,295,388	6,212,822	10,508,205
	1985				4,668,631	6,598,119	11,266,750
	1984				4,503,053	6,419,697	10,922,747
PORTLAND, OREGON	1988						
	1987				4,886,942		
	1986				5,649,500		
	1985				4,638,572		
	1984				3,506,392		
VANCOUVER, B.C.	1988	562,033	1,839,498	359,144			
	1987	674,502	1,871,343	1,146,599			
	1986	727,546	2,085,867	1,256,824			
	1985	495,107	1,532,553				
	1984	620,867	1,105,248				
Total Production	1988	689,000	3,497,000	1,627,000	8,584,938	6,125,315	
	1987	793,500	3,450,000	2,342,800	16,301,323	5,775,791	
	1986	846,000	3,920,000	2,417,000	17,834,370	6,212,822	
	1985	603,000	3,100,000	1,065,000	17,335,885	6,598,119	
	1984	732,000	3,031,000	875,000	15,985,648	6,419,697	

C. The Full Cost Scenario

This model illustrates the effect if Alberta producers pay the full cost of rail transportation. Northern Alberta requires an average of 16 percent of regional barley production to satisfy regional requirements. In two of the five years, 1985 and 1986, all shipments of extra barley move to Vancouver for export. In 1984, similar volumes of barley are shipped to central and southern Alberta. In 1987 and 1988 all excess barley production from northern Alberta is shipped to central Alberta.

For central Alberta, the average amount of barley production which stays in the region is 39 percent. In 1984, 1987 and 1988, all extra barley production is shipped to Great Falls, Montana. In 1985, three percent of production is shipped to Calgary, while 49 percent goes to Great Falls. In one year, 1986, all the extra barley produced in the region is shipped to Vancouver.

In southern Alberta, an average of 67 percent of production remains within the region. In 1984 and 1985, all production is required within the region. In 1986, all extra production is shipped to Vancouver, while in 1987 all extra barley is shipped to Portland. In 1988 the extra barley is shipped to Great Falls.

The northern United States has a varied shipment pattern with an average of 35 percent of regional feedgrain production used for regional requirements, 28 percent was shipped to Stockton, and 37 percent shipped to Portland for export.

One hundred percent of the feedgrain produced in the U.S. south region remained within the region to partly satisfy regional requirements.

Table 4: Trade flows under the full cost scenario, with tariff barriers and Alberta producers paying the full cost of rail transportation for 1988 to 1984, in tonnes.

Destination:		Source:					Total
		ALBERTA NORTH	ALBERTA CENTRAL	ALBERTA SOUTH	U.S. NORTH	U.S. SOUTH	Consumption
ALBERTA NORTH	1988	126,967					126,967
	1987	118,998					118,998
	1986	118,454					118,454
	1985	107,893					107,893
	1984	111,133					111,133
ALBERTA CENTRAL	1988	562,033	1,095,469				1,657,502
	1987	674,502	904,455				1,578,957
	1986		1,834,133				1,834,133
	1985		1,464,949				1,464,949
	1984	236,168	1,304,885				1,541,053
ALBERTA SOUTH	1988			1,267,856			1,267,856
	1987			1,196,201			1,196,201
	1986			1,160,176			1,160,176
	1985		102,498	1,065,000			1,167,498
	1984	384,699		875,000			1,259,699
U.S. NORTH	1988		2,401,531	359,144	2,299,639		5,060,314
	1987		2,545,845		4,727,248		7,273,093
	1986				7,889,482		7,889,482
	1985		1,532,553		6,496,124		8,028,677
	1984		1,726,115		6,250,090		7,976,205
U.S. SOUTH	1988				3,723,681	6,125,315	9,848,996
	1987				4,141,285	5,775,791	9,917,076
	1986				4,295,388	6,212,822	10,508,205
	1985				4,668,631	6,598,119	11,266,750
	1984				4,503,053	6,419,997	10,922,747
PORTLAND, OREGON	1988				2,561,618		
	1987			1,146,599	7,432,787		
	1986				5,649,500		
	1985				6,171,125		
	1984				5,232,507		
VANCOUVER, B.C.	1988						
	1987						
	1986	727,546	2,085,867	1,256,824			
	1985	495,107					
	1984						
Total Production	1988	689,000	3,497,000	1,627,000	8,584,938	6,125,315	
	1987	793,500	3,450,300	2,342,800	16,301,323	5,775,791	
	1986	846,000	3,920,000	2,417,000	17,834,370	6,212,822	
	1985	603,000	3,100,000	1,065,000	17,335,885	6,598,119	
	1984	732,000	3,031,000	875,000	15,985,648	6,419,697	

D. The Tariff Free Border Scenario

In this scenario, priced border costs are removed, but Alberta producers continued to pay rail rates subsidized by the WGTA. Northern Alberta uses an average of 16 percent of regional barley production to satisfy local feedgrain requirements. In 1984, all extra barley produced is shipped to Calgary and Red Deer, in about equal amounts. In the other four years, 1985 to 1988, all extra barley produced in the region is shipped to Vancouver for export.

In central Alberta, an average of 46 percent of regional barley production is required to satisfy regional feed requirements. In 1984, 1987 and 1988, the barley extra to that requirement is shipped to Great Falls. In 1985 the majority of extra production is shipped to Vancouver, while three percent of production is sent to Calgary. In 1986, all extra regional production moves to Vancouver.

Southern Alberta averages 67 percent of regional barley production required to help satisfy regional feedgrain requirements. In 1984 and 1985, no local barley production is extra to local requirements. In 1986 and 1988, all extra production is shipped to Vancouver, while in 1987 all extra barley is shipped to Stockton, California.

In the U.S. north region, an average of 41 percent of feedgrain production stays in the region, 27 percent is shipped to Stockton and 33 percent moves to Portland for export.

In the six southern United States states, 100 percent of feedgrain production remains within the region in all years.

Table 5: Trade flows under the tariff free border scenario, with the removal of priced border costs and a continuation of producer payments as under the WGTA for 1988 to 1984, in tonnes.

