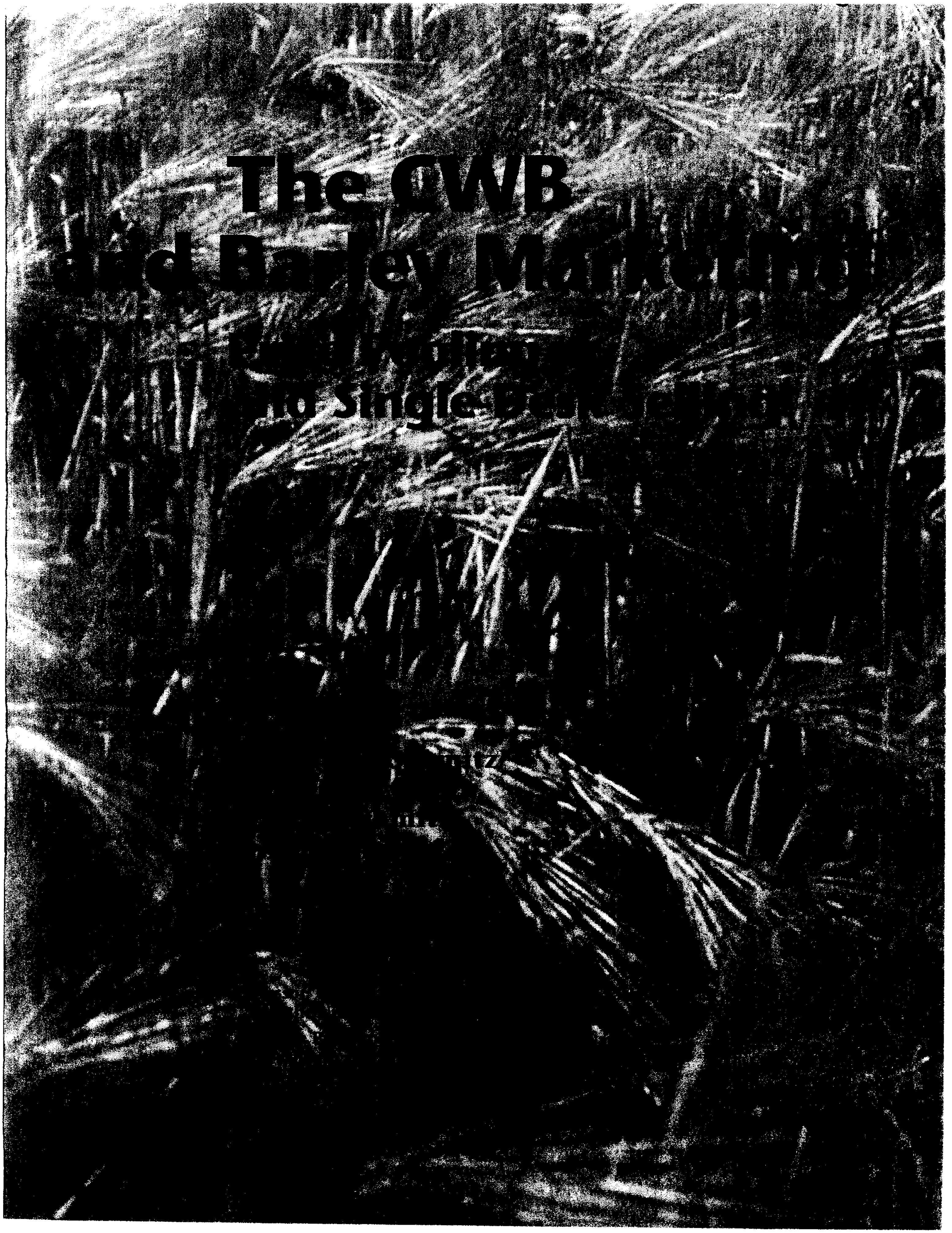
The CWB
and Barley Marketing

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Executive Summary

Issues and Objectives

The operation of the Canadian Wheat Board (CWB) as the single-desk seller of western Canadian feed and malting barley for export and domestic human consumption within Canada is at the center of ongoing debate and controversy in Western Canada. The key issues raised in the debate are as follows.

1) Does the CWB deliver higher returns to western Canadian feed and malting barley producers than would be the case in a multiple-seller environment?
2) Are there benefits provided to producers through the price pooling operations of the CWB, i.e., risk management?
3) What are the inherent problems of arbitrage between the annual pooled return provided by the CWB and the cash off-Board market price?
4) Are there additional marketing costs that are unique to the operation of the CWB as a single-desk seller?

Several economic studies of the Canadian barley marketing system and several government processes directly addressed the national and international issues involved in the debate. These studies included a federal government Round Table process in 1992/93 that funded a study by Carter (1993) and led to a federal Ministerial decision by the Honourable Charles Mayer to create a Continental Barley Market (CBM) beginning August 1, 1993. This change in marketing structure was reversed by a federal court ruling on Sept. 10, 1993. Following this ruling, in 1994/95, the Canada-U.S. Joint Commission on Grains examined issues relating to the potential for harmonization of the Canadian and U.S. marketing systems. The results of the Commission were provided to a federally mandated Western Grain Marketing Panel (WGMP) in 1995/96 that examined all issues in the western Canadian grain marketing industry. The WGMP made several recommendations to the federal government that would (1) increase the operational flexibility of the CWB in procuring grain from producers, (2) provide payment alternatives to increase flexibility of cash flow, (3) change the governance structure of the CWB to allow for direct producer control of the organization through a board of directors with producer-elected representatives, (4) establish a full open market for feed barley, with participation by the CWB, and (5) continue the single-desk selling of malting barley by the CWB.

The current Minister of Agriculture, the Honourable Ralph Goodale, announced on October 7, 1996 that the Government of Canada would implement the majority of the operational and governance recommendations of the WGMP. The Panel's recommendation to create a full open market for feed barley sales while maintaining the single-desk status of the CWB in malting barley markets was not accepted. The Minister of Agriculture announced that a producer vote should take place on this issue.

Recent public studies that have examined the economic issues surrounding barley marketing in Western Canada and North America have focused primarily on feed barley, with less emphasis on malting barley. The lack of focus on the interrelationship between these two different barley markets has limited the usefulness of earlier studies in determining the implications of various possible marketing arrangements for barley producers and for the livestock and malting industries. In addition, these studies are limited in scope because they had little or no access to actual CWB sale prices and contract terms. Finally, although problems of arbitrage within the western Canadian domestic feed barley market have been identified in some of these studies, very little has been done to formalize

concept of arbitrage in the context of CWB price oling or to quantify the effects within a formal nomic framework.

Using formalized and integrated economic analyses, overall objective of this study is to evaluate the nomic performance of the CWB with respect to the rketing of both feed and malting barley domestically d internationally. The specific objectives of this study to:

1) provide an overview of the world barley trade for both malting and feed barley (Chapter 2);
2) review previous studies that have examined the role of the CWB in the domestic and international barley market (Chapter 3);
3) develop a theoretical framework to examine the CWB's role in domestic and international feed, malt and malting barley markets, and the potential for the CWB and other market participants to exercise market power (Chapter 4);
4) test, using actual CWB contract data for the period 1980/81 through 1994/95, whether the CWB exhibits market power in the international feed barley market (Chapter 5);
5) estimate the returns from single-desk selling using an economic model that incorporates actual CWB sales data (Chapter 5);
6) use historical price data to estimate arbitrage losses resulting from annual price pooling (Chapter 6); and
7) review and evaluate the marketing costs that have been attributed to the CWB in previous studies (Chapter 6).

World and Canadian Barley Markets

Canada is a major player in the world barley market. among the top three exporters of both feed and ting barley in the world. At times, total exports from European Union, Canada and Australia have been in ss of 78% of total world barley exports. Canada and tralia together have had more than 50% market share arley exports. For malting barley, Canada's export ket share has been as high as 40%. From a market spective, the Canadian domestic market for feed les has been the largest component of total adian barley consumption.

Export Enhancement Program (EEP) subsidies and tution payments have been central to the export of and E.U. barley, respectively. The European Union halted restitution payments in May 1995, but these were reintroduced in September 1996. For barley, these subsidies commonly exceeded US $60/mt. The United States has not subsidized barley exports since July 1995. However, the 1996 Farm Bill authorized EEP funding of US $350 million in fiscal 1996, $250 million in 1997, $500 million in 1998, $550 million in 1999, $579 million in 2000, and $478 million in 2001 and 2002.

Selected Previous Studies

Consensus cannot be reached as to the benefits and costs of the CWB as a single-desk seller. A number of studies have concluded that substantial benefits were associated with this system. Other studies that do not support these results have argued that, while price premiums may have existed, they were small relative to the added marketing and other costs associated with the CWB. The studies provide a basis for the modeling approach used in this study, however, a major limitation of almost all the studies is that they model the effects on the feed grain market separately from the malting barley market. Also, generally, no formal models have been developed for the malting barley market that parallel the analysis of the feed grain sector. Rather, assumptions have been made about the link between feed barley prices and malting barley prices. In other cases, malting barley price premiums have been calculated by comparing U.S. and Canadian prices.

When modeling the behavior of the CWB, one cannot *a priori* assume that it acts in a perfectly competitive manner. The world barley market consists of relatively few sellers. Also, in view of the work by Haley et al. (1992), one must test whether the CWB has market power. Determining whether the CWB has market power is empirically difficult, unless actual contract pricing data are available. The issue of market power and the nature of competition is very important. As Johnson et al. (1994) pointed out, assuming competitive behavior (i.e. no market power) misses the major argument in the current debate over barley marketing.

Much of the confusion in the present barley marketing debate is based upon the lack of a clear distinction between additional revenues earned by a single-desk seller and the total efficiency or inefficiency of a single-desk seller versus multiple sellers. For example, it is theoretically possible for the CWB to earn price premiums and still have a situation in which producers could be worse off than they would be under multiple sellers. However, that situation could only occur if

the CWB system resulted in higher costs. To highlight this point, in their study on wheat, Kraft et al. (1996) concluded that the CWB earned significant price premiums over multiple sellers. These price premiums were calculated (free on board) f.o.b. Vancouver and not at the farm gate. If the marketing costs under the CWB were at least as low as under a multiple seller-situation, the farmer would do better under the CWB system. However, Carter and Loyns (1996) contended the single-desk system adds costs to those that would exist under a multiple-seller system, and these costs outweigh the premiums.

Theory of Single-Desk Selling

The CWB is a form of collective action by Canadian grain producers in an attempt to maximize returns by jointly providing marketing services and countervailing power against large multinational grain trading companies. The CWB's existence is a direct result of public policy as it requires federal legislation (i.e. the Canadian Wheat Board Act). The CWB is set up to operate as a producer marketing board and it has adopted the objective of maximizing returns from sales of wheat and barley. The CWB acts as the producer's agent through which all sales and payments are made. The theory of producer marketing boards has been discussed in several works including Bieri and Schmitz (1974), Just et al. (1979), McCalla and Josling (1981), Schmitz et al. (1981), and Just et al. (1982).

In theory, the CWB is a producer monopolist. It's not a middle man (i.e. where a firm attempts to exploit both producers and consumers) nor a monopsonist (i.e. where a firm exploits producers). In other words, the profits earned from sales by the CWB are returned directly to producers (i.e. producers are the "shareholders" of the CWB).

A major feature of the international barley market is that marketing boards, such as the CWB and the Australian barley boards, sell into a market in competition with multinational grain companies. Their behavior is influenced by state trading entities including the E.U. Cereals Management Committee and the U.S. Commodity Credit Corporation. State trading dominates the world barley market. Roughly one half of barley trade is dominated by single-desk sellers.

The marketing of grain in the United States is very different from the marketing of CWB grains. As pointed out by Hill (1992), large multinational trading companies dominate the export stage of the U.S. grain marketing system. The dominant multinational trading companies involved in the export of U.S. grain are Cargill (American-based), Continental (American-based but owned by a French family), Archer Daniels Midland (American-based) which has a joint export venture with Toepfer (German-based), Bunge (Argentinian-based), Louis Dreyfus (French-based), and several subsidiaries of large Japanese corporations whose headquarters are in the United States. All of these companies source grain from the United States and other origins. In essence, the U.S. multinational trading companies behave as middlemen with respect to the buying and selling of U.S. and other origin grains. They buy grain from optional origins and sell it to foreign buyers.

The ability of a single-desk seller to generate additional revenue through price discrimination is well founded in economic theory. There is general agreement that the CWB is able to price discriminate. However, there are other reasons why the CWB may be able to increase revenue above what would exist under multiple sellers. One reason, suggested by Carter (1992), is that the steady supply guaranteed by the CWB spreads the risk that grain companies face in dealing with the day-to-day transactions. If the CWB did not exist, higher variability in quantity, quality, and price might force these companies to manage risk through the futures exchange. These companies would incur additional costs in coordinating information and hiring experts in the futures market. Hence, the presence of the CWB may be a lower-cost solution to these companies than alternative risk spreading, such as the use of futures market options. The CWB may be able to extract premiums for many of these companies who are willing to pay for this lower risk. It may also be the case that the CWB can obtain premiums simply because the multinational trading firms may charge higher margins in a system where they did not have to deal with the CWB.

Test for Market Power

A key consideration in the debate over feed barley marketing in Canada is whether the CWB is able to price discriminate and, therefore, exert market power in world markets. To test for market power, actual CWB feed barley contract data by import market and sale date from 1980/81 through 1994/95 were examined. The data for sales made via Canada's ports on the West Coast during this period were aggregated on a f.o.b. vessel basis into the following regions: 1) Japan; 2) the United States; and 3) the rest of the world (ROW). A mean difference test was then conducted to examine whether

Table 1: Mean Difference Test of CWB Prices Achieved for Feed Barley

me Period	Japan - U.S.	U.S. - ROW[1] - Cdn $/mt -	Japan - ROW
980/81 - 1994/95	25.29*	4.46*	20.73*
980/81 - 1985/86	1.46	4.32	13.99*
985/86 - 1994/95	26.84*	4.47*	23.74*

ically different from zero with a probability greater than 95%.
rest of the world.
As calculated by authors.

stically significant differences existed among the s in these markets.

As indicated in the results, statistically significant ferences existed among the f.o.b. contract prices tained by the CWB in these markets (Table 1). Thus, WB has been able to price discriminate. The CWB's ity to price discriminate has allowed it to capture a gher price than would otherwise exist if there were ltiple sellers of western Canadian barley. Therefore, stern Canadian feed barley producers have benefited the CWB. The average difference between CWB con- ct prices for Japan and the United States, over the 1980/ through 1994/95 period, was significant and averaged 5.29/mt (tonne). The difference between CWB con- ct prices for the U.S. and ROW markets was also sig- ficant, with an average price difference of 1.46/mt. The difference between CWB contract prices Japan and the ROW markets was significant and raged $20.73/mt.

s shown in the results, the introduction of the U.S. and the resulting feed barley trade war between the ited States and the European Union increased the gree to which the CWB price discriminated. The ge difference between Japan and the United States e from $1.46/mt in the early 1980s to $26.84/mt in trade-war period. Similarly, the average difference ween Japan and the ROW increased from $13.99/mt the early 1980s to $23.74/mt.

mparing the CWB against Multiple ellers

In this study, data are used from every CWB sale of barley, 6-row malting barley and 2-row malting barley for the period 1985/86 through 1994/95. The data are compiled from CWB contract records. All prices are brought to a common basis point of either f.o.b. Vancouver or f.o.b. Thunder Bay. The sales data are aggregated into the following nine market segments: 1) Japanese feed market; 2) U.S. feed market; 3) all other offshore feed markets; 4) Canadian domestic 6-row malting market; 5) U.S. 6-row malting market; 6) offshore 6-row malting markets; 7) Canadian domestic 2-row malting market; 8) U.S. 2-row malting market; and 9) offshore 2-row malting markets.

The objective of CWB marketing is modeled as the allocation of the total quantity of barley that it received from producers in a given crop year across the above nine markets so as to maximize total sales revenue. In order to measure the impact that multiple sellers of Canadian feed and malting barley would have had on returns and trade flows, a comparison is made between the actual market structure (i.e., prices and quantities) observed under the CWB and the prices and quantities that would have existed if there were multiple sellers of Canadian feed and malting barley.

In this study, two economic models are developed to determine the extent of price discrimination by the CWB in world barley markets and the resulting benefits derived by western Canadian barley producers. The first model incorporates the market power of the CWB in world barley markets by assuming that the CWB allocates its sales in order to simultaneously maximize revenue across world feed barley markets, domestic and world 6-row malting barley markets and domestic and world 2-row malting barley markets. The equilibrium domestic feed barley price is assumed to be equal to the weighted average pooled price for CWB exports of all feed barley. Using actual CWB sales data for 1985/86 through 1994/95, the excess demand elasticity for each type of

Canadian barley in each market is determined by the model, given the domestic demand elasticity for Canadian feed barley and the excess demand elasticity for Canadian feed barley in the non-Japanese offshore markets. The demand elasticities are used to generate demand curves for Canadian barley in each market. The second model replaces the CWB with multiple sellers of Canadian barley by assuming that multiple sellers would introduce perfect competition in feed markets and malting barley markets. Under this assumption, the law of one price would hold across all feed barley markets and would also hold across all malting barley markets. The first and second models are compared to determine the economic benefits or losses incurred under the CWB.

The key difference between the CWB system and a multiple-seller system is the ability to price discriminate. In the absence of any constraints on the quantity of feed barley, 6-row malting barley, and 2-row malting barley available for sale by Canadian producers, the law of one price would have to hold for all international and domestic barley sales in a multiple-seller environment. In the model, multiple sellers were assumed to be fully competitive, and this competition resulted in one market price for feed barley and one market price for malting barley at any point in time. This is a characteristic of all competitive markets.

Overall Impact

The impact of introducing multiple sellers on Canadian feed and malting barley prices and total Canadian producer revenue is shown in Table 2 for each year from 1985/86 through 1994/95. Overall, the returns from CWB single-desk selling are significantly higher than would be the case in a multiple-seller environment. During the time period, the CWB earned an additional average return of $72 million annually over the multiple-seller scenario.

Impact on 6-Row Malting Barley

The introduction of multiple sellers in 1985/86 would have reduced the average price of Canadian 6-row malting barley by $95.70/mt. The annual average additional revenue or revenue "benefit" earned by the CWB for Canadian 6-row malting barley producers over

Table 2: Impact of Introducing Multiple Sellers on Canadian Feed/Malting Barley Prices and on Total Canadian Producer Revenue

Crop Year	Feed Barley Price $/mt	6-Row Malting Barley Price $/mt	2-Row Malting Barley Price $/mt	Total Producer Revenue[1] $ mln
1985/86	(4.91)	(95.70)	(80.93)	(104)
1986/87	(4.46)	(63.16)	(30.08)	(96)
1987/88	(11.36)	(84.08)	(13.18)	(156)
1988/89	1.10	(72.63)	(59.20)	(35)
1989/90	0.86	(37.18)	(47.90)	(19)
1990/91	(7.89)	(28.28)	(2.50)	(102)
1991/92	(7.90)	(9.17)	(19.23)	(96)
1992/93	(4.68)	(12.50)	(36.05)	(66)
1993/94	(2.62)	1.23	(16.05)	(48)
1994/95	6.62	(18.66)	(35.51)	7
Average	**(3.52)**	**(42.01)**	**(34.06)**	**(72)**

Note: Brackets indicate a loss for multiple sellers.
[1] Includes the impact on the domestic feed barley market.
Base Case:
Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.
Assumes the Canadian domestic feed demand elasticity is -0.53.
Assumes the malting barley price remains at a $15/mt premium to feed barley.
Source: As calculated by authors.

10 year period 1985/86 through 1994/95 was ...01/mt. The CWB earned a higher price for 6-row ...ting barley than multiple sellers would have earned ...l years but 1993/94. In this year, a multiple-seller ...tem would have earned a slightly higher price of ...3/mt.

...mpact on 2-Row Malting Barley

The introduction of multiple sellers would have ...uced the annual average price for Canadian 2-row ...lting barley by $34.06/mt from 1985/86 through ...4/95. The CWB prices were higher in every year. The ...gest premium was $80.93/mt in 1985/86 and the ...west premium was in 1990/91 at $2.50/mt.

...mpact on Feed Barley

From 1985/86 through 1994/95, the introduction of ...ltiple sellers would have reduced the annual average ...ce for feed barley in Canada by $3.52/mt (Table 2). ...e CWB returned the highest revenue benefits to ...nadian producers relative to the multiple-seller ...nario in 1987/88 ($11.36/mt). The CWB also obtained ...ded revenue in 1985/86, 1986/87, and 1990/91 through ...93/94. However, the multiple-seller structure would ...ve returned higher revenue relative to the CWB in feed ...rkets in 1988/89, 1989/90, and 1994/95 ($1.10/mt, ...86/mt and $6.62/mt, respectively).

As a caveat to the above, during the 1988/89 and ...89/90 crop years, Japan did not represent the highest ...ue market for CWB sales of feed barley. Because of ...global shortage of feed barley in those years, the CWB ...tained a price that was significantly higher than the ...anese price (in excess of $15/mt) on approximately ...0,000 mt of sales to offshore markets other than ...an. However, the results (Table 2) were based on a ...del with four regions of demand for feed barley (i.e. ...an, the U.S., the ROW, and the Canadian domestic ...rket). By aggregating these higher-priced markets ...th the ROW, the difference between the ...anese price and the price in the ROW was reduced. ...s gave the appearance that the CWB was unable to ...ce discriminate during the 1988/89 and 1989/90 crop ...rs. To address this issue, the results for the 1988/89 ...1989/90 crop years were recalculated with the ...ions of feed barley demand being redefined. ...ecifically, Japan was aggregated with the ROW and ...ated as a separate region by those markets in which ...CWB obtained a substantial premium. With the introduction of multiple sellers, feed barley prices would have decreased by $1.70/mt in 1988/89 and increased by $0.07/mt in 1989/90. From 1985/86 through 1994/95, the introduction of multiple sellers would have resulted in an average annual decrease in Canadian feed barley prices of $3.88/mt.

Impact on Total Producer Revenue

If multiple sellers would have replaced the CWB, producers' revenues would have decreased by an average of $72 million per year for the period 1985/86 through 1994/95. Under a multiple-seller scenario, the change in revenue would have ranged from a loss to Canadian feed and malting barley producers of $156 million in 1987/88, to a gain of $7 million in 1994/95. The 1994/95 year would have been the only year to show a gain under the multiple-seller structure. Generally, the magnitude of the increases in total revenue attributed to the single-desk structure followed the same pattern as the per-unit EEP subsidies provided by the United States on feed barley sales to the ROW.

Costs of Single-Desk Selling

We identify the additional revenue from barley sales that the CWB derives from the marketplace though price discrimination. However, there still remains the issue of the costs associated with the CWB as a single-desk seller. For example, Carter (1993) and KenAgra (1996) identified price pooling and the lack of a clear price signal as costs to the western Canadian feedgrain industry. This study finds these costs to be overstated.

Pooling Price Arbitrage Losses

The CWB currently uses an annual pooled return to allocate sales revenue to producers. This mechanism does not provide a signal to producers that fully responds on a timely basis to changing market conditions within a given marketing year. If export market prices change substantially during a crop year, the prevailing pooled return will not reflect this change on a timely basis. This creates some economic losses because the export value of feed barley at a given point in time is not reflected in the CWB Pool Return Outlook (PRO), nor in the cash price in the domestic feed barley market in Western Canada.

Arbitrage losses resulting from the operation of the

CWB's annual pool for feed barley are calculated by measuring the difference in the change in price of feed barley at two U.S. points (Great Falls, Montana and Devils Lake, North Dakota) relative to the price of feed barley at Lethbridge, Alberta from the beginning of the crop year for the period from 1988/89 through 1995/96. The efficiency loss from price pooling averaged $4.9 million per year for both the Great Falls, Montana and Devils Lake, North Dakota comparisons with most of the losses concentrated in the 1995/96 crop year (Table 3). The 1995/96 crop year was unique as during this year international prices rose dramatically after the beginning of the crop year due to a significant reduction in U.S. corn production at a time of low carryover stocks of feedgrains. This created a large price wedge between the Canadian domestic feed barley price (which reflected the PRO) and the Great Falls/Devils Lake feed barley prices.

Price Variability in Feed Barley Markets

From a livestock producer's perspective, the issue of price variability is of major concern. Three measures of feed barley price variability are calculated in this study:

1) the variability in the price of barley within the crop year;
2) the variability of barley prices in the subsequent six-month period; and
3) the variability of barley prices relative to U.S. corn prices.

To compare barley price variability, Lethbridge off-Board feed barley prices were compared to the U.S. feed barley prices at Great Falls, Montana and Devils Lake, North Dakota. As shown in column 1 of Table 4, the average annual standard deviation in the Lethbridge cash price, from 1988/89 through 1995/96, was $7.88/mt. This indicates that the average September cash price in Lethbridge was on average $7.88/mt above or below the average price for the crop year. This compares to $7.88/mt and $7.23/mt measured at Great Falls and Devils Lake, respectively. Comparisons, among Canadian and U.S. feed barley prices for each month relative to the subsequent six months (column 2 of Table 4) from 1988/89 through 1995/96, show similar levels of variability. As well, substantial differences do not appear to exist in the variability of Canadian and U.S. feed barley prices relative to U.S. corn prices in the Pacific Northwest (PNW) (column 3 of Table 4). This analysis suggests that Canadian feed barley prices do not exhibit anymore variability than U.S. feed barley prices.

Carter and Loyns

As shown in our empirical results and confirmed by the analysis in this report, it is clear that the CWB has been able to exercise market power to the benefit of western Canadian farmers. However, Carter and Loyns (1996) argued that there are extra costs due to the CWB's marketing of barley calculated at roughly $37/mt.

Our general conclusion is that while some of the costs addressed by Carter and Loyns are present in the Canadian system, they are not unique to CWB grain marketing and would be incurred by producers and government in the absence of the CWB as a single-desk seller. Part of the problem with the study by Carter and Loyns is that the methodology upon which their cost estimates were based was not spelled out. From a methodological standpoint, when the CWB is placed in the context of the entire Canadian grain regulatory framework, many of the costs that Carter and Loyns attribute to the CWB would disappear. It is possible that costs could be higher in the absence of the present regulatory framework and the CWB.

Conclusions

This study clearly establishes that the single-desk selling of barley creates more sales revenue for western Canadian farmers than would be created if there were multiple sellers due to the ability of the CWB to exercise market power on behalf of western Canadian farmers. The magnitude of the additional revenue created varies for different years depending upon a number of factors, including the occurrence and degree of export subsidization in feed and malting barley markets.

Given the dominance of the CWB as a marketer of malting barley in a relatively small world malting barley market, it is not surprising that the benefits of the CWB's single-desk status are largest for malting barley. In contrast to the situation with malting barley, the CWB is a somewhat smaller player in the world feed barley market and, as a result, its ability to exercise market power through price discrimination, while significant, has less of an overall impact on prices.

One of the common criticisms of the CWB marketing system is the lack of arbitrage between the CWB feed barley pool return, western Canadian feed barley prices and international feed barley prices. This study addresses this problem using formal economic analysis to estimate

Table 3: Canada-U.S. Barley Price Movements and Arbitrage Efficiency Losses

	Arbitrage Efficiency loss* - $ mln -		Price movement difference** - $/mt -	
	Great Falls	Devils Lake	Great Falls	Devils Lake
1988/89	5.154	4.068	16.69	14.43
1989/90	2.404	5.334	11.60	17.46
1990/91	1.409	.813	(6.27)	(3.82)
1991/92	.541	.624	(0.86)	(2.71)
1992/93	.129	.286	(0.46)	(1.45)
1993/94	2.355	2.088	(10.60)	(9.60)
1994/95	6.006	6.875	17.30	19.08
1995/96	21.067	18.955	(33.05)	(31.10)
88/89-95/96 Ave.	4.883	4.880	(0.71)	0.29

Source: Calculated from weekly average spot barley prices. Lethbridge barley price: high end of daily range data extracted from AGDATA database, Alberta Agriculture, Food And Rural Development; Devils Lake: local cash prices as reported in AGWEEK; Great Falls: feed barley prices (cash) USDA - Montana Grain Weekly Summary.

* Domestic demand elasticity = -.53

** Price movements (Lethbridge less U.S. prices) for each week were calculated versus the average price in the first week of the September.

Table 4: Monthly Average Cash Barley Price Variability, 1988/89 - 1995/96*

	Crop Year	Subsequent 6 Months**	PNW Corn-Barley Basis
		- $/mt -	
Lethbridge Barley	7.88	6.48	11.19
Great Falls Barley	7.88	6.04	10.72
Devils Lake Barley	7.23	5.57	11.62
PNW Corn	11.45	8.95	0

* Standard deviation.

** The absolute average of the difference between the average feed barley price in each month relative to the average price in the subsequent 6 months.

Source: As calculated by authors.

associated losses. These losses are small relative to price premiums earned by the CWB. Even so, they could have been significantly reduced by providing the CWB with added flexibility, including cash trading.

From a policy perspective, the results from this study provide additional information to policy makers and producers regarding difficult choices among alternative marketing structures for Canadian barley. Issues such as equity and producer risk management are not addressed. However, it is clear that the CWB has been able to earn additional revenue from the sale of western Canadian barley over what would have been achieved under multiple sellers.

