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State Trading Enterprises and Revenue Gains from Market Power: The Case of Barley Marketing and the Canadian Wheat Board

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According to the U.S. General Accounting Office, the Canadian Wheat Board (CWB) is the largest state trading enterprise reporting to the World Trade Organization under Article XVII requirements. This study estimates the market power exerted by the CWB in international barley markets. The analysis incorporates international price discrimination across markets for similar types of barley, the intertwining relationships between feed and malting barley markets, and producer behavior in the absence of the CWB. The CWB was able to capture an annual average of $72 million in additional revenue beyond the amount that would have been generated by purely competitive multiple sellers of Canadian barley during the period 1985–94.

Key words: Canadian Wheat Board, feed barley, malting barley, market power, price discrimination, selection rates, state trading, trade disputes

Introduction

The marketing practices of state trading enterprises (STEs) have become one of the most prevalent international trade issues since the completion of the Uruguay Round of trade negotiations under the General Agreement on Tariffs and Trade (GATT) that culminated in establishment of the World Trade Organization (WTO) in 1995. The U.S. General Accounting Office (GAO) recently released at least three major reports related to state trading (U.S. GAO 1995, 1996, 1998). In its 1996 report, the GAO focused on the marketing practices of the Canadian Wheat Board (CWB), the Australian Wheat Board, and the New Zealand Dairy Board as three of the most important state trading enterprises affiliated with WTO member countries. Of all countries that report state trading activities to the GATT/WTO under Article XVII requirements, the CWB is the largest both in terms of volume and annual sales. The United States has argued that STEs such as the CWB significantly distort trade and that their actions should be disciplined as a part of the next round of WTO negotiations.

The CWB, as the sole exporter of wheat and barley from western Canada, has often been cast as a villain in recent trade disputes. Some analysts believe that the CWB has an unfair advantage in international grain markets because its single-desk exporter status is used to exercise market power, thereby unfairly increasing the returns to

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Canadian wheat and barley producers at the expense of U.S. and other global competitors. Some argue that the CWB purposefully dumps grain into the U.S. market below cost. Yet others contend the CWB is not successful at increasing producer revenue because the increase in returns due to CWB market power, if indeed such additional returns even exist, are outweighed by the excess administrative, handling, and other costs accrued by the CWB.

Both national and international debates involving the CWB prompted an unprecedented series of events in the 1990s, triggered by analyses undertaken by a multifaceted group of players involved in all sides of this complex issue. A continental barley market, which involved liberating U.S. markets for Canadian feed barley exporters, was established in August 1993. This continental barley market was repealed after just six weeks of operation because it was found to violate various Canadian internal laws. The implications of the continental barley markets were investigated extensively in various studies (e.g., CWB; Gray, Ulrich, and Schmitz; Schmitz, Gray, and Ulrich; Carter 1993a,b, 1994; Brooks; Veeman; and Schmeiser).

In 1994, a "voluntary" export restraint was placed on Canadian durum exports to the U.S. (Duncan and Koo). This restraint was lifted after one year. A Western Grain Marketing Panel was established to study possible future directions for the CWB, and a Canada-U.S. Joint Commission on Grains was formed to recommend changes to U.S.-Canadian grain trade practices. In 1996, a federal lawsuit was filed in Canada (Archibald et al. vs. the CWB and Her Majesty the Queen) for the purpose of removing the statutory authority of the CWB to control grain exports; however, the Canadian courts ruled in favor of the CWB (see Schmitz 1996a,b, and Carter and Loyns).

In February 1997, a plebiscite of barley producers was held in western Canada. Canadian barley producers voted to retain the single-desk status of the CWB. A "Record of Understanding" between Canada and the U.S. was signed in December 1998 (U.S. Trade Representative's Office), which eventually led to the establishment in April 1999 of a Consultative Committee on Agriculture to improve cooperation on agricultural trade issues (U.S. Department of Agriculture, Foreign Agricultural Service).

While portions of this debate will never be resolved through empirical explication, the answers to at least three major questions, posed below, can be analyzed within an economic framework:

1. Has the CWB been able to achieve price discrimination across different international markets, and how do export subsidies in other countries, such as the U.S. Export Enhancement Program (EEP), affect the ability of the CWB to price discriminate?

2. Are the administrative, handling, and other costs of marketing grain in Canada higher or lower than those incurred by large grain marketing organizations in other countries, such as Cargill? If higher, what portion of this inefficiency can be attributed to the CWB, and how much can be attributed to inefficiencies in other aspects of the Canadian marketing system that are not directly controlled by the CWB?

3. If there is significant evidence that the CWB has been able to price discriminate among importers, does this imply that the CWB has been able to achieve market power in international markets? If so, what is the magnitude of the benefits accruing to Canadian producers as a direct result of this market power?

The first question has been explored by Brooks and Schmitz; Kraft, Furtan, and Tyrchniewicz; Clark; Goodwin and Smith; and Carter (1993a,b). Brooks and Schmitz found evidence of price discrimination by the CWB across international feed barley markets, regardless of whether the United States provided EEP subsidies or not. Kraft, Furtan, and Tyrchniewicz found evidence of price discrimination by the CWB across international wheat markets. Both of these studies had access to CWB contract data regarding sales of Canadian grain by destination. Carter did not find evidence of price discrimination across barley markets. Using a Granger causality test, Clark did not find evidence the CWB influenced international barley prices. Goodwin and Smith found that the CWB "Granger-causes" international wheat prices to move downward, implying the CWB behaves as a price leader in international wheat markets. The latter three studies did not have access to data concerning prices received by the CWB from different destination markets.

The second question has been investigated by Carter, Loyns, and Berwald; Schmitz, Furtan, Brooks, and Gray; Schmitz, Gray, Schmitz, and Storey; Carter and Loyns; Schmitz (1996a,b); and Furtan, Kraft, and Tyrchniewicz. However, a detailed analysis of this issue is beyond the scope of this paper.[1]

The third question has been partially addressed by Carter and Loyns (1993a,b); Schmitz, Gray, and Ulrich; and Gray, Ulrich, and Schmitz. These articles present opposite sides of the debate regarding the continental barley market which was briefly introduced in 1993. Schmitz, Gray, and Ulrich provide evidence of market power exercised by the CWB in both the international feed and malting barley markets. Carter and Loyns argue that the CWB exerts no market power in international feed barley markets, but they also concede that the CWB exercises at least some market power in international malting barley markets. The analyses of the continental barley market presented in these studies are incomplete in that they examine the restricted possibility of allowing direct exports by Canadian producers to the U.S. market only. They do not explore the less restrictive case of complete export liberalization to all international markets, nor do they attempt to capture the intertwining relationships between feed and malting barley markets.