Destination:		Source:					Total
		ALBERTA NORTH	ALBERTA CENTRAL	ALBERTA SOUTH	U.S. NORTH	U.S. SOUTH	Consumption
ALBERTA NORTH	1988	126,967					126,967
	1987	118,998					118,998
	1986	118,454					118,454
	1985	107,893					107,893
	1984	111,133					111,133
ALBERTA CENTRAL	1988		1,657,502				1,657,502
	1987		1,578,957				1,578,957
	1986		1,834,133				1,834,133
	1985		1,464,949				1,464,949
	1984	136,168	1,304,885				1,541,053
ALBERTA SOUTH	1988			1,267,856			1,267,856
	1987			1,196,201			1,196,201
	1986			1,160,176			1,160,176
	1985		102,498	1,065,000			1,167,498
	1984	384,699		875,000			1,259,699
U.S. NORTH	1988		1,839,498		3,220,816		5,060,314
	1987		1,871,343		5,401,750		7,273,093
	1986				7,889,482		7,889,482
	1985				8,028,677		8,028,677
	1984		1,726,115		6,250,090		7,976,205
U.S. SOUTH	1988				3,723,681	6,125,315	9,848,996
	1987			1,146,599	2,994,686	5,775,791	9,917,076
	1986				4,295,388	6,212,822	10,508,205
	1985				4,668,631	6,598,119	11,266,750
	1984				4,503,053	6,419,697	10,922,747
PORTLAND, OREGON	1988				1,640,441		
	1987				7,904,884		
	1986				5,649,500		
	1985				4,638,572		
	1984				5,232,507		
VANCOUVER, B.C.	1988	562,033		359,144			
	1987	674,502					
	1986	727,546	2,085,867	1,256,824			
	1985	495,107	1,532,553				
	1984						
Total Production	1988	689,000	3,497,000	1,627,000	8,854,938	6,125,315	
	1987	793,500	3,450,300	2,342,800	16,301,323	5,775,791	
	1986	846,000	3,920,000	2,417,000	17,834,370	6,212,822	
	1985	603,000	3,100,000	1,065,000	17,335,885	6,598,119	
	1984	732,000	3,031,000	875,000	15,985,648	6,419,697	

E. The Full Cost and Tariff Free Border Scenario

This version of the model shows the potential impacts from removing priced border costs and requiring Alberta farmers to pay the full cost of rail transportation. Under this scenario, an average of 16 percent of northern Alberta barley production is required to satisfy regional feedgrain requirements. In 1984, the extra production is split between Red Deer and Calgary. In 1985 and 1986, all extra barley is shipped to Vancouver. In 1987 and 1988, all extra barley production goes to Red Deer.

In central Alberta, barley shipments from the north meant an average of only 39 percent of barley production was required to fulfill regional requirements. In 1985 three percent of annual production was shipped to Calgary, while 49 percent went to Great Falls. In 1984, 1986, 1987 to 1988 all barley production above that required locally was shipped to Great Falls, Montana.

In southern Alberta an average of 67 percent of local barley production was needed to satisfy regional feedgrain requirements. In 1984 and 1985 this value was 100 percent. In 1986 all extra production was shipped to Vancouver, while in 1987 the extra went to Stockton. In 1988 the extra barley production was shipped to Great Falls.

In the five northern U.S. states an average of 34 percent of regional feedgrain production was needed to help satisfy regional requirements, 26 percent of production was shipped to Stockton, and 40 percent went to Portland. In every year feedgrain was shipped to both destinations.

In the U.S. south region an average of 100 percent of the feedgrain produced was used within the region. In every year all feedgrain production was used in the region.

Table 6: Trade flows under the full cost and tariff free border scenario, with the removal of priced border costs and Alberta producers paying the full cost of rail transportation for 1988 to 1984, in tonnes.

Destination:		Source:					Total
		ALBERTA NORTH	ALBERTA CENTRAL	ALBERTA SOUTH	U.S. NORTH	U.S. SOUTH	Consumption
ALBERTA NORTH	1988	126,967					126,967
	1987	118,998					118,998
	1986	118,454					118,454
	1985	107,893					107,893
	1984	111,133					111,133
ALBERTA CENTRAL	1988	562,033	1,095,469				1,657,502
	1987	674,502	904,455				1,578,957
	1986		1,834,133				1,834,133
	1985		1,464,946				1,464,949
	1984	236,168	1,304,885				1,541,053
ALBERTA SOUTH	1988			1,267,856			1,267,856
	1987			1,196,201			1,196,201
	1986			1,160,176			1,160,176
	1985		102,498	1,065,000			1,167,498
	1984	384,699		875,000			1,259,699
U.S. NORTH	1988		2,401,531	359,144	2,299,639		5,060,314
	1987		2,545,845		4,727,248		7,273,093
	1986		2,085,867		5,803,615		7,889,482
	1985		1,532,553		6,496,124		8,028,677
	1984		1,726,115		6,230,090		7,976,205
U.S. SOUTH	1988				3,723,681	6,125,315	9,848,996
	1987			1,146,599	2,994,686	5,775,791	9,917,076
	1986				4,295,388	6,212,822	10,508,205
	1985				4,668,631	6,598,119	11,266,750
	1984				4,503,053	6,419,697	10,922,747
PORTLAND, OREGON	1988				2,561,618		
	1987				8,579,386		
	1986				7,735,367		
	1985				6,171,125		
	1984				5,232,507		
VANCOUVER, B.C.	1988						
	1987						
	1986	727,546		1,256,824			
	1985	495,107					
	1984						
Total Production	1988	689,000	3,497,000	1,627,000	8,854,938	6,125,315	
	1987	793,500	3,450,300	2,342,800	16,301,323	5,775,791	
	1986	846,000	3,920,000	2,417,000	17,834,370	6,212,822	
	1985	603,000	3,100,000	1,065,000	17,335,885	6,598,119	
	1984	732,000	3,031,000	875,000	15,985,648	6,419,697	

F. Competitive Trucking Scenario

This simulation models full cost rail rates, a tariff free border and rail competitive trucking rates. Under this scenario, there are no barley shipments to Vancouver.