Many issues have been raised including those presented in a highly controversial report by Carter and Loyns. After an examination of the costs of single-desk selling identified by Carter and Loyns, it is clear that while some of the costs are present in the Canadian system, they are not unique to CWB grain marketing, and would be incurred by producers and government in the absence of the CWB as a single-desk seller. This does not mean these costs should be disregarded in policy analyses. Ways in which the Canadian grain marketing system can be made more efficient need to be constantly examined. Policies that would result in a reduction in these costs should be explored further.

I. Introduction

Key Questions

Over the past 25 years, there has been considerable debate regarding the most appropriate barley marketing system for Western Canada. At the center of this debate is the operation of the Canadian Wheat Board (CWB), which is the monopoly, or single-desk seller, of western Canadian feed and malting barley for export destinations. In the domestic market, the CWB is the sole seller of western Canadian barley for human consumption, but operates alongside an open cash market for domestic feed barley in Western Canada. The open market for domestic barley producers and users has been increasing in size and importance over this same time period.

The key questions in this debate are as follows:

1) Does the CWB deliver higher returns to western Canadian feed and malting barley producers than would be the case if the marketing of barley were to be handled by multiple sellers?
2) Are there benefits provided to producers through the price pooling operations of the CWB?
3) What are the inherent problems of arbitrage between the annual pooled return provided by the CWB and the cash off-Board market price?
4) Are there additional marketing costs brought about by the existence of the CWB over those that would exist in a multiple-seller environment?

Policy and Operational Alternatives

The recent debate has focused on a range of policy and operational alternatives. These include:

a) a continental barley market (CBM) in which there would be a multiple-seller environment for feed and malting barley in the United States and Canada, but the CWB single-desk system for all other markets would continue;
b) a dual market for feed and malting barley in which a multiple-seller environment would exist for Canadian barley in all markets;
c) a hybrid system in which a full open market would exist for feed barley sales to all markets while the CWB would remain as the single-desk seller in all malting barley markets;
d) alternative governance structures for the CWB; and
e) alternative operational approaches such as cash trading for the CWB to alleviate problems of arbitrage between the off-Board prices and the annual CWB pooled return.

Several economic studies of the Canadian barley marketing system and several government processes have directly addressed the national and international issues involved in the debate. These included a federal government Round Table process in 1992/93 that funded a study by Carter (1993) and led to a federal Ministerial decision by the Honourable Charles Mayer to create a CBM beginning August 1, 1993. This change in marketing structure was reversed by a federal court ruling on September 10, 1993. Following this, in 1994/95, the Canada-U.S. Joint Commission on Grains examined issues relating to the potential for harmonization of the Canadian and U.S. marketing systems. The results of the Commission were provided to a federally-appointed Western Grain Marketing Panel (WGMP) in 1995/96, who were mandated to examine all issues in the western Canadian grain marketing industry. The WGMP made several recommendations to the federal government that would (1) increase the operational flexibility of the CWB in procuring grain from producers, (2) provide payment

alternatives to increase flexibility of cash flow, (3) change the governance structure of the CWB to allow for direct producer control of the organization through a board of directors with producer-elected representatives, and (4) establish a full open market for feed barley, with participation by the CWB, and a continuation of the single-desk selling of malting barley by the CWB.

The current Minister of Agriculture, the Honourable Ralph Goodale, announced on October 7, 1996, that the Government of Canada would implement the majority of the operational and governance recommendations of the WGMP. The Panel's recommendation to create a full open market for feed barley sales while maintaining the single-desk status of the CWB in malting barley markets was not accepted. The Minister of Agriculture announced that a producer vote should take place on this issue.

Studies that have analyzed the effects of the operations of the CWB in the barley market have a number of limitations. First, no study has rigorously integrated the feed and malting barley markets in Canada and throughout the world. All of the studies to date have generally modeled the CWB's effect on the feed grain market separately from its effect on the malting barley market. No study has examined and modeled the world malting barley market in a manner that has come close to paralleling the analysis of the feed grain sector. Rather, in some cases, assumptions were made about the link between feed barley prices and malting barley prices. In other cases, malting barley price premiums were calculated by comparing Canadian and U.S. prices. Clearly, from an analytical perspective, these approaches have major limitations. These studies suffered from major data limitations because they had little or no access to actual CWB sales prices and contract terms. Finally, although problems of arbitrage were identified in some of these studies, very little was done to formalize the concept of arbitrage in the context of CWB price pooling. Furthermore, no study attempted to quantify these effects within a formal economic framework.

The analysis of the appropriate direction for western Canadian producers' marketing of barley has been complicated by several international and domestic factors. These include: (1) the presence of government policies such as the U.S. Export Enhancement Program (EEP), which was a significant subsidy to U.S. export sales of barley over the 1985/86 through 1994/95 period; (2) the production and export subsidy programs of the European Union; and (3) the predominance of state trading agencies, including the CWB, the Australian barley boards, the U.S. Commodity Credit Corporation and the E.U. Cereals Management Committee.

Study Objectives

In light of the overall uncertainies for barley marketing that are outlined above, additional information is needed to resolve many of the outstanding issues surrounding the marketing of Canadian barley. Using formalized and integrated economic analysis, the overall objective of this study is to evaluate the economic performance of the CWB with respect to the domestic and international marketing of both feed and malting barley. The specific objectives of this study are to:

1) provide an overview of the world barley trade for both malting and feed barley (Chapter 2);
2) review previous studies that have examined the role of the CWB in the domestic and international barley market (Chapter 3);
3) develop a theoretical framework to examine the CWB's role in domestic and international feed, malt and malting barley markets, and the potential for the CWB and other market participants to exercise market power (Chapter 4);
4) test, using actual CWB contract data for the period 1980/81 through 1994/95, whether the CWB exhibits market power in the international feed barley market (Chapter 5);
5) estimate the returns from single-desk selling using an economic model which incorporates actual CWB sales transaction data (Chapter 5);
6) use historical price data to estimate arbitrage losses resulting from annual price pooling (Chapter 6); and
7) review and evaluate the additional marketing costs that have been attributed to the CWB in previous studies (Chapter 6).

II. The World and Canadian Barley Markets

The world markets for feed and malting barley are characterized by a concentration of buyers and sellers in world trade and market distortions created by government involvement in production, marketing, and trade. With the introduction of the U.S. EP in 1985, international barley trade from 1985/86 through 1994/95 was highly subsidized. This subsidization, combined with the concentration of buyers and sellers of both feed and malting barley, resulted in a market structure that is difficult to model and understand conceptually.

Market Overview

World Barley Production

World barley production averaged 169.4 million tonnes (mmt) from 1985/86 through 1994/95. The European Union was the largest barley producer with an average of 49.5 mmt, followed by the Russian Federation at 24.8 mmt, Canada at 12.4 mmt, the Ukraine at 10.4 mmt, and the United States at 7.8 mmt.

World Barley Trade

World barley trade averaged 17.5 mmt from 1990/91 through 1994/95. Over the same period, five importers—Saudi Arabia (5.6 mmt), the Russian Federation (1.8 mmt), Eastern Europe (1.1 mmt), Japan (1.6 mmt), and China (1.0 mmt)—accounted for roughly 60% of all barley imports.

The exporters of bulk barley (calculated excluding malt) were also very concentrated. For the 1985/86 through 1994/95 period, the European Union had 38.9% of the world export barley market (7.0 mmt), Canada's share was 22.1% (3.9 mmt), Australia had 13.7% (2.4 mmt) of the market and the United States had 10.3% (1.8 mmt).

Table 2.1: Export Market Shares, Major Barley Exporters*

	1995/96		1996/97	
	mmt	%	mmt	%
Australia	3.3	27.1	3.0	23.7
Canada	2.6	21.6	3.4	26.9
European Union	3.0	25.0	3.5	27.7
United States	1.1	9.2	0.8	5.9
Others	2.1	17.2	2.0	15.8
Total	12.0	100.0	12.6	100.0

*Excludes barley malt.
Source: USDA, Foreign Agricultural Service, Circular Series, FG 6-96, Page 31, Grain: World Market and Trade.

illustrated in Table 2.1, the European Union, a, and Australia together are forecasted to have 78% export market for feed and malting barley in 1996/ With the addition of market share for the United the top four exporters make up about 80% of the export market. This makes the marketing structure sport policies of each of these countries important mining the structure of trade.

World Feed Barley Market

world barley trade, approximately 85% is feed During the 1990/91 through 1994/95 period, the European Union exported an average of 7.0 mmt of barley (40% of world trade) per year, of which 90% was feed barley. About 41% of E.U. barley exports went to Saudi Arabia, all of which was feed barley.

Even with large EEP subsidies, the U.S. market share remained below Canada's share for the 1985/86 through 1994/95 period. For the 1996/97 crop year, Canada's market share for barley is forecast to rise to 26.9%, while the E.U. share is forecast to drop to 27.7%. Australia, Canada, and the European Union together are forecasted to have 78.3% of the barley export market.

Canada was the world's second largest feed barley

Table 2.2: Major Malting Barley Exporters and Importers by Rank and Canada's Market Share

	Exports					
	1990/91	1991/92	1992/93 Average	1993/94	1994/95	5-Year
	'000 mt					
	1,013	769	746	1,325	785	928
	638	936	335	807	1,388	821
	100	282	117	390	567	291
	147	115	73	53	194	116
	143	182	163	40	27	111
	174	235	286	150	220	213
	2,215	2,519	1,720	2,765	3,181	2,480
Market Share	29	37	19	29	44	33
	Imports					
September	1990/91	1991/92	1992/93 Average	1993/94	1994/95	5-Year
	'000 mt					
	877	1,044	665	1,167	1,377	1,026
	340	282	92	496	721	386
	165	296	139	160	161	184
	120	182	146	208	181	167
	90	23	108	65	101	77
	150	41	51	40	80	72
	73	62	80	75	70	72
	28	12	56	129	105	66
	43	76	45	67	70	60
	69	46	54	47	43	52
	13	38	36	42	69	40
	10	33	35	20	16	23
	29	25	22	20	15	22
	25	25		25	10	21
	8	6	8	10	5	7
	175	328	183	194	157	207
	2,215	2,519	1,720	2,765	3,181	2,480

individual experts reports and private sources.

exporter from 1990/91 through 1994/95. Total barley exports averaged 3.4 mmt per year, and of this total, 2.6 mmt was feed barley. However, as a percentage of total Canadian barley exports, feed exports fell from 86% in 1990/91 to 54% in 1994/95. During that time, Canada's main feed barley export markets were Japan, Saudi Arabia, and the United States.

Australia was the third most important barley exporting country, with average exports from 1990/91 through 1994/95 of 2.5 mmt, of which about 1.5 mmt was for feed purposes. Australia's primary feed barley export markets were Japan, Saudi Arabia, and Taiwan. The fourth major exporter, the United States, averaged exports of approximately 1.6 mmt of barley from 1990/91 through 1994/95, of which almost all was feed barley.

Saudi Arabia was the largest feed barley import market in the world with average annual imports of 4.6 mmt over the 1990/91 through 1994/95 period (approx. 35% of world feed barley trade). Japan was the second largest barley importer with 1.6 mmt per year for the 1990/91 through 1994/95 period, of which approximately 95% was feed barley.

The World Malting Barley Market

Since 1990/91, world malting barley trade increased by 44% to 3.2 mmt in 1994/95 (Table 2.2). The major exporters of bulk malting barley were Australia, Canada, and the European Union. These three exporters accounted for about 80% of the world malting barley exports over 1990/91 through 1994/95, with market shares of about 37%, 33%, and 10%, respectively.

China and the United States accounted for more than half of world malting barley imports (Table 2.2). Chinese demand was a key factor in the world malting barley market since it comprised roughly 40% of world imports from 1990/91 through 1994/95. In 1994/95, China imported about 1.4 mmt of malting barley—57% more than in 1990/91. Canada's share of the Chinese market increased from 25% in 1992/93 to an estimated 45% in 1995/96.

Canada's malting barley export market share increased from 19% in 1992/93 to over 44% in 1994/95. Market share for 1995/96 and 1996/97 is expected to be over 40%. The United States and China are expected to be Canada's largest customers over this time period.

More than 80% of the malting barley traded worldwide consists of 2-row malting barley varieties. Australian and Canadian offshore malting barley exports are virtually all 2-row varieties. As well, E.U. malting barley exports are almost entirely 2-row varieties.

Canadian Barley Production and Markets

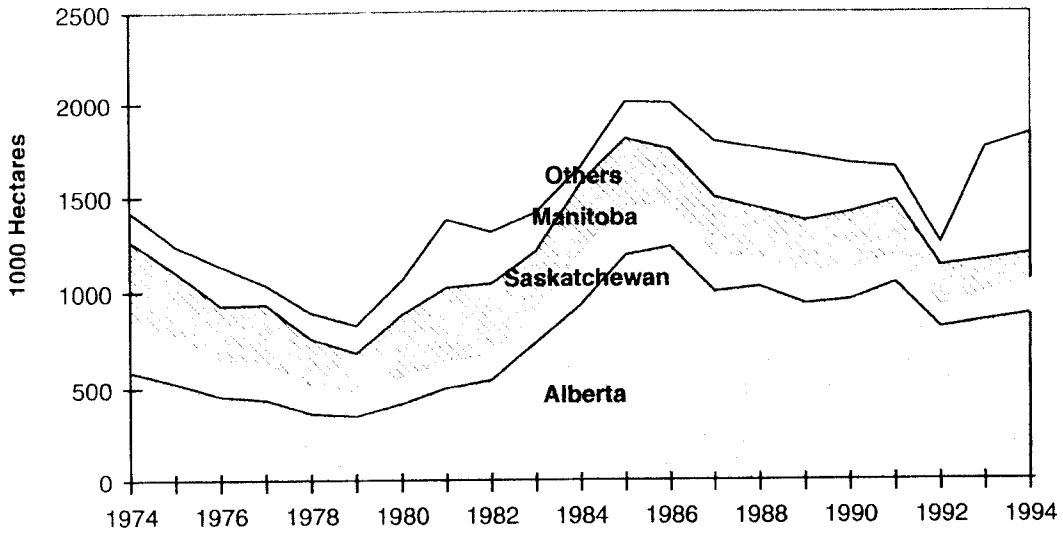
The area planted in Canada to feed barley varieties by region from 1974 through 1994, is illustrated in Figure 2.1. Alberta had the largest area seeded to barley over the entire period.

The total Canadian barley area planted to each type of barley from 1970 through 1994 is shown in Figure 2.2. Plantings of feed and 2-row malting barley increased over time while plantings of 6-row malting barley decreased significantly. Canadian feed barley plantings increased from 671,000 hectares in 1970 to 1,414,000 hectares in 1994. The area planted to 2-row malting barley varieties increased from 733,000 hectares in 1970 to 1,866,000 hectares in 1994. The area planted to 6-row malting barley varieties decreased from 2,600,000 hectares in 1970 to only 811,000 hectares in 1994. In 1994, 35% of the total Canadian barley area was seeded to feed varieties, 45% was seeded to 2-row malting varieties, and 20% was seeded to 6-row malting varieties.

While producers planted malting barley varieties on more than 60% of their barley acreage, weather and other factors reduced the supplies of malting barley available for both domestic and export customers. As a result, only a small percentage of the malting barley produced in Canada was exported. Malting barley for export and domestic use generally represented less than 20% of all feed and malting barley produced (Table 2.3). The largest percentage of Canadian production was used domestically for feeding purposes (60-80%). Less than 50% of Canadian production was exported.

U.S. Barley Production and Markets

The United States can be segmented into three distinct barley growing regions. The midwest region contains North Dakota, Minnesota, and South Dakota, which comprise roughly one-half of the entire U.S. barley area. The area planted to malting and feed varieties in the midwestern U.S. from 1970 through 1994 is shown in Figure 2.3.[1] In 1994, North Dakota farmers seeded 971,000 hectares of barley while Minnesota and South Dakota seeded 263,000 and 160,000 hectares, respectively. In 1980, 88% of midwest barley plantings



Source: T. Schmitz and W. Koo.

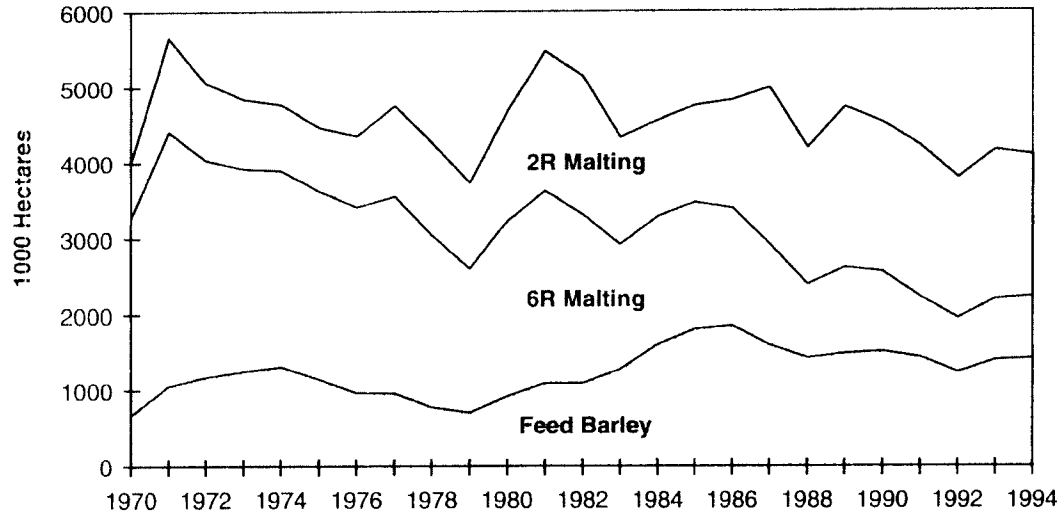
Figure 2.1: Area Planted to Feed Barley Varieties in Canada

...re 6-row malting varieties. This number declined to ...% in 1994.

The western region contains Montana, Idaho, ...ashington, Oregon, Colorado and Wyoming. These ... states comprise over 40% of all barley planted in the ...ited States. The areas planted to feed, 2-row malting ...d 6-row malting barley in the western United States ...m 1970 through 1994 are shown in Figure 2.4. The ...tal area seeded to barley peaked in 1985 at 2.2 million ...ctares and steadily decreased to a level of 1.1 million ...ctares in 1994. In 1994, 71% of total plantings were ...d varieties while 24% and 5% were 2-row and 6-row malting varieties respectively.

The third region includes California and the rest of the United States. This region accounted for roughly 10% of total barley area in the United States (350,000 hectares in 1994). Virtually all barley planted in this region consisted of feed varieties.[2]

U.S. exports and imports of barley along with domestic use are outlined in Table 2.4. The United States is a net exporter of feed barley and a net importer of malting barley.



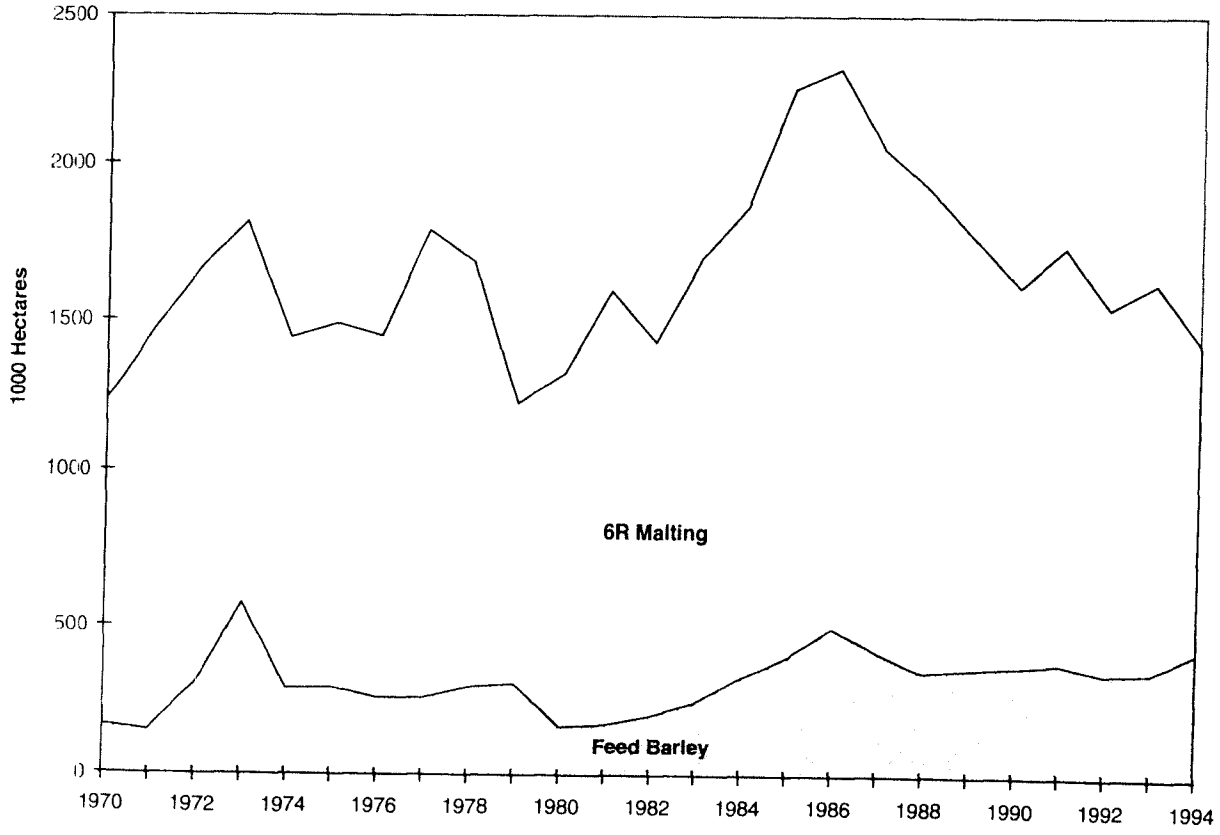
Source: T. Schmitz and W. Koo.

Figure 2.2: Area Planted to Different Barley Varieties in Canada

Production and Malting Barley Use

		Malting Barley			
		Exports*	Domestic Use	Total	Malting Barley as % of Total Barley Production
	'000 mt	'000 mt			%
1985	12,387	53	592	645	5.2
1986	14,568	329	697	1,026	7.0
1987	13,957	498	564	1,062	7.6
1988	10,212	325	748	1,073	10.5
1989	11,784	181	629	810	6.9
1990	13,441	637	817	1,454	10.8
1991	11,617	935	749	1,684	14.5
1992	11,032	337	580	917	8.3
1993	12,972	857	871	1,728	13.3
1994	11,690	1,388	872	2,260	19.3

*Crop year beginning 1985/86
Source: CWB Annual Reports.
T. Schmitz and W. Koo.



Source: T. Schmitz and W. Koo.

Figure 2.3: Area Planted to Barley in the Midwestern United States

Comparison of Canadian and U.S. Consumption

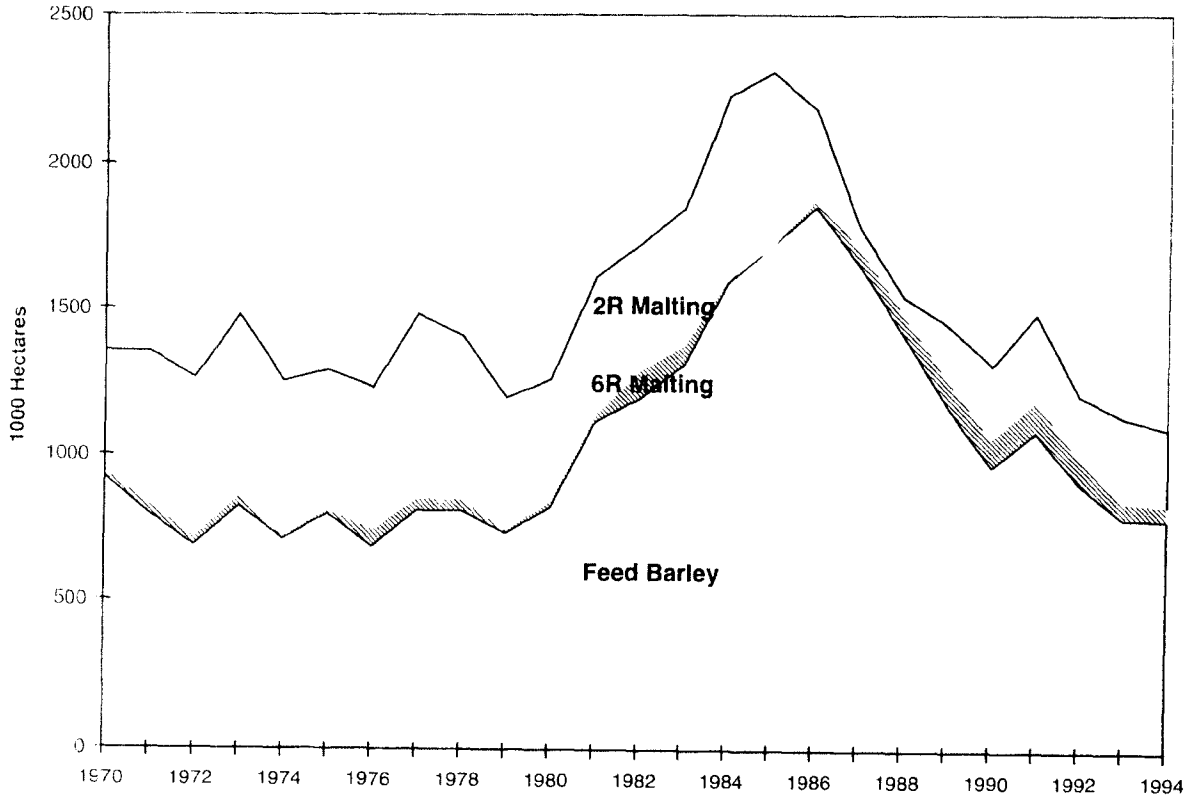
The consumption of feed and malting barley in both the United States and Canada is shown in Table 2.5. Note that Canada's feed consumption was generally higher than in the United States, whereas malting barley consumption was much higher in the United States. Between 30% and 40% of barley production in the United States was used for malting purposes, which was well above the Canadian percentage. In terms of seeded acreage, a greater percentage of malting barley planted in the United States was used for malting purposes as compared to Canada. In North Dakota, for example, the percentage was 70% to 80%, while in Saskatchewan the percentage was 20% to 30%.

The Australian Barley Market

Australia produces barley in five states: South Australia, Victoria, Western Australia, New South Wales, and Queensland. A small amount of barley is also grown in Tasmania. Australia covers a huge area, but most grain is produced near the region spanning the southwest to southeast coasts. Sheep and wheat compete with barley for land. It is common practice in Australia to rotate land use between wheat, 2-row barley, and sheep grazing.

Australian barley producers plant 2-row varieties almost exclusively. The Australian Bureau of Statistics reported that in 1987, only 107,000 hectares of 6-row barley were planted in Australia along with 2.2 million hectares of 2-row barley. After 1987, the percentage of 6-row barley in Australia declined even further.[3]

The total barley area planted in Australia increased from 1.8 million hectares in 1974 to a record high of 3.5 million hectares in 1984. It dropped significantly in 1986 due to the low pooled price in 1985. It reached another peak in 1993 at 3.4 million hectares. In 1994, the projected area was 2.5 million hectares, nearly one million hectares less than 1993 due to low pooled returns in 1993. Unfortunately, consistent data were unavailable for the percentage of barley planted to malting varieties in each Australian growing region. The Australian Barley Board only reported figures for South Australia and Victoria. In Victoria, from 1989 through



Source: T. Schmitz and W. Koo.

Figure 2.4: Area Planted to Barley in the Western United States

Table 2.4: United States Barley Production, Exports and Imports

Year	Production	Exports*		Imports*	
		Total	Malting Barley	Feed Barley	Malting Barley
		'000 mt			
1985	12,850	755	—	—	—
1986	13,249	2,938	—	—	—
1987	11,354	2,810	—	—	—
1988	6,314	1,718	—	—	—
1989	8,800	1,798	—	—	—
1990	9,912	1,507	147	48	340
1991	10,110	2,090	115	192	282
1992	9,908	1,611	73	90	92
1993	8,666	1,553	53	131	496
1994	8,162	1,355	194	534	721

*Exports and imports are for crop years.
— Not calculated.
Source: T. Schmitz and W. Koo.

993, an average of 88% of barley planted was malting rieties. On the other hand, South Australia had an erage of only 35% seeded to malting varieties over the me period.

The E.U. Barley Market

n the European Union, barley varieties differ depend- g upon whether they are planted in the fall or the spring. Winter barley is usually used in rotation with other crops nd is typically grown for use as feed. The southern egions of the European Union (Italy, Greece, and Portu- al) do not grow significant quantities of spring arley. On the other hand, the northern regions Sweden and Finland) do not grow significant quantities winter barley. The majority of area planted to winter rley in the European Union is 2-row feed varieties though some regions (notably France) grow significant quantities of 6-row winter varieties as well. Spring barley can be of feed or malting quality. Because Europeans use 2-row varieties for malting almost exclusively, nearly all spring malting varieties are 2-row. The market for 6-row malting barley in the European Union is almost nonexistent.