In this study, we seek to answer the third question by constructing a synthetic model that estimates the import demand parameters for Canadian feed, two-rowed, and six-rowed malting barley by country of destination. These parameters are estimated as an entire system using a set of equations to capture the interaction between feed and malting barley markets at the margin, under the assumption that the CWB exerts some market power in international barley markets. Once these demand parameters have been estimated, a counterfactual model is constructed to simulate the revenue that would accrue to Canadian barley producers if the statutory marketing powers of the CWB were removed. This latter model assumes a system of purely competitive multiple sellers of Canadian feed and malting barley would arise if the statutory marketing authority of the CWB had not been granted. The actual revenue realized by Canadian feed and malting barley producers from 1985–94 is compared to the revenue that would have accrued to producers if the CWB had not exercised control over feed and malting barley exports during that same period.

[1] For a more detailed survey of the issues surrounding the CWB and a more detailed comparison of the results of past investigations that attempted to answer questions 1 and 2, see Brooks and Schmitz.

The CWB and International Feed and Barley Markets

The CWB is the single-desk seller of western Canadian wheat, feed barley, and malting barley for export destinations. In the domestic market, the CWB is the sole seller of western Canadian wheat and barley for human consumption, but operates alongside an open cash market for feed barley and feed wheat in western Canada. In addition, it must compete with imports of food and feed grain into the domestic market. 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 existence of the CWB is a direct result of public policy through the Canadian Wheat Board Act. The CWB operates as a marketing agency for producers and has adopted as its objective the maximization of returns from sales of wheat and barley. The CWB acts as the producers' agent through which all sales and payments are made.

The CWB is a major player in world feed and malting barley markets. Canada and Australia together have more than a 50% market share of world barley exports. For malting barley, Canada's export market share reached as high as 44% in 1994/95. The Canadian domestic market for feed barley comprises the largest portion of total Canadian barley sales in most years.

Sales of feed barley by Canadian producers directly into the domestic market are not controlled by the CWB. These direct sales generally represent over 50% of total Canadian barley production within a typical year. The CWB is not allowed to sell feed barley into the domestic market and it does not directly control the level of domestic production. Any surplus over cost earned from sales by the CWB is returned to producers. Producers receive these payments in the form of an initial payment upon delivery, possible interim payments if deemed necessary, and a final payment which is received sometime after the end of each pooling period. For these reasons, with respect to Canadian barley, the CWB cannot be viewed as a pure monopolist, a middleman, or a monopsonist. However, the CWB does have power to sell Canadian barley into different markets at different prices in order to maximize the return to pool, subject to the aforementioned constraints.

The CWB cannot directly control the quantity of feed barley it receives from Canadian producers because producers have the option of selling feed barley directly into the domestic market. Canadian producers must make their sales decisions by comparing the current market price with the current expected pool return for feed barley as estimated by the CWB. Because the CWB does not enter into domestic feed barley markets, maximizing the return to pool can either increase or reduce the total revenue accruing to Canadian barley producers. The exact impact of the CWB on Canadian barley producers depends upon many factors, including the shape of the domestic supply curve, the domestic demand curve, and the foreign excess demand curves for Canadian feed and malting barley in different countries.

Canadian barley producers plant both malting varieties and feed varieties. 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. This marginal barley could be sold as malting barley in years when the average quality of the barley crop around the world is poor, because importers reduce their quality specifications on malting barley under these situations. This decision is

made through the dynamic interaction of selectors, importers, and the CWB. Hence, on the margin, feed barley can be substituted for malting barley and the CWB has direct influence over the selection rate. That is, within a certain range, the CWB influences the percentage of the total amount of Canadian barley actually sold as malting barley, based upon both domestic and global market demand for malting barley.

A Model of CWB Strategic Behavior

In order to compare Canadian barley producer revenue under the CWB with the revenue that would be generated by multiple sellers, a synthetic model designed to approximate the behavior of the CWB must be specified. Once the synthetic model is specified, estimates of the demand parameters associated with the synthetic model must be generated and then inserted into a second, counterfactual model that simulates a multiple-seller environment.

The following model of CWB behavior incorporates price discrimination across international markets for barley of similar types.[2] It also specifies behavioral relationships that determine the amount of Canadian six-rowed barley actually sold for malting purposes versus the quantity of six-rowed barley sold as feed. In addition, the model incorporates behavioral relationships that determine the amount of Canadian two-rowed barley actually sold for malting purposes versus the amount of two-rowed barley sold as feed.

The objective of the CWB is to allocate the total quantity of barley it receives from producers in a given crop year across international feed barley markets, domestic and international two-rowed malting barley markets, and domestic and international six-rowed malting barley markets, in order to maximize the return to pool (RTP). Mathematically, this objective can be written as follows:

$$\text{(1)} \qquad \text{Max } RTP(Q_F, Q_S, Q_T) = \sum_{i=1}^{L} P_F^i(Q_F^i)Q_F^i + \sum_{j=1}^{M} P_S^j(Q_S^j)Q_S^j + \sum_{k=1}^{N} P_T^k(Q_T^k)Q_T^k,$$

with respect to $Q_F = \{Q_F^1, \ldots, Q_F^L\}$, $Q_S = \{Q_S^1, \ldots, Q_S^M\}$, and $Q_T = \{Q_T^1, \ldots, Q_T^N\}$. From this objective, $P_F^i(Q_F^i)$ and Q_F^i represent the inverse excess demand function for Canadian feed barley and the quantity of Canadian feed barley sold in international market i, respectively; $P_S^1(Q_S^1)$ and Q_S^1 represent the inverse demand function and the quantity of six-rowed malting barley sold into the domestic market; $P_S^j(Q_S^j)$ and Q_S^j $(\forall j \neq 1)$ represent the inverse excess demand function for Canadian six-rowed malting barley and the quantity of Canadian six-rowed malting barley sold in international market j; $P_T^1(Q_T^1)$ and Q_T^1 represent the inverse demand function and the quantity of two-rowed malting barley sold into the domestic market; and finally, $P_T^k(Q_T^k)$ and Q_T^k $(\forall k \neq 1)$ represent the inverse excess demand function for Canadian two-rowed malting barley and the quantity of Canadian two-rowed malting barley sold in international market k.