Northern Alberta uses an average of 16 percent of regional barley production to satisfy local feedgrain requirements. In 1984 all the extra production is shipped to Stockton, California. In 1985, seventeen percent of production is shipped to Calgary, while 65 percent goes to Portland for export. In 1986 to 1988, all extra barley production is shipped to Portland.

In central Alberta, an average of 48 percent of regional barley production is used to satisfy regional feedgrain requirements. In 1984, 42 percent of annual production is shipped to Calgary and eight percent goes to Portland. In the years 1985 to 1987, all extra production is shipped to Portland for export. In 1988, 36 percent of annual production is sent to Calgary, six percent to Great Falls, and 11 percent to Portland.

Southern Alberta uses an average of 52 percent of barley production to partly fulfill feedgrain requirements. In 1984 and 1988, 100 percent of local production goes to Portland. In 1985, 100 percent of production is used locally. In 1986 and 1987, all barley production above that required locally is shipped to Portland.

The northern United States region has a varied shipping pattern with shipments to both Stockton and Portland in all years except 1988. An average of 47 percent of feedgrain production is used locally, 26 percent is shipped to Stockton and 27 percent sent to Portland. In 1988, there are no shipments to Portland.

In all years, the southern United States region require 100 percent of regional production to partly meet regional feedgrain requirements.

Table 7: Trade flows under the rail competitive trucking scenario, with trucking rates equal to full cost rail rates, the removal of priced border costs, and Alberta producers paying the full cost of rail transportation for 1988 to 1984, in tonnes.

Destination:		Source:					Total
		ALBERTA NORTH	ALBERTA CENTRAL	ALBERTA SOUTH	U.S. NORTH	U.S. SOUTH	Consumption
ALBERTA NORTH	1988	126,967					126,967
	1987	118,998					118,998
	1986	118,454					118,454
	1985	107,893					107,893
	1984	111,133					111,133
ALBERTA CENTRAL	1988		1,657,502				1,657,502
	1987		1,578,957				1,578,957
	1986		1,834,133				1,834,133
	1985		1,464,949				1,464,949
	1984		1,541,053				1,541,053
ALBERTA SOUTH	1988		1,267,856				1,267,856
	1987			1,196,201			1,196,201
	1986			1,160,176			1,160,176
	1985	102,498		1,065,000			1,167,498
	1984		1,259,699				1,259,699
U.S. NORTH	1988		199,057		4,861,257		5,060,314
	1987				7,273,093		7,273,093
	1986				7,889,482		7,889,482
	1985				8,028,677		8,028,677
	1984				7,976,205		7,976,205
U.S. SOUTH	1988				3,723,681	6,125,315	9,848,996
	1987				4,141,285	5,775,791	9,917,076
	1986				4,295,388	6,212,822	10,508,205
	1985				4,668,631	6,598,119	11,266,750
	1984				4,503,053	6,419,697	10,922,747
PORTLAND, OREGON	1988	562,033	372,585	1,627,000			
	1987	674,502	1,871,343	1,146,599	4,886,942		
	1986	727,546	2,085,867	1,256,824	5,649,500		
	1985	392,609	1,635,051		4,638,572		
	1984	620,867	230,248	875,000	3,506,392		
VANCOUVER, B.C.	1988						
	1987						
	1986						
	1985						
	1984						
Total Production	1988	689,000	3,497,000	1,627,000	8,854,938	6,125,315	
	1987	793,500	3,450,300	2,342,800	16,301,323	5,775,791	
	1986	846,000	3,920,000	2,417,000	17,834,370	6,212,822	
	1985	603,000	3,100,000	1,065,000	17,335,885	6,598,119	
	1984	732,000	3,031,000	875,000	15,985,648	6,419,697	

G. The Net Revenue Results

1. Original results from the scenarios

The total net revenue for all five regions considered illustrates the steady decrease in nominal net revenue from 1984 to 1988. This trend appears in all six simulations, suggesting that changes in policy could not have fully offset these declines.

Table 8 lists the total net revenue over all five regions for each year, as well as ranks each scenario within each year. When the scenarios are ranked in each year, there is no consistent pattern. In two of the five years, 1985 and 1986, three scenarios have the same total net revenue value. In 1985 the baseline, no trade, and tariff free border scenarios have the second highest net revenue value. In 1986, the same three tie with the highest net revenue value of the six scenarios. The rail competitive trucking scenario has the highest net revenue value of the six scenarios in three of the five years, while the baseline scenario ranks first in two of the five years. The tariff free border scenario ranks second in three of five years, while the no trade scenario ranks second in two of the five years. The scenario that includes both full cost rail rates and a tariff free border ranks fifth in three of the five years, and sixth in two of the five years. The full cost scenario ranks last in three of the five years.

Table 8: Total net revenue values and ordering of total net revenue for all six scenarios for 1988 to 1984, in millions of nominal Canadian dollars.

Scenario:	Year: 1988		1987		1986		1985		1984	
	$ '000,000	order	$ '000,000	order	$ '000,000	order	$ '000,000	order	$ '000,000	order
Baseline	2,380	4	3,004	1	3,263	1	3,524	2	3,978	3
No Trade	2,382	3	2,998	2	3,263	1	3,524	2	3,955	4
Full Cost Rail	2,300	6	2,925	4	3,106	5	3,446	6	3,926	6
Tariff Free Border	2,385	2	2,861	5	3,263	1	3,524	2	3,984	2
Full Cost & Tariff Free	2,307	5	2,785	6	3,110	6	3,451	5	3,932	5
Rail Comp. Trucking	2,438	1	2,935	3	3,257	4	3,584	1	4,067	1

In Table 9, the total net revenue values in Table 8 are shown by region.[4] One immediate observation is that the two U.S. regions, both individually and combined, are much larger in terms of net revenue than all three Alberta regions combined. This occasionally leads to net revenue results for the United States overshadowing Alberta results.

4 Differences in net revenue values between the two tables are due to rounding.

Table 9: Regional net revenue results for all scenarios for 1988 to 1984, in thousands of nominal Canadian dollars.