The estimated area planted to spring barley for each country in the European Union is shown in Table 2.6.[4] In 1994, Spain had the largest area (2.2 million hectares), followed by Greece (780,000 hectares). Denmark, France, the United Kingdom, and Finland each had roughly 475,000 hectares of spring barley. There was a consistent downward trend in the area planted to spring barley since 1980 with the exception of Germany and Spain. The increase in area planted in Germany after 1989 can be attributed to the unification of East and West Germany. The Spanish spring barley area was on an upward trend from 1981 through 1992, but dropped

Table 2.5: Feed and Malting Barley Consumption in the United States and Canada

Year	Feed Barley Consumption		Malting Barley Consumption	
	United States	Canada	United States	Canada
	'000 mt			
1990	5,041	7,498	3,508	817
1991	5,191	7,560	3,555	749
1992	4,255	7,088	3,449	580
1993	5,841	8,211	3,547	871

Source: T. Schmitz and W. Koo.

993 and 1994. In 1980, the total area planted ring barley in the European Union was 8.9 mmt. By his level dropped to 5.7 mmt.

estimated area planted to winter barley for each in the European Union from 1980 through 1994 in Table 2.7. In 1994, Spain and Germany had gest area (1.4 and 1.3 million hectares respectively), d by France and the United Kingdom. Unlike the barley case, the area planted to winter barley in opean Union did not start to decline until 1985 decreased at a slower rate than the spring barley In 1980, the winter barley area planted was lion hectares. The area increased to 7.6 million s in 1985 and has steadily declined since then. In otal winter barley area was down to 5.3 million . The total barley area in the European Union d from 16 million hectares in 1980 to 11 million s in 1994.

Impact of Government Programs on the World Barley Market

The two most important programs affecting the world barley export market are the U.S. EEP and the E.U. Export Restitution Payments. These programs are discussed below.

The U.S. Export Enhancement Program

EEP, established under the 1985 Farm Bill, provided subsidies to U.S grain companies on certain grain shipments sold to targeted countries. Algeria, Bulgaria, Cyprus, Egypt, the former Soviet Union, Iraq, Israel, Jordan, Morocco, Poland, Romania, Saudi Arabia, and Tunisia all benefited from lower prices due to EEP subsidies for feed barley. China (1994) and Slovenia (1993) benefited from EEP subsidies for malting barley, but as of 1994/95, they each received only one EEP shipment of malting barley. Since 1985 (with the exception of 1988 and 1989), virtually all feed barley export sales received substantial EEP bonuses. In 1988, only 35% of sales

Table 2.6: Area Planted to Spring Barley in the European Union.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
							(1000 Hectares)								
	224	217	204	204	196	200	199	174	175	175	175	162	165	159	156
m & Lux.	37	34	36	28	22	31	28	27	33	24	17	14	15	17	18
	1570	1535	1467	1288	976	1044	1027	890	1110	914	769	770	759	534	525
	533	570	540	550	566	646	589	583	682	517	486	541	473	458	470
	1196	1081	1093	797	669	863	685	587	587	479	368	389	441	519	480
(East)	322	320	326	295	288	293	297	296	290	292					
(West)	820	745	1055	775	669	760	681	629	726	682	913	1006	909	738	780
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	291	282	255	231	250	265	251	244	240	238	211	198	174	139	137
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
nds	41	39	37	27	23	32	33	42	56	42	29	35	28	36	41
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1778	1744	1798	1858	1884	2031	2356	2187	2235	2465	2528	2562	2470	1970	2197
	648	681	635	618	644	667	638	545	537	477	468	460	432	420	450
Kingdom	421	1503	1344	1240	964	940	957	862	1022	722	633	551	514	516	475
al Spring	8881	8751	8790	7910	7151	7772	7741	7066	7693	7027	6597	6687	6379	5506	5729
al Winter	7059	7052	6659	7158	7914	7616	7391	7440	6892	6850	6922	6630	6348	5787	5261
AI	15940	15803	15449	15068	15065	15388	15132	14506	14585	13877	13519	13318	12728	11292	10990

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received EEP bonuses while roughly 55% of sales in 1989 received bonuses. The weighted average of EEP bonuses per shipment from 1986 through 1994 (excluding 1988 and 1989) was $39.33/mt. However, as result of the 1988 drought and lessened international competition, the average EEP bonuses in 1988 and 1989 were only $6.49/mt and $12.11/mt, respectively.

Yearly U.S. feed barley exports versus those exports that have received EEP subsidies are illustrated in Figure 2.5. More than 90% of feed barley exports received EEP bonuses from 1990 through 1993. For the entire EEP period, (1986 through 1993) more than 80% of all exports received bonuses under EEP.

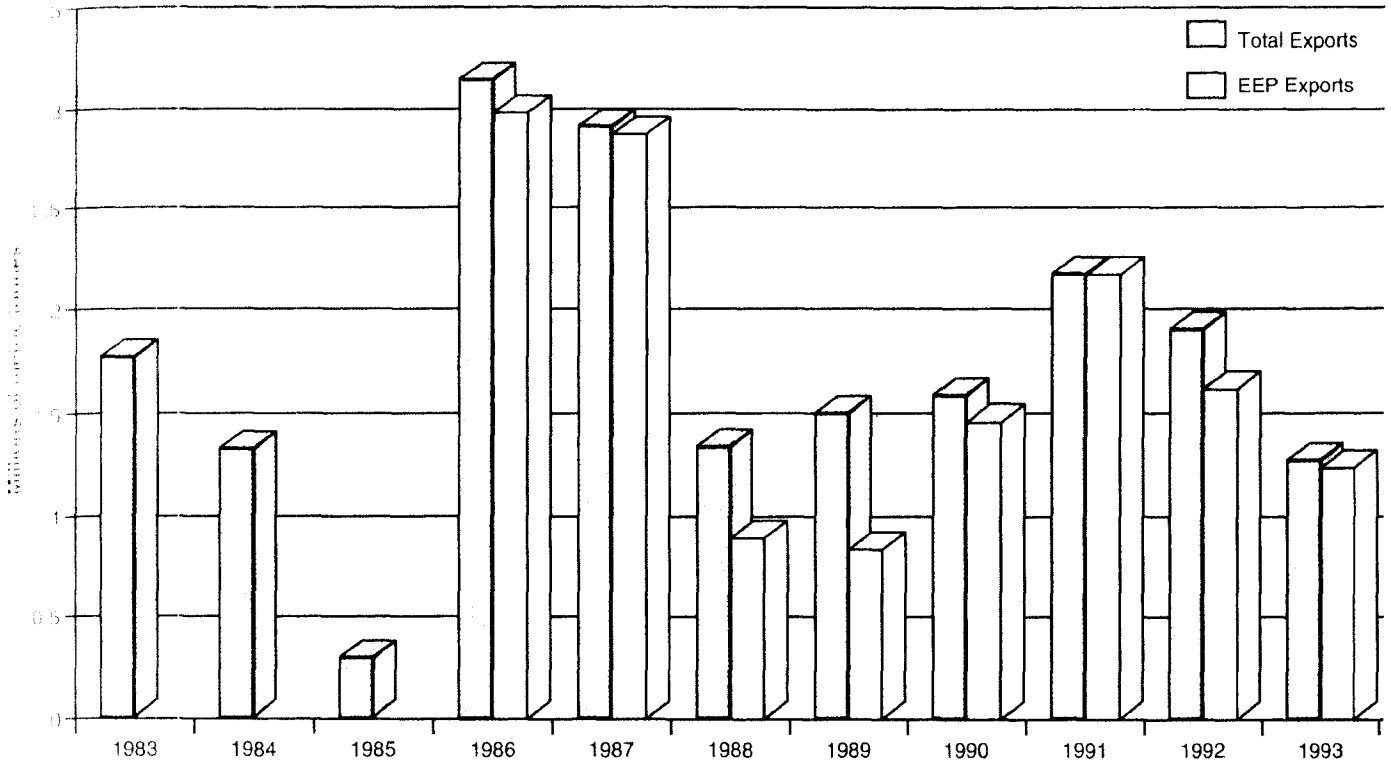
The main impact of EEP is to keep the U.S. domestic price high while decreasing returns for other exporters of barley. The monthly weighted average per unit EEP bonus versus the U.S./Canada price spread for spot cash feed barley from 1980 through 1995 is shown in Figure 2.6. During the period from January 1980 through May 1986, the United States did not provide any EEP subsidies for feed barley. In Figure 2.6, when the dark line is above the axis, it indicates that the U.S. cash feed barley price for No. 2 feed was higher than the Canadian cash feed barley price for No. 2 feed. Similarly, when the dark line is below the axis, it indicates that the Canadian feed barley price was higher than the U.S. feed barley price. The difference between the feed barley price in the United States and Canada fluctuated between US $22/mt - US $24/mt. As illustrated in Figure 2.6, the cash price paid by Canadian users of feed barley was slightly higher than the U.S. feed barley cash price.

After the introduction of EEP in June, 1986, the cash price paid by U.S. users of No. 2 feed barley was almost always significantly higher than the cash price paid by Canadian users. It is important to recognize that the cash price quoted at Duluth or Winnipeg for No. 2 feed barley is only an unweighted average spot cash price that differs from the actual prices received by Canadian and U.S. producers.

Table 2.7: Area Planted to Winter Barley in the European Union.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	(1000 Hectares)														
Austria	150	145	136	136	132	134	133	117	117	117	117	108	110	107	104
Belgium & Lux.	135	138	114	132	129	104	118	112	105	100	93	75	72	62	59
Denmark	6	7	18	77	204	60	61	62	35	83	141	147	151	187	185
Finland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	1453	1478	1295	1349	1446	1393	1412	1387	1330	1355	1388	1360	1359	1104	937
Germany (East)	647	644	655	594	578	589	598	595	584	587					
Germany (West)	1182	1299	966	1260	1337	1189	1266	1221	1110	1064	1699	1524	1499	1463	1301
Greece	334	303	311	312	365	312	266	241	261	231	190	169	171	167	162
Ireland	26	28	34	31	34	34	32	31	25	23	26	30	37	38	28
Italy	329	336	352	385	434	468	465	445	450	471	469	467	450	425	399
Netherlands	12	14	7	10	11	7	9	8	6	10	8	7	6	4	3
Portugal	79	74	77	83	84	86	87	88	73	82	79	83	67	67	67
Spain	1797	1763	1817	1877	2139	2214	1984	2165	1940	1846	1830	1810	1642	1515	1392
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	909	824	877	912	1021	1026	960	968	856	881	882	850	784	648	624
Total Winter	7059	7052	6659	7158	7914	7616	7391	7440	6892	6850	6922	6630	6348	5787	5261
Total Spring	8881	8751	8790	7910	7151	7772	7741	7066	7693	7027	6597	6687	6379	5506	5729
TOTAL	15940	15803	15449	15068	15065	15388	15132	14506	14585	13877	13519	13318	12728	11292	10990

Source: T. Schmitz and W. Koo.



Source: Yearly EEP shipments of feed barley are aggregated from data supplied by Nancy Morgan, USDA Foreign Agricultural Service. Feed barley exports are from authors' estimates contained in T.G. Schmitz and W. Koo (1996).

Figure 2.5: Yearly Feed Barley Exports vs. EEP Exports

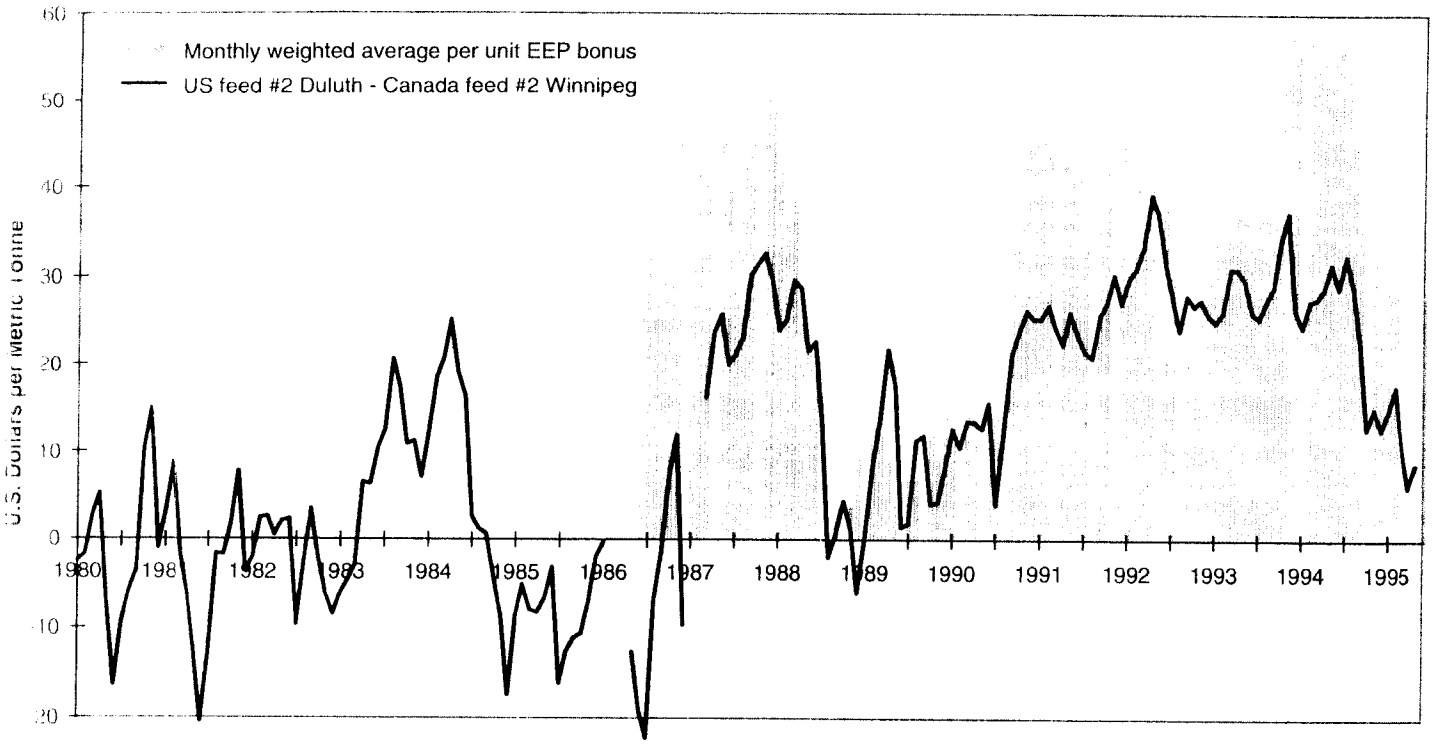
As shown by the bars in Figure 2.6, the difference between U.S. and Canadian user prices varied proportionally with the average EEP bonus. That is, when the average EEP subsidy provided by the U.S. government increased, the price spread between the U.S. and Canadian feed barley price increased as well. Conversely, when the average EEP subsidy declined, so did the difference between the U.S. and Canadian feed barley price.

Haley et al. (1992) evaluated the performance of the EEP for U.S. feed barley exports. The analysis covered the 1986/87 and 1987/88 crop years, the first two years of EEP. They concluded that EEP likely caused U.S. barley prices to increase $6/mt to $11/mt in 1986/87 and $8/mt and $13/mt in 1987/88, respectively. For 1986/87, they estimated that EEP caused export prices to increase by 5% for Australia, 3% for Canada, and 2% for the European Union. For 1987/88, they estimated that EEP caused all competitors' export prices to decrease by approximately 2%.

Schmitz et al. (1996) developed a hybrid spatial equilibrium model of world barley trade to evaluate changes in feed and malting barley production and consumption under alternative domestic and agricultural trade policy regimes. The study concluded that under 1991-93 EEP market conditions Canadian barley producers lost an average of US $75 million per year in revenue from feed barley sales and lost an average of $8 million per year in revenue from malting barley sales.

E.U. Restitution Payments

The E.U. Common Agricultural Policy provides for a system of export subsidies known as export restitution payments that distort trade. These government payments make up the difference between internal support prices and prices received in the export market. Prior to the introduction of EEP, the use of export restitution payments by the European Union had a negative impact on other exporters of feed barley. During its application of EEP, the United States stated that one of its main objectives was to increase the cost of the E.U. restitution payments in an effort to force the European Union to a common mindset regarding export subsidies in the



Source: Monthly average per unit EEP subsidies compiled from data supplied by Nancy Morgan, USDA Foreign Agricultural Service.
Duluth #2 cash price is from USDA Feed Situation and Outlook reports. Various issues.
Winnipeg #2 cash price Grain Trade of Canada Catalogue 22-201. Statistics Canada. Various issues.

Figure 2.6: Monthly Weighted Average Per Unit EEP Bonuses vs. the U.S./Canada Price Spread for Feed Barley

uguay Round of the GATT. To offset the high level of bsidies under the U.S. EEP during the 1986/87 crop ar, E.U. export refunds on feed barley reached as high s 139.75 European Currency Units (ECU)/mt. By the 88/89 crop year, the maximum refund available pped as low as 59.95 ECU/mt as a result of smaller S. EEP subsidies during that period.

ummary and Overview

Canada is a major player in the world barley market. s among the top three exporters of both feed and lting barley in the world. At times, total exports from European Union, Canada, and Australia made up in ess of 78% of total world barley exports. Canada and stralia together had more than a 50% market share of ley exports. For malting barley, Canada's export arket share reached as high as 44% in 1994/95. From a arket perspective, the Canadian domestic market for l barley was the largest component of total Canadian ley sales.

EEP and restitution payments were central to the export of U.S. and E.U. barley, respectively. The European Union halted restitution payments in May 1995, but these were reintroduced in September 1996. For barley, they exceeded US $30/mt. The United States has not subsidized exports since July, 1995. However, the 1996 Farm Bill authorized EEP funding of US $350 million in fiscal 1996, $250 million in 1997, $500 million in 1998, $550 million in 1999, $579 million in 2000, and $478 million for 2001 and 2002.

III. Selected Previous Studies

Most of the analytical work on the world barley market that took account of the predominant use of export subsidies by the United States and the European Union began in the early 1990s. The following provides a brief discussion of these studies.

1) Haley et al. (1992) demonstrated the importance of the U.S. EEP on producer prices and market shares for feed barley. Specifically, this study evaluated the effects of the EEP program on U.S. and competitor barley export volumes, prices, and U.S. welfare. Their analysis modeled the impact of E.U. subsidy retaliation and focused on the 1986/87 and 1987/88 crop years. They used the SWOPSIM model developed by the USDA, which is a static, partial equilibrium, non-spatial modeling framework. Haley et al. concluded that EEP caused U.S. feed barley prices to increase within a range of US $6/mt to $11/mt in 1986/87 and within a range of US $8/mt to $13/mt in 1987/88. The study also determined that EEP increased U.S. export revenue from US $99 million to $180 million in 1986/87 and from US $109 million to $180 million in 1987/88. The study did not examine the effects that EEP had on malting barley prices that resulted from changes in feed barley prices.

2) Carter (1993) undertook an analysis of the implications of a CBM on western Canadian feed and malting barley producers. He concluded that significant opportunities existed for expanded Canadian sales of both feed and malting barley to the United States and that these increased exports would increase producer revenues. The study stated that these opportunities would exist under a CBM and were not being exploited under the single-desk structure of the CWB. Overall, Carter estimated that a CBM would raise annual producer revenues from barley by 17 percent. Carter used various methods to arrive at this conclusion including a revenue-maximizing spatial equilibrium model (Canadian Regional Agricultural Model, CRAM). This model separated the prairie region into 22 crop producing areas. Malting barley production and markets were included separately from feed barley.

Carter's study had several shortcomings. First, many of the benefits that he concluded would accrue from a CBM would have also been attainable under the CWB single-desk structure. These included enhanced producer returns from growing higher-yielding feed barley varieties and lower marketing costs due to reduced elevation tariffs. Second, questions can be raised about several of his price assumptions. For example, Carter's model assumed that price differentiation would continue between the U.S. and Canadian malting markets under a CBM. This would be inconsistent with typical arbitrage conditions in a competitive environment. Third, Carter concluded that the CWB was unable to price discriminate in world barley markets. This conclusion, however, was based on a test using data that were inappropriate for this type of analysis. As Brooks (1993) points out in a critique of Carter's study, the Statistics Canada data over this period reflect public CWB price quotes rather than actual contracted prices.[5]

3) Schmitz et al. (1993) employed a four-country spatial trade model for feed barley, in which Canada exported feed barley to the United States, Japan, and the rest of the world (ROW), to evaluate the impact of a CBM. Further, the study estimated the impact of a CBM on malting barley premiums. However, it did not model the interaction and interrelationship that existed between feed and malting barley prices and trade flows. Also, the study did not address the issue of whether marketing costs would be lower or higher under a CBM. Schmitz et al. concluded that a CBM would reduce total barley revenue for producers by more than $20 million annually. The majority of this loss occurred because of reduced premiums for malting barley under a CBM.

4) Johnson et al. (1994) conducted a detailed spatial equilibrium analysis of the North American barley market. The study reported several policy simulations. The base case corresponded to a CBM trade regime. The study concluded that Canada had considerable potential for exporting barley to the United States. In the base case scenario, Canada captured 43% of the U.S. feed barley market and 24% of the U.S. malting barley market. Like earlier studies, this study did not formally model the malting barley market. In addition, it assumed a competitive marketing environment. As the authors pointed out:

> "This ignores one of the principal features of Canada's current marketing system, the role of the Canadian Wheat Board. By virtue of its single-seller status in Canada, the CWB can price barley differently to U.S. and offshore markets and, so (in principle), maximize returns to Canadian producers. In fact, this is a principal tenet of the Canadian marketing system. ...neither feature is consistent with the type of competitive behavior implicit in our spatial model." (P. 64)

5) Schmeiser (1995) analyzed the impact of a CBM on western Canadian barley producers using a spatial partial equilibrium model with eight markets, including four markets for malt barley and four for feed barley. In the model, the CWB maximized producer revenue by allocating a fixed supply of barley across the domestic and export markets for feed and malting barley so that the marginal revenue across all markets was equal. Schmeiser concluded that producer revenue for total barley would fall by approximately $15-17 million under a CBM (based on the 1991/92 crop year). His analysis was limited to data for one crop year and focused on a CBM. That is, he did not examine the implications of a full dual market.

6) Clark (1995), using cointegration analysis, evaluated the impact that the CBM (announced June 3, 1993, effective August 1, 1993, and removed September 10, 1993) had on feed barley prices. He was testing for structural breaks in the feed barley price over this period. He concluded that there was no change in the long run equilibrium relationship in feed grain prices as a result of the CBM. According to Clark, this evidence does not support the findings of Schmitz et. al. (1993). However, Clark's analysis has several shortcomings. First, cointegration analysis is not appropriate for looking at structural changes. Second, U.S. barley was not compared to close substitutes such as U.S. corn. Over this time period, corn prices increased significantly. Thus, while U.S. feed grain prices in general were rising, U.S. barley prices were not and U.S. barley was falling in relative value. This was not discussed or evaluated in the study. Third, the appropriate starting point for the analysis should have been June 3, 1993 (when the CBM was announced).[6] Clark's analysis only encompassed the period from August 1, 1993, to September 10, 1993.

7) Carter and Loyns (1996) examined the benefits and costs of the CWB as a single-desk seller of western Canadian wheat and barley. Using various arguments supported by anecdotal evidence, the study concluded the costs that resulted from the single-desk selling of wheat and barley far outweighed the benefits. They suggested that the added costs of the CWB were roughly $37/mt in any given year. However, their study has many shortcomings. For example, the study concluded that delays in varietal development were due to the CWB, when in fact varietal registration is the responsibility of the Prairie Regional Recommending Committee on Grains. The CWB is only one of many players represented on this committee. Likewise, they attributed high elevation costs to the CWB. Until recently, however, the maximum rates were established by the Canadian Grain Commission and are now competitively determined. Finally, their analysis did not adequately identify the marketing costs associated with non-CWB crops like canola and flax. As Kraft et al. pointed out, the cost of buying and selling flax and canola on a margin basis is at least $5.53/mt higher than the costs of managing the transactions in the wheat pool account. Given the demonstrated reality that non-CWB grains have higher marketing costs than CWB grains, it is difficult to see how Carter and Loyns could have concluded that the costs associated with marketing CWB grains would fall if they were marketed like non-CWB grains.

8) Mao et al. (1996) determined how policy changes in major feed barley trading countries affected world feed barley trade and net social payoffs. The study used a static spatial equilibrium model based on a quadratic programming algorithm, which included four exporting regions and nine importing regions. This model allowed Canadian feed barley producers to directly ship their barley to U.S. regions. For the other exporting countries, the study considered only offshore shipments of feed barley. Mao et al. reached several conclusions in their study. For example, elimination of the U.S. EEP reduced U.S. exports by 26%. Removal of the WGTA freight subsidy in Western Canada reduced Canadian off-shore exports by 15%. The introduction of NAFTA

...eased Canadian feed barley exports to the United States and Mexico. Under a world free trade scenario, EU ...ed barley exports declined by 48%. As the authors ...inted out, one of the limitations of this study was that ...ly considered feed barley.

...) Schmitz et al. (1996) developed a hybrid spatial ...uilibrium model of world barley trade to evaluate ...anges in feed and malting barley production and ...nsumption under alternative domestic and agricultural ...de policy regimes. A spatial equilibrium was established ...which the CWB and Australian marketing boards ...haved as oligopolists in export markets under ...ntrage conditions brought about by the export ...bsidy policies of the United States and the European ...on. The analysis disaggregated barley area and ...duction into feed, 6-row malting barley and 2-row ...al ...ng barley in each of the four major barley trading ...gions and evaluated both supply and demand responses ...various policy changes in each exporting country. ...though the selection rates for malting barley were ...termined endogenously, the analysis assumed that ...anges in agricultural policy regimes did not alter the ...ce relationship between feed barley and malting ...arley.

...0) In a study commissioned by the Western Grain ...rseting Panel, KenAgra Management Services Ltd. ...996) undertook a qualitative assessment of malting and ...d barley marketing in Canada. KenAgra outlined the ...fferences in economic and political perspectives that ...e evident among barley producers in the debate on ...ley marketing and outlined the reasons why they ...sted. KenAgra highlighted the issue of incomplete ...ntrage between the western Canadian barley market ...d U.S. barley markets but did not model or measure ...mpacts. They also examined many operational ...ues and provided examples of price and contract inef-...ency. KenAgra outlined alternative marketing struc-...s and attempted to qualitatively measure them ...inst economic and political criteria. This study did not ...clude which alternative should be implemented but ...icated that some movement to a multiple-seller ...ronment for feed barley would be economically and ...itically acceptable. In the evaluation of an alternative ...t would have full open competition in feed ...ley but would leave malting barley under the single-...k selling system of the CWB, the study argued that it ...uld be possible to maintain malting barley (especially ...w) premiums over feed barley because the U.S. and ...shore markets demanded predominantly 6-row and ...w varieties of malting barley, respectively. This study ...med that it would be possible to stop the marketing of feed barley as malting barley outside of the CWB. Therefore, it was concluded that the premium available to Canadian 2-row varieties of malting barley would not be eroded. This alternative was eventually recommended by the WGMP. This study has a number of limitations. Most importantly, it is qualitative in nature and therefore does not attempt to model either the feed or malting barley market. For this reason, the internal consistency of the assumptions and arguments are not verified.

Overview

Lack of agreement exists as to the benefits and costs of the CWB as a single-desk seller. A number of studies concluded that there were substantial benefits associated with the CWB as a single-desk seller. Other studies that do not support these results argued that while price premiums may have existed, these were small relative to the added costs they associated with the CWB. The above studies provide a basis for the modeling approach used in this study. However, a major limitation of almost all the studies that have analyzed the effects of the operations of the CWB versus multiple sellers is that they model the effects on the feed grain market separately from the malting barley market. Also, generally no formal models have been developed for the malting barley market that parallel the analysis of the feed grain sector. Rather, assumptions are made about the link between feed barley prices and malting barley prices. In other cases, malting barley price premiums are calculated by comparing U.S. and Canadian prices.

When modeling the behavior of the CWB, one cannot *a priori* assume that it acts in a perfectly competitive manner when competing with other firms. The world barley market consists of relatively few sellers. Also, in view of work by Haley et al. (1992) on the impact of EEP, one has to test whether the CWB has market power. However, determining whether the CWB has market power is empirically difficult, unless actual contract pricing data is available. The issue of market power and the nature of competition is very important. As Johnson et al. (1994) pointed out, to assume competitive behavior (i.e. no market power) fails to address the major argument in the current debate over barley marketing.

Much of the confusion in the present debate is based upon the lack of a clear distinction between additional revenues earned by a single-desk seller as opposed to the

otal efficiency (e.g. added marketing costs due to the WB) of a single-desk seller versus multiple sellers. For xample, it is theoretically possible for the CWB to earn rice premiums and still have a situation in which roducers could be worse off than they would be under ultiple sellers. That could only occur, however, if the WB system resulted in higher costs. To highlight this oint, in their study on wheat, Kraft et al. concluded that e CWB earned significant price premiums over ultiple sellers. These price premiums were calculated .b. Vancouver and not at the farm gate. If the market- g costs under the CWB were at least as low as under a ultiple-seller situation, the farmer would do better nder the CWB system. However, Carter and Loyns (1996) ntend that, even though the CWB earns emiums, there are added costs imposed by the CWB stem over what would exist in a multiple-seller stem and that these added costs outweigh the emiums earned.