[2] Refer to Brooks and Schmitz for a series of tests providing evidence of price discrimination by the CWB across international feed barley markets.

Notice that the inverse demand for feed in the Canadian domestic market ($P_D(Q_D)$) is not part of the pool account, and is therefore not considered in the objective function of the CWB. However, the behavior of producers regarding the allocation of sales of feed barley to the CWB versus sales to the domestic market must be incorporated into the model.

Given the total amount of barley produced in a given year, Canadian barley producers have several options. If their barley is of high enough quality to be sold as six-rowed or two-rowed malting barley, they must deliver it to the CWB in order to capture any malting premiums they might receive. If they sell feed barley, they have the option to deliver to the domestic feed market or to the CWB for export. If the expected world price is high relative to current domestic prices, the producer delivers to the pool. If the expected world price is low, the producer delivers to the domestic feed market. Therefore, the price the producer eventually receives for feed barley can be approximated by the weighted average price received by the CWB for all feed barley exports in a given year.[3] Mathematically, this condition can be expressed as:

$$P_D(Q_D) = \frac{\sum_{i=1}^{L} P_F^i Q_F^i}{\sum_{i=1}^{L} Q_F^i}, \tag{2}$$

where $P_D(Q_D)$ is the Canadian feed barley market price, and Q_D is domestic feed consumption. The term on the right-hand side approximates the pooled price for feed barley, which equals the weighted average price received by the CWB from all international feed barley markets. The solution to objective (1) subject to equation (2) 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:

$$L = RTP(Q_F, Q_S, Q_T) + \lambda\left[Q_B - \sum_{i=1}^{L} Q_F^i(P_F^i) - \sum_{j=1}^{M} Q_S^j(P_S^j) - \sum_{k=1}^{N} Q_T^k(P_T^k) - Q_D(P_D)\right], \tag{3}$$

where $RTP(Q_F, Q_S, Q_T)$ is the return to pool as defined by (1); λ is the shadow value which measures the additional revenue that would accrue to Canadian barley producers if they were to sell one more bushel of barley at the margin; Q_B is the total quantity of barley available to be delivered to both the domestic market and the CWB in a given year; and $Q_X^Y(P_X^Y)$ represents the demand function for any good x in any market y.

We proceed by assuming the inverse demand can be approximated by the following linear functions:

$$P_X^Y(Q_X^Y) = \alpha_X^Y - \beta_X^Y Q_X^Y \quad \forall \text{ goods } x \text{ into market } y. \tag{4}$$

[3] Fortunately or unfortunately, as the case may be, the CWB was not in the business of predicting its final yearly pooled price until measures such as the "Expected Pool Return" and "Pool Return Outlook" were released to its producers starting in 1993. Consequently, there is no way to determine exactly what producers expected to receive prior to 1993. Hence, the pooled price is used as an approximation.

Under the above assumptions, the first-order conditions can be derived from relationships (2)–(4) by taking the derivative of the Lagrangian with respect to each quantity (Q_X^Y). This process yields the following set of first-order conditions:

$$\lambda = \frac{\Phi_F^i(\alpha_F^i, \beta_F^i, Q_F^i)}{\left[1 + \frac{P_D(Q_D) - \Phi_F^i(\alpha_F^i, \beta_F^i, Q_F^i)}{\beta_D \sum_{i=1}^{L} Q_F^i}\right]} \quad \forall\, i = 1, \ldots, L, \tag{5.1}$$

$$\lambda = \Phi_S^j(\alpha_S^j, \beta_S^j, Q_S^j) \quad \forall\, j = 1, \ldots, M, \tag{5.2}$$

and

$$\lambda = \Phi_T^k(\alpha_T^k, \beta_T^k, Q_T^k) \quad \forall\, k = 1, \ldots, N, \tag{5.3}$$

where $\Phi_X^Y(\alpha_X^Y, \beta_X^Y, Q_X^Y) = \alpha_X^Y - 2\beta_X^Y Q_X^Y$, which can be interpreted as the "standard" marginal revenue condition for a profit-maximizing monopolist with respect to good x into market y. If the bottom expression in equation (5.1) were equal to one, implying that the domestic price is equal to the standard marginal revenue condition for a price-discriminating monopolist, the CWB objective would be the same for feed markets as for malting barley markets. In general, however, this is not the case because the CWB does not maximize revenue with respect to sales into the domestic feed barley market.

Equations (2), (5.1), (5.2), and (5.3) can be rewritten in terms of the price elasticities of demand for different types of Canadian barley in different markets using the following relationship:

$$\varepsilon_X^Y = \frac{\partial Q_X^Y}{\partial P_X^Y}\frac{P_X^Y}{Q_X^Y} = -\frac{P_X^Y}{\beta_X^Y Q_X^Y}. \tag{6}$$

In addition, the intercept parameter α_X^Y for barley of type x sold into market y can be recovered from the price (P_X^Y) and the demand elasticity (ε_X^Y) through the relationship:

$$\alpha_X^Y = P_X^Y(1 - 1/\varepsilon_X^Y). \tag{7}$$

Inserting relationships (6) and (7) into equations (2), (5.1), (5.2), and (5.3) yields the following system of equations in terms of prices, quantities, and demand elasticities:

$$P_D(Q_D) = \frac{\sum_{i=1}^{L} P_F^i Q_F^i}{\sum_{i=1}^{L} Q_F^i}, \tag{8.1}$$

$$\lambda = \frac{P_F^i(1 + 1/\varepsilon_F^i)}{\left[1 + \frac{\varepsilon_D Q_D}{P_D \sum_{i=1}^{L} Q_F^i}\left[P_F^i(1 + 1/\varepsilon_F^i) - P_D\right]\right]} \quad \forall\, i = 1, \ldots, L, \tag{8.2}$$

$$\lambda = P_S^j(1 + 1/\varepsilon_S^j) \quad \forall j = 1, \ldots, M, \tag{8.3}$$

and

$$\lambda = P_T^k(1 + 1/\varepsilon_T^k) \quad \forall k = 1, \ldots, N. \tag{8.4}$$