Region:	Year	Scenario: BASELINE	NO TRADE	FULL COST	TARIFF FREE	BOTH	RAIL COMP. TRUCKING
ALBERTA NORTH	1988	54,314	54,314	27,958	54,314	27,958	59,375
	1987	52,411	52,411	21,130	52,411	21,130	60,184
	1986	77,840	77,840	59,787	77,840	59,787	67,710
	1985	62,471	62,471	51,695	62,471	51,695	58,722
	1984	58,109	70,067	45,358	58,109	45,358	90,863
ALBERTA CENTRAL	1988	275,992	274,480	267,678	293,003	273,610	220,860
	1987	282,137	226,857	280,535	248,471	234,736	242,499
	1986	359,503	359,503	271,342	359,503	250,025	322,217
	1985	319,534	319,534	253,845	319,534	259,117	316,591
	1984	314,613	287,303	290,851	320,551	296,789	247,849
ALBERTA SOUTH	1988	128,435	128,435	102,333	128,435	103,220	176,383
	1987	154,976	154,976	126,564	140,128	113,596	164,253
	1986	222,606	222,606	171,970	222,606	171,970	204,019
	1985	110,441	110,441	91,771	110,441	91,771	91,771
	1984	83,834	83,834	68,985	83,834	68,985	126,963
ALBERTA TOTAL	1988	458,742	457,229	397,969	475,752	404,788	456,618
	1987	489,524	434,244	428,229	441,010	369,462	466,936
	1986	659,949	659,949	503,099	659,949	481,782	593,946
	1985	492,446	492,446	397,311	492,446	402,583	467,084
	1984	456,556	441,204	405,194	462,494	411,132	465,675
	Avg	**511,443**	**497,014**	**426,360**	**506,330**	**413,949**	**490,052**
U.S. NORTH	1988	948,165	951,154	928,312	935,451	928,312	1,007,818
	1987	1,700,908	1,750,124	1,683,168	1,606,145	1,602,213	1,654,460
	1986	1,654,439	1,654,439	1,654,439	1,654,396	1,679,219	1,713,945
	1985	1,951,925	1,951,925	1,968,476	1,951,925	1,968,476	2,036,996
	1984	2,268,266	2,260,741	2,268,266	2,268,266	2,268,266	2,348,509
U.S. SOUTH	1988	973,558	973,558	973,558	973,558	973,558	973,558
	1987	813,578	813,578	813,578	813,578	813,578	813,578
	1986	948,884	948,884	948,884	948,884	948,884	948,884
	1985	1,080,046	1,080,046	1,080,046	1,080,046	1,080,046	1,080,046
	1984	1,252,804	1,252,804	1,252,804	1,252,804	1252,804	1,252,804
U.S. TOTAL	1988	1,921,723	1,924,712	1,901,870	1,909,009	1,901,870	1,981,376
	1987	2,514,486	2,563,702	2,496,746	2,419,723	2,415,791	2,468,038
	1986	2,603,323	2,603,323	2,603,323	2,603,323	2,628,103	2,662,829
	1985	3,031,971	3,031,971	3,048,522	3,031,971	3,048,522	3,117,042
	1984	3,521,070	3,513,545	3,521,070	3,521,070	3,521,070	3,601,313
	Avg	**2,718,515**	**2,727,451**	**2,714,306**	**2,697,019**	**2,703,071**	**2,766,120**
TOTAL NET REVENUE	1988	2,380,465	2,381,941	2,299,839	2,384,761	2,306,658	2,437,994
	1987	3,004,010	2,997,946	2,924,975	2,860,733	2,785,253	2,934,974
	1986	3,263,272	3,263,272	3,106,422	3,263,272	3,109,885	3,256,775
	1985	3,524,417	3,524,417	3,445,833	3,524,417	3,451,105	3,584,126
	1984	3,977,626	3,954,749	3,926,264	3,983,564	3,932,202	4,066,988
	Avg	**3,229,958**	**3,224,465**	**3,140,667**	**3,203,349**	**3,117,021**	**3,256,171**

Table 9 reveals that there are few consistent changes within each scenario in terms of net revenue. In Alberta in 1985 and 1986, the baseline, no trade and tariff free border scenarios are all ranked number one in terms of provincial net revenue. Both the baseline and tariff free scenarios are ranked number one in Alberta in three of the five years. The no trade scenario ranks number one in two of the five years. The rail competitive trucking scenario ranks number one in one of the five years. The full cost scenario ranks sixth in three of the five years and fifth in the other two years. The scenario with both full cost rail rates and a tariff free border ranks fifth in three of the five years, and sixth in two of the five years.

By contrast, in the United States, the rail competitive trucking scenario outshines the other simulations. In four of the five years modelled, the rail competitive trucking scenario ranks number one. The net revenue results from the remaining scenarios give a less clear picture. The scenario with both full cost rail rates and a tariff free border ranks second in three of the five years, while the full cost scenario ranked third in three of the five years. The tariff free border scenario ranked fourth in two of the five years, while the no trade scenario was ranked from one to six over the five years.

2. Results using a consistent set of prices

The results from the six scenarios are compared in Table 8. The use of full cost rail rates in three of the scenarios results in dramatic drops in Alberta feedgrain prices, due to the method by which the prices were calculated. The different prices used to evaluate each version of the model make it difficult to compare results in monetary terms. The WGTA rate structure, and the way the model is formulated, indicate that the status quo would have been most beneficial to Alberta farms from a net revenue point of view.

In order to provide a more appropriate comparison of the scenarios, the net revenue results are standardized by evaluating all the trade lows generated by the six scenarios using a single set of prices for Alberta feedgrain. The price series used is that calculated under full cost rail rates. This form of evaluation meant the net revenue values would not change for the United States regions, as their feedgrain prices are not affected by Alberta's rail transportation costs. However, some of the Alberta, and hence total, net revenue values do change. The total net revenues for the full cost, full cost and tariff free, and full cost, tariff free and rail competitive trucking rate scenarios do not change as the Alberta feedgrain price already incorporate full cost rail rates. The total net revenue values for the six scenarios, evaluated using Alberta feedgrain prices calculated using full cost rail rates, as well as the ranking for these values, are shown in Table 10.