The remainder of this study deals with both of these ues in the context of barley marketing. The issue of ice premiums is addressed in Chapter 5. The issue of stem costs is addressed in Chapter 6.

IV. The Theory of Single-Desk Selling

Introduction

The CWB is a form of collective action by western Canadian grain producers that attempts to maximize returns by jointly providing marketing services and countervailing power against large multinational grain trading companies. The CWB's existence is a direct result of public policy as it requires legislation through the Canadian Wheat Board Act. The CWB is set up to operate as a producer marketing board and has adopted as its objective the maximization of returns from sales of wheat and barley. The CWB acts as the producer's agent through which all sales and payments are made. The theory of producer marketing boards has been discussed in several works including Bieri and Schmitz (1974), Just et al. (1979), McCalla and Josling (1981), Schmitz et al. (1981) and Just et al. (1982).

In theory, the CWB is a producer monopolist. It is not a middle man (i.e. where a firm attempts to exploit both producers and consumers) nor a monopsonist (i.e. where a firm exploits producers). In other words, the profits earned from sales by the CWB are returned directly to producers (i.e. producers are the "shareholders" of the CWB).

A major feature of the international barley market is that marketing boards, such as the CWB and the Australian barley boards, sell into a market in competition with multinational grain companies whose behaviors are influenced by state trading entities, including the E.U. Cereals Management Committee and the U.S. Commodity Credit Corporation. State trading dominates the world barley market. In addition, roughly one half of barley trade is dominated by single-desk sellers.

The marketing of grain in the United States is very different from the marketing of CWB grains. As pointed out by Hill (1992), large multinational trading companies dominate the export stage of the U.S. grain marketing system. The dominant companies involved in the export of U.S. grain are: Cargill (American-based); Continental (U.S.-based but owned by a French family); Archer Daniels Midland (American-based) that has a joint export venture with Toepfer (German-based); Bunge (Argentinian-based); Louis Dreyfus (French-based); and several subsidiaries of large Japanese corporations whose headquarters are in the United States. All of these companies source grain from the United States and other origins. In essence, the U.S. multinational grain trading firms behave as middlemen with respect to the buying and selling of U.S. and other origin grains. They buy grain from optional origins and sell it to foreign buyers.

Cargill, Louis Dreyfus, Continental Grain, and Bunge control over 80% of the total volume of barley exports from the United States. However, many grain trading firms trade within their specific niche regions and/or niche commodities. As a result, from a world trading perspective, a few firms are principals in 70% to 80% of world trade in feed barley. For instance, Toepfer controls a large portion of international feed barley trade because of its dominance in the European Union. To the extent that these firms can earn profits from market power this is a return to firm shareholders rather than to producers.

There has been considerable debate as to the effectiveness of multiple sellers versus single-desk sellers. However, the following excerpt by Schmitz (1996a) is important to keep in mind when examining this issue.

> "Some have gone as far to suggest that because of the CWB, there is a lack of

buying competition at the farm gate. In order for this statement to be true, one would have to view the CWB as a monopsonist with respect to the purchase of grain for domestic consumption and export. A monopsony is defined as the mirror image of monopoly: a market in which there is a single buyer—a buyer's monopoly. While the CWB is the single buyer of grain for domestic consumption and export, it does not exert any monopsony pricing power over suppliers. A monopsonist exerts control over its suppliers by limiting the quantities that it purchases below competitive levels in order to maximize its own profits. However, one of the mandates of the CWB is to maximize revenue accruing to producers, not to the CWB itself. This objective contradicts the assertion that the CWB is a monopsonist. The CWB is a marketing board set up for Canadian grain producers. It is producers that ultimately receive any additional revenue obtained by the CWB as part of their final payment in each year. Hence, the CWB can not be construed as a monopsonist, and any reference to efficiency losses due to the lack of buying competitiveness on the part of the CWB is incorrect. Within this context why would the existence of a number of smaller Canadian firms increase the "competitiveness", or the revenue received by Canadian producers, at the farm gate? As Harold and Rossmiller state: 'In effect, the CWB will not take advantage of the producer, while the private grain traders have few qualms about lowering price offered to the producer and raising consumer price in order to increase their profit margin.""

Umitz (1996a) goes on to state:

> "One possible outcome of the removal of the CWB would be that the multinational firms in the United States could take over the job of marketing Canadian grain. These firms already have well-established offices in countries all over the world, including Canada. It would not be that difficult for these firms to expand their purchasing activities to include Canada. Remember that these large multinationals currently purchase most of their grain from cooperative agencies in the United States who, in turn, procure grain from local producers. In the absence of governmental regulation, the country elevator system currently in place in Canada could be used by U.S. multinationals in the same way that they currently use local cooperative organizations in the United States." (P. 66-67)

Several authors have referred to the CWB as a monopoly. A monopoly is a market structure in which a commodity is supplied by only one firm. The CWB is a monopolist in two ways. First, it is the only supplier (single-desk seller) of barley for human consumption in the domestic Canadian market. Second, it is the only supplier of Canadian-produced barley into international markets. It is important to stress the fact that the CWB is not a pure monopoly because it does not restrict the overall supply of grain marketed by competitors internationally.

The role of the CWB in pricing wheat in international markets has been the subject of many investigations, but little research has been done on barley. Several investigators view international grain markets in an oligopolist framework. An oligopoly is a situation of imperfect competition in which an industry is dominated by a small number of suppliers. An oligopolist is not a price taker. It has some market power since it can affect prices by controlling the quantity that is sold into each market but does not have as much market power as a pure monopolist.

Even if one views the CWB as a monopolistic competitor, it could still earn increased revenue above what would exist in a perfectly competitive environment. Monopolistic competition is defined as a market structure in which there are large numbers of sellers who are supplying goods that are close, but not perfect, substitutes. In such a market, each firm can exercise some influence on its price. The CWB is a monopolistic competitor in the sense that its grain is a close, but not perfect, substitute for grain from other countries and that it competes with many other grain companies in the United States and elsewhere.

Price Discrimination

The clearest case in which a single-desk seller can extract additional revenue from the market over multiple sellers is through price discrimination. The gain to price discrimination is the additional revenue that can be earned from charging different customers different prices as compared to the multiple-seller situation in which all buyers of Canadian barley face the same price. A single seller of a product who sells to more than one market can increase revenue above that received by multiple sellers of the same product, by reducing quantities and charging a higher price in markets that are less price sensitive, i.e. inelastic, and increasing quantities and charging a lower price in markets that are more price sensitive, i.e. elastic. Revenue is at a maximum where the marginal revenue, derived from the excess demand curve in each market, is equal across all markets. In the case of competition among multiple sellers, full arbitrage of prices occurs at a single price for a single point in time to clear the market (i.e. the law of one price must hold in a competitive market environment). Clearly, given the inability of multiple sellers to price discriminate, the returns must be lower than those attainable with an organization that has the ability to price discriminate. The only exception is in markets where the single-desk seller is unable to determine either price or quantity sold. This is true for the CWB in the case of the domestic feed barley market in which the price and quantity sold is a function of the expected pool return for feed barley.

The policies of other exporting countries can increase the magnitude of price discrimination by the CWB. For example, when the United States is offering EEP subsidies to some countries and not to others, the CWB can price discriminate by charging high (fully commercial) prices in some markets, and lower prices in other markets where it is necessary to compete against export subsidies.

The CWB is the single seller of Canadian barley. To the extent that each CWB customer has a downward sloping demand curve for Canadian barley, the CWB can adjust quantities on each demand curve to maximize revenue across all markets. For instance, suppose the CWB is negotiating a sale of barley to Japan where the Japanese demand curve for Canadian barley is downward sloping. However, to purchase 300,000 mt of barley from Canada, the Japanese Food Agency is willing to pay $130/mt. If the CWB wanted the Japanese buyer to agree to purchase 600,000 mt of barley, the CWB would need to offer a lower price (e.g. $115/mt) to close the deal. In this way the CWB can influence the price received in each market by adjusting the quantity sold in each market. What is unique about the CWB as a single-desk seller is that it does not have to fear being undercut by another company offering to sell Canadian barley. This allows the CWB to "price discriminate" and charge different prices to different customers. Also, a single-desk seller can influence the amount of barley it sells as either malting or feed, based upon how much barley is selected for malting. Given the limited demand for malting barley, not all malting barley grown in Western Canada can be sold as malting barley, but rather it is sold into the domestic or international feed market (Schmitz et al., 1993).

The above argument can be illustrated by the simple numerical example depicted in Figure 4.1. Suppose there were two buyers, each demanding 50 mt of barley at a price of $100/mt. If there were multiple sellers in this market with 100 mt to sell, the price would be $100/mt in both markets (because of the law of one price) and total sales revenue would be $10,000. As long as the price in one market was less sensitive to quantity than another market, revenue could be increased through price discrimination. If the demand in Market 1 was more inelastic than in Market 2, a single-desk seller could shift 10 mt of sales away from Market 1 into Market 2 to increase revenue through price discrimination. Suppose the demand curves were such that a 10 mt shift from Market 1 to Market 2 resulted in a $10/mt increase in the price in Market 1 and only a $2/mt reduction in the price in Market 2, the market revenue would now be

$110/mt x 40 mt + $98/mt x 60 mt = $10,280.

For these demand curves, the single-desk seller would be able to increase the average price received from $100/mt. to $102.80/mt.

The CWB is the single seller of Canadian feed barley exports, and it is the single seller of Canadian 6-row and 2-row malting barley into all markets. In some ways, it can behave similarly to a price-discriminating monopolist. However, the CWB does not behave as a pure monopolist. Firstly, it cannot directly price discriminate between the domestic feed and feed export markets as the CWB cannot currently enter the domestic off-Board market and buy barley at the competitive cash price for sale to offshore markets, even if arbitraging these two markets were profitable. Secondly, the objective of the CWB is not to maximize the sum of profits accruing to all Canadian barley producers across all barley markets. Instead, the CWB functions as a marketing board whose

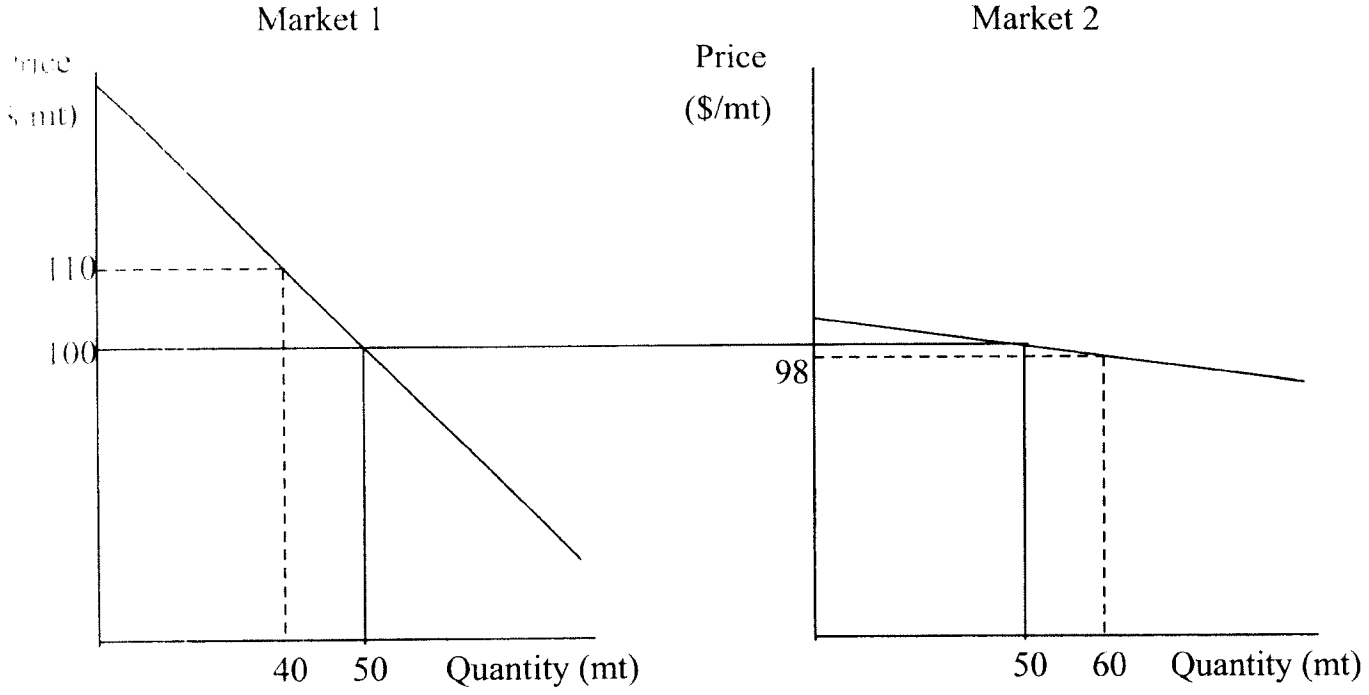


Figure 4.1: Returns from Price Discrimination

...ve is to maximize the revenue from the sale of all ...y that is available in the pool. This objective is ...ed to as maximizing the return to pool (RTP).

The CWB receives all malting barley produced by ...tern Canadian farmers and selected by maltsters and ...trade and places it in the designated barley pool. ...ever, the CWB does not receive all feed barley ...uced by western Canadian farmers. In fact, western ...adian feed barley producers directly control the ...ntity of feed barley sold into the CWB pool. ...ever, the CWB can indirectly influence the farmer's ...ation decision. If the CWB's expected pool return is ...r than the price in the domestic market, the farmer ...ld sell feed barley into the domestic market rather ...n through the CWB. Therefore, the CWB faces an ...quisition constraint" with respect to the total ...ntity of feed barley available in the pool.

The CWB maximizes RTP with respect to the quanti... of malting barley sold to the domestic market and ...gn markets and with respect to the quantities sold to ...rt feed barley markets subject to the "acquisition ...straint" described above. As part of this process, the ...B can influence the selection rate for Canadian ...ey. That is, within a certain range, the CWB influ...s the percentage of the total amount of Canadian ...ey that is actually sold as malting barley, based upon ...all market demand for malting barley. Canadian barley producers seed both malting varieties and feed varieties. However, not all malting varieties planted can be used for malting purposes after the harvest due to poor quality. There exists some portion of barley produced in Canada that is marginal in malting quality. That is, it could be sold as malting barley in years when the average quality of the barley crop around the world is poor. In these years, importers can reduce their quality specifications on malting barley, such that this marginal quantity could be sold to these markets. However, in years when the average quality of the barley crop around the world is good, the marginal barley can be sold as feed. This decision is ultimately made by the selectors, importers and the CWB. Because, on the margin, feed barley can be substituted for malting barley, the marginal revenue for malting barley must be equal to the marginal revenue for feed barley. Hence, as a single-desk seller, the CWB can not only price discriminate across different markets for the same type of barley, it can also price discriminate across all feed export markets, 6-row malting markets, and 2-row malting markets. This results in different prices being charged to different customers in all international markets into which the CWB sells barley.

The objective of the CWB's Sales Division is to maximize RTP. The individual sales desks, within the CWB's Sales Division, meet regularly to discuss sales opportunities and develop coordinated selling strategies.

s long as the CWB sales strategy has been consistent ith revenue-maximizing behavior, it is possible to educe considerable information about the demand curve e CWB faces in each market by observing the actual icing and sales behavior. This requires confidential WB sales data.

There are other reasons why the CWB may be able to crease revenue above what would exist under multiple llers. One reason suggested by Carter (1992), is that e steady supply guaranteed by the CWB spreads the sk that grain companies face in dealing with the day-to-y transactions. If the CWB did not exist, higher riability in quantity, quality and price might force these mpanies to manage risk through the futures exchange. ese companies would incur additional costs due to co-dinating information and hiring experts in the tures market. Hence, the presence of the CWB may be lower-cost solution to these companies than alterna-e risk spreading, such as the use of futures market tions. The CWB may be able to extract premiums from any of these companies (especially maltsters and ewers that purchase malting barley) who are willing to y for this lower risk. It may also be the case that the WB can obtain premiums simply because the multina-al trading firms may charge higher margins in a stem where they did not have to deal with the CWB. is is another source of increased revenue under a single-sk seller versus the obvious price discrimination that n occur in an export subsidy environment.

Single-Desk Seller vs. Multiple Sellers

A much more complicated model of price discrimination is presented in Figure 4.2. This model illustrates graphically the multiple-seller versus the single-desk seller equilibrium. Figure 4.2 consists of four panels, panel A, B, C and D. Panel A depicts the domestic demand for feed barley (D). Vertical line Q*Q* represents the total amount of feed barley produced. For the purpose of this discussion, consider only the feed barley market. Panel B gives the excess supply (ES_t) of feed barley available for export from Canada. This curve represents the portion of the feed barley crop that is produced and not consumed domestically (i.e. exported) in Panel A at any given price. For example, the quantity of feed barley that is exported from Panel A at price P^c (the competitive equilibrium price) is equivalent to the difference between Q^c and Q*. The competitive equilibrium price P^c is derived in Panel B at the point where the excess demand curve (ΣED_t) intersects the excess supply curve (ES_t). ΣED_t represents the total excess demand for Canadian feed barley and is the sum of the excess demand curves for Canadian barley exhibited in panels C and D. Panels C and D represent two regions with different elasticities of demand for Canadian feed barley. ED_1 represents the excess demand curve for feed barley in region 1 (Panel C) and ED_2 represents the excess demand curve for feed barley in region 2 (Panel D). At the competitive equilibrium price (P^c), region 1 demands quantity Q^1 and

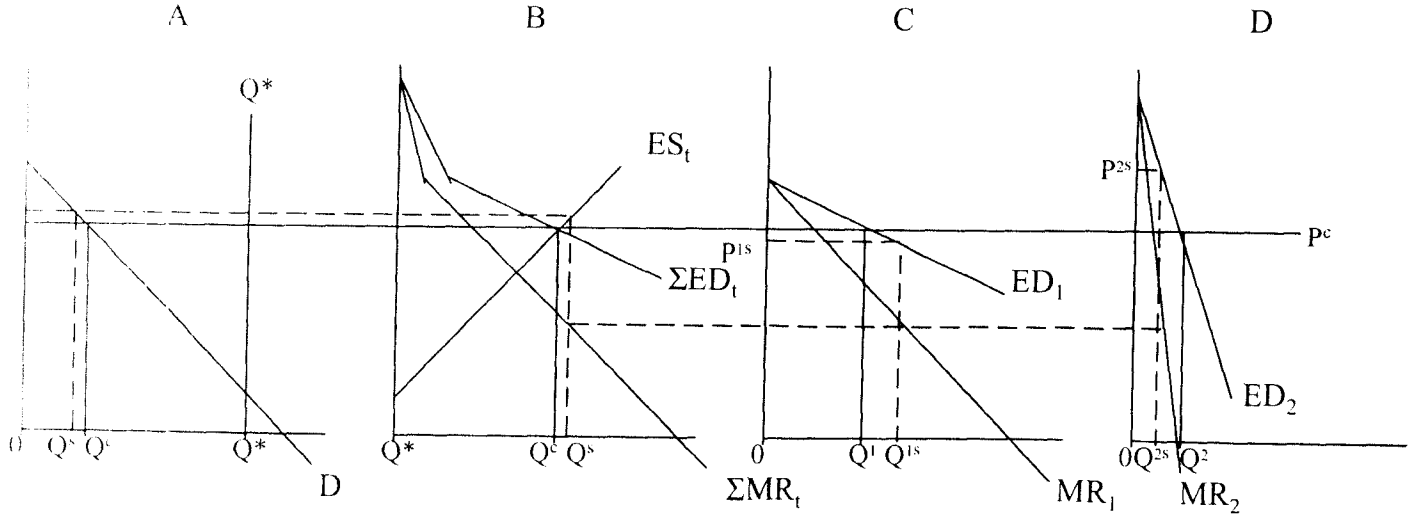


Figure 4.2: Multiple Seller versus the Single-desk Seller Equilibrium

gion 2 demands quantity Q^2. Quantities Q^1 and Q^2 sum the level of total exports from Canada (i.e. the difference between Q^c and Q^*). The quantity of feed barley consumed domestically would be Q^c. The point to be is that the price is the same across all markets in the competitive equilibrium.

Given that the elasticity of demand in region 1 is different than region 2, it is clear that a single-desk seller can out-perform multiple sellers by price discriminating. The maximum revenue that a single-desk seller can generate occurs where the marginal revenues in regions 1 and 2 are equal for the given quantity of barley that it is to sell. What makes the situation facing the CWB interesting is that the amount of barley the CWB is able to market depends on the weighted average price the CWB obtained in the export market. Therefore, if the CWB were able to obtain a higher overall price in the export market through price discrimination, it is faced with the prospect of marketing additional barley. This, in turn, would limit the increase in the weighted average price that the CWB is able to obtain in the export market. The price P^s, which is reflected back to producers under the single-desk seller equilibrium, would be greater than the price that would exist if there were multiple sellers (i.e. the competitive equilibrium price, P^c).

At the single-desk selling equilibrium, quantity Q^s would be consumed domestically at price P^s and the difference between quantity Q^s and Q^* would be exported. The corresponding quantities that would be demanded in regions 1 and 2 would be Q^{1s} and Q^{2s}, respectively. Region 1 would pay a price of P^{1s}, below the competitive equilibrium price, and region 2 would pay a price of P^{2s}, above the competitive equilibrium price. The weighted average of prices P^{1s} and P^{2s} would be above the competitive equilibrium price (as illustrated earlier in Figure 4.1) and equal to P^s.

In the model presented in the next chapter, Figure 4.2 is modified to account for several dimensions unique to marketing both feed and malting barley. This includes encompassing the linkages between feed and malting barley markets

Summary

The ability of a single-desk seller to generate additional revenue through price discrimination is well grounded in economic theory. There is general agreement that the CWB is able to price discriminate. However, there are other reasons why the CWB may be able to increase revenue above what would exist under multiple sellers. One reason, suggested by Carter (1992), is that the steady supply guaranteed by the CWB spreads the risk that grain companies face in dealing with the day-to-day transactions. If the CWB did not exist, higher variability in quantity, quality, and price might force these companies to manage risk through the futures exchange. These companies would incur additional costs in coordinating information and hiring experts in the futures market. Hence, the presence of the CWB may be a lower-cost solution to these companies than alternative risk spreading, such as the use of futures market options. The CWB may be able to extract premiums for many of these companies who are willing to pay for this lower risk. It may also be the case that the CWB can obtain premiums simply because the multinational trading firms may charge higher margins in a system where they did not have to deal with the CWB.

V. Empirical Model and Results

Introduction

We begin with a description of the data used in this study. This is followed by a simple test for market power that illustrates that the CWB is, in fact, price discriminating. We then present a detailed description of the economic model used to measure the effects of price discrimination. The estimated revenues from single-desk selling as compared to those that would exist in a multiple-seller environment are then presented and discussed.

Data Description

The CWB provided detailed contract data on its feed barley, 6-row malting barley and 2-row malting barley sales from 1985/86 through 1994/95. All prices were brought to a common f.o.b. basis Vancouver or Thunder Bay. Daily sales data were aggregated into nine distinct markets and categorized as follows: (1) the Japanese feed market; (2) the U.S. feed market; (3) all other offshore feed barley markets; (4) the Canadian domestic 6-row malting market; (5) the U.S. 6-row malting market; (6) offshore 6-row malting markets; (7) the Canadian domestic 2-row malting market; (8) the U.S. 2-row malting market; and (9) offshore 2-row malting markets. Data for the Canadian domestic 2-row and 6-row malting barley markets included only domestically consumed barley. The 2-row and 6-row malting barley that was domestically processed into malt and/or beer and subsequently exported to the United States or offshore was included as sales to these respective markets. The data for each of the aforementioned nine markets were aggregated over the crop year from August 1 through July 31 based on the date of sale. This approximates the pool return but does not necessarily match perfectly because of differences between the timing of sales relative to deliveries to the pool. The yearly quantity sold into a particular market was computed as the simple sum of all sales into that market for the crop year. The yearly average price received from each market was computed as the weighted average of all sales into that market over the crop year. The total quantity of barley available for sale in Western Canada in a given crop year was estimated as the total volume of CWB barley sales plus the domestic feed barley consumption estimate reported by Statistics Canada.

Test for Market Power

A key consideration in the debate surrounding feed barley marketing in Canada is whether the CWB can price discriminate in world markets. This was tested by Carter (1993) using a Knetter equations test on data compiled by Statistics Canada. On the basis of this analysis, Carter concluded that in the feed barley market there was no evidence of market power exercised by the CWB. As pointed out earlier, the critical problem with Carter's study was that it utilized Statistics Canada export revenue data. These data were inappropriate for this analysis as they reflected CWB published or card prices, not actual CWB contract prices. These were the prices the CWB publicly offered but not the prices at which the CWB actually sold barley. As the CWB card prices were the same regardless of destination, the test results indicated that there were no differences in the prices received by the CWB in different markets, i.e., no differential pricing and no market power.

We provide results on the extent to which the CWB was able to price discriminate in the international feed

market using actual 1980/81 through 1994/95 CWB contract data for feed barley. A simple statistical used instead of Knetter equations because all CWB to foreign markets were evaluated in U.S. values. The contract prices for sales made during period and shipped via Canada's ports on the West were aggregated on a f.o.b. vessel basis for the wing regions: 1) Japan, 2) the United States and 3) ROW. The sales were aggregated to a weighted age price per month for each market. The data were niversally verified but a random spot check of contracts was conducted. Each of the selected tract sales values matched the reported data. No pancies were revealed between actual contract sales and data provided for the study.

simple difference was taken between the markets very observed sale month over this time period, i.e. minus United States, Japan minus the ROW, United s minus the ROW. A mean difference test was then ducted to examine whether the differences between market prices were, from a statistical standpoint, significantly different from zero. Of additional interest was whether the presence of EEP during the intense subsidy trade war period (1985/86 - 1994/95) had an impact on the degree of price discrimination by the CWB. For this reason the test was also run separately on the 1980/81-1984/85 and 1985/86 - 1994/95 time periods.

The results in Table 5.1 indicate that statistically significant differences existed between the f.o.b. contract prices within market pairs. This clearly indicates that the CWB price discriminated between markets and that the law of one price did not hold for Canadian feed barley exports over the tested time periods. The average price difference of $25.29/mt between CWB contract prices for Japan and the United States over the 1980/81 through 1994/95 period was significant (Table 5.1). The average difference of $4.46/mt between CWB contract prices for the United States and the ROW was also significant as was the $20.73/mt difference between Japan and the ROW. The average price differences

Table 5.1: Mean Difference Test of Market Power on CWB Export Sales of Feed Barley

	Japan - U.S.	U.S. - ROW	Japan - ROW
		1980/81 to 1994/95	
f.o.b. price difference ($/mt)	25.29	4.46	20.73
standard error ($/mt)	1.56	1.95	1.63
t statistic	16.19*	2.28*	12.70*
number of observations	49	36	121
		1980/81 to 1984/85	
f.o.b. price difference ($/mt)	1.46	4.32	13.99
standard error ($/mt)	2.05	1.83	2.81
t statistic	0.71	2.36	4.97*
number of observations	3	3	37
		1985/86 to 1994/95	
f.o.b. price difference ($/mt)	26.84	4.47	23.70
standard error ($/mt)	1.37	2.12	1.92
t statistic	19.57*	2.10*	12.34*
number of observations	46	33	84
		1985/86 to 1994/95**	
f.o.b. price difference ($/mt)	23.86	4.47	28.33
standard error ($/mt)	1.23	2.12	1.86
t statistic	19.45*	2.10*	15.23*
number of observations	33	33	33

Estimated by authors.
statically significantly different than zero with a probability greater than 95%.
Results for months with sales to all market segments

reported above for these three comparisons are not directly comparable because the sales data used to derive the results were not standardized by the date of sale. That is, the timing (i.e. dates that sales were made) of CWB sales to Japan and the United States did not correspond to the timing of sales to either Japan and the ROW or the United States and the ROW.

To address the issue of the comparability of the results for the three comparisons made above, a second set of mean difference tests were performed using only those months when the CWB made sales to all three markets (i.e. Japan, the United States and the ROW). These results are shown in the last section of Table 5.1. Only the results for the period 1985/86 through 1994/95 are reported in this section of Table 5.1, given that a limited number of observations were available for the 1980/81 through 1984/85 period under this restricted data set. Using this data, the average price differences for each of the three market pairs were significantly different from zero with an average price difference of $28.33/mt between CWB sales to Japan and the ROW, $4.47/mt between CWB sales to the United States and the ROW and $23.86/mt between CWB sales to the United States and Japan.

The ability of the CWB to price discriminate was dependent on the size of the EEP subsidy used by the United States. In the pre-EEP period, 1980/81 through 1984/85, the contract prices between Japan and the United States were not significantly different from one another whereas they were during the 1985/86 through 1994/95 period (Table 5.1). However, the price difference between Japan and the ROW was statistically significant. The average price difference between CWB sales to Japan and the ROW increased from $13.99/mt pre-EEP to $23.70/mt during the export subsidy period. The average price difference between CWB sales to Japan and the United States rose from $1.46/mt in the early 1980s to $26.84/mt during the trade war period. In general, the price difference for each market pair during the 1985/86 through 1994/95 period was significantly higher than during the early 1980s. This indicates that the export subsidies of the United States and the European Union had a major impact on the CWB's export pricing of Canadian feed barley.