The purpose of formulating the system of equations represented by (8.1)–(8.4) is to approximate the demand parameters associated with Canadian feed, six-rowed, and two-rowed malting barley by taking into account the behavior of the CWB and the behavior of Canadian producers who deliver to the CWB. For the purposes of this study, a complete data set containing prices and quantities sold into each market by the CWB is available. Given these prices and quantities, the solution to the above system of equations approximates the demand elasticities associated with each type of barley into each market. However, even when prices and quantities are known, the above system contains $(L + M + N + 1)$ equations, but actually has $(L + M + N + 3)$ unknowns. Once the elasticities into two different markets are provided exogenously, the solution to (8.1)–(8.4) will generate the unknown demand elasticities associated with all other markets.

A Model of Strategic Behavior by Multiple Sellers

To measure the impact of multiple sellers on the allocation of Canadian barley across markets and the prices realized by multiple sellers, a counterfactual simulation model must be developed that approximates the behavior of Canadian producers in the absence of the CWB. In equilibrium, the law of one price would have to hold for all domestic and international sales of Canadian barley of the same type under pure competition. Under a multiple-seller regime, the price of Canadian feed barley sold to all markets would be equal, the price of six-rowed malting barley sold to all markets would be equal, and the price of two-rowed malting barley sold to all markets would be equal as long as they are valued at a common domestic location. The price of malting barley could never drop below the price of feed barley or it would simply be marketed as feed. Moreover, the price of malting barley would remain at a premium to feed barley in order for producers to seed these varieties given the additional management and costs required to grow malting barley and the lower yield of malting barley varieties relative to feed barley varieties in some areas of western Canada.

Using the excess demand elasticities in each of the barley markets as derived in the previous section, one can approximate the prices and quantities that would have resulted under multiple sellers in each year. The objectives underlying the behavior of multiple sellers in pure competition are as follows:

$$\text{Max } TR(Q_D, Q_F, Q_S, Q_T) = \sum_{i=1}^{L} P_F^i(Q_F^i)Q_F^i + \sum_{j=1}^{M} P_S^j(Q_S^j)Q_S^j + \sum_{k=1}^{N} P_T^k(Q_T^k)Q_T^k + P_D(Q_D)Q_D \tag{9}$$

with respect to $Q_F = \{Q_F^1, \ldots, Q_F^L\}$, $Q_S = \{Q_S^1, \ldots, Q_S^M\}$, $Q_T = \{Q_T^1, \ldots, Q_T^N\}$, and Q_D, and subject to:

$$(9.1) \qquad Q_B = \sum_{i=1}^{L} Q_F^i(P_F^i) + \sum_{j=1}^{M} Q_S^j(P_S^j) + \sum_{k=1}^{N} Q_T^k(P_T^k) + Q_D(P_D),$$

$$(9.2) \qquad \left[P_F^i(Q_F^i) - P_D(Q_D)\right](Q_F^i) = 0 \quad \forall\, i \in \{1, \ldots, L\},$$

$$(9.3) \qquad \left[P_S^j(Q_S^j) - P_S^1(Q_S^1)\right](Q_S^j) = 0 \quad \forall\, j \in \{2, \ldots, M\},$$

$$(9.4) \qquad \left[P_T^k(Q_T^k) - P_T^1(Q_T^1)\right](Q_T^k) = 0 \quad \forall\, k \in \{2, \ldots, N\},$$

$$(9.5) \qquad P_S^j(Q_S^j) = P_D(Q_D) + \Delta_S \quad \forall\, j \in \{1, \ldots, M\},$$

and

$$(9.6) \qquad P_T^k(Q_T^k) = P_D(Q_D) + \Delta_T \quad \forall\, k \in \{1, \ldots, N\},$$

where Δ_S and Δ_T are exogenous parameters that capture the average cost difference between growing feed barley and growing six-rowed and two-rowed malting barley, respectively. Unlike the objectives of the CWB in (1), the objectives of multiple sellers in (9) involve 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 equilibrium prices and quantities that would have been allocated by multiple sellers across markets in a given year can be estimated by solving the system represented by (9) simultaneously, given the quantity of all barley available, estimates of Δ_S and Δ_T, and the demand elasticities generated by the synthetic CWB model.

Estimates of Demand Elasticities (1985–94)

For purposes of this study, the CWB provided detailed contract data on its daily sales of feed barley, six-rowed malting barley, and two-rowed malting barley sales by destination from 1985/86 through 1994/95. All prices are in Canadian dollars and were brought to a common f.o.b. basis point (Vancouver or Thunder Bay).

Daily sales made by the CWB were aggregated into nine distinct markets categorized as follows: (*a*) the Japanese feed market, (*b*) the U.S. feed market, (*c*) all other offshore feed barley markets (ROW), (*d*) the Canadian six-rowed malting market, (*e*) the U.S. six-rowed malting market, (*f*) offshore six-rowed malting markets (ROW), (*g*) the Canadian two-rowed malting market, (*h*) the U.S. two-rowed malting market, and (*i*) offshore two-rowed malting markets (ROW). Data for the Canadian domestic two-rowed and six-rowed malting barley markets are comprised of only domestically consumed barley. The malting barley domestically processed into malt and/or beer and subsequently exported is not included as sales to these respective markets.[4]

The data for each of the markets were further aggregated on a yearly basis using the crop year from August 1 through July 31.[5] The yearly quantity sold into a particular

[4] These data were obtained under a strict confidential agreement between the authors and the Canadian Wheat Board. As such, they can be disseminated in aggregate form only.

[5] This approximates the pool return, but does not match it perfectly because of differences in the timing of sales and deliveries.