When the total net revenue results are ranked in each year the full cost, tariff free, and rail competitive scenario ranks first every year. The full cost and tariff free scenario rank second in four of the five years. The remaining four scenarios are less consistent. In 1984, 1985, and 1986 several of the scenarios have the same total revenue values. This is supported by the slight differences in trade flow patterns between the models in those years.

Table 10: Total net revenue values and ranking of total net revenue, evaluated using Alberta feedgrain prices calculated using full cost rail rates, for all six scenarios for 1988 to 1984, in millions of nominal Canadian dollars.

Scenario:	Year: 1988		1987		1986		1985		1984	
	$ '000,000	order	$ '000,000	order	$ '000,000	order	$ '000,000	order	$ '000,000	order
Baseline	2,255	5	2,897	3	3,106	3	3,437	4	3,926	4
No Trade	2,252	6	2,846	4	3,106	3	3,437	4	3,873	6
Full Cost Rail	2,300	3	2,925	2	3,106	3	3,446	3	3,926	4
Tariff Free Border	2,297	4	2,779	6	3,106	3	3,437	4	3,932	2
Full Cost & Tariff Free	2,307	2	2,785	5	3,110	2	3,451	2	3,932	2
Rail Comp. Trucking	2,438	1	2,935	1	3,257	1	3,584	1	4,067	1

IV DISCUSSION

This chapter describes the differences between the results from the baseline version of the model and the five other scenarios. Differences are shown in trade volumes and in net revenues among the six scenarios.

A. A Comparison of Differences in Trade Volumes

Table 11 shows the annual out-of-province barley shipments from Alberta. Both the actual volumes and the volumes calculated from the model are presented. Over the five years examined the model estimates shipments that are 101 percent of actual shipments. This varies from estimated shipments that are 60 percent of actual shipments in 1984, to estimated shipments 128 percent of actual in 1986.

Table 11: Alberta's annual out-of-province barley exports, both actual shipments and model estimates, from 1988 to 1984.

Year	Actual Exports[1] - '000 tonnes -	Estimated Exports[2] - '000 tonnes -	Estimated/ Actual - % -
1984	2,885	1,726	60
1985	1,738	2,028	117
1986	3,192	4,070	128
1987	3,421	3,462	101
1988	2,733	2,761	101
Average	2,794	2,809	101

1 - Source: Alberta Agriculture, Statistics Branch. *Alberta's Agricultural Exports*. Various years.
2 - Total out-of-province export estimates are the same for all scenarios and are calculated as total Alberta production minus total Alberta requirements.

In Table 12 the actual volumes and values of barley shipments from Alberta to the United States from 1984 to 1988 are presented. Canadian records did not distinguish between malt and feed barley, nor do available data indicate shipments to the eleven states used in the study model.

Table 12: Alberta barley shipments to the United States from 1988 to 1984.

Year	Volume - tonnes -	Value - $ '000 -
1984	52,835	10,601
1985	32,134	7,372
1986	49,517	7,083
1987	114,770	12,276
1988	174,543	17,891
Average	84,760	11,045

Source: Alberta Agriculture, Statistics Branch. *Alberta's Agricultural Exports*. Various years.

Table 13: Estimated barley shipments to the United States from Alberta under the six scenarios of the model from 1988 and 1984.

Scenario:	Total Shipments - tonnes -	5 Year Average - tonnes/ year -
Baseline	1,925,172	385,034
No Trade	0	0
Full Cost	9,711,787	1,942,357
Tariff Free	6,583,555	1,316,711
Both	11,797,654	2,359,531
Rail Comp. Trucking	14,277,131	2,855,426

Table 13 presents the total volume of shipments, and the five year average shipments, from Alberta to the eleven states as calculated under the six scenarios. Results presented in chapter four suggest that there exists potential for shipments of feed barley from Alberta to the northwest United States. Even the baseline scenario where barriers to exports exist in the form of discriminatory transportation pricing and tariff barriers, indicates that approximately two million tonnes of barley could have moved from Alberta to the United States over the five year period; an average of 385,034 tonnes per year.

Differences between actual barley shipments to the United States and the values estimated by the model for the eleven northwest states are the result of several assumptions within the model. The model allows for only two sources of feedgrain: Alberta and the northwest United States. This excludes feedgrains from the corn belt of the United States from entering the eleven state area. Only in 1988, when both U.S. regions were feedgrain deficit, were Alberta barley shipments a response to American feedgrain requirements. In four of the five years the eleven state area was a feedgrain surplus area.

Under several of the scenarios, the model suggested that large volumes of grain would move to the United States from Alberta. This occurred at the expense of shipments through Vancouver to the rest of the world. The fact that such large differences existed between what did happen and what the model estimated suggests that there were forces in effect not included in the model. The most likely explanations are price barriers or institutional rigidities.

The most probable type of price barrier that would limit barley movement from Alberta to the United States is a tariff barrier. However, tariffs are included in the model and are small. Another potential price barrier is high transportation costs. It may be that actual trucking rates are much higher than those modelled. This however, is not borne out in conversations with Cliff Weber of the Agricultural Transportation Branch, Alberta Agriculture. He suggested consistent, long-haul trucking rates for barley would probably be lower than the trucking rates used in all but the rail competitive trucking scenario. One final price barrier may have been the American prices used for barley. It is possible that the prices used in the study were less than the majority of feed barley exporters would actually have faced.

There are several possible sources of institutional rigidities which are not included in the model. The Canadian Wheat Board requires permits to export grain to the United States. Other potential institutional rigidities may exist in the transportation portion of the model. Trucking regulations exist on both sides of the border that restrict the free flow of commodities.

B. A Comparison of Differences in Net Revenue Values

1. Original net revenue values

The purpose of this study is to compare the potential impacts of several policy changes. One way this is done is to compare the net revenue, or monetary, results of the six scenarios of the model. This comparison is based on the outcome of the baseline model, considered similar to the situation during the five years examined, 1984 to 1988. Tables 14 and 15 illustrate the dollar value and percent differences between the baseline scenario and the other five scenarios from the net revenue maximization model.

Initial examination shows that the rail competitive trucking model averages an increase in net revenue of $26,139,000 per year over the baseline scenario. All the other scenarios indicate average declines in net revenue compared to the baseline simulation. In the instance of the full cost and 'both' scenarios, this makes intuitive sense as transportation costs within the system are dramatically increased. As well, in the case of the no trade scenario, the lack of higher priced United States markets for Alberta barley suggests a decline in net revenue.