In summary, this analysis shows clearly that the CWB used its power as a single-desk seller to price discriminate among markets. Also, the ability of the CWB to price discriminate increased during the EEP period. However, even for the non-EEP period, the CWB was still able to price discriminate among markets, but to a lesser extent.

Comparison of the CWB with Multiple Sellers of Canadian Barley

A key issue in the debate over barley marketing in Canada is the extent to which the degree of market power exerted by the CWB in world barley markets benefits western Canadian barley producers. To determine the economic impact of the CWB on Canadian barley producers, it is necessary to distinguish between the current pricing behavior of the CWB and the pricing behavior that would prevail under alternative marketing systems. In this section, two economic models of the structure of international barley markets are developed. The first model considers the behavior (or objectives) of the CWB with respect to actual sales of Canadian feed, 6-row, and 2-row malting barley in domestic and world markets. The second model considers the behavior of multiple sellers of Canadian feed and malting barley under the assumption that all Canadian barley producers have unrestricted access to the domestic, U.S. and offshore markets for both feed and malting barley.[7] Hence, we are analyzing the effects of a "dual" or "open" market structure for both feed and malting barley and not a "continental" barley market (which would be more limited in scope). Sales data provided by the CWB are used to empirically estimate prices, quantities, and revenue that would accrue to the average Canadian barley grower from the introduction of multiple sellers in 1985/86 through 1994/95. These results are compared to the actual prices, quantities, and revenue received under the CWB over the same period.

CWB Objectives

The objective of the CWB is to allocate the total quantity of barley that it receives from producers in a given crop year across the nine markets (as indexed above in the data description section) in order to maximize total revenue. This is also sometimes referred to as maximizing the return to pool (RTP). Mathematically, this objective can be written as follows:

$$(1)\ \text{Maximize RTP} = TR_{FE} + TR_{6M} + TR_{2M} \text{ with respect to } Q_1,\ldots,Q_9$$

In this equation, TR_{FE} equals the total revenue from Canadian feed barley exports (into markets 1, 2 and 3), TR_{6M} equals the total revenue from all sales of Canadian 6-row malting barley for malting purposes (into markets 4, 5 and 6), and TR_{2M} equals the total revenue from all sales of Canadian 2-row malting barley for malting

purposes (into markets 7, 8 and 9). Q_1 through Q_9 represent the quantity of barley sold into each indexed market, respectively.

Define $P_1(Q_1), \ldots, P_9(Q_9)$ as the prices received by the CWB for sales into each of the above nine markets in a given year. Equation (1) becomes:

$$\text{Maximize RTP} = \sum_{i=1}^{9} P_i(Q_i)Q_i \quad \text{with respect to } Q_1, \ldots, Q_9.$$

Given the total amount of barley produced in a given year, Canadian barley producers have several options. If they were to sell 6-row or 2-row barley as malting barley, they would have to deliver it to the CWB. However, if they were selling feed barley, they would have the option to deliver to the CWB or to the domestic feed market. The expected CWB pooled return, as perceived by producers, would determine the amount of feed barley available in the pool. For instance, if the expected pooled price was high, farmers would deliver more to the pool and less to the domestic market. The price that a farmer would eventually receive for feed barley would be determined by the weighted average price that the CWB received for all feed exports in a given year. In equilibrium, this pooled feed barley price would have to be equal to the domestic feed price because if it were not, Canadian producers could do better by selling more feed barley into the highest-priced market until the price in that market was driven down to the lower-priced market. Mathematically, this condition can be expressed as:

$$P_0(Q_0) = \frac{\sum_{i=1}^{3} P_i(Q_i)Q_i}{\sum_{i=1}^{3} Q_i}$$

where P_0 is the Canadian domestic feed price and Q_0 is domestic feed consumption. The term on the right hand side represents the pooled price for feed barley, which includes the weighted average price received by the CWB from (1) the Japanese feed market; (2) the U.S. feed market; and (3) all other offshore feed markets.

The solution to objective (1) determines the sales behavior of the CWB. The optimality conditions can be solved simultaneously using the method of Lagrangian multipliers. Formally, the Lagrangian is written as:

$$L = \sum_{i=1}^{9} P_i(Q_i)Q_i + \lambda\left[\overline{Q_B} - \sum_{i=1}^{9} Q_i(P_i) - Q_0(P_0)\right] \quad (2)$$

where Q_B is the total (fixed) quantity of barley delivered to both the domestic market and the CWB in a given year, and λ is the shadow value that measures the additional revenue that would accrue to Canadian barley producers if they were to sell one more bushel of barley at the margin. We proceed by assuming that the demand curves in (2) take the form:

$$(3)\quad P_i(Q_i) = \alpha_i - \beta_i Q_i \quad \text{for } i = 0, \ldots, 9.$$

$P_0(Q_0)$, $P_4(Q_4)$, and $P_7(Q_7)$ represent the Canadian domestic demand curves for feed barley, 6-row malting barley, and 2-row malting barley, respectively. $P_1(Q_1)$ represents the Japanese excess demand curve for Canadian feed barley. $P_2(Q_2)$, $P_5(Q_5)$, and $P_8(Q_8)$ represent the U.S. excess demand curves for Canadian feed barley, Canadian 6-row malting barley and Canadian 2-row malting barley, respectively. $P_3(Q_3)$, $P_6(Q_6)$, and $P_9(Q_9)$ represent the excess demand curves in the ROW for Canadian feed barley, Canadian 6-row malting barley and Canadian 2-row malting barley, respectively. These curves implicitly contain the effects of domestic agricultural policies and export subsidies of foreign competitors (e.g., the European Union, Australia and the United States), and the reactions of these competitors to Canadian sales decisions.

Under the above assumptions, the first order conditions can be derived from (2) and (3). It is perhaps simplest to start with the malting barley markets (markets 4 through 9). The first order conditions in each of these markets can be derived by taking the first derivative of the Lagrangian with respect to Q_i and by setting the expression equal to 0. In simplified form, these conditions are:

$$(4)\quad \lambda = SMR_i = \alpha_i - 2\beta_i Q_i \quad \text{for malting barley markets } i = 4, \ldots, 9,$$

where SMR_i refers to the standard marginal revenue curve derived from a linear demand curve.

Now consider the markets for Canadian feed barley (markets 0 through 3). The CWB has only indirect

ontrol over the total quantity of barley available in the ool because it is not a single-desk seller with respect to e domestic feed market. In addition, it is constrained the fact that it must sell all of the barley delivered to e pool and by the fact that there is only a certain amount Canadian barley produced in a given year. This conraint can be derived by taking the first derivative of the agrangian with respect to λ and setting the expression qual to 0. Mathematically, this condition is expressed

$$(5)\quad \overline{Q}_B = \sum_{i=1}^{9} Q_i(P_i) - Q_0(P_0)$$

Inder this constraint, the first order conditions of e CWB in markets 1 through 3 can be derived by aking the first derivative of the Lagrangian with respect Q_i. In simplified form, these conditions are:

$$(6)\quad \lambda = \frac{SMR_i}{\left[1 + \frac{P_0(Q_0) - SMR_i}{\beta_0 \sum_{i=1}^{3} Q_i}\right]}$$

here:

$$(7)\quad P_0(Q_0) = \frac{\sum_{i=1}^{3} P_i(Q_i)Q_i}{\sum_{i=1}^{3} Q_i}$$

the weighted average price (pooled price) the CWB eives for feed exports, that, in equilibrium, must be ual to the Canadian domestic feed barley price. In uation (6), if the bottom expression were equal to 1 plying that the pooled price, $P_0(Q_0)$, is equal to the ndard marginal revenue condition for a price discrimiting monopolist), the CWB objective with respect to d export markets would be the same in markets 1 ough 3 as they were for the malting barley markets 4 ough 9. In general, however, this is not the case. It is portant to recognize that, the CWB does not maximize enue with respect to sales into the domestic feed ley market

summary, the equilibrium conditions across all barley markets in the presence of the CWB are the solutions to the simultaneous system of equations given in (3) through (7). Eliminating the constant, λ, and assuming that the intercept parameters α_i and slope parameters β_i are known, the resulting system contains nine equations and nine unknowns. The nine unknowns are the quantities of barley sold into markets 1 through 9, with the quantity sold into the domestic feed market (market 0) determined endogenously. This system of equations, which defines the behavior of the CWB in the world market place, is different in three ways, from the system of equations that would define the behavior of a pure monopolist operating across all 10 markets (markets 0 through 9). First, the CWB is constrained by the total quantity of barley available in a given year. A pure monopolist would choose the optimal quantity of barley produced, as well as the optimal allocation of that quantity across all markets. Second, the CWB is constrained by the total production constraint (equation (5)) which potentially could result in a sub-optimal amount of barley available in its pool. Third, the CWB does not maximize revenue across all 10 markets. A pure price discriminating monopolist would set marginal revenue equal across all markets, including the domestic feed market. In that case the system of equations would look like equation (4), but would hold across all 10 markets (i = 0,...,9). However, the CWB does not equate the marginal revenue in the domestic feed market with the other nine markets because it cannot operate as a price discriminating monopolist with respect to the domestic market.

In general, the intercepts and slopes are unknown. In addition, these parameters may vary from year to year. However, using actual CWB sales data for 1985/86 through 1994/95, and actual domestic feed barley consumption data provided by Statistics Canada, one can indirectly derive these parameters by working backwards. Given the actual prices and quantities in markets 1 through 9, the total quantity of barley produced in Canada in a given year, and the system of equations defined by conditions (3) through (7), one can infer these parameters by specifying two price elasticities of demand for Canadian barley in any two arbitrary markets.

In this study, we specify the elasticity of demand for Canadian feed barley in the domestic market, and the excess demand elasticity for Canadian feed barley in the rest of the world.

The price elasticity of demand for Canadian barley into a given market is defined as the percentage change in the quantity of Canadian barley sold into that market

...sults from a percentage change in the price of ... in that market. Given the demand curves defined ...uation (3), the elasticity of Canadian barley into ... is:

$$\varepsilon_i = \frac{\partial Q_i}{\partial P_i}\frac{P_i}{Q_i} = -\frac{P_i}{\beta_i Q_i}$$

...addition, the intercept parameter α_i for market i, ...be recovered from the price, P_i and the elasticity, ε_i ...ugh the relationship: $\alpha_i = P_i (1 - 1/\varepsilon_i)$.

...ing these elasticity relationships and inserting them ...equations (3) through (7) yields the following ...m of equations, the solution to which will determine ...emand elasticity for Canadian barley in each ...et:

$$(8)(8.1) \quad P_0 = \frac{\sum_{i=1}^{3} P_i Q_i}{\sum_{i=1}^{3} Q_i} \quad \text{for market 0.}$$

$$(8.2) \quad \hat{\lambda} = \frac{P_i(1+1/\varepsilon_i)}{1+\frac{\varepsilon_0 Q_0}{P_0\sum_{i=1}^{3} Q_i}\left[P_i(1+1/\varepsilon_i)-P_0\right]}$$

for markets i = 1,...,3.

(8.3) $\lambda = P_i (1 + 1/\varepsilon_i)$ for markets i = 4,...,9.

...he above system contains only 10 equations but has ...nknowns. Thus, two demand elasticities for any two ...kets must be exogenously provided in order to solve ...system.

...it is assumed that the elasticity of domestic feed ...ey demand in Canada in each year is -0.53 as ...mated by Schmitz and Koo (1996). The elasticity of ...ss demand for Canadian feed barley in the ROW is ...med to be -20 in every year. This value is reasonable ...n that the CWB does not have a large effect on the ...ce in that market because of export subsidies by the ...ited States and European Union, and the large quanti... of feed barley sold by its competitors. The results of ...solution to (8) in the 1991/92 crop year under the ...assumptions are provided in Table 5.2. The 10 ...kets available to Canadian barley producers are listed ...olumn 1 of Table 5.2. The CWB sells into all of the markets shown in column 1 except the Canadian domestic feed markets. For purposes of Table 5.2, it is assumed that the Canadian domestic feed price is equal to the weighted average price from Japan, the United States, and the ROW. The weighted average f.o.b. prices received by the CWB in each market are shown in column 2. The quantities sold by the CWB into each market in 1991/92 are shown in column 3. The revenue accrued by the CWB in 1991/92 is shown in column 4. It is clear that the CWB was able to price discriminate across the feed markets, the 6-row malting barley markets and the 2-row malting barley markets. For example, the difference between the feed price received by the CWB in Japan and the ROW was $31.53/mt. The difference between the 6-row malting price received by the CWB in Canada and the ROW was $35.70/mt. The difference between the 2-row malting price received by the CWB in Canada and the ROW was $28.85/mt. The weighted average prices received by the CWB in 1991/92 for each type of barley are shown at the bottom of the table. The weighted average prices received by the CWB were $117.18/mt for feed barley, $133.46/mt for 6-row malting barley, and $143.52/mt for 2-row malting barley.

Now consider the fifth column of Table 5.2. This shows the demand elasticities generated by the system of equations in (8). Notice that the elasticity of demand for Canadian feed barley in the United States was -13.8 in 1991/92. This result is well within the expected range. Also, the elasticity of demand for Canadian feed barley in Japan was -3.69. This result also seems reasonable. The elasticities for the malting barley markets are also shown. Note that they range between -1.91 and -2.74. These elasticities seem plausible given the fact that they are excess demand elasticities into individual markets for Canadian malting barley only. They do not include, for example, Australian malting barley exports. Hence, a change in the price of Canadian malting barley in a certain market affects the quantity of Canadian malting barley sold into the market more severely than the quantity of all malting barley sold by all exporting countries into that market. In addition, the price elasticity of demand for Canadian sales of malting barley in different markets would typically be much lower under a competitive market structure (e.g., multiple sellers) because the volume of barley sold for malting would likely increase.

Multiple Seller Objectives

To measure the impact of multiple sellers on barley prices and quantities in Canada, a comparison must be

Table 5.2: Barley Markets Under the CWB in 1991/92

Market	F.O.B. Price ($/mt)	Quantity Sold ('000 mt)	Market Revenue ($ mln)	Demand Elasticity
		Feed Markets		
Japan	135.74	1015	138	-3.69
United States	106.73	143	15	-13.80
Rest of the World	104.21	1336	139	-20.00
Canada Domestic	117.18	7229	847	-0.53
		6-Row Malting Markets		
Canada Domestic	163.09	91	15	-1.96
United States	125.81	288	36	-2.74
Rest of the World	127.39	83	11	-2.68
		2-Row Malting Markets		
Canada Domestic	167.78	137	23	-1.91
United States	147.01	111	16	-2.19
Rest of the World	138.93	804	112	-2.36
		Totals		
Feed Exports	117.18	2494	292	-13.01
All Feed	117.18	9723	1139	-3.73
6-row Malting	133.46	463	62	-2.58
2-row Malting	143.52	1051	151	-2.28
All Barley	120.32	11238	1352	-3.55

Base Case:
Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.
Assumes the Canadian domestic feed demand elasticity is -0.53.
Assumes the malting barley price remains at $15/mt premium to feed barley

made between the market structure observed under the influence of the CWB, and the prices and quantities that would have existed if the market had multiple sellers. Given a fixed Canadian supply of total barley in any given year and in the absence of any additional distributional constraints with respect to the availability of feed barley, 6-row malting barley, and 2-row malting barley in that year, the law of one price would have to hold for all sales of Canadian barley into all markets under a multiple seller equilibrium. As the theory discussed earlier illustrated, multiple sellers are assumed to behave in a perfectly competitive fashion with respect to sales of Canadian barley, and this competition would result in one market price for all buyers at any point in time. This is a characteristic of all competitive markets. Kraft et al. (1996) described the law of one price as follows:

> "In a market that does not have barriers to entry or exit, only one price will clear the market at any particular point in time, and all participants in that market (whether they are buyers or sellers) will have to meet that price. Markets that are separated by distance will have a transport cost that will reflect the cost of moving the product between areas. Similarly, if the product moves from one currency to another then the exchange rate difference will be present in the market. If situations ever exist such that prices are different by more than the cost of freight, or exchange rate conversions, arbitrage quickly takes place to move prices back in line.

One way to think of the "law of one price" is to suppose that the United States is exporting wheat to a country at US$100 per mt free on board (FOB) out of the Gulf ports and this is the lowest price market serviced by the United States. This means that in the absence of the EEP, a grain company is able to source grain in the interior of the United States, and

transport it to the Gulf port, such that it can sell it for US$100 per mt and not lose money. If one company can do this, then all companies in the same area must also offer grain out of the Gulf ports at US$100 per mt. Many customers would likely be willing to pay more than the US$100 per mt, but they do not have to given the sellers will compete for all the business they can get at the US$100 per mt level. No buyer need pay more and no buyer can pay less. Prices only vary by quality and transportation costs between regions. This is essentially how all competitive markets operate and how the U.S. grain market operated prior to the introduction of EEP." (Pages 28-29)

For the purposes of our study, it is assumed that the e of malting barley would remain at a premium to barley for producers to seed these varieties, given additional management and costs required to grow ting barley and the lower yield of malting barley eties relative to feed barley varieties in some areas of stern Canada. In other words, it is assumed that some ting barley would be grown under contract and that ducers would not be interested in these contracts ess there was a premium offered for the malting ity barley. In a multiple-seller world, the price of sold to all markets would be equal, the price of w malting barley sold to all markets would be equal, the price of 2-row malting barley sold to all markets ld be equal. The price of malting barley could never below the price of feed barley or it would simply be keted as feed. Given the elasticities for the excess and curves in each of the barley markets available to CWB (as derived in the previous section), and ming that these demand curves take the form of those the previous section, we can compute the prices and ities that would have resulted under multiple s in each year.

In the absence of distributional constraints placed on quantity of 6-row and 2-row Canadian barley lable for sale as malting barley, the objectives under- the behavior of multiple sellers under perfect petition can be mathematically specified as:

$$(9)\ \text{Maximize } TR = \sum_{i=0}^{9} P_i(Q_i)Q_i \quad \text{with respect to } Q_i \text{ for all } i = 0,\ldots,9$$

Subject to:

$$(9.1)\ \text{supply constraint: } \overline{Q}_B = \sum_{i=0}^{9} Q_i(P_i)$$

$$(9.2)\ \text{feed arbitrage: } [P_i(Q_i) - P_j(Q_j)]\cdot Q_i = 0 \text{ for all } i,j \in \{0,\ldots,3\}$$

$$(9.3)\ \text{6-row arbitrage: } [P_i(Q_i) - P_j(Q_j)]\cdot Q_i = 0 \text{ for all } i,j \in \{4,\ldots,6\}$$

$$(9.4)\ \text{2-row arbitrage: } [P_i(Q_i) - P_j(Q_j)]\cdot Q_i = 0 \text{ for all } i,j \in \{7,\ldots,9\}$$

$$(9.5)\ \text{6-row cross arbitrage: } P_i(Q_i) + \Delta = P_j(Q_j),\ i \in \{0,\ldots,3\} \text{ and } j \in \{4,\ldots,6\}$$

$$(9.6)\ \text{2-row cross arbitrage: } P_i(Q_i) + \Delta = P_j(Q_j),\ i \in \{0,\ldots,3\} \text{ and } j \in \{7,\ldots,9\}$$

where Δ is an exogenous parameter that captures the average cost difference between growing feed barley and growing malting barley. Notice that unlike the objectives of the CWB in (1), the objective of multiple sellers in (9) involves the allocation of Canadian barley across all markets, including the domestic feed market. Under the above system of equations, the introduction of multiple sellers has the possibility to result in either a lower or a higher price in the domestic feed market. The empirical values for the intercepts and slopes of the excess demand curves (determined in the previous section) in a given year, combined with the solution to the objective function (9) determine the equilibrium prices and quantities that would have been realized under multiple sellers in that year.

The solution to (9) determines the trade flows and prices resulting from the introduction of multiple sellers of Canadian barley under the assumption that multiple sellers could increase the quantity of 6-row and 2-row barley sold for malting purposes, by taking the marginal quality barley sold as feed under the CWB, and by selling into malting barley markets. However, in some years, the overall quality of the Canadian barley crop was so low that not much additional malting quality barley was available. In those years the constraints in (9) were altered. Specifically, in years when the quantity of 6-row barley sold as malting barley under multiple sellers was higher than that deemed available, constraint (9.5) was replaced with

$$(9.5a)\ \sum_{i=4}^{6} Q_i(P_i) = \sum_{i=4}^{6} Q_i^{CWB} + \delta_6$$

where Q_i^{CWB} is the amount of 6-row malting barley actually sold by the CWB into market i (markets 4 through 6) in a given year and δ_6 is the additional 6-row barley available for sale as marginal quality 6-row malting barley beyond what was actually sold by the CWB in that year. Similarly, in years when the quantity of 2-row barley sold as malting barley under multiple sellers was higher than that deemed available, constraint (9.6) was replaced with

$$(9.6a)\ \sum_{i=7}^{9} Q_i(P_i) = \sum_{i=7}^{9} Q_i^{CWB} + \delta_2$$

where Q_i^{CWB} is the amount of 2-row malting barley actually sold by the CWB into market i (markets 7 through 9) in a given year and δ_2 is the additional amount of 2-row barley available for sale as marginal 2-row malting barley beyond what was actually sold by the CWB in that year.

The results of the multiple seller solution (9) in the 1991/92 crop year are provided in Table 5.3. This table has the same format as Table 5.2, but provides the multiple seller solution. Under multiple sellers, the equilibrium market price for all sales of Canadian feed barley is $109.29/mt, and the price received for sales of both 6-row and 2-row Canadian malting barley is $124.29/mt. The $15/mt difference in malting and feed barley prices arises because of the cost difference (Δ in equations 9.5 and 9.6) imposed under the base assumptions. In equilibrium, 6-row malting barley sales by multiple sellers would have been 520,000 mt in 1991/92. 2-row malting barley sales by multiple sellers would have been 1.36 mmt in that same year. Malting barley sales in 1991/92 would have been higher under multiple sellers than under the CWB and malting barley prices would have dropped under multiple sellers (Table 5.2). This implies lower demand elasticities for Canadian

Table 5.3: Barley Markets Under Multiple Sellers in 1991/92

Market	F.O.B. Price ($/mt)	Quantity Sold ('000 mt)	Market Revenue ($ mln)	Demand Elasticity
		Feed Markets		
Japan	109.29	1746	191	-1.73
United States	109.29	96	10	-21.12
Rest of the World	109.29	32	4	-866.54
Canada Domestic	109.29	7487	818	-0.48
		6-Row Malting Markets		
Canada Domestic	124.29	134	17	-1.02
United States	124.29	298	37	-2.62
Rest of the World	124.29	89	11	-2.46
		2-Row Malting Markets		
Canada Domestic	124.29	204	25	-0.95
United States	124.29	148	18	-1.38
Rest of the World	124.29	1004	125	-1.69
		Totals		
Feed Exports	109.29	1874	205	-17.65
All Feed	109.29	9361	1023	-3.91
6-row Malting	124.29	520	65	-2.18
2-row Malting	124.29	1356	169	-1.54
All Barley	111.79	11238	1256	-3.55

Base Case:

Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.
Assumes the Canadian domestic feed demand elasticity is -0.53.
Assumes the malting barley price remains at $15/mt premium to feed barley

malting barley under multiple sellers (e.g. -0.95 for the Canadian domestic 2-row malting barley demand elasticity in column 5 of Table 5.3). In addition, the drop in the price received by Canadian producers for exports of feed barley to Japan under multiple sellers would have reduced the Japanese excess demand elasticity for Canadian feed barley to -1.73. However, the rise in feed prices received from sales to the U.S. and the rest of the world in 1991/92 would have increased the excess demand elasticities for Canadian barley in those markets.

Impact on Prices and Revenue of Replacing the CWB with Multiple Sellers

The impact on prices and revenue of replacing the CWB with multiple sellers of feed barley, 6-row malting barley and 2-row malting barley prices for each year from 1985/86 through 1994/95 are depicted in Table 5.4. In the model, it is assumed that the amount of 6-row and 2-row malting barley available to multiple sellers in a given year is constrained by the total selectable malting barley as estimated annually by UGG in its harvest quality survey.[8] First, consider the 6-row malting barley market prices (column 3 in Table 5.4). The annual average price increase earned by the CWB for 6-row malting barley relative to the multiple seller structure, over the 10-year period from 1985/86 through 1994/95, was $42.01/mt. This number was computed as the simple average of the difference in the weighted average price of 6-row malting barley under the CWB vs. the equilibrium price of 6-row malting barley generated by the multiple-seller model. For example, the 1991/92 price difference is $9.17/mt and is equal to the difference between the weighted average price of 6-row malting barley under the CWB (from Table 5.2) and the weighted average price of 6-row malting barley under multiple

Table 5.4: Impact of Replacing the CWB with Multiple Sellers of Canadian Barley

Crop Year	Feed Barley Price ($/mt)	6-Row Malting Barley Price ($/mt)	2-Row Malting Barley Price ($/mt)	Total Producer Revenue[3] ($ mln)
1985/86	(4.91)	(95.70)	(80.93)	(104)
1986/87[1]	(4.46)	(63.16)	(30.08)	(96)
1987/88[2]	(11.36)	(84.08)	(13.18)	(156)
1988/89	1.10	(72.63)	(59.20)	(35)
1989/90	0.86	(37.18)	(47.90)	(19)
1990/91[2]	(7.89)	(28.28)	(2.50)	(102)
1991/92	(7.90)	(9.17)	(19.23)	(96)
1992/93	(4.68)	(12.50)	(36.05)	(66)
1993/94	(2.62)	1.23	(16.05)	(48)
1994/95	6.62	(18.66)	(35.51)	7
Average	(3.52)	(42.01)	(34.06)	(72)

Note: Brackets indicate a loss for multiple sellers.
[1] The quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the UGG estimate.
[2] The quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the CWB level.
[3] Includes the impact on the domestic feed barley market
Source: Case:
Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.
Assumes the Canadian domestic feed demand elasticity is -0.53.
Assumes the malting barley price remains at a $15/mt premium to feed barley.
Source: As calculated by authors.

sellers (from Table 5.3). Replacing the CWB with multiple sellers in 1985/86 would have resulted in a $95.70/mt decrease in the price received by Canadian 6-row malting barley producers. The CWB, relative to multiple sellers, is estimated to have captured higher prices on sales of 6-row malting barley in all years except 1993/94. In that year, multiple sellers are estimated to have achieved a small price increase of $1.23/mt relative to the single-desk selling structure.

Consider the 2-row malting barley market prices (column 4 of Table 5.4). The calculated annual average price difference between the CWB and the multiple-seller structure, on sales of 2-row malting barley for the 1985/86 through 1994/95 period is $34.06/mt. In 1985/86, the CWB is calculated to have achieved a price increase of $80.93/mt on sales of 2-row malting barley relative to a multiple seller environment. The CWB, relative to multiple sellers, is estimated to have captured higher prices in 2-row malting barley markets in every year considered here. The lowest price advantage for 2-row malting barley was $2.50/mt in 1990/91.

Consider the feed barley market prices (column 2 of Table 5.4). The CWB is estimated to have increased the price of feed barley by $11.36/mt over multiple sellers in 1987/88. The CWB is estimated to have increased the prices received by Canadian feed barley producers in 1985/86, 1986/87, and 1990/91 through 1993/94. On the other hand, the multiple-seller structure would have earned a higher average price for Canadian feed barley, relative to the CWB, on sales into feed markets in 1988/89, 1989/90 and 1994/95 ($1.10/mt, $0.86/mt and $5.62/mt, respectively). Canadian feed barley producers would have received an average of $3.52/mt less for feed barley sales under multiple sellers relative to the CWB over the 1985/86 through 1994/95 period.

In comparing the additional revenue received by the CWB for feed barley relative to malting barley, it is not surprising that the amounts earned were considerably greater for malting barley. This result can occur because the CWB can price discriminate to a larger degree in malting markets. Canada has more market power in the malting barley export market than in the world feed barley export market because it controls a much larger percentage of the malting barley trade when compared to feed barley (section 2).

The impact on producer revenue from replacing the CWB with multiple sellers of Canadian barley is given in column 5 of Table 5.4. The introduction of multiple sellers of Canadian feed and malting barley in 1987/88 would have caused Canadian barley producers to lose $156 million in total revenue. Over the 1985/86 through 1994/95 period, the introduction of multiple sellers would have resulted in an annual average loss of $72 million in revenue accruing to Canadian barley producers.

In our study, the losses resulting from the introduction of multiple sellers over a single-desk seller are larger than those calculated in previous studies (section 3). Four major reasons for this result are: (1) the price wedges from actual CWB sales contract data are larger than those assumed in previous studies; (2) the above model examined the impact of a full dual market rather than of a CBM; (3) we include the impact on the domestic feed market in our calculations; and (4) since these other studies were completed, CWB sales of malting barley have increased significantly.