Table 1. Barley Markets Under the Canadian Wheat Board in 1991/92

Market	F.O.B. Price ($/mt)	Quantity Sold (000s mt)	Market Revenue ($ mil.)	Demand Elasticity
Feed Markets:				
Japan	135.74	1,015	138	-3.69
United States	106.73	143	15	-13.80
Rest of World (ROW)	104.21	1,336	139	-20.00
Canada Domestic	117.18	7,229	847	-0.53
6-Rowed Malting Markets:				
Canada Domestic	163.09	91	15	-1.96
United States	125.81	288	36	-2.74
Rest of World (ROW)	127.39	83	11	-2.68
2-Rowed Malting Markets:				
Canada Domestic	167.78	137	23	-1.91
United States	147.01	111	16	-2.19
Rest of World (ROW)	138.93	804	112	-2.36
Totals:				
Feed Exports	117.18	2,494	292	-13.01
All Feed	117.18	9,723	1,139	-3.73
6-Rowed Malting	133.46	463	62	-2.58
2-Rowed Malting	143.52	1,051	151	-2.28
All Barley	120.32	11,238	1,352	-3.55

Sources: Elasticities calculated by the authors; all other data provided by the CWB.
Note: All prices are given in Canadian dollars per metric tonne.

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 actual CWB barley sales in that year, plus domestic feed barley consumption reported by Statistics Canada.

To obtain estimates using the solution to system (8.1)–(8.4), it is assumed that the elasticity of domestic feed barley demand in Canada in each year is -0.53, as estimated by Schmitz and Koo. The elasticity of excess demand for Canadian feed barley in the ROW is assumed to be -20 in every year. This value is reasonable given the CWB does not have a large effect on the price in that market because of export subsidies by the United States and European Union, and the large quantities of feed barley sold by its competitors.

The system is solved individually for each of the 10 crop years from 1985–94, yielding a different set of demand elasticities for each year. In the interest of brevity, the full set of resulting elasticities for each of the 10 years is not reproduced here.[6] However, the results for the 1991/92 crop year are provided in table 1. The 10 markets available to

[6] The full set of resulting elasticities is available from the authors upon request.

Canadian barley producers are listed in the first column of table 1. The CWB made sales into all of the markets shown with the exception of the Canadian domestic feed markets. The weighted average f.o.b. prices actually received by the CWB in each market are shown in column 2. The average prices received for feed barley, six-rowed malting barley, and two-rowed malting under the CWB in 1991/92 were $117.18/mt, $133.46/mt, and $143.52/mt, respectively. These prices reflect the average price received at a common basis point. Hence, they are not comparable to prices contained in CWB annual reports or in other published series that provide average spot prices at other locations.

The actual quantities sold by the CWB into each market in 1991/92 are shown in table 1, column 3, and the revenue accrued by the CWB is reported in column 4. The demand elasticities generated by the synthetic model are provided in column 5. Notice that the elasticity of excess demand for Canadian feed barley in the United States was −13.8 in 1991/92. Also, the elasticity of excess demand for Canadian feed barley in Japan was −3.69. These results are well within the expected range. 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 elasticities for excess demand functions in individual markets for Canadian malting barley only.

Estimates of Prices and Trade Flows Under Multiple Sellers (1985–94)

The simultaneous solution to (9) determines the trade flows and prices resulting from the introduction of multiple sellers of Canadian barley. For empirical purposes, the cost differences (Δ_S and Δ_T) between feed and malting barley prices required for equations (9.5) and (9.6) are set at $15/mt in most years. 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 (9.5) and/or (9.6) were replaced with:

$$\sum_{j=1}^{M} Q_S^j(P_S^j) = Q_S^{CWB} + \delta_S \tag{9.5a}$$

and/or

$$\sum_{k=1}^{N} Q_T^k(P_T^k) = Q_T^{CWB} + \delta_T, \tag{9.6a}$$

where Q_S^{CWB} and Q_T^{CWB} denote the amount of six-rowed malting and two-rowed malting barley, respectively, actually sold by the CWB in that year, and δ_S and δ_T represent the additional quantity of six-rowed or two-rowed barley of marginal quality available for sale beyond the amount that was actually sold by the CWB.

The total quantity of Canadian six-rowed and two-rowed malting barley available in each year was estimated by the United Grain Growers (UGG) in its Harvest Quality Survey. These estimates were calculated as percentages of the entire Canadian barley crop. They were used as constraints in the model so that there were different values for δ_S and δ_T for each year. The maximum amount of two-rowed malting barley deemed selectable by the UGG in 1986/87 (5.5% of total barley production) was the only case in which constraints (9.5a) and/or (9.6a) were binding. Further, when comparing UGG estimates to actual CWB contract data, the selectable two-rowed estimates by the UGG

Table 2. Barley Markets Under Multiple Sellers in 1991/92

Market	F.O.B. Price ($/mt)	Quantity Sold (000s mt)	Market Revenue ($ mil.)	Demand Elasticity
Feed Markets:				
Japan	109.29	1,746	191	-1.73
United States	109.29	96	10	-21.12
Rest of World (ROW)	109.29	32	4	-866.54
Canada Domestic	109.29	7,487	818	-0.48
6-Rowed Malting Markets:				
Canada Domestic	124.29	134	17	-1.02
United States	124.29	298	37	-2.62
Rest of World (ROW)	124.29	89	11	-2.46
2-Rowed Malting Markets:				
Canada Domestic	124.29	204	25	-0.95
United States	124.29	148	18	-1.38
Rest of World (ROW)	124.29	1,004	125	-1.69
Totals:				
Feed Exports	109.29	1,874	205	-17.65
All Feed	109.29	9,361	1,023	-3.91
6-Rowed Malting	124.29	520	65	-2.18
2-Rowed Malting	124.29	1,356	169	-1.54
All Barley	111.79	11,238	1,256	-3.55

Source: Calculated by the authors.

Notes: All prices are given in Canadian dollars per metric tonne. Table calculations make the following three assumptions:

(1) the elasticity of demand for Canadian feed barley in the ROW is -20,
(2) the Canadian domestic feed demand elasticity is -0.53, and
(3) the malting barley price remains at a $15/mt premium to feed barley.

were lower than what the CWB actually sold in 1987/88 and 1991/92. Hence, the amount of two-rowed malting barley available for sale by multiple sellers was constrained by the actual amount that was sold by the CWB in these two years.[7]

The results of the counterfactual multiple-seller solution (9) in the 1991/92 crop year are provided in table 2. This table has the same format as table 1, but provides the multiple-seller solution. Under multiple sellers, the equilibrium market price for all sales of Canadian feed barley would have been $109.29/mt, and the price received for sales of both six-rowed and two-rowed Canadian malting barley would have been $124.29/mt. Point elasticities for Canadian malting barley under the counterfactual simulation are also provided for the interested reader.[8]

[7] For more detailed data and a thorough discussion of the quantity of marginal malting barley available under multiple sellers compared to that with the CWB, see Schmitz, Gray, Schmitz, and Storey.