In Table 16 the average annual net revenue of Alberta barley producers from each of the six scenarios is listed. The scenarios are ordered in two ways. In column three, the scenarios are ordered, from largest to smallest, based on the average annual estimated net revenue for Alberta barley producers. In the last column, the scenarios are ordered, from largest to smallest, based on the estimated average annual volume of barley shipments from Alberta to the eleven state area.

Table 14: Differences in original net revenue values between the baseline scenario and the five other scenarios for Alberta, the U.S. and the total system for 1988 to 1984, in thousands of nominal Canadian dollars.

Scenario:	Region:	Year: 1988	1987	1986	1985	1984	5 Year Average
NO TRADE	Alberta	-1,513	-55,280	0	0	-15,352	-14,429
	U.S.	+2,989	+49,216	0	0	-7,525	+8,936
	Total	+1,476	-6,064	0	0	-22,877	-5,495
FULL COST	Alberta	-60,773	-61,295	-156,803	-95,135	-51,362	-85,083
	U.S.	-19,853	-17,740	0	+16,551	0	-4,209
	Total	-80,626	-79,035	-156,850	-78,584	-51,362	-89,291
TARIFF	Alberta	+17,010	-48,514	0	0	+5,938	-5,113
FREE	U.S.	-12,714	-94,763	0	0	0	-21,496
BORDER	Total	+4,296	-143,277	0	0	+5,938	-26,609
BOTH	Alberta	-53,954	-120,062	-178,167	-89,863	-45,424	-97,494
	U.S.	-19,853	-98,695	+24,780	+16,551		-15,444
	Total	-73,807	-218,757	-153,387	-73,312	-45,424	-112,937
RAIL COMP.	Alberta	-2,124	-22,588	-66,003	-25,362	+9,119	-21,391
TRUCKING	U.S.	+59,653	-46,448	+59,506	+85,071	+80,243	+47,605
	Total	+57,529	-69,036	-6,497	+59,709	+89,362	+26,213

Table 15: Percent differences in original net revenue values between the baseline scenario and the five other scenarios for Alberta, the U.S., and the total system for 1988 to 1984.

Scenario:	Region:	Year: 1988	1987	1986	1985	1984	5 Year Average
NO TRADE	Alberta	-0.3	-11.3	0	0	-3.4	-2.8
	U.S.	+0.2	+2.0	0	0	-0.2	+0.3
	Total	+0.1	-0.2	0	0	-0.6	-0.2
FULL COST	Alberta	-13.2	-12.5	-23.8	-19.3	-11.2	-16.6
	U.S.	-1.0	-0.7	0	+0.5	0	-0.2
	Total	-3.4	-2.6	-4.8	-2.2	-1.3	-2.8
TARIFF	Alberta	+3.7	-9.9	0	0	+1.3	-1.0
FREE	U.S.	-0.7	-3.8	0	0	0	-0.8
BORDER	Total	+0.2	-4.8	0	0	+0.1	-0.8
BOTH	Alberta	-11.8	-24.5	-27.0	-18.2	-9.9	-19.1
	U.S.	-1.0	-3.9	+0.9	+0.5	0	-0.6
	Total	-3.1	-7.3	-4.7	-2.1	-1.1	-3.5
RAIL COMP.	Alberta	-0.5	-4.6	-10.0	-5.2	+2.0	-4.2
TRUCKING	U.S.	+3.1	-1.8	+2.3	+2.8	+2.3	+1.8
	Total	+2.4	-2.3	-0.2	+1.7	+2.2	+0.8

The correlation between the two measurements was negative, but low. It is notable that the baseline, tariff free and no trade scenarios, which are the top three in net revenue terms, are the bottom three in terms of exports to the United States. At the same time the rail competitive trucking, full cost and both full cost and tariff free scenarios, which are ranked at the bottom three in terms of net revenue, are the top three in terms of exports to the United States.

Table 16: Average annual net revenue for Alberta barley producers estimated from various policy scenarios, in thousands of nominal Canadian dollars.

Scenario:	Average Estimated Net Revenue - $ '000 -	Net Revenue - order -	Shipments to U.S. - order[1] -
Baseline	511,433	1	5
No Trade	497,014	3	6
Full Cost	426,360	5	3
Tariff Free	506,329	2	4
Both	413,827	6	2
Rail Comp. Trucking	490,052	4	1

1 - Ordering was according to average annual volume of estimated shipments to the U.S. as illustrated in Table 13, in descending order.

2. Net revenue values using a consistent price series

To overcome the confusion associated with the use of several price series the original trade flows for the six scenarios are valued using a single price series that incorporated full cost rail rates. This means the baseline scenario trade flows and the trade flows from the full cost scenario are valued using an identical price series. The difference in the net revenue value could then be attributed solely to differences in trade flow patterns. The differences in net revenue between the baseline trade flows valued using full cost rail rates and the other five models trade flows values using full cost rail rates are illustrated in Table 17.

The difference in average net revenue between the baseline scenario and the full cost scenario, when both are valued using full cost rail rates, is an annual increase of $16,386,000. That is, when only full cost rail rates were used, the trade patterns illustrated in Table 4 resulted in a higher net revenue for Alberta barley producers compared to the pattern illustrated in Table 2.

The results of the no trade scenario illustrate a decrease in net revenue when compared to the baseline scenario, which allows for cross border movements. The average decrease of $21,429,000 per year is due solely to differences in trade patterns.

In the three remaining models, the tariff free model, the model with full cost rail rates and a tariff free border, and the rail competitive trucking rates model, the results are less clear. The removal of tariff cost, a change in trucking rates and changes in trade patterns all interact to lead to variable results from year to year.

In Table 19, the average annual net revenue of Alberta barley producers is indicated, based on a single full cost rail rate price series for the six scenarios. The scenarios are ordered for (1) the average annual estimated net revenue for Alberta barley producers, and (2) based on the estimated average annual volume of barley shipments from Alberta to the eleven state area. There is a strong positive correlation in the ordering. It is noteworthy that in all cases except the full cost and 'both' scenarios, the ordering is identical.