When interpreting the above results, one must keep in mind that total barley supply response under alternative market structures was not modeled explicitly. Each year total barley production was assumed to remain the same regardless of the type of seller. Carter (1993) argued that the production of feed barley would increase under a CBM. This was a surprising result given that he concluded that overall prices would decrease under a CBM. We argue the opposite. Given our results that the price of barley would have decreased under a multiple-seller environment, there would have been less barley available. Since we modeled total barley supply as exogenous in each year (i.e. perfectly inelastic), we underestimated the losses that would result from the introduction of multiple sellers. Thus, the revenue lost from a multiple-seller situation would have been greater than the loss estimated in this study because less barley would have been available under the multiple-seller scenario than was assumed in our model.

Alternative Model Specification

Generally, the magnitude of the increases in total producer revenue attributed to the CWB in Table 5.4 follow the same pattern as the per-unit EEP subsidies provided by the United States on feed barley sales to the rest of the world. For example, 1986/87 and 1987/88 were years during which U.S. feed barley was heavily subsidized, and in those years, Canadian barley producers received higher producer revenue under the CWB. On the other hand, 1988/89 and 1989/90 were years during which U.S. feed barley was only lightly subsidized. This is reflected in the large revenue gains accruing to the

CWB in these years. It is interesting to note that even in these years, the CWB earned additional revenue of $35 million and $19 million, respectively, for Canadian barley producers. The 1988/89 and 1989/90 crop years were also characterized by an increase in Canadian feed barley prices estimated under a multiple-seller situation. Feed barley prices increased $1.10/mt and $0.86/mt, respectively.

Analysis of the data reveals that during the 1988/89 and 1989/90 crop years, Japan did not represent the highest value market for CWB sales of feed barley. Due to the global shortage of feed barley in these years, the CWB attained a price that was significantly higher than the Japanese price (in excess of $15/mt) on approximately 800,000 mt of sales to offshore markets other than to Japan. However, the results shown in Table 5.4 are based on a model with four regions of demand for feed barley (i.e., Japan, the United States, the rest of the world and the Canadian domestic market). By aggregating these higher priced markets with the rest of the world, the difference between the Japanese price and the price in the rest of the world was reduced. This gives the appearance that the CWB was unable to price discriminate during the 1988/89 and 1989/90 crop years.

The above problem with the model is a result of aggregating the number of markets to reduce the number of variables. Ideally, one would like to use a price discrimination model that would include variables for all CWB markets. However, the viabillty of this approach was limited by (1) the number of observations that were available for markets that the CWB infrequently made sales to, and (2) the number of variables that could be handled in a reasonable manner. To address the above issue within our 10 region model, the results for the

Table 5.5: An Alternative Model Specification of the Impact of Replacing the CWB with Multiple Sellers of Canadian Barley

Crop Year	Feed Barley Price ($/mt)	6-Row Malting Barley Price ($/mt)	2-Row Malting Barley Price ($/mt)	Total Producer Revenue[3] ($ mln)
85/86	(4.91)	(95.70)	(80.93)	(104)
86/87[1]	(4.46)	(63.16)	(30.08)	(96)
87/88[2]	(11.36)	(84.08)	(13.18)	(156)
88/89[4]	(1.70)	(75.20)	(61.78)	(68)
89/90[4]	0.07	(37.92)	(48.64)	(28)
90/91[2]	(7.89)	(28.28)	(2.50)	(102)
91/92	(7.90)	(9.17)	(19.23)	(96)
92/93	(4.68)	(12.50)	(36.05)	(66)
93/94	(2.62)	1.23	(16.05)	(48)
94/95	6.62	(18.66)	(35.51)	7
Average	(3.88)	(42.34)	(34.40)	(76)

a/ Brackets indicate a loss for multiple sellers.
b/ Quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the UGG estimate.
c/ Quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the CWB level.
d/ Includes the impact on the domestic feed barley market
e/ Feed barley markets adjusted to reflect the decline of Japan as the highest priced market.
f/ Case:
1 Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.
2 Assumes the Canadian domestic feed demand elasticity is -0.53.
3 Assumes the malting barley price remains at a $15/mt premium to feed barley.
g/ As calculated by authors.

1988/89 and 1989/90 crop years were recalculated with the regions of feed barley demand re-specified. Specifically, Japan was aggregated with the rest of the world and replaced as a separate region by those markets where the CWB obtained a substantial premium. An alternative model of the impact of replacing the CWB with multiple sellers of Canadian barley is reported in Table 5.5. Under this alternative scenario, the price of feed barley in a multiple seller environment would have decreased by $1.70/mt in 1988/89 and would have increased by $0.07/mt in 1989/90. Total producer revenue would have decreased by $68 million and $28 million in 1988/89 and 1989/90, respectively.

From 1985/86 through 1994/95, the replacement of the CWB with multiple sellers of Canadian barley would have resulted in an annual average price decrease for Canadian barley producers of $3.88/mt for feed barley, $42.34/mt for 6-row malting barley and $34.40/mt for 2-row malting barley, as well as an annual average loss of $76 million in Canadian producer revenue.

Pool Account Deficits

It is important to recognize that the results in our study are based on actual CWB sales data and, therefore, do not account for the benefits that producers receive when sales returns less costs of marketing are below the initial payment made by the CWB (i.e. feed barley and designated barley pool account deficits). Over the study period, there were three deficits in the feed barley pool account that amounted to additional revenue of $264 million from government payments for western Canadian feed barley producers. In the designated barley pool account there was one deficit in 1986 that accounted for just under $18 million in government payments. These benefits to producers are not addressed by the results presented in Tables 5.4 and 5.5.

Impact of Multiple Sellers on Trade Flows

Why would the introduction of multiple sellers of

Table 5.6: Change in Trade Flows under a Multiple Seller

Crop Year	Domestic Feed Barley Consumption	Export Feed Barley Sales	6-Row Malting Barley Sales	2-Row Malting Barley Sales
		('000 mt)		
1985/86	175	(634)	266	193
1986/87	225	(575)	216	134
1987/88	524	(753)	229	0
1988/89	(30)	(506)	169	367
1989/90	(23)	(391)	100	314
1990/91	294	(527)	233	0
1991/92	258	(620)	58	305
1992/93	134	(556)	76	347
1993/94	96	(323)	(16)	242
1994/95	(220)	(258)	58	419
Average	143	(514)	139	232

Note: Brackets indicate a decrease under multiple sellers.
Base Case:
Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.
Assumes the Canadian domestic feed demand elasticity is -0.53.
Assumes the malting barley price remains at a $15/mt premium to feed barley.
Source: As calculated by authors.

adian barley generate such large losses for Canadian ey producers in most years? Consider Table 5.6 that ws the change in barley trade flows under the replacement of the CWB by multiple sellers of barley in each from 1985/86 through 1994/95. In most years, tiple sellers would have sold more of the marginal ley into the 6-row and 2-row malting barley markets the CWB would have sold. If available, multiple rs would have reallocated some barley that the CWB as feed into the malting barley markets because they ld receive a higher price for malting barley. However, increase in the volume of malting barley sales into malting markets would have decreased the lting barley price because of the inelastic nature of mand. At the same time, the decrease in the sales of barley in the feed barley markets would have eased the price of feed barley. This additional flow of ting barley would have reduced the malting ley price to the point where the total revenue received Canadian barley producers would be lower than that er the CWB (as illustrated in Tables 5.2 and 5.3). For mple, on average, over the 1985/86 through 1994/95 iod, multiple sellers would have exported 514,000 mt less feed barley than under the CWB. They would have increased the average amount of 6-row malting barley sold by 139,000 mt and increased the average amount of 2-row malting barley by 232,000 mt. In most years, domestic feed consumption would rise under multiple sellers when compared to the CWB because the feed barley price would be lower.

It is worth noting that in 1987/88 and 1990/91, 2-row malting barley sales would not have changed if the CWB were replaced by multiple sellers of Canadian barley. This is because of an additional binding constraint that was added to the model that was binding in those years. In 1987/88 and 1990/91 the CWB had acquired, and sold, all of the 2-row malting barley that was selectable for use as malting barley. The quantity of barley selected for malting purposes under the CWB versus what would have been selected under multiple sellers is shown in Table 5.7. The UGG estimates of the total amount of 6-row and 2-row malting barley that was selectable in a given year are also shown. All numbers are given as selection rates and are in percentage units. The selection rate equals the amount

Table 5.7: Malting Barley Selection Rates (percentage)

	6-Row Malting Barley			2-Row Malting Barley		
p Year	CWB Selected	Multiple Sellers	UGG Selectable	CWB Selected	Multiple Sellers	UGG Selectable
85/86	3.04	5.33	10.00	2.35	4.00	11.00
86/87	2.58	4.05	8.60	4.59	5.50[1]	5.50
87/88	3.69	5.72	11.50	6.26	6.26[2]	4.60
88/89	2.14	3.57	14.60	5.27	8.39	11.60
89/90	2.09	2.99	5.00	4.80	7.61	8.60
90/91	4.49	6.32	14.10	9.16	9.16[2]	6.70
91/92	4.12	4.63	7.60	9.36	12.07	15.50
92/93	3.25	4.00	5.40	7.31	10.76	14.00
93/94	4.13	4.00	7.00	12.43	14.36	16.50
94/95	3.75	4.24	9.40	13.57	17.04	25.30

[1] quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the UGG estimate.
[2] quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the CWB level.
Case:
Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.
Assumes the Canadian domestic feed demand elasticity is -0.53.
Assumes the malting barley price remains at a $15/mt premium to feed barley.
As calculated by authors.

of Canadian 6-row or 2-row barley sold as malt and is shown as a percentage of the entire production of all Canadian barley in a given year.

Consider a given year such as 1991/92 (also see Tables 5.2 and 5.3). In that year, the CWB sold 4.12% of all Canadian barley for 6-row malting purposes. Under a multiple seller scenario, 4.66% of all Canadian barley would have been sold for 6-row malting purposes. However, in that year, the UGG estimated that 7.6% of the total Canadian 6-row barley crop could have been used for 6-row malting purposes. Hence, in 1991/92, the increased sales of 6-row malting barley generated by the model, and caused by the introduction of multiple sellers, would not have exceeded the quantity of selectable 6-row barley for sale as malting barley. According to UGG estimates, as shown in Table 5.7, the quantity of 6-row barley sold as malting barley under the CWB and the quantity that would have been sold under multiple sellers does not exceed the amount of 6-row barley selectable for sale as malt. Similarly, in 1991/92, UGG estimated that 15.5% of the barley grown in Canada was selectable as 2-row malting barley. However, only 12.1% of total Canadian barley would have been sold as 2-row malting barley by multiple sellers in that year. This falls within the selectable range, hence, no further constraints were required for that year.

Columns 5 through 7 of Table 5.7 show a different result for some years. According to UGG estimates, in 1986/87, the amount of selectable 2-row barley was 5.50% of the entire Canadian barley crop. The CWB sold 4.59% for 2-row malting purposes. This was within the range of the UGG estimates. However, the replacement of the CWB by multiple sellers of Canadian barley under the base assumptions reallocated more barley into 2-row malting barley markets than was deemed selectable by UGG. In this case, constraint (9.6) was replaced by constraint (9.6a) with δ_2 equal to the difference between the amount deemed selectable by the UGG and the quantity of 2-row malting barley actually sold by the CWB in that year. This is indicated by superscript one in Table 5.7.

A comparison of columns 5 and 7 in Table 5.7 reveals a contradiction between the quantities of malting barley exported by the CWB and the UGG's estimates of the quantities of malting barley available for selection for the 1987/88 and 1990/91 crop years. In those two years, the UGG estimates of the amount of selectable 2-row malting barley were lower than what the CWB actually sold as 2-row malting barley. This is due to the estimation error inherent in the UGG estimates. In these two years, the revenue maximization problem (9) was altered. Constraint (9.6) was replaced by (9.6a) with $\delta_2 = 0$. This is indicated by superscript two in Table 5.7. These constraints are also reflected in Tables 5.3 through 5.6. For example, Table 5.6 reflects these constraints by indicating that there would have been no increase in the quantity of 2-row barley sold for malting purposes under multiple sellers in 1987/88 and 1990/91.

The 1994/95 Crop Year

As shown in the modeling results, 1994/95 was a unique year that illustrates an underperformance of the CWB on sales of feed barley relative to other years in the 10-year time frame, and relative to a multiple-seller structure for feed barley for that year. Table 5.4 indicates that in 1994/95, multiple sellers could have increased the average price received for Canadian feed barley by $6.62/mt and increased total revenue to producers by $7 million.

The 1994/95 crop year was affected by numerous events, all of which tightened the world supply and demand balance for feed and malting barley. These events are as follows:

- From July to November, 1994, Australian barley production decreased from forecasts of 5.8 mmt to 2.6 mmt.
- Due to low Australian supplies of malting barley, there was record demand for Canadian malting barley. Canadian exports increased by 50% over the previous record to 2.1 mmt.
- Canadian domestic consumption was a record 9.7 mmt. This was 1.0 mmt greater than the previous record. The fact that there would be record consumption in 1994/95 was not correctly identified until February 1995 when Statistics Canada released its December 31, 1994 stocks report.

The available Canadian exportable surplus of barley fell from 4.4 mmt assuming 2.0 mmt of carryout (Dec. 6, 1994, Statistics Canada) to actual exports over that crop year of 3.49 mmt, leaving a record low carryout of 1.89 mmt. Of the 3.49 mmt of barley exported in 1994/95, a record 2.1 mmt was malting barley. The realized exports of feed barley of 1.39 mmt were almost 1.6 mmt below that estimated by Agriculture Canada well into the crop year.

Given the tight feed barley situation, the western Canadian off-Board feed barley market traded at values well above the CWB PRO for the latter part of the year. This made the CWB's origination of barley difficult even though world barley prices were rising. On top of this, origination delays meant that the CWB incurred demurrage and late shipment penalties on export business at the end of the crop year which negatively affected pool returns.

It is important to address the model assumption that multiple sellers would have the same sales pattern as the CWB. As has already been indicated, the bulk of CWB feed barley sales were made early in the crop year. As a result, it is an open question as to what a multiple-seller environment would have achieved in terms of sales pattern during that crop year. Given that the information used by the CWB is the same information that would have been available to multiple sellers, it is likely that sales patterns in the first six months would have been similar to the CWB.

However, a multiple seller-environment would have kept up the off-Board cash price to the export market price in the latter portion of the crop year and would have likely completed some additional sales during this period, despite a very tight feed barley carryout situation. Similarly, it is also important to note that had the CWB had the ability to cash price feed barley in the 1994/95 crop year it would also have been able to service the Japanese market in the highest-price part of the crop year and thus arbitrage prices across the domestic and export markets. In addition, it could have avoided demurrage and late delivery penalties that were incurred that crop year.

Model Limitations

The availability of CWB barley sales contract data allowed this study to go far beyond previous studies for which these types of data were not available. In addition, the effort to model both malting and feed demand and the acquisition constraint in the domestic market represents a significant improvement over previous models that address the same question. The model estimates are consistent with the assumptions used to represent the reality of the domestic and international barley market. However, these assumptions can also be viewed as limitations to our study:

(1) The differences in prices observed across markets (except with respect to the domestic market, represent a CWB revenue-maximizing strategy. In other words, the CWB has knowledge of how competitor prices will respond to additional quantities offered for sale in each market and can use this information in its sales decisions.

(2) The demand curves are linear over the range of actual and simulated competitive prices and quantities. If the actual demand curves were nonlinear, there would be small changes (either positive or negative) in the calculated differences between the model results and the actual outcomes.

(3) The timing of sales throughout the year is the same as that which would have occurred in a multiple-seller environment. In other words, both gains and losses that could have occurred with a different timing of sales were not modeled. This implicitly assumes that the CWB is equal to the private trade in deciding what time of year to make sales.

(4) The aggregation of sales data into nine market segments tends to mask the extent to which the CWB is able to price discriminate across different markets. While this aggregation was viewed to be necessary to maintain continuity of the data, it is important to recognize that this aggregation will underestimate the benefits associated with the CWB's ability to price discriminate.

VI. Costs of CWB Single-Desk Selling with Annual Pooling

Chapter 5 identified the additional revenue from barley sales that the CWB was able to derive from the marketplace through price discrimination. However, there is still the issue of added costs associated with the CWB as a single-desk seller. Carter (1993) and KerrAgra (1996) identified price pooling and the lack of a clear price signal as costs to the western Canadian feedgrain industry. Also, Carter and Loyns (1996) stated that the added costs, due to the single-desk selling of barley by the CWB, were roughly $37/mt.

The purpose of this chapter is to address these costs. First, we calculate the losses that resulted from price pooling. Second, we measure the variability in Canadian feed barley prices relative to U.S. feedgrain prices. Third, we review the Carter and Loyns (1996) estimates of added costs due to CWB single-desk selling to assess whether these costs actually existed and whether they would change if the CWB were removed from barley marketing.

Pooled Pricing Arbitrage Losses

If export feed barley prices increased during the crop year and the PRO did not rise as rapidly, there would be less feed barley delivered to the CWB pool than there would be in the absence of the pool (Figure 6.1). This results in more feed barley sold into the domestic market under price pooling than in its absence. This represents an economic loss due to a lack of arbitrage from annual price pooling. A loss would also occur if export barley prices fell during a crop year and the PRO did not fall as rapidly (Figure 6.2). In this situation, the PRO and Canadian domestic feed barley prices would be above the prevailing world price. As a result, more feed barley would be delivered to the CWB, less feed barley would be sold to the domestic market, and feed barley exports to the world market would be larger than the volume of exports that would occur in the absence of the annual price pooling mechanism.

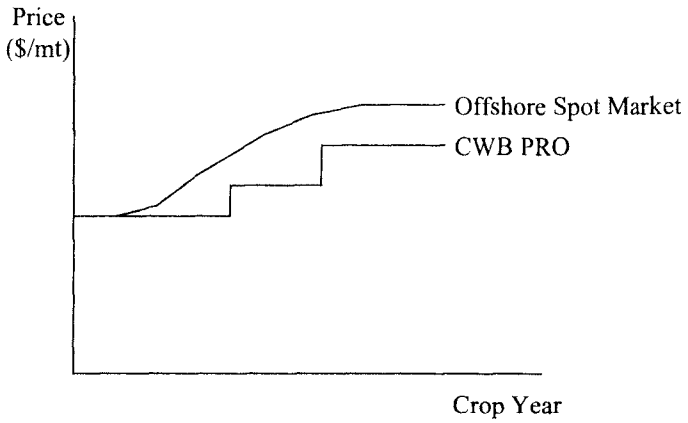


Figure 6.1: Rising Market Scenario for Feed Barley

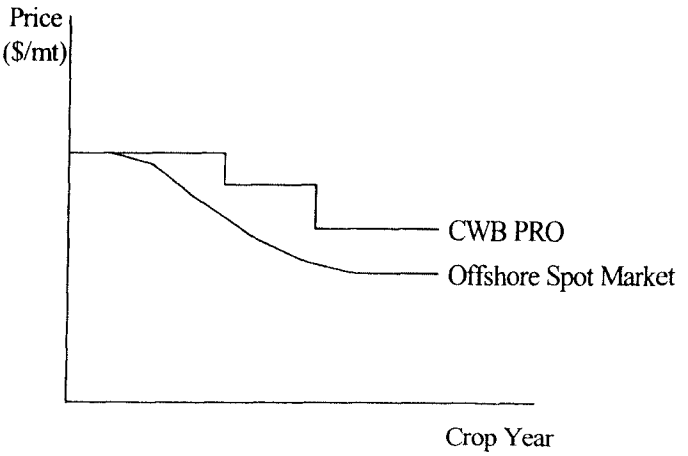


Figure 6.2: Falling Market Scenario for Feed Barley

Three separate issues are at stake here. The first issue whether income transfers are created by price pooling. Domestic prices in Canada on average did not rise as much as export prices (Figure 6.1), this would create a transfer from barley producers to feed barley users. Conversely, if the Canadian domestic price fell less than the export price (Figure 6.2), then pooling would create additional revenue for producers at the expense of feed users. The issue is whether the markets tend to look like Figure 6.1 or 6.2 or a combination of the two. Measuring this income transfer involves an examination of actual domestic price movements as compared to price movements in export markets.

The second and related issue is whether the lack of daily price arbitrage created by annual price pooling enhances or reduces the total return to feed barley producers. When the PRO does not follow current export prices, the quantities fed, and those sold through the CWB for export, are affected. When the domestic price is high relative to the export values, there is a reduction in the domestic demand, but an offsetting increase in the quantity sold in the export market which reduces the export price. When annual price pooling results in domestic prices that are lower than current export prices, the amount fed domestically increases. In this case, an offset occurs that reduces the quantity exported and increases the market price. Measuring all of these effects on the total income received by barley producers is difficult given the many different elasticities in the export market. This measurement is beyond the scope of this study. However, if domestic price movements are similar to those movements in export markets, there would be little impact on the quantities domestically fed and exported. In that case, the effect on revenue would be small. On the other hand, if the bias in how domestic prices move relative to export prices were significant, these impacts could be potentially large and would indicate that these effects should be investigated further.

The third issue is the inefficiency created in the Canadian economy when domestic feed prices do not reflect their export value. Carter and Loyns (1996) and McAgra (1996) argued that the annual pooling of returns by the CWB leads to economic inefficiencies because it does not provide a complete or timely signal of changes in market conditions over the course of the marketing year. This generates economic losses because the export value of feed barley, at a given point in time, is neither reflected in the CWB PRO nor in the Canadian cash domestic feed barley market. Measuring the arbitrage losses associated with pooled pricing over a crop year requires using actual price data and assumptions about what prices would prevail if arbitrage were allowed to occur. This problem is presented in Figure 6.3.

The amount of feed barley that is fed to domestic livestock is represented by the domestic demand curve (D^D) in Figure 6.3. At high feed prices, less barley is fed. At low feed prices, more is fed. As discussed earlier, when export market prices fall during the crop year, the PRO and the domestic cash price (P^F) tend to remain higher than the export market price (P^W). This price wedge decreases the quantity fed domestically from Q^W to Q^F. Barley producers gain area abP^WP^F from the higher domestic prices but feed users lose, as shown by a larger area, acP^WP^F. The net loss (area abc) is the efficiency loss to the Canadian economy created by the poor price signal. Conversely, when market prices have risen, the PRO and the cash price (P^R) would be below the export price P^W. In this case, the price wedge increases feed use to Q^R. Livestock producers gain income equal to area ceP^RP^W from the lower price while barley producers lose a greater area deP^RP^W. The efficiency loss in this case is area cde.

Income Transfer Due to Annual Price Pooling

For the crop year periods from 1988/89 through 1995/96, within crop year price movements were examined. This was the period for which all the necessary data were available. These price movements are reported in the first two columns of Table 6.1. The movements in the Canadian domestic feed barley prices are measured as changes in the Lethbridge weekly average price from the price that prevailed during the first week of September for each crop year[9]. As a measure of changes in international feed barley prices, the spot markets in Great Falls, Montana and Devils Lake, North Dakota are used[10]. The changes in these prices are also calculated relative to the average price for the first week of September.

The results show that for some years, there are large differences in the price movements between the Lethbridge price and in the cash markets at Great Falls and Devils Lake. For instance, in the 1995/96 crop year, prices in Great Falls rose by $30/mt more than the Lethbridge cash price. However, the eight-year average indicated that there was very little bias in these relative price movements. On average for the eight crop years, the Lethbridge price rose by $0.71/mt less than the Great

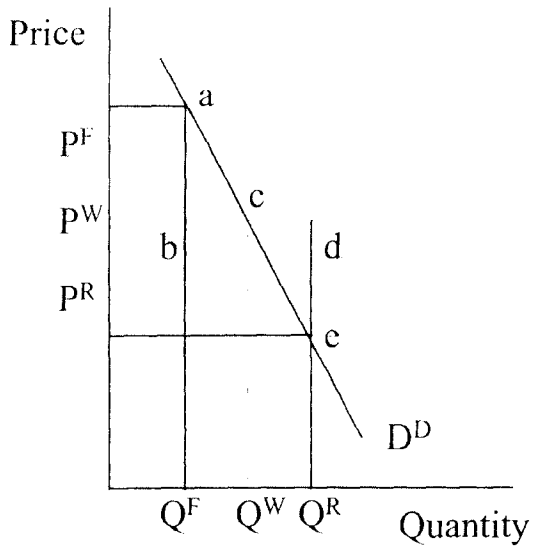


Figure 6.3: Economic Losses in Rising and Falling Markets From Pooled Pricing

...ls price during the crop year, but by $0.29/mt more ...n the Devils Lake price. This suggests that while there ...re large transfers between users and producers in some ...p years, or average these transfers summed to ...tually zero. This was consistent with the efficient ...eration of the cash market at both locations where the ...ce at the beginning of the crop year reflected an ...biased estimate of prices in the coming months.

The lack of a bias in price movement also suggests ...t annual price pooling has little impact on the ...erage amount fed in Western Canada and the amount ...ported. While not a direct measure, this lack of bias ...ould suggest that the impact on the total revenue from ...ports and domestic sales would also be small.

...nefficiencies in the Canadian Economy ...ue to Annual Price Pooling

Measuring the pooling arbitrage losses requires ...alyzing the actual movement in the Canadian domes... price relative to the movement in the export price. ...e movements in the Canadian domestic feed price ...re measured as changes in the Lethbridge weekly ...erage price from the price that prevailed during the first ...ek of September for each crop year. As a measure of ...nge in international feed barley prices, the spot mar...s in Great Falls, Montana and Devils Lake, North ...kota were used. The changes in these prices were also ...culated relative to the average price for the first week ...September.

In the calculations to follow, the arbitrage loss was measured from the difference in domestic price movement relative to export (U.S.) price movement over the crop year. For example, if the average price in Lethbridge for the first of January ($115/mt) had increased $15/mt from the first week of September ($100/mt), and the corresponding world (U.S.) price had increased $25/mt during the same period, there would be a -$10/mt ($15/mt-$25/mt) difference in price movement for that week.

The arbitrage losses were calculated for each week of a crop year. The difference in price movement for each week is applied to one week's demand (1/52 of the annual demand) to calculate the arbitrage losses. This procedure was repeated for each week of the crop year to compute an average price movement difference and a total arbitrage loss for the crop year. The results of these calculations are reported in Table 6.1 and 6.2.

As reported in the last two columns of Table 6.1, using the best estimate of a domestic demand elasticity of -.53, the efficiency loss from price pooling averaged $4.9 million per year. In Table 6.2, the sensitivity analysis shows a somewhat wider range from $2.4 to $7.3 million when the elasticity of domestic demand was decreased and increased by 50%, respectively. While these losses amounted to less than $0.50/mt on average, they represented an economic loss to the Canadian economy from annual pooled pricing.

Table 6.1: Canada-U.S. Barley Price Movements and Arbitrage Efficiency Losses

	Price movement difference* $/mt		Arbitrage Efficiency loss $ mln**	
	Great Falls	Devils Lake	Great Falls	Devils Lake
1988/89	16.69	14.43	5.154	4.068
1989/90	11.60	17.46	2.404	5.334
1990/91	(6.27)	(3.82)	1.409	.813
1991/92	(0.86)	(2.71)	.541	.624
1992/93	(0.46)	(1.45)	.129	.286
1993/94	(10.60)	(9.60)	2.355	2.088
1994/95	17.30	19.08	6.006	6.875
1995/96	(33.05)	(31.10)	21.067	18.955
88/89-95/96 Ave.	(0.71)	0.29	4.883	4.880

Source: Calculated from weekly average spot barley prices. Lethbridge barley price: high end of daily range, data extracted from AGDATA Database, Alberta Agriculture, Food And Rural Development; Devils Lake: local cash prices as reported in AGWEEK; Great Falls: feed barley prices (cash) USDA, Montana Grain Weekly Summary.

*Price movements (Lethbridge less U.S. prices) for each week were calculated versus the average price in the first week of September.

**Domestic demand elasticity = (-.53)

Table 6.2: Sensitivity Analysis for Arbitrage Efficiency Losses in Barley Marketing

	Arbitrage Efficiency loss $ mln		Arbitrage Efficiency loss $ mln	
	Domestic demand elasticity = -.26		Domestic demand elasticity = -.79	
	Great Falls	Devils Lake	Great Falls	Devils Lake
1988/89	2.577	2.034	7.732	6.103
1989/90	1.202	2.667	3.606	8.002
1990/91	.704	.406	2.113	1.219
1991/92	.270	.312	.812	.93601
1992/93	.064	.143	.194	.429
1993/94	1.177	1.044	3.533	3.133
1994/95	3.003	3.437	9.010	10.312
1995/96	10.533	9.477	31.6	28.433
88/89-95/96 Ave.	2.441	2.440	7.325	7. 321

Source: Calculated from weekly average spot barley prices. Lethbridge barley price: high end of daily range, data extracted from AGDATA Database, Alberta Agriculture, Food And Rural Development; Devils Lake: local cash prices as reported in AGWEEK; Great Falls: feed barley prices (cash) USDA, Montana Grain Weekly Summary.

Price Variability in Feed Barley Markets

From a livestock producer's perspective, the magnitude of price variability in the feed barley market is a major concern. Two forms of variability are important. First, the variability in the price of barley is important because the more variable barley prices are, the more actions livestock feeders have to take to protect themselves from the variability, including hedging, forward contracting and increasing storage. This variability is important for the typical length of a production cycle which is generally more than one month but less than one year. Second, the variability in barley prices relative to corn prices must be taken into account.