[8] Note that if table 1 is compared to table 2, multiple sellers would have exported more six-rowed and two-rowed malting barley to the United States in 1991/92. These results are consistent with those of Johnson and Wilson, and Wilson and Johnson.

Table 3. Impacts of Replacing the Canadian Wheat Board with Multiple Sellers of Canadian Barley (1985/86–1994/95)

Crop Year	Feed Barley Price ($/mt)	6-Rowed Malting Barley Price ($/mt)	2-Rowed Malting Barley Price ($/mt)	Total Producer Revenue [a] ($ mil.)
1985/86	-4.91	-95.70	-80.93	-104
1986/87 [b]	-4.46	-63.16	-30.08	-96
1987/88 [c]	-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 [c]	-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

Source: Calculated by the authors.

Notes: All prices are given in Canadian dollars per metric tonne. Table calculations make the following three assumptions:

(1) the elasticity of demand for Canadian feed barley in the ROW is -20,

(2) the Canadian domestic feed demand elasticity is -0.53, and

(3) the malting barley price remains at a $15/mt premium to feed barley, except as denoted below.

[a]Total producer revenue includes the impact on the domestic feed barley market.

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

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

Impacts of Replacing the CWB with Multiple Sellers

The impacts on prices and revenue from replacing the CWB with multiple sellers of feed barley, six-rowed malting barley, and two-rowed malting barley in each year from 1985/86 through 1994/95 are reported in table 3. For example, the 1991/92 price difference represents a $9.17/mt decline for six-rowed malting barley under multiple sellers. This number is equal to the difference between the weighted average price of six-rowed malting barley sold under the CWB (from table 1) and the weighted average price of six-rowed malting barley that would have been sold under multiple sellers (from table 2). The CWB captured higher prices than multiple sellers on sales of six-rowed malting barley in all years except 1993/94. In that year, multiple sellers could have achieved a small price increase of $1.23/mt on sales of six-rowed malting barley. The annual average price increase earned by the CWB for six-rowed malting barley relative to multiple sellers, over the 10-year period from 1985/86 through 1994/95, was $42.01/mt.

Consider two-rowed malting barley market prices (column 4 of table 3). The calculated annual average price difference between the CWB and the multiple-seller structure on sales of two-rowed malting barley for the 1985/86–1994/95 period is $34.06/mt. The premiums range from $2.50/mt in 1990/91 to $80.93/mt in 1985/86. Based on our results,

Table 4. Change in Trade Flows Under Multiple Sellers of Canadian Barley (1985/86–1994/95)

Crop Year	Domestic Feed Barley Consumption (000s mt)	Export Feed Barley Sales (000s mt)	6-Rowed Malting Barley Sales (000s mt)	2-Rowed Malting Barley Sales (000s mt)
1985/86	175	-634	266	193
1986/87[a]	225	-575	216	134
1987/88[b]	524	-753	229	0
1988/89	-30	-506	169	367
1989/90	-23	-391	100	314
1990/91[b]	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

Source: Calculated by the authors.

Note: Table calculations make the following three assumptions:
(1) the elasticity of demand for Canadian feed barley in the ROW is -20,
(2) the Canadian domestic feed demand elasticity is -0.53, and
(3) the malting barley price remains at a $15/mt premium to feed barley, except as denoted below.

[a]The quantity of 2-rowed barley sold as malting barley under multiple sellers is constrained by the UGG estimate.
[b]The quantity of 2-rowed barley sold as malting barley under multiple sellers is constrained by the CWB level.

the CWB captured higher prices for two-rowed malting barley than multiple sellers would have received in every year considered here.

Multiple sellers of Canadian feed barley would have experienced a reduction of $3.52/mt in the average price received in all feed barley markets (including the domestic market) from 1985/86–1994/95. Premiums on feed barley earned by the CWB over multiple sellers range from -$6.62/mt to +$11.36/mt (table 3). The CWB is estimated to have increased the prices received by Canadian feed barley producers in 1985/86, 1986/87, and 1990/91–1993/94. Conversely, multiple sellers would have earned a higher average price for Canadian feed barley on sales into feed markets in 1988/89, 1989/90, and 1994/95 ($1.10/mt, $0.86/mt, and $6.62/mt, respectively).

The impact on average producer revenue from replacing the CWB with multiple sellers of all Canadian barley is given in column 5 of table 3. Over the 1985/86–1994/95 period, the introduction of multiple sellers would have resulted in an annual average loss of $72 million on aggregate sales to feed and malting barley markets. Five additional scenarios were estimated in order to perform a sensitivity analysis: the elasticity of demand for Canadian feed barley in the rest of the world was changed from -20 to -5; the elasticity of the domestic demand for Canadian feed barley was changed from -0.53 to -0.20, and then changed again to -1.00; and the malting barley price premium relative to feed barley under multiple sellers was changed from $15/mt to $10/mt, and then changed again to $20/mt. The estimated annual average gain attributed to the CWB relative to

multiple sellers in feed and malting barley markets ranged from $50 million to $75 million depending upon the different parameters.[9]

The estimates of barley trade flows under multiple sellers are provided in table 4. In most years, if available, multiple sellers would have reallocated into malting barley markets some marginal quality barley that the CWB sold as feed, because they could receive a higher price for it. On average, over the 1985/86–1994/95 period, multiple sellers would have exported 514,000 mt less feed barley than under the CWB. They would have increased the average amount of six-rowed malting barley sold by 139,000 mt, and increased the average amount of two-rowed malting barley by 232,000 mt.