Table 17: Differences in net revenue values between the baseline scenario and the five other scenarios when all the original trade flows are valued using full cost rail rates, for Alberta, the U.S. and the total system for 1988 to 1984, in thousands of nominal Canadian dollars.

Scenario:	Region:	Year: 1988	1987	1986	1985	1984	5 Year Average
NO TRADE	Alberta	-6,065	-99,818	0	0	-46,213	-30,420
	U.S.	+2,989	+49,216	0	0	-7,525	+8,936
	Total	-3,076	-50,602	0	0	-53,738	-21,483
FULL COST	Alberta	+64,281	+46,172	0	-7,479	0	+20,594
	U.S.	-19,853	-17,740	0	+16,551	0	-4,209
	Total	+44,428	+28,432	0	+9,072	0	+16,387
TARIFF	Alberta	+54,528	-23,083	0	0	+5,938	+7,476
FREE	U.S.	-12,714	-94,763	0	0	0	-21,496
BORDER	Total	+41,814	-117,846	0	0	+5,938	-14,019
BOTH	Alberta	+71,100	-12,595	-21,367	-2,207	+5,938	+8,183
	U.S.	-19,853	-98,695	+24,780	+16,551	0	-15,444
	Total	+51,247	-111,290	+3,463	+14,344	+5,938	-7,259
RAIL COMP.	Alberta	+122,930	+84,879	+90,847	+62,294	+60,481	+84,286
TRUCKING	U.S.	+59,653	-46,448	+59,506	+85,071	+80,243	+47,605
	Total	+182,583	+38,431	+150,353	+147,365	+140,724	+131,891

Table 18: Percent differences in net revenue values between the baseline scenario and the five other scenarios when all the original trade flows are valued using full cost rail rates for Alberta, the U.S., and the total system for 1988 to 1984.

Scenario:	Region:	Year: 1988	1987	1986	1985	1984	5 Year Average
NO TRADE	Alberta	-1.8	-26.1	0	0	-11.4	-7.5
	U.S.	+0.2	+2.0	0	0	-0.2	+0.3
	Total	-0.1	-1.7	0	0	-1.4	-0.7
FULL COST	Alberta	+19.3	+12.1	0	-1.8	0	+5.1
	U.S.	-1.0	-0.7	0	+0.5	0	-0.2
	Total	+2.0	+1.0	0	+0.3	0	+0.5
TARIFF	Alberta	+16.3	-6.0	0	0	-1.5	+1.8
FREE	U.S.	-0.7	-3.8	0	0	0	-0.8
BORDER	Total	+1.9	-4.1	0	0	+0.2	-0.4
BOTH	Alberta	+21.3	-3.3	-4.2	-0.5	+1.5	+2.0
	U.S.	-1.0	-3.9	+0.9	+0.5	0	-0.6
	Total	+2.3	-3.8	+0.1	+0.4	+0.2	-0.2
RAIL COMP.	Alberta	+36.8	+22.1	+18.1	+15.4	+14.9	+20.8
TRUCKING	U.S.	+3.1	-1.8	+2.3	+2.8	+2.3	+1.8
	Total	+8.1	+1.3	+4.8	+4.3	+3.6	+4.2

Table 19: Average annual estimated net revenue values for Alberta barley producers using original trade flows valued using full cost rail rates, in thousands of nominal Canadian dollars.

Scenario:	Average Full Cost Net Revenue[1] - $ '000 -	Net Revenue - order -	Shipments to U.S. - order[2] -
Baseline	405,766	5	5
No Trade	375,401	6	6
Full Cost	426,360	2	3
Tariff Free	413,242	4	4
Both	413,947	3	2
Rail Comp. Trucking	490,052	1	1

1 - Study data.
2 - Ordering was according to average annual estimated shipments to the U.S. as illustrated in Table 13, in descending order.

V SUMMARY AND RECOMMENDATIONS

A. Summary

This study examines the potential for trade in feedgrains with eleven northwest states of the United States. The primary hypothesis is that there exists potential for movement of Alberta feed barley into the United States. In order to test this hypothesis, a retrospective revised net revenue, partial spatial equilibrium, linear programming model is used.

The model maximizes revised net revenue in each of the five years 1984 to 1988 over the five regions examined. Net revenue is defined as market price minus transportation costs and priced border costs. Each region has pre-determined feedgrain production and requirement volumes measured in barley equivalents. By maximizing overall net revenue trade flows are generated. Two export ports, Vancouver, British Columbia and Portland, Oregon, are used to accept grain but are not allowed to ship to the five regions.

The baseline model incorporates the producers' cost of rail transportation under the WGTA, the border costs existing in the years examined, and trucking rates. The five other simulations estimate trade flows when i) no trade between countries is allowed; ii) producers have to pay the full cost of rail transportation; iii) border costs are removed; iv) producers have to pay the full cost of rail movement and the border is free of priced barriers; and v) producers have to pay the full cost of rail transportation, the border is tariff free, and trucking rates are the same as full cost rail rates on a per tonne per mile basis.

The five regions would have been best off with the final scenario. Vancouver is not, however, used for Alberta barley export in this scenario. In the other simulations, the results are highly dependant on the year modelled. In most instances, changes in trade flows from Alberta are at the expense of flows to Vancouver. There does exist the potential for movement of Alberta barley into the United States, even under the baseline model. This indicates that barley exports are restricted under present regulation.

The trade flows developed using the net revenue maximization program are also examined after being valued at full cost rail rate prices. These results are more consistent. The indication is that once distortions due to different price series were removed, all trade flow patterns, except those from the no trade model, resulted in increases in net revenue for Alberta barley producers. On average increased barley shipments to the United States increased Alberta's net revenue from barley.

BIBLIOGRAPHY

Abbott, Philip C. 1979. "Modelling International Grain Trade with Government Controlled Markets". *American Journal of Agricultural Economics*, 61(1):22 - 31.

Alberta Agriculture, Production Economics Branch and Alberta Economic Development and Trade, Transportation Services. Various years. *Statutory Grain Freight Rates from Alberta to Vancouver/ Prince Rupert and Thunder Bay.* Alberta Agriculture: Edmonton.