We measure the first type of price variability in two ways. The first is a "within crop year price variation" which is the standard deviation in monthly average prices around the crop year mean. The second is the average absolute difference between the monthly average prices and the prices in each of the subsequent six months. This measure indicates how well, at the time of making a decision to fill a feedlot or a hog barn, cash barley prices reflect the actual barley prices paid in the subsequent months.

To examine how feed barley price variability was influenced by the CWB, Lethbridge, Alberta feed barley prices were compared to the U.S. price at Great Falls, Montana, Devils Lake, North Dakota and other U.S. points. The first estimate of price variability is reported in column 1 of Table 6.3. The average annual standard deviation in the Lethbridge cash price for the 1988/89 through the 1995/96 crop years was $7.88/mt. Thus, the monthly average Lethbridge price was on average $7.88/mt above or below the average price for the crop year. This compares to $7.23/mt measured at Devils Lake. Hence, there was little measurable difference in price variability between Lethbridge and U.S. feed barley prices. The second estimate of barley price variability, the average absolute difference between the monthly average price in each month relative to the average price in the subsequent six months for the period 1988/89 through 1995/96, is shown in column 2 of Table 6.3. By this measure, the prices at Great Falls were slightly less variable at $6.04/mt than they were at Lethbridge ($6.48/mt). Price variability at Devils Lake was smaller still at $5.57/mt (Table 6.3). The similarity between the variability in prices is very striking. It is also interesting to note that these variations were all significantly less than the variability of corn prices at the PNW of the United States which exhibited an average annual standard deviation of $11.45/mt (column 1 of Table 6.3) and a future six month variation of $8.95/mt.

The second type of variability is the basis variability or change in barley prices relative to U.S. corn prices. The U.S. corn price establishes the feeding cost for a large portion of the U.S. beef, hog, and pork sectors. If there is considerable barley price variability relative to the price of corn, this will affect the competitiveness of Canadian feeding operations as the corn price influences anticipated feeding margins.

The basis variability is measured by the annual average standard deviation in the basis between Lethbridge barley prices and PNW corn prices. For

Table 6.3: Variability of Monthly Average Cash Barley and Corn Prices (1988/89 through 1995/96)

	Crop Year standard dev.	Subsequent 6 Months[1] standard dev.	PNW Corn-barley basis Standard dev.
	$/mt	$/mt	$/mt
Lethbridge Barley	7.88	6.48	11.19
Great Falls Barley	7.88	6.04	10.72
Devils Lake Barley	7.23	5.57	11.62
Great Lakes Corn	11.08	9.24	3.14
PNW Barley	11.32	7.98	11.34
PNW Corn	11.45	8.95	0.00
Duluth Superior Barley	13.79	9.19	15.95

[1] The absolute average of the difference between the average feed barley price in each month relative to the average price in the subsequent 6 months.

Source: As calculated by authors.

...hbridge the average annual standard deviation is ...19/mt (Table 6.3). This means that within a typical ...p year the basis relative to PNW corn changes by ...19/mt. This is slightly higher than the $10.72/mt ...Great Falls and slightly lower than the $11.62/mt for ...evils Lake. In this respect, it appears that Lethbridge ...oducers faced similar feed barley price variability ...ative to their U.S. counterparts from 1988/89 through ...995/96.

By each of the above three measures of variability, ...nada and the United States have had very similar ...ls of feed barley price variability and basis variability. ...m this examination, there is little evidence to support ...e notion that Canadian feed barley users ...ve faced any more or less variability than their U.S. ...unterparts just across the border.

...arter and Loyns (1996)

...Overview

The extra costs from the CWB marketing of barley ...re calculated by Carter and Loyns (1996) and are given ...Table 6.4. The extra costs estimated were roughly ...7/mt.

The costs of marketing grain in Canada are of major ...ncern to producers. However, some of the costs given ...Table 6.4 are non-existent[11]. In addition, many of the ...sts present in the Canadian system are not unique to ...WB grain marketing and would be incurred by ...oducers and government in the absence of the CWB as a single-desk seller. As we demonstrate by reviewing each of these costs, part of the problem with the study by Carter and Loyns was that the methodology upon which their cost estimates were based was not spelled out. From a methodological standpoint, when the CWB is placed in the context of the entire Canadian grain regulatory framework, many of the costs identified in Table 6.4 cannot be attributed to the CWB. In other words, it is not clear how these costs would change if barley were marketed in a multiple-seller environment.

CWB Administration

Carter and Loyns identified the CWB costs of administration and general expenses for barley at $1.75/mt, as incremental costs due to the single-desk structure of marketing barley. If the CWB were a private firm, it would have to recoup the cost of marketing services for barley. Carter and Loyns provided no evidence that these costs would be lower for a private firm than they would be for the CWB. In addition, marketing off-Board grain takes more time and effort on the part of producers because they must gather market information to decide where and when to sell their product. In this study, we assume that the administration costs are the same in the private sector as they are for the CWB.

Varietal Development

Carter and Loyns assumed that barley varietal development was delayed because of the CWB and that the cost of these delays was $4/mt. There was no evidence presented that barley varietal development was delayed. Their reference to the study by Ulrich et al.

...able 6.4: Extra Costs from the CWB as Estimated by Carter and Loyns (1996)

...ost Item	Barley $/mt
...WB Administration	1.75
Protein and Grade Giveaway	0.00
Delays in Varietal Development	4.00
Excess Malting Barley and Maltster Free Storage	5.50
Excessive Handling Charges	4.00
Overages, Demurrage, Extra Freight and Port Congestion	3.10
Excess Cleaning	2.80
Production Inefficiency	4.00
Delays in CWB Payments	3.35
Taxpayer Costs	9.00

...rce: Carter and Loyns, P. 89.

(1986) does not support their case. Ulrich et al. (1986) examined the effect of private sector investment on the development of malting versus feed barley varieties. They did not, however, attribute this influence to the CWB.

Two points are worth mentioning concerning varietal development. First, since 1981, there were 63 new barley varieties registered for use in Western Canada (Schmitz, 1996a). Second, the Prairie Registration Recommending Committee for Grain provides recommendations for the registration of barley varieties in Western Canada. It consists of industry-wide representation from the Canadian Grain Commission (CGC), the CWB, Agriculture and Agri-Food Canada, university researchers, plant breeders, producers and end-users. This coordinated approach ensures that varieties are selected in the best interests of the industry. Given that the process is not under the CWB's control, neither the costs or the benefits of this process could reasonably be expected to change if barley were removed from the CWB's jurisdiction.

Excess Malting Barley Storage Charges

Carter and Loyns attributed to the CWB $5.50/mt in excess malting barley charges. They did not indicate the time frame in which these alleged costs were incurred or did they provide a benchmark for comparison. They simply stated that maltsters were receiving free storage at $3.50/mt and that the excess malting barley being stored was costing producers an average of $2.00/mt. Given that storage costs are a part of any grain marketing system, if farmers, rather than malsters, were to pay the cost of storage directly, then the CWB would receive a higher price for grain. These storage costs would exist and would ultimately be paid by producers with or without a single-desk system. The derivation of the $2.00/mt cost due to excess malting barley was not discussed in the study and there is no basis on which to validate whether any such cost exists.

Excessive Handling Charges

The excessive handling charges of $4.00/mt estimated by Carter and Loyns have no formal economic derivation and are suspect on a market structure basis given that

1) Handling charges for elevator companies are established by the companies themselves and not by the CWB. At one time a cap was placed on handling charges by the CGC, but this is no longer the case.
2) Charges are influenced by the competition among elevator companies for the market share of producer deliveries. In the absence of the CWB and the quota and contracting system for barley and wheat, access to the primary elevator system would be rationed by price. Given that the primary elevator capacity must turn over 7 to 9 times per year, price-rationed access to the constrained Canadian primary elevator system would likely result in higher handling charges for barley producers.
3) Non-CWB grains in Canada are charged similar or higher costs for primary and terminal elevation and storage than CWB grains. For example, the 1995/96 primary elevation for barley was $8.70/mt compared to $11.60/mt for canola. Terminal elevation for this same year was $7.63/mt for barley and $9.48/mt for canola.

In addition, non-CWB grains have added costs because of the wide marketing basis required to manage the risk inherent in marketing. The study by Kraft et al. (1996) indicated that the cost of risk management by the private trade was at least $5.53/mt higher for canola and flax than for wheat marketed by the CWB. This comparison is reasonable as canola and flax are commodities with a large component of export movement and utilize the same logistics as wheat and barley.

Overages, Demurrage, Extra Freight and Port Congestion

Carter and Loyns attributed to the CWB, costs of $3.00/mt for overages, demurrage, extra freight and port congestion. The authors then assumed that these costs would not have existed if the CWB were removed as a single-desk seller. Carter and Loyns based their conclusions on a misunderstanding of what costs applied to CWB versus non-CWB grains. In their discussion, Carter and Loyns implied that there were no shrinkage charges for non-CWB grains. In addition, they implied that non-CWB crops did not incur demurrage, marketing costs and carrying charges. If these implications were correct, shrinkage and overages in canola, flax and other non-CWB crops would not be observed. In addition, demurrage on these crops would not be incurred and port congestion would not be a problem. This clearly is not the case because these costs are normal components of marketing, and all of these costs are evident for

non-CWB grains in both the Canadian and U.S. marketing systems. The fact that these costs exist and are normal for non-CWB grains and for the U.S. marketing system indicates that they would not be expected to disappear if the CWB were removed as a single-desk seller.

It is important to recognize that the grain marketing system in Western Canada has many constraints and bottlenecks. These would not disappear in an open market environment. This is particularly relevant given that the open market system relies on futures markets which operate most efficiently when there is an unfettered ability to deliver to all points at all times. Constrained access at any point in the system has very real negative impacts on the performance of both futures markets and the relationship between futures and cash markets.

Excess Cleaning

The cleaning of export grain is a requirement of the C.G.C. The cleaning tariff of $2.80/mt for barley was identified by Carter et al. as a cost imposed on western Canadian producers by the CWB. Non-CWB grains are also cleaned to meet export standards and their costs tend to be higher than those for CWB grains. For instance, in 1995/96 the CGC reported terminal cleaning charges of $3.85/mt for barley, relative to $4.97/mt for canola. There is no evidence that these costs would diminish if the CWB were no longer a single-desk seller of barley.

Allocative (Production) Inefficiency

Carter and Loyns argued that the lack of clear price signals from the CWB, for pre-planting decisions by producers and for marketing decisions, leads to sub-optimal resource allocation and estimated losses of $4.00/mt. Even if there were a lack of information, this estimate would be somewhat suspect. Carter and Loyns assumed a loss equal to 1% of all farm cash receipts in Western Canada and applied this figure across all barley tonnage.

It is important to note that there is a Lethbridge, Alberta, futures contract that provides an unbiased forecast of prices, and producers have the ability to hedge the price of feed barley for the coming months. There is, however, no futures contract for malting barley in Canada or in the United States. It is very unclear how the removal of CWB as a single-desk seller would provide additional information to producers or improve resource allocation.

Delays in CWB Payments

Carter and Loyns estimated added costs of $3.35/mt for barley due to delays in payment. However, their analysis did not recognize that:

1) The grain export capacity in Western Canada is constrained. As a result, it takes most of a crop year to move the crop to export positions. This delay in generating sales would not change in a multiple-seller environment.
2) To the extent that the CWB retains money in the pool account until it is paid out in the form of interim and/or final payments, it earns interest in the pool account.
3) Cash advances are available to producers through the Prairie Grain Advance Payments Act, up tp $50,000 per CWB permit book holder is available interest-free to producers using stored grain as collateral to resolve many of the farmers' cash flow problems.

Carter and Loyns did not show that producer interest and storage costs would decrease in aggregate with the removal of a single-desk seller. These costs may change for specific individuals, but the aggregate producer interest and storage costs would continue to be logistically determined. There was no discussion or illustration of how these costs would be reduced under a different system.

Taxpayer Costs

The CWB receives no direct payments from the Government of Canada except in the event of a deficit in the pool account. These transfers are not costs to producers - they are benefits. For the last ten years, these transfers occurred in 1985/86, 1986/87 and 1990/91. They amounted to an average of $8.13/mt for the 1985/86 through 1994/95 period. These deficits occurred during a period of intense export subsidy competition and corresponded to times when the government contributed direct support to producers to offset income reductions.

Summary and Policy Implications

It is clear that, while some of the costs of single-desk selling identified by Carter and Loyns are present in the Canadian system, they are not unique to CWB grain marketing, and would be incurred by producers and government in the absence of the CWB as a single-desk seller. This does not mean these costs should be disregarded in policy analyses. Ways in which the Canadian grain marketing system can be made more efficient need to be constantly examined. Policies that would result in a reduction in these costs should be explored further.

The costs associated with arbitrage due to the operation of an annual price pool, in some years can be substantial, but overall, the losses are much smaller than the additional revenues earned by the CWB over multiple sellers. Also, there are distributional implications. In some years, barley users gain and on others barley producers gain from price pooling. However, over time these effects cancel out.

Arbitrage losses due to annual pooled pricing would be eliminated in a multiple-seller environment. However, it is important to recognize that the losses from incomplete arbitrage could be addressed by giving the CWB more flexibility, including the ability to purchase cash barley in order to procure barley for export in years where markets rise dramatically after the commencement of the crop year. Options for contracting which commit producers for delivery early in the crop year should also be examined.

Summary and Conclusions

Issues and Objectives

The operation of the Canadian Wheat Board (CWB) as the single-desk seller of western Canadian feed and malting barley for export and domestic human consumption within Canada is at the center of ongoing debate and controversy in Western Canada. The key issues raised in the debate are as follows.

1) Does the CWB deliver higher returns to western Canadian feed and malting barley producers than would be the case in a multiple-seller environment?
2) Are there benefits provided to producers through the price pooling operations of the CWB, i.e., risk management?
3) What are the inherent problems of arbitrage between the annual pooled return provided by the CWB and the cash off-Board market price?
4) Are there additional marketing costs that are unique to the operation of the CWB as a single-desk seller?

Several economic studies of the Canadian barley marketing system and several government processes directly addressed the national and international issues involved in the debate. These activities included a federal government Round Table process in 1992/93 that funded a study by Carter (1993) which led to a federal Ministerial decision by the Honourable Charles Mayer to create a Continental Barley Market (CBM) beginning August 1, 1993. This change in marketing structure was reversed by a federal court ruling on Sept. 10, 1993. Following this ruling, in 1994/95, the Canada-U.S. Joint Commission on Grains examined issues relating to the potential for harmonization of the Canadian and U.S. marketing systems. The results of the Commission were provided to a federally mandated Western Grain Marketing Panel (WGMP) in 1995/96 that examined all issues in the western Canadian grain marketing industry. The WGMP made several recommendations to the federal government that would (1) increase the operational flexibility of the CWB in procuring grain from producers, (2) provide payment alternatives to increase flexibility of cash flow, (3) change the governance structure of the CWB to allow for direct producer control of the organization through a board of directors with producer-elected representatives, (4) establish a full open market for feed barley, with participation by the CWB, and (5) continue the single-desk selling of malting barley by the CWB.

The current Minister of Agriculture, the Honourable Ralph Goodale, announced on October 7, 1996 that the Government of Canada would implement the majority of the operational and governance recommendations of the WGMP. The Panel's recommendation to create a full open market for feed barley sales while maintaining the single-desk status of the CWB in malting barley markets was not accepted. The Minister of Agriculture announced that a producer vote should take place on this issue.

Recent public studies that have examined the economic issues surrounding barley marketing in Western Canada and North America have focused primarily on feed barley, with less emphasis on malting barley. The lack of focus on the interrelationship between these two different barley markets has limited the usefulness of earlier studies in determining the implications of various possible marketing arrangements for barley producers and for the livestock and malting industries. In addition, these studies are limited in scope because they had little or no access to actual CWB sale prices and contract terms. Finally, although problems of arbitrage within the western Canadian domestic feed barley market have been identified in some of these studies, very little has been done to formalize

concept of arbitrage in the context of CWB price ling or to quantify the effects within a formal nomic framework.

Using formalized and integrated economic analyses, overall objective of this study is to evaluate the nomic performance of the CWB with respect to the keting of both feed and malting barley domestically nternationally. The specific objectives of this study to

1) provide an overview of the world barley trade for both malting and feed barley (Chapter 2);
2) review previous studies that have examined the role of the CWB in the domestic and international barley market (Chapter 3);
3) develop a theoretical framework to examine the CWB's role in domestic and international feed, malt and malting barley markets, and the potential for the CWB and other market participants to exercise market power (Chapter 4);
4) test, using actual CWB contract data for the period 1980/81 through 1994/95, whether the CWB exhibits market power in the international feed barley market (Chapter 5);
5) estimate the returns from single-desk selling using an economic model that incorporates actual CWB sales data (Chapter 5);
6) use historical price data to estimate arbitrage losses resulting from annual price pooling (Chapter 6); and
7) review and evaluate the marketing costs that have been attributed to the CWB in previous studies (Chapter 6)

World and Canadian Barley Markets

anada is a major player in the world barley market. s among the top three exporters of both feed and ing barley in the world. At times, total exports from uropean Union, Canada and Australia have been in ss of 78% of total world barley exports. Canada and tralia together have had more than 50% market share arley exports. For malting barley, Canada's export set share has been as high as 40%. From a market spective, the Canadian domestic market for feed ley has been the largest component of total adian barley consumption.

Export Enhancement Program (EEP) subsidies and stution payments have been central to the export of U.S. and E.U. barley, respectively. The European Union halted restitution payments in May 1995, but these were reintroduced in September 1996. For barley, these subsidies commonly exceeded US $60/mt. The United States has not subsidized barley exports since July 1995. However, the 1996 Farm Bill authorized EEP funding of US $350 million in fiscal 1996, $250 million in 1997, $500 million in 1998, $550 million in 1999, $579 million in 2000, and $478 million in 2001 and 2002.

Selected Previous Studies

Consensus cannot be reached as to the benefits and costs of the CWB as a single-desk seller. A number of studies have concluded that substantial benefits were associated with this system. Other studies that do not support these results have argued that, while price premiums may have existed, they were small relative to the added marketing and other costs associated with the CWB. The studies provide a basis for the modeling approach used in this study, however, a major limitation of almost all the studies is that they model the effects on the feed grain market separately from the malting barley market. Also, generally, no formal models have been developed for the malting barley market that parallel the analysis of the feed grain sector. Rather, assumptions have been made about the link between feed barley prices and malting barley prices. In other cases, malting barley price premiums have been calculated by comparing U.S. and Canadian prices.

When modeling the behavior of the CWB, one cannot *a priori* assume that it acts in a perfectly competitive manner. The world barley market consists of relatively few sellers. Also, in view of the work by Haley et al. (1992), one must test whether the CWB has market power. Determining whether the CWB has market power is empirically difficult, unless actual contract pricing data are available. The issue of market power and the nature of competition is very important. As Johnson et al. (1994) pointed out, assuming competitive behavior (i.e. no market power) misses the major argument in the current debate over barley marketing.

Much of the confusion in the present barley marketing debate is based upon the lack of a clear distinction between additional revenues earned by a single-desk seller and the total efficiency or inefficiency of a single-desk seller versus multiple sellers. For example, it is theoretically possible for the CWB to earn price premiums and still have a situation in which producers could be worse off than they would be under multiple sellers.

however, that situation could only occur if the CWB system resulted in higher costs. To highlight this point, in their study on wheat, Kraft et al. (1996) concluded that the CWB earned significant price premiums over multiple sellers. These price premiums were calculated (free on board) f.o.b. Vancouver and not at the farm gate. If the marketing costs under the CWB were at least as low as under a multiple seller-situation, the farmer would do better under the CWB system. However, Carter and Loyns (1996) contended the single-desk system adds costs to those that would exist under a multiple-seller system, and these costs outweigh the premiums.

Theory of Single-Desk Selling

The CWB is a form of collective action by Canadian grain producers in an attempt to maximize returns by jointly providing marketing services and countervailing power against large multinational grain trading companies. The CWB's existence is a direct result of public policy as it requires federal legislation (i.e. the Canadian Wheat Board Act). The CWB is set up to operate as a producer marketing board and it has adopted the objective of maximizing returns from sales of wheat and barley. The CWB acts as the producer's agent through which all sales and payments are made. The theory of producer marketing boards has been discussed in several works including Bieri and Schmitz (1974), Just et al. (1979), McCalla and Josling (1981), Schmitz et al. (1981), and Just et al. (1982).

In theory, the CWB is a producer monopolist. It's not a middle man (i.e. where a firm attempts to exploit both producers and consumers) nor a monopsonist (i.e. where a firm exploits producers). In other words, the profits earned from sales by the CWB are returned directly to producers (i.e. producers are the "shareholders" of the CWB).

A major feature of the international barley market is that marketing boards, such as the CWB and the Australian barley boards, sell into a market in competition with multinational grain companies. Their behavior is influenced by state trading entities including the E.U. Cereals Management Committee and the U.S. Commodity Credit Corporation. State trading dominates the world barley market. Roughly one half of barley trade is dominated by single-desk sellers.

The marketing of grain in the United States is very different from the marketing of CWB grains. As pointed out by Hill (1992), large multinational trading companies dominate the export stage of the U.S. grain marketing system. The dominant multinational trading companies involved in the export of U.S. grain are Cargill (American-based), Continental (American-based but owned by a French family), Archer Daniels Midland (American-based) which has a joint export venture with Toepfer (German-based), Bunge (Argentinian-based), Louis Dreyfus (French-based), and several subsidiaries of large Japanese corporations whose headquarters are in the United States. All of these companies source grain from the United States and other origins. In essence, the U.S. multinational trading companies behave as middlemen with respect to the buying and selling of U.S. and other origin grains. They buy grain from optional origins and sell it to foreign buyers.

The ability of a single-desk seller to generate additional revenue through price discrimination is well founded in economic theory. There is general agreement that the CWB is able to price discriminate. However, there are other reasons why the CWB may be able to increase revenue above what would exist under multiple sellers. One reason, suggested by Carter (1992), is that the steady supply guaranteed by the CWB spreads the risk that grain companies face in dealing with the day-to-day transactions. If the CWB did not exist, higher variability in quantity, quality, and price might force these companies to manage risk through the futures exchange. These companies would incur additional costs in coordinating information and hiring experts in the futures market. Hence, the presence of the CWB may be a lower-cost solution to these companies than alternative risk spreading, such as the use of futures market options. The CWB may be able to extract premiums for many of these companies who are willing to pay for this lower risk. It may also be the case that the CWB can obtain premiums simply because the multinational trading firms may charge higher margins in a system where they did not have to deal with the CWB.

Test for Market Power

A key consideration in the debate over feed barley marketing in Canada is whether the CWB is able to price discriminate and, therefore, exert market power in world markets. To test for market power, actual CWB feed barley contract data by import market and sale date from 1980/81 through 1994/95 were examined. The data for sales made via Canada's ports on the West Coast during this period were aggregated on a f.o.b. vessel basis into

Table 1: Mean Difference Test of CWB Prices Achieved for Feed Barley

Time Period	Japan - U.S.	U.S. - ROW[1] - Cdn $/mt -	Japan - ROW
1980/81 - 1994/95	25.29*	4.46*	20.73*
1980/81 - 1985/86	1.46	4.32	13.99*
1985/86 - 1994/95	26.84*	4.47*	23.74*

*Statistically different from zero with a probability greater than 95%.
[1]ROW = rest of the world.
Source: As calculated by authors.

the following regions: 1) Japan; 2) the United States; and 3) the rest of the world (ROW). A mean difference test was then conducted to examine whether statistically significant differences existed among the prices in these markets.

As indicated in the results, statistically significant differences existed among the f.o.b. contract prices obtained by the CWB in these markets (Table 1). Thus, the CWB has been able to price discriminate. The CWB's ability to price discriminate has allowed it to capture a higher price than would otherwise exist if there were multiple sellers of western Canadian barley. Therefore, western Canadian feed barley producers have benefited from the CWB. The average difference between CWB contract prices for Japan and the United States, over the 1980/81 through 1994/95 period, was significant and averaged $25.29/mt (tonne). The difference between CWB contract prices for the U.S. and ROW markets was also significant, with an average price difference of $4.46/mt. The difference between CWB contract prices for Japan and the ROW markets was significant and averaged $20.73/mt.

As shown in the results, the introduction of the U.S. EP and the resulting feed barley trade war between the United States and the European Union increased the degree to which the CWB price discriminated. The average difference between Japan and the United States rose from $1.46/mt in the early 1980s to $26.84/mt in the trade-war period. Similarly, the average difference between Japan and the ROW increased from $13.99/mt in the early 1980s to $23.74/mt.

Comparing the CWB against Multiple Sellers

In this study, data are used from every CWB sale of feed barley, 6-row malting barley and 2-row malting barley for the period 1985/86 through 1994/95. The data are compiled from CWB contract records. All prices are brought to a common basis point of either f.o.b. Vancouver or f.o.b. Thunder Bay. The sales data are aggregated into the following nine market segments: 1) Japanese feed market; 2) U.S. feed market; 3) all other offshore feed markets; 4) Canadian domestic 6-row malting market; 5) U.S. 6-row malting market; 6) offshore 6-row malting markets; 7) Canadian domestic 2-row malting market; 8) U.S. 2-row malting market; and 9) offshore 2-row malting markets.

The objective of CWB marketing is modeled as the allocation of the total quantity of barley that it received from producers in a given crop year across the above nine markets so as to maximize total sales revenue. In order to measure the impact that multiple sellers of Canadian feed and malting barley would have had on returns and trade flows, a comparison is made between the actual market structure (i.e., prices and quantities) observed under the CWB and the prices and quantities that would have existed if there were multiple sellers of Canadian feed and malting barley.

In this study, two economic models are developed to determine the extent of price discrimination by the CWB in world barley markets and the resulting benefits derived by western Canadian barley producers. The first model incorporates the market power of the CWB in world barley markets by assuming that the CWB allocates its sales in order to simultaneously maximize

evenue across world feed barley markets, lomestic and world 6-row malting barley markets and lomestic and world 2-row malting barley markets. The quilibrium domestic feed barley price is assumed to be qual to the weighted average pooled price for CWB xports of all feed barley. Using actual CWB sales data or 1985/86 through 1994/95, the excess demand lasticity for each type of Canadian barley in each narket is determined by the model, given the domestic lemand elasticity for Canadian feed barley and the xcess demand elasticity for Canadian feed barley in the ion-Japanese offshore markets. The demand elasticities ire used to generate demand curves for Canadian barley n each market. The second model replaces the CWB vith multiple sellers of Canadian barley by assuming that multiple sellers would introduce perfect competition in eed markets and malting barley markets. Under this assumption, the law of one price would hold across all eed barley markets and would also hold across all malting barley markets. The first and second models are ompared to determine the economic benefits or losses incurred under the CWB.

The key difference between the CWB system and a multiple-seller system is the ability to price discriminate. In the absence of any constraints on the quantity of feed barley, 6-row malting barley, and 2-row malting barley available for sale by Canadian producers, the law of one price would have to hold for all international and domestic barley sales in a multiple-seller environment. In the model, multiple sellers were assumed to be fully competitive, and this competition resulted in one market price for feed barley and one market price for malting barley at any point in time. This is a characteristic of all competitive markets.

Overall Impact

The impact of introducing multiple sellers on Canadian feed and malting barley prices and total Canadian producer revenue is shown in Table 2 for each year from 1985/86 through 1994/95. Overall, the returns from CWB single-desk selling are significantly higher than would be the case in a multiple-seller environment. During the time period, the CWB earned an additional average return of $72 million annually over the multiple-seller scenario.

Table 2: Impact of Introducing Multiple Sellers on Canadian Feed/Malting Barley Prices and on Total Canadian Producer Revenue

Crop Year	Feed Barley Price $/mt	6-Row Malting Barley Price $/mt	2-Row Malting Barley Price $/mt	Total Producer Revenue[1] $ mln
1985/86	(4.91)	(95.70)	(80.93)	(104)
1986/87	(4.46)	(63.16)	(30.08)	(96)
1987/88	(11.36)	(84.08)	(13.18)	(156)
1988/89	1.10	(72.63)	(59.20)	(35)
1989/90	0.86	(37.18)	(47.90)	(19)
1990/91	(7.89)	(28.28)	(2.50)	(102)
1991/92	(7.90)	(9.17)	(19.23)	(96)
1992/93	(4.68)	(12.50)	(36.05)	(66)
1993/94	(2.62)	1.23	(16.05)	(48)
1994/95	6.62	(18.66)	(35.51)	7
Average	(3.52)	(42.01)	(34.06)	(72)

Note: Brackets indicate a loss for multiple sellers.
[1] Includes the impact on the domestic feed barley market.
Base Case:
Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.
Assumes the Canadian domestic feed demand elasticity is -0.53.
Assumes the malting barley price remains at a $15/mt premium to feed barley.
Source: As calculated by authors.