Limitations of the Analysis

The results of the analysis are based on price discrimination by the Canadian Wheat Board across barley markets of a similar type and reflect the power of the CWB to influence the selection rate associated with six-rowed and two-rowed malting barley. The availability of actual CWB barley sales contract data allowed this study to go beyond previous studies for which such detailed data were not available. The effort to capture the relationship among feed and malting barley markets subject to the acquisition constraint in the domestic market represents a significant improvement over previous models that attempt to measure market power exerted by the CWB. Even so, the following limitations should be kept in mind:

- The analysis does not include the benefits that Canadian producers have received when sales returns, less costs of marketing, were below the initial payment made by the CWB. Over the 1985–94 study period, there were three deficits in the feed barley pool account that amounted to additional revenue of $264 million from government payments to 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.
- The aggregation of sales data into only 10 market segments biases our estimates of the benefits from market power exerted by the CWB downward.
- Supply responses under alternative market structures were not integrated into this analysis. However, if we had allowed a supply response by Canadian producers, total production would have decreased under multiple sellers in most years. The decrease in production would have lowered the amount of barley available for sale by multiple sellers, which would have decreased export revenue even further.
- The differences in prices observed across all markets, except in the domestic feed market, represent a CWB revenue-maximizing strategy. It is assumed that the CWB has knowledge of how competitor prices will respond to additional quantities offered for sale in each market and that the CWB uses this information in its sales decisions.

[9] In the interest of brevity, the five appendices showing results of the sensitivity analysis are not included. However, these tables are available from the authors upon request.

- Multiple sellers are assumed to behave in a purely competitive fashion. However, if the removal of the CWB resulted in a small number of large firms, these firms could potentially behave as oligopolists with respect to Canadian barley. If this were to occur, the premium attributed to the CWB in this study is biased upward. On the other hand, if multiple sellers could behave as oligopsonists with respect to domestic producers, then the premium attributed to the CWB in this study is biased downward.

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

- The timing of sales throughout the year is assumed to be the same as that which would have occurred in a multiple-seller environment. Neither the gains nor the losses that could have accrued under different timing of sales were captured in the analysis.[10]

- The empirical analysis does not account for the potential interest lost by those producers who receive initial payment from the CWB and then are forced to wait up to 18 months to receive the final payment. The advent of multiple sellers would allow all producers to receive immediate full payment, similar to those producers who currently sell off-board feed barley. Our estimates of the benefits of market power exerted by the CWB are biased upward due to the exclusion of this loss of potential interest.

Policy Implications

Our analysis demonstrates the increase in revenue that can be generated by the Canadian Wheat Board through international price discrimination and market power, relative to multiple sellers of Canadian barley in competition. Some feel that because state trading enterprises (STEs) such as the CWB can exercise market power in international markets due to the authority granted them by their governments, their activities should be curtailed or eliminated under WTO rules. However, at least in the case of international grain markets, state trading seems to be more the rule than the exception. Other STEs that deal in grain (under any definition of state trading) are the Australian Wheat Board, the Japanese Food Agency, BULOG of Indonesia, and the China National Cereals, Oils, and Foodstuffs Import and Export Corporation (COFCO). In addition, Ackerman and Dixit classify the activities of the Commodity Credit Corporation (CCC) of the United States as a type-II STE prior to policy reform in 1996, and a type-I STE after policy reform. Moreover, using their classification scheme, the European Union Common Agricultural Policy (CAP) would seem to fit under the type-II classification.

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[10] For a detailed discussion of the potential arbitrage losses attributed to differences in timing associated with pooled pricing schemes, see Schmitz, Gray, Schmitz, and Storey.

State trading will be a major topic of discussion during upcoming WTO negotiations pertaining to agriculture, especially with the potential of China's ascension.[11] As discussed by Baban, STEs must meet three criteria to avoid violating WTO rules: (*a*) price discrimination can be used, but only for commercial reasons and not for political reasons; (*b*) the use of quantitative restrictions is to be limited; and (*c*) the WTO must be notified of all state trading activities by each member country. A major problem arises because of the ambiguities inherent in the definitions of these three criteria—it can be simultaneously argued that the CWB satisfies all three criteria, or that the CWB satisfies none of these criteria, depending upon which position one wishes to take.

The first criterion for WTO compliance is that a country must not price discriminate for political reasons. Brooks and Schmitz provide statistical evidence that the CWB does price discriminate among countries. However, many attribute this to hard price discrimination, a view consistent with the analysis performed in this study. That is, the CWB price discriminates in order to maximize revenue by withholding barley in relatively inelastic markets and redistributing sales to relatively elastic markets. This form of discrimination is certainly driven by commercial reasons, which does not violate WTO rules. On the other hand, during most of the period of this analysis, the U.S. also practiced price discrimination through the Export Enhancement Program (EEP). The U.S. used taxpayers' dollars to subsidize exports during the EEP period. However, on rare occasions, the CWB also used government subsidies to pay the deficit in the pool account caused by high initial payments.

The second criterion for WTO compliance is that the use of quantitative restrictions must be limited. While the CWB does not limit the volume of barley grown by producers, by practicing hard price discrimination, it is essentially restricting quantities into certain countries. If this violates the second criterion, then it also contradicts the first. Prior to 1996, the U.S. restricted domestic quantities through its Acreage Reduction Program. Even as of the year 2000, the Conservation Reserve Program might be viewed as restricting quantities as well.

The final criterion is that member countries must notify the WTO of state trading activities. Historically, the WTO has been notified of state trading activities by the CWB. However, there is some debate as to how much information should be contained in such notification. Some suggest that the CWB must become completely transparent, implying that it should report not only the volume of exports to each country but also the individual prices received. Others argue that private grain companies do not report their prices, so why should the CWB? Indeed, U.S. grain companies do not report their prices except when they receive EEP bonuses.

Perhaps the criterion for measuring state trading activities should be revised and viewed in the context of an STE's ability to distort trade. Through welfare analysis and trade theory, models have been developed to measure the degree of trade distortion caused by government policies. For example, Alston and Gray performed an analysis of trade distortions caused by state trading versus export subsidies. They compared Canadian policies to U.S. policies in the case of wheat and found: "Relative to the marketing board, the transfer efficiency of export subsidies can be higher or lower, in terms of benefits to producers per dollar of harm to domestic consumers and taxpayers, but it

[11] For further details regarding state trading and the World Trade Organization, see Schmitz, Furtan, and Baylis, and also Schmitz and Schmitz.

cannot be lower in terms of benefits to producers per dollar of harm to third countries" (p. 65). Unfortunately, this type of analysis must be performed on a case-by-case basis because one model does not fit all situations. Moreover, the process of obtaining empirical results is inherently complicated by the lack of data available for most countries.

Conclusions

This study addresses the issue of market power exerted by a state trading exporter using the Canadian Wheat Board and international barley markets as an example. First, a synthetic model was derived to estimate the import demand parameters for Canadian feed, two-rowed, and six-rowed malting barley by country of destination in each year from 1985–94. These parameters were estimated as an entire system using a set of equations to capture the price-discriminating behavior of the CWB across markets for similar types of barley, the interaction between feed and malting barley markets at the margin, and the behavior of Canadian producers with respect to the CWB.

Second, these parameters were inserted into a counterfactual model which simulated the revenue that would accrue to Canadian barley producers if the CWB were replaced by purely competitive multiple sellers. The actual revenue realized by Canadian feed and malting barley producers from 1985–94 was compared to the revenue that would have accrued to producers if the CWB had not exercised control over feed and malting barley exports over the same period.

Based on the results of our analysis, the CWB was able to obtain higher prices for Canadian two-rowed malting barley producers in every year from 1985/86 through 1994/95. It obtained higher prices for Canadian six-rowed malting barley producers in every year except 1993/94, and higher prices for Canadian feed barley producers in every year except 1988/89, 1989/90, and 1994/95. From 1985/86 through 1994/95, the CWB was able to generate an average of $72 million more in annual revenue than what purely competitive multiple sellers would have generated on all barley sales in aggregate. Only in 1994/95 would a multiple-seller market structure have been able to perform better than the CWB on aggregate sales of Canadian barley, generating an increase of $7 million in total barley revenue in that year.

The increase in average revenue accruing to Canadian barley producers attributed to the CWB is larger than estimates from previous studies. Four major reasons explain this result: (*a*) the price wedges from actual CWB sales contract data are larger than those assumed in previous studies, (*b*) our model examines the impact of a full dual market rather than the more restrictive case of a continental barley market, (*c*) we include the intertwining relationships between feed and malting barley markets in our analysis, and (*d*) we include the impact on the domestic feed market in our calculations.

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References

Ackerman, K. Z., and P. M. Dixit. "An Introduction to State Trading in Agriculture." Agr. Econ. Rep. No. 783, USDA/Economic Research Service, Washington DC, October 1999.

Alston, J. M., and R. Gray. "State Trading versus Export Subsidies: The Case of Canadian Wheat." *J. Agr. and Resour. Econ.* 25(July 2000):51–67.

Baban, R. "State Trading and the GATT." *J. World Trade Law* 11(1977):334–53.

Brooks, H. G. "First, Let's Assume We Have a Can Opener: An Analysis of the Economics of a Single North American Barley Market." *Can. J. Agr. Econ.* 41(1993):271–81.

Brooks, H. G., and T. G. Schmitz. "Price Discrimination in the International Grain Trade: The Case of Canadian Wheat Board Feed Barley Exports." *Agribus.: An Internat. J.* 15,3(1999):313–22.

Canada-U.S. Joint Commission on Grains. "Final Report." Report of the Commission's recommended changes to U.S.-Canadian grain trade practices. Winnipeg, Manitoba, Canada, January 1996.

Canadian Wheat Board. "Performance of a Single-Desk Marketing Organization in the North American Barley Market." Winnipeg, Manitoba, Canada, December 1992.

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

———. "The Economics of a Single North American Barley Market." *Can. J. Agr. Econ.* 41(1993b): 243–55.

———. "The Economics of a Single North American Barley Market: A Reply." *Can. J. Agr. Econ.* 42(1994):413–19.

Carter, C. A., and R. M. A. Loyns. "The Economics of Single-Desk Selling of Western Canadian Grains." Alberta Agriculture, Food, and Rural Development, Edmonton, Alberta, Canada, March 1996.

Carter, C. A., R. M. A. Loyns, and D. Berwald. "Domestic Costs of Statutory Marketing Authorities: The Case of the Canadian Wheat Board." *Amer. J. Agr. Econ.* 80,2(May 1998):313–24.

Clark, J. S. "Single-Desk Selling by the Canadian Wheat Board: Does It Have an Impact?" *Can. J. Agr. Econ.* 43(1995):225–36.

Duncan, M., and W. W. Koo. "The United States/Canada Durum Wheat War." *Choices* (1st Quarter 1995):29–34.

Furtan, W. H., D. F. Kraft, and E. W. Tyrchniewicz. "Can the Canadian Wheat Board Extract Monopoly Rents? The Case of the Spring Wheat Market." *Internat. J. Econ. Bus.* 6(1999):417–37.

Goodwin, B. K., and V. H. Smith. "Price Discrimination in International Wheat Markets." A report prepared for the Wheat Export Trade Education Committee, Washington DC, March 1995.

Gray, R., A. Ulrich, and A. Schmitz. "A Continental Barley Market: Where Are the Gains?" *Can. J. Agr. Econ.* 41(1993):257–70.

Johnson, D. D., and W. W. Wilson. "Competition and Policy Conflicts in Canada-U.S. Barley Trade." *J. Agr. and Resour. Econ.* 20(July 1995):64–81.

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

Schmeiser, D. C. J. "The Short-Run Impact on Producer Revenue of the Adoption of the Continental Barley Market Policy." Unpub. M.S. thesis, Dept. of Agr. Econ., University of Saskatchewan, April 1995.

Schmitz, A. "Economic Performance of the Canadian Wheat Board: Myth and Reality." Filed in Court Case of Archibald et al. vs. CWB and Her Majesty the Queen (Canadian Federal Court No. T-2473-93), August 1996a.

———. Rebuttal to the affidavit of Dr. Carter filed in the court case of Archibald et al. vs. CWB and Her Majesty the Queen (Canadian Federal Court No. T-2473-93), August 1996b.

Schmitz, A., H. Furtan, and K. Baylis. "State Trading and the Upcoming WTO Discussions." *Choices* (2nd Quarter 1999):30–33.

Schmitz, A., H. Furtan, H. G. Brooks, and R. Gray. "The Canadian Wheat Board: How Well Has It Performed?