Alberta Agriculture, Statistics Branch a. Various years. *Alberta's Agricultural Exports*. Alberta Agriculture: Edmonton.

Alberta Agriculture, Statistics Branch b. Various years. *Agriculture Statistics Yearbook.* Alberta Agriculture: Edmonton.

Alberta Agriculture and Alberta Wheat Pool. 1989. *Impact of Change to a Pay the Producer Method of Payment on Alberta's Grain and Livestock Sectors.* Alberta Agriculture: Edmonton.

Allen, G.C. and E.F. Hodges. 1974. *Livestock-feed Relationships: National and State.* Statistical Bulletin No. 530. Economic Research Service, USDA: Washington.

Baldwin, E.D. and D.W. Larson. 1985. *U.S. Grain Marketing System for the 1990's: Alternative Policy Scenarios.* Research Bulletin 1169. Ohio Agricultural Research and Development Center. Ohio State University: Wooster, Ohio.

Bawden, D. Lee. 1964. "An Evaluation of Alternative Spatial Models". *Journal of Farm Economics*, 46(5):1372 - 1379.

Bawden, D. Lee. 1966. "A Spatial Price Equilibrium Model of International Trade". *Journal of Farm Economics*, 48(4):862 - 874.

Canada Grains Council. 1985. *The Structure of the Feed Grain Market in Western Canada.* Canada Grains Council: Winnipeg.

Canada Grains Council. Various years. *Statistical Handbook.* Canada Grains Council:Winnipeg.

Carter, C.A., A.B. Hickson and D.F. Kraft. 1984. "The Welfare Effects of Export Constraints on the Canadian Feed Grain Market". *Canadian Journal of Agricultural Economics*, 32:25 - 36.

Chaudhary, G.N. 1986. *Impact of the Statutory Rates on Trucking.* Alberta Agriculture, Production and Resources Economics Branch: Edmonton.

Clary, G.M., R.A. Dietrich and D.E. Farris. 1986. "Effects of Increased Transportation Costs on Spatial Price Differences and Optimum Locations of Cattle Feeding and Slaughter". *Agribusiness.* 2(2): 235-246.

Dunlop, Diane. 1988. *The Impact of Grain Price Pooling on Producer Returns and System Costs.* Department of Rural Economy, University of Alberta. M.Sc. thesis.

Enke, Stephen. 1951. "Equilibrium Among Spatially Separated Markets: Solution by Electric Analogue". *Econometrica*, 19(1):40 - 47.

Fox, Karl A. And Richard C. Taeuber. 1955. "Spatial Equilibrium Models of the Livestock - Feed Economy". *American Economic Review*, 45(4):584 - 608.

Furtan, W.H., J.G. Nagy and G.G. Storey. 1979. "The Impact on the Canadian Rapeseed Industry from Changes in Transport and Tariff Rates". *American Journal of Agricultural Economics*, 61(2):238 - 248.

Ghosh, Sukesh K. 1972. "A Quadratic Programming Interregional Trade Model: An Application and a Perspective". *Canadian Journal of Agricultural Economics*, 20(2):65 - 77.

Groenewegen, John R. 1983. *The Canadian Coarse Grains Industry*. Commodity Markets Analysis Division, Marketing and Economics Branch, Agriculture Canada: Ottawa.

Heads, John (editor). 1989. *Developments in Canadian Grain Transportation Policy - Proceedings of a Conference*. Occasional Paper No. 7. University of Manitoba, Transport Institute: Winnipeg.

Hickson, A.B. and C.A. Carter. 1987. "An Analysis of Policy Changes in the Canadian Feed Grain Market". *Western Journal of Agricultural Economics*, 12(2):126 - 134.

Koo, W.W. 1984. *A Spatial Equilibrium Analysis of the U.S. Wheat industry Under Alternative Trade Restrictions and Transportation Costs*. Research Report 99. North Dakota Agricultural Experiment Station: Fargo.

Leath, M.N. and L.D. Hill. 1983. *Grain Movements, Transportation Requirements, and Trends in U.S. Grain Marketing Patterns During the 1970's*. North Central Regional Research Publication 288. University of Illinois.

Lewis, J.H. and D.D. Sharp. 1979. *Projected Livestock - Feed Balances for Colorado 1980, 1985, 1990*. Bulletin 5685. Colorado State University Experiment Station: Fort Collins.

Malmberg, L.A. 1980. *The Anatomy of the Canadian Barley Market*. Planning and Research Secretariat, Alberta Agriculture: Edmonton.

Mines and Resources Canada. 1974. *National Atlas of Canada*. Macmillian Company of Canada Ltd.: Toronto.

Roy, Sujit K. and M. Edwin Ireland. 1975. "An Econometric Analysis of the Sorghum Market". *American Journal of Agricultural Economics*, 57(3):513 - 516.

Statistics Canada. 1988. *Canadian Economic Observer, Historical Statistical Supplement, 1987*. Catalogue 11-210, Volume 2. Minister of Supply and Services Canada: Ottawa.

Statistics Canada. 1989. *Consumer prices and price indexes*. Statistic Canada: Ottawa.

Takayama, Takashi and George G. Judge. 1971. *Spatial and Temporal Price and Allocation Models*. North - Holland Publishing Company: Amsterdam.

United States Department of Agriculture. 1989. *Feed Yearbook*. USDA: Washington, D.C.

United States Department of Agriculture. Various years. *Agricultural Statistics*. USDA: Washington, D.C.

United States Department of Agriculture. Various years. *Agricultural Prices*. USDA: Washington, D.C.

United States Department of Agriculture. Various years. *Annual Crop Summary*. USDA: Washington, D.C.

Weinschenck, G., W. Henrichsmeyer and F. Aldinger. 1969. "The Theory of Spatial Equilibrium and Optimal Location in Agriculture: A Survey". *Review of Marketing and Agricultural Economics*, 37(1):3 - 70.

Wilson, W.W. and W.W. Koo. 1985. "Grain Transportation Rates and Export Market Development". *North Central Journal of Agricultural Economics*. 7(1): 27-39.