Impact on 6-Row Malting Barley

The introduction of multiple sellers in 1985/86 would have reduced the average price of Canadian 6-row malting barley by $95.70/mt. The annual average additional revenue or revenue "benefit" earned by the CWB for Canadian 6-row malting barley producers over the 10 year period 1985/86 through 1994/95 was $42.01/mt. The CWB earned a higher price for 6-row malting barley than multiple sellers would have earned in all years but 1993/94. In this year, a multiple-seller system would have earned a slightly higher price of $1.23/mt.

Impact on 2-Row Malting Barley

The introduction of multiple sellers would have reduced the annual average price for Canadian 2-row malting barley by $34.06/mt from 1985/86 through 1994/95. The CWB prices were higher in every year. The largest premium was $80.93/mt in 1985/86 and the lowest premium was in 1990/91 at $2.50/mt.

Impact on Feed Barley

From 1985/86 through 1994/95, the introduction of multiple sellers would have reduced the annual average price for feed barley in Canada by $3.52/mt (Table 2). The CWB returned the highest revenue benefits to Canadian producers relative to the multiple-seller scenario in 1987/88 ($11.36/mt). The CWB also obtained added revenue in 1985/86, 1986/87, and 1990/91 through 1993/94. However, the multiple-seller structure would have returned higher revenue relative to the CWB in feed markets in 1988/89, 1989/90, and 1994/95 ($1.10/mt, $0.86/mt and $6.62/mt, respectively).

As a caveat to the above, during the 1988/89 and 1989/90 crop years, Japan did not represent the highest value market for CWB sales of feed barley. Because of the global shortage of feed barley in those years, the CWB obtained a price that was significantly higher than the Japanese price (in excess of $15/mt) on approximately 500,000 mt of sales to offshore markets other than Japan. However, the results (Table 2) were based on a model with four regions of demand for feed barley (i.e. Japan, the U.S., the ROW, and the Canadian domestic market). By aggregating these higher-priced markets with the ROW, the difference between the Japanese price and the price in the ROW was reduced. This gave the appearance that the CWB was unable to price discriminate during the 1988/89 and 1989/90 crop years. To address this issue, the results for the 1988/89 and 1989/90 crop years were recalculated with the regions of feed barley demand being redefined. Specifically, Japan was aggregated with the ROW and replaced as a separate region by those markets in which the CWB obtained a substantial premium. With the introduction of multiple sellers, feed barley prices would have decreased by $1.70/mt in 1988/89 and increased by $0.07/mt in 1989/90. From 1985/86 through 1994/95, the introduction of multiple sellers would have resulted in an average annual decrease in Canadian feed barley prices of $3.88/mt.

Impact on Total Producer Revenue

If multiple sellers would have replaced the CWB, producers' revenues would have decreased by an average of $72 million per year for the period 1985/86 through 1994/95. Under a multiple-seller scenario, the change in revenue would have ranged from a loss to Canadian feed and malting barley producers of $156 million in 1987/88, to a gain of $7 million in 1994/95. The 1994/95 year would have been the only year to show a gain under the multiple-seller structure. Generally, the magnitude of the increases in total revenue attributed to the single-desk structure followed the same pattern as the per-unit EEP subsidies provided by the United States on feed barley sales to the ROW.

Model Limitations

The availability of CWB barley sales contract data allowed this study to go far beyond previous studies for which these types of data were not available. In addition, the effort to model both malting and feed demand and the acquisition constraint in the domestic market represents a significant improvement over previous models that address the same question. The model estimates are consistent with the assumptions used to represent the reality of the domestic and international barley market. However, these assumptions can also be viewed as limitations to our study:

(1) The differences in prices observed across markets except with respect to the domestic market, represent a CWB revenue-maximizing strategy. In other words, the CWB has knowledge of how competitor prices will respond to additional quantities offered for sale in each market and can use this information in its sales decisions.

(2) The demand curves are linear over the range of actual and simulated competitive prices and quantities. If the actual demand curves were nonlinear, there would be small changes (either positive or negative) in the calculated differences between the model results and the actual outcomes.

(3) The timing of sales throughout the year is the same as that which would have occurred in a multiple-seller environment. In other words, both gains and losses that could have occurred with a different timing of sales were not modeled. This implicitly assumes that the CWB is equal to the private trade in deciding what time of year to make sales.

(4) The aggregation of sales data into nine market segments tends to mask the extent to which the CWB is able to price discriminate across different market opportunities. While this aggregation was viewed to be necessary to maintain continuity of the data, it is important to recognize that this aggregation will underestimate the benefits associated with the CWB's ability to price discriminate.

Costs of Single-Desk Selling

We identify the additional revenue from barley sales that the CWB derives from the marketplace though price discrimination. However, there still remains the issue of the costs associated with the CWB as a single-desk seller. For example, Carter (1993) and KenAgra (1996) identified price pooling and the lack of a clear price signal as costs to the western Canadian feedgrain industry. This study finds these costs to be overstated.

Pooling Price Arbitrage Losses

The CWB currently uses an annual pooled return to allocate sales revenue to producers. This mechanism does not provide a signal to producers that fully responds on a timely basis to changing market conditions within a given marketing year. If export market prices change substantially during a crop year, the prevailing pooled return will not reflect this change on a timely basis. This creates some economic losses because the export value of feed barley at a given point in time is not reflected in the CWB Pool Return Outlook (PRO), nor in the cash price in the domestic feed barley market in Western Canada.

Arbitrage losses resulting from the operation of the CWB's annual pool for feed barley are calculated by measuring the difference in the change in price of feed barley at two U.S. points (Great Falls, Montana and Devils Lake, North Dakota) relative to the price of feed barley at Lethbridge, Alberta from the beginning of the crop year for the period from 1988/89 through 1995/96. The efficiency loss from price pooling averaged $4.9 million per year for both the Great Falls, Montana and Devils Lake, North Dakota comparisons with most of the losses concentrated in the 1995/96 crop year (Table 3). The 1995/96 crop year was unique as during this year international prices rose dramatically after the beginning of the crop year due to a significant reduction in U.S. corn production at a time of low carryover stocks of feedgrains. This created a large price wedge between the Canadian domestic feed barley price (which reflected the PRO) and the Great Falls/Devils Lake feed barley prices.

Price Variability in Feed Barley Markets

From a livestock producer's perspective, the issue of price variability is of major concern. Three measures of feed barley price variability are calculated in this study:

1) the variability in the price of barley within the crop year;
2) the variability of barley prices in the subsequent six-month period; and
3) the variability of barley prices relative to U.S. corn prices.

To compare barley price variability, Lethbridge off-Board feed barley prices were compared to the U.S. feed barley prices at Great Falls, Montana and Devils Lake, North Dakota. As shown in column 1 of Table 4, the average annual standard deviation in the Lethbridge cash price, from 1988/89 through 1995/96, was $7.88/mt. This indicates that the average September cash price in Lethbridge was on average $7.88/mt above or below the average price for the crop year. This compares to $7.88/mt and $7.23/mt measured at Great Falls and Devils Lake, respectively. Comparisons, among Canadian and U.S. feed barley prices for each month relative to the subsequent six months (column 2 of Table 4) from 1988/89 through 1995/96, show similar levels of variability. As well, substantial differences do not appear to exist in the variability of Canadian and U.S. feed barley prices relative to U.S. corn prices in the Pacific Northwest (PNW) (column 3 of Table 4). This analysis suggests that Canadian feed barley prices do not exhibit anymore variability than U.S. feed barley prices.

Table 3: Canada-U.S. Barley Price Movements and Arbitrage Efficiency Losses

	Arbitrage Efficiency loss* - $ mln -		Price movement difference** - $/mt -	
	Great Falls	Devils Lake	Great Falls	Devils Lake
1988/89	5.154	4.068	16.69	14.43
1989/90	2.404	5.334	11.60	17.46
1990/91	1.409	.813	(6.27)	(3.82)
1991/92	.541	.624	(0.86)	(2.71)
1992/93	.129	.286	(0.46)	(1.45)
1993/94	2.355	2.088	(10.60)	(9.60)
1994/95	6.006	6.875	17.30	19.08
1995/96	21.067	18.955	(33.05)	(31.10)
88/89-95/96 Ave.	4.883	4.880	(0.71)	0.29

Source: Calculated from weekly average spot barley prices. Lethbridge barley price: high end of daily range data extracted from AGDATA database, Alberta Agriculture, Food And Rural Development; Devils Lake: local cash prices as reported in AGWEEK; Great Falls: feed barley prices (cash) USDA - Montana Grain Weekly Summary.

*domestic demand elasticity = -.53

**Price movements (Lethbridge less U.S. prices) for each week were calculated versus the average price in the first week of the September.

Table 4: Monthly Average Cash Barley Price Variability, 1988/89 - 1995/96*

	Crop Year	Subsequent 6 Months**	PNW Corn-Barley Basis
		- $/mt -	
Lethbridge Barley	7.88	6.48	11.19
Great Falls Barley	7.88	6.04	10.72
Devils Lake Barley	7.23	5.57	11.62
PNW Corn	11.45	8.95	0

Standard deviation.

*The absolute average of the difference between the average feed barley price in each month relative to the average price in the subsequent six months.

Source: As calculated by authors.

Carter and Loyns

As shown in our empirical results and confirmed by the analysis in this report, it is clear that the CWB has been able to exercise market power to the benefit of western Canadian farmers. However, Carter and Loyns (1996) argued that there are extra costs due to the CWB's marketing of barley calculated at roughly $37/mt.

Our general conclusion is that while some of the costs addressed by Carter and Loyns are present in the Canadian system, they are not unique to CWB grain marketing and would be incurred by producers and government in the absence of the CWB as a single-desk seller. Part of the problem with the study by Carter and Loyns is that the methodology upon which their cost estimates were based was not spelled out. From a methodological standpoint, when the CWB is placed in the context of the entire Canadian grain regulatory framework, many of the costs that Carter and Loyns attribute to the CWB would disappear. It is possible that costs could be higher in the absence of the present regulatory framework and the CWB.

onclusions

This study clearly establishes that the single-desk ling of barley creates more sales revenue for western nadian farmers than would be created if there were ultiple sellers due to the ability of the CWB to exercise arket power on behalf of western Canadian farmers. e magnitude of the additional revenue created varies different years depending upon a number of factors, cluding the occurrence and degree of export subsidiza- n in feed and malting barley markets.

Given the dominance of the CWB as a marketer of alting barley in a relatively small world malting barley arket, it is not surprising that the benefits of the CWB's gle-desk status are largest for malting barley. In ntrast to the situation with malting barley, the CWB is somewhat smaller player in the world feed barley arket and, as a result, its ability to exercise market power rough price discrimination, while significant, has less an overall impact on prices.

One of the common criticisms of the CWB market- g system is the lack of arbitrage between the CWB feed rley pool return, western Canadian feed barley prices d international feed barley prices. This study addresses is problem using formal economic analysis to estimate the associated losses. These losses are small relative to the price premiums earned by the CWB. Even so, they could have been significantly reduced by providing the CWB with added flexibility, including cash trading.

From a policy perspective, the results from this study provide additional information to policy makers and producers regarding difficult choices among alternative marketing structures for Canadian barley. Issues such as equity and producer risk management are not addressed. However, it is clear that the CWB has been able to earn additional revenue from the sale of western Canadian barley over what would have been achieved under multiple sellers.

Many issues have been raised including those presented in a highly controversial report by Carter and Loyns. After an examination of the costs of single-desk selling identified by Carter and Loyns, it is clear that while some of the costs are present in the Canadian system, they are not unique to CWB grain marketing, and would be incurred by producers and government in the absence of the CWB as a single-desk seller. This does not mean these costs should be disregarded in policy analyses. Ways in which the Canadian grain marketing system can be made more efficient need to be constantly examined. Policies that would result in a reduction in these costs should be explored further.

Endnotes

[1] Data for 1970 through 1985 were calculated from the barley variety surveys conducted by the USDA. The data give total area planted and percentages for each barley variety in each state by name. The acceptable 2-row and 6-row malting varieties listed by the AMBA in Know Your Malting Barley Varieties for each state and year were used to aggregate the data. Only those varieties that were accepted in a particular state in a given year were considered malting varieties. Any variety that did not fit this criterion was considered feed.

[2] Survey data are available only for California, and no data exist after 1985. A small amount (roughly 3%) of the area in California was planted to 2-row malting varieties before 1982, and roughly 2% was planted to 6-row malting varieties before 1973. The data reported for 1982 to 1985 show that 100% of the barley grown in California was planted to feed varieties.

[3] Data for Australian barley area by state from 1970 through 1979 are from the Australian Barley Board Annual Reports, and data for 1980 through 1993 are from the ABARE Commodity Statistical Bulletins. Tasmania is not included because under 40,000 hectares are planted to barley each year.

[4] Most data for the area planted to spring barley come from the Gerson and Gauger Statistical Digests for the August to July crop year with the following additional assumptions. Disaggregate data for Finland and Sweden are not available so it is assumed that these two countries don't grow any winter barley. Due to data limitations on winter vs. spring area in some years, the following values were interpolated: it is assumed that Austria has the same winter/spring area ratio as they did in 1993, East Germany has the same winter/spring area ratio before 1990 as they did in 1990, and Spain and UK have the same winter/spring ratio from 1980 through 1983 as they did during the three year average period from 1984 through 1986.

[5] In testimony at the court case of *Archibald et al. v. CWB & HMQ (Federal Court No. T-2473-93)* in 1996, Dr. Carter agreed that the data he used were inappropriate for arriving at many of the conclusions reached in his study.

[6] In testimony at the court case of *Archibald et al. v. CWB & HMQ (Federal Court No. T-2473-93)* in 1996, Dr. Carter agreed that the starting point for analyzing the impacts of the CBM should have been the date the CBM was announced (June 3, 1993) not the date it was implemented (September 10, 1993).

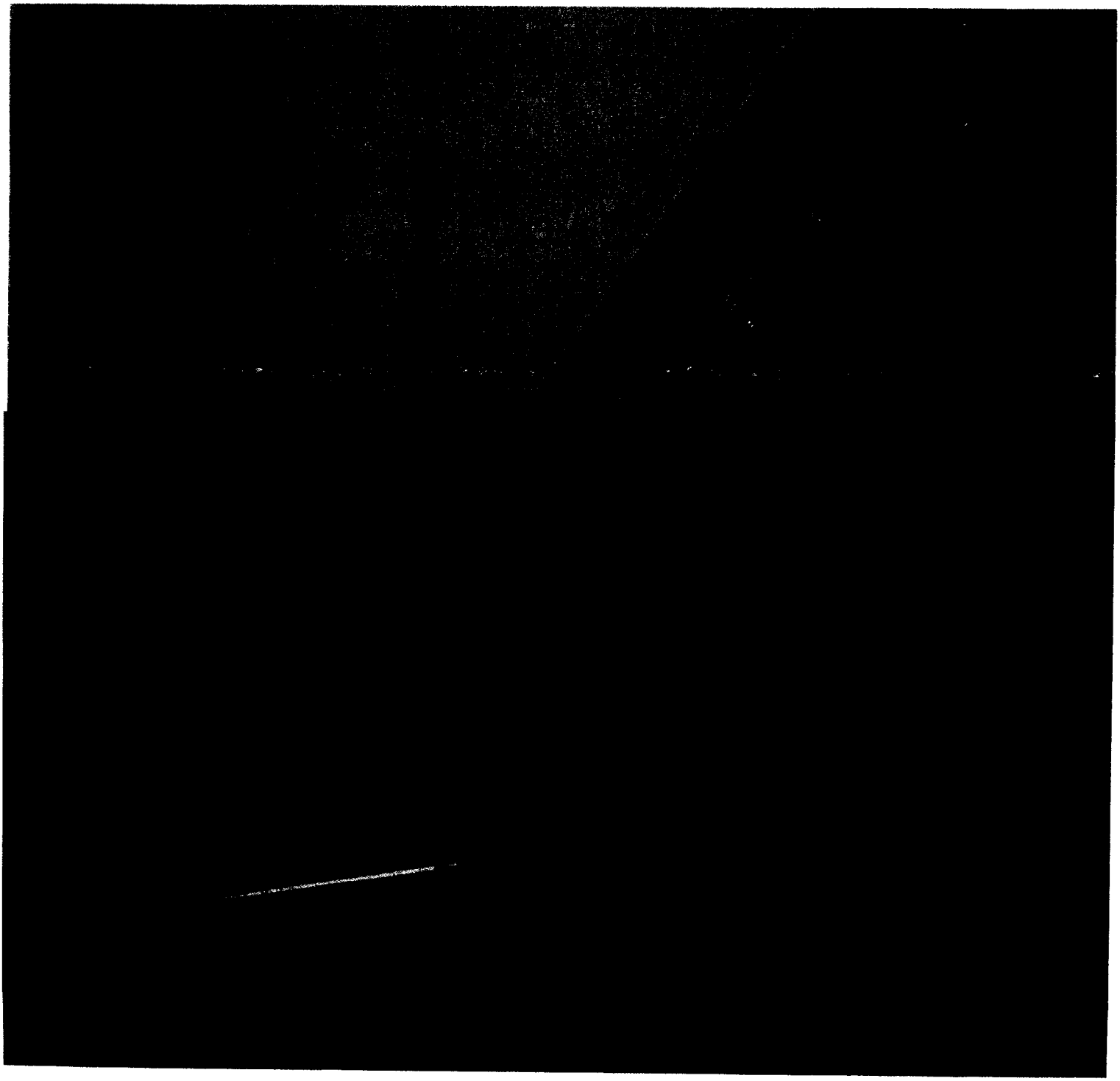
[7] This model applies regardless of whether the CWB is one of the multiple sellers or not.

[8] An analysis of the sensitivity of the results in Table 5.3 to changes in the domestic Canadian feed barley demand elasticity, the excess demand elasticity for Canadian feed barley by the rest of the world, and the cost difference between malting and feed barley are given in Appendix A.

Price in the first week of September should reflect the expected value of the new crop at that time. If farmers perceive that prices have a high probability of rising, they would be in a position to store their grain at that time and sell it later. Similarly, if there was an anticipated drop in price, this would be reflected in the September price as farmers would choose to sell, rather than hold inventory that was expected to be worth less as time passed.

While changes in these prices should generally reflect changes in export prices, we recognize they will not accurately reflect the change in offshore export returns for barley (minus freight and handling charges) when the U.S. is actively applying EEP. They are used for the lack of a better export price value.

In a written rebuttal to the affidavit of Dr. Carter (which included as an exhibit the study by Carter and Loyns (1996)) filed in the court case of *Archibald et al. v. CWB & HMQ (Federal Court No. T-2473-93)*, Schmitz (1996a) seriously questioned the costs estimated by Carter and Loyns (1996).



Appendix A: Sensitivity Analysis

Appendix A.1: Price Impact from Introducing Multiple Sellers (ROW feed demand elasticity equals -5.0)

rop Year	Feed Barley Price ($/mt)	6-Row Malting Barley Price ($/mt)	2-Row Malting Barley Price ($/mt)	Total Producer Revenue ($ mln)
985/86	(2.03)	(92.83)	(78.05)	(71)
986/87[1]	(2.84)	(61.54)	(31.20)	(75)
987/88[2]	(9.15)	(81.86)	(12.17)	(132)
988/89	2.70	(71.02)	(57.60)	(19)
989/90	1.99	(36.05)	(46.77)	(9)
990/91[2]	(4.22)	(24.60)	(2.07)	(61)
991/92	(2.93)	(4.21)	(14.27)	(43)
992/93	(0.55)	(8.37)	(31.92)	(27)
993/94	(2.37)	1.48	(15.79)	(46)
994/95	4.91	(20.37)	(37.22)	(15)
verage	(1.45)	(39.94)	(32.71)	(50)

se Case:

sumes the elasticity of demand for Canadian feed barley in the rest of the world is -5.0.

sumes the Canadian domestic feed demand elasticity is -0.53.

sumes the malting barley price remains at a $15/tonne premium to feed barley.

he quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the UGG estimate.

he quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the CWB level.

Appendix A.2: Price Impact from Introducing Multiple Sellers (domestic feed demand elasticity equals 1.0)

Crop Year	Feed Barley Price ($/mt)	6-Row Malting Barley Price ($/mt)	2-Row Malting Barley Price ($/mt)	Total Producer Revenue ($ mln)
1985/86	(4.77)	(95.56)	(80.78)	(102)
1986/87[1]	(4.35)	(63.05)	(30.32)	(95)
1987/88[2]	(7.08)	(79.80)	(12.31)	(111)
1988/89	0.96	(72.76)	(59.34)	(37)
1989/90	0.76	(37.28)	(48.00)	(21)
1990/91[2]	(7.55)	(27.93)	(2.30)	(99)
1991/92	(6.80)	(8.08)	(18.14)	(85)
1992/93	(4.50)	(12.32)	(35.87)	(65)
1993/94	(2.21)	1.64	(15.63)	(44)
1994/95	3.95	(21.34)	(38.18)	(26)
Average	(3.16)	(41.65)	(34.09)	(68)

Base Case:

Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.

Assumes the Canadian domestic feed demand elasticity is -1.0.

Assumes the malting barley price remains at a $15/tonne premium to feed barley.

[1] The quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the UGG estimate.

[2] The quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the CWB level.

Appendix A.3: Price Impact from Introducing Multiple Sellers (domestic feed demand elasticity equals- 0.20)

Crop Year	Feed Barley Price ($/mt)	6-Row Malting Barley Price ($/mt)	2-Row Malting Barley Price ($/mt)	Total Producer Revenue ($ mln)
1985/86	(5.02)	(95.81)	(81.03)	(104)
1986/87[1]	(4.53)	(63.23)	(29.91)	(97)
1987/88[2]	(19.78)	(92.49)	(14.35)	(245)
1988/89	1.21	(72.51)	(59.09)	(33)
1989/90	0.96	(37.09)	(47.81)	(18)
1990/91[2]	(8.14)	(28.52)	(2.69)	(105)
1991/92	(8.15)	(9.43)	(19.49)	(97)
1992/93	(4.75)	(12.57)	(36.11)	(66)
1993/94	(2.89)	0.97	(16.31)	(51)
1994/95	11.57	(13.72)	(30.56)	66
Average	(3.95)	(42.44)	(33.74)	(75)

Base Case:

Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.

Assumes the Canadian domestic feed demand elasticity is -0.20.

Assumes the malting barley price remains at a $15/tonne premium to feed barley.

[1] The quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the UGG estimate.

[2] The quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the CWB level.

Appendix A.4: Price Impact from Introducing Multiple Sellers ($10 cost difference between malting and feed)

Crop Year	Feed Barley Price ($/mt)	6-Row Malting Barley Price ($/mt)	2-Row Malting Barley Price ($/mt)	Total Producer Revenue ($ mln)
985/86	(4.88)	(100.67)	(85.89)	(108)
986/87[1]	(4.44)	(68.14)	(30.08)	(99)
987/88[2]	(11.07)	(88.79)	(13.18)	(156)
988/89	1.21	(77.51)	(64.09)	(40)
989/90	0.98	(42.04)	(52.78)	(23)
990/91[2]	(7.82)	(33.20)	(2.50)	(105)
991/92	(6.96)	(13.24)	(23.30)	(94)
992/93	(4.44)	(17.27)	(40.81)	(71)
993/94	(1.63)	(2.78)	(20.05)	(46)
994/95	7.82	(22.47)	(39.31)	9
verage	(3.12)	(46.61)	(37.20)	(73)

e Case:

sumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.

sumes the Canadian domestic feed demand elasticity is -0.53.

sumes the malting barley price remains at a $10/tonne premium to feed barley.

e quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the UGG estimate.

e quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the CWB level.

Appendix A.5: Price Impact from Introducing Multiple Sellers ($20 cost difference between malting and feed)

Crop Year	Feed Barley Price ($/mt)	6-Row Malting Barley Price ($/mt)	2-Row Malting Barley Price ($/mt)	Total Producer Revenue ($ mln)
985/86	(4.95)	(90.74)	(75.96)	(99)
986/87[1]	(4.48)	(58.18)	(30.08)	(94)
987/88[2]	(11.66)	(79.37)	(13.18)	(156)
988/89	0.98	(67.74)	(54.32)	(30)
989/90	0.74	(32.33)	(43.02)	(16)
990/91[2]	(7.97)	(23.36)	(2.50)	(100)
991/92	(8.25)	(4.53)	(14.59)	(93)
992/93	(4.92)	(7.74)	(31.28)	(63)
993/94	(3.62)	5.23	(12.04)	(51)
994/95	5.43	(14.86)	(31.71)	4
Average	(3.87)	(37.36)	(30.87)	(70)

Base Case:

Assumes the elasticity of demand for Canadian feed barley in the rest of the world is -20.

Assumes the Canadian domestic feed demand elasticity is -0.53.

Assumes the malting barley price remains at a $20/tonne premium to feed barley.

The quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the UGG estimate.

The quantity of 2-row barley sold as malting barley under multiple sellers is constrained by the CWB level.

References

Bieri, J. and A. Schmitz. "Market Intermediaries and Price Instability: Some Welfare Implications." *American Journal of Agricultural Economics.* 56(May 1974):280-285.

Brooks, H. G. "First, Let's Assume We Have a Can Opener: An Analysis of the Economics of a Single North American Barley Market." *Canadian Journal of Agricultural Economics*, Vol. 41 (Nov.1993):271-281.

Carter, C. A. *An Economic Analysis of a Single North American Barley Market.* Report prepared for the Associate Deputy Minister, Grains and Oilseeds Branch Agriculture Canada, Ottawa, March 1993.

Carter, C. "The Participation of China and the Soviet Union in the Global Wheat Market", in Tilman Becker, Richard Gray and Andrew Schmitz, eds., *Improving Agricultural Trade Performance Under The GATT.* Kiel, Germany: Wissenschaftsverlag Vauk, 1992.

Carter, C. A. and R.M.A. Lyons. *The Economics of Single-desk Selling of Western Canadian Grain.* Edmonton, Alberta: Alberta Agriculture, Food and Rural Development, 1996.

Clark, J.S. "Single-desk Selling by the Canadian Wheat Board: Does it Have an Impact?" *Canadian Journal of Agricultural Economics* 43(2) (July 1995):225-236.

Daley, S. L., P. A. Riley, K. Z. Ackerman and M. E. Smith. "Evaluating Export Subsidy Programs: The Case of U.S. Barley". *Journal of International Food & Agribusiness Marketing.* 4(1) (1992):1-29.

Harold, C. A., G. E. Rossmiller. "Canada", in *State Trading in International Agricultural Markets: Institutional Dimensions and Select Cases.* Study prepared for the International Policy Council on Agriculture and Trade, Washington, D.C. 1991.

Hill, L. "Policies and Group Actions that Affect the Grain Markets", in Michael McGarry and Andrew Schmitz, eds., *The World Grain Trade.* Boulder, CO: Westview Press, 1992.

Just, R. E., A. Schmitz and D. Zilberman. "Price Controls and Optimal Export Policies under Alternative Market Structures." *The American Economic Review.* 69(September, 1979):706-714.

Just, R. E., D. L. Hueth and A. Schmitz. *Applied Welfare Economics and Public Policy.* Englewood Cliffs: Prentice-Hall, Inc. 1982.

Johnson, D. and W. Wilson. *North American Barley Trade Competition.* Agricultural Economics Report No. 314, North Dakota State University, February 1994.

KenAgra Management Services. *Barley Marketing: Issues and Alternatives.* Study prepared for the Western Grain Marketing Panel, Edmonton, Alberta. 1996.

Kraft, D.F., W. H. Furtan, and E. W. Tyrchniewicz. *Performance Evaluation of the Canadian Wheat Board.* Winnipeg: Canadian Wheat Board. 1996.

Mao, W., W. Koo and M. Krause. *World Feed Barley Trade Under Alternative Trade Policy Scenarios.* Agricultural Economics Report No. 350, North Dakota State University, April 1996.

McCalla, A. F. and A. Schmitz. "Grain Marketing Systems: The Case of the United States versus Canada." *American Journal of Agricultural Economics,* 61(2)(May 1979):199-212.

Schmitz, A., *Economic Performance of the Canadian*

Wheat Board: Myth and Reality. Filed in the Court Case of *Archibald et al. v. CWB & HMQ (Federal Court No. T-2473-93)*, 1996a.

Schmitz, A., *Rebuttal to the Affidavid of Dr. Colin Carter.* Filed in the Court Case of *Archibald et al. v. CWB & HMQ (Federal Court No. T-2473-93)*, 1996b.

Schmitz, A., R. Gray and A. Ulrich. *A Continental Barley Market. Where are the Gains?* Saskatoon: University of Saskatchewan, Dept. of Agricultural Economics. 1993.

Schmitz, A., A. McCalla, D. O. Mitchell and C. A. Carter. *Grain Export Cartels.* Cambridge, MA: Ballinger Publishing Company, 1981.

Schmitz, T. and W. Koo. *An Economic Analysis of International Feed and Malting Barley Markets: An Econometric Spatial Oligopolistic Approach.* Agricultural Economics Report No. 375, North Dakota State University, September 1996.

Schmeiser, D.C.J. *The Short Run Impact on Producer Revenue of the Adoption of the Continental Barley Market Policy.* Unpublished Master's Thesis, University of Saskatchewan, Spring 1995.

Ulrich, A., W.H. Furtan and A. Schmitz. "Public and Private Returns From Joint Venture Research: An Example from Agriculture". *Quarterly Journal of Economics*, Vol. XXXVII (January 1986):103-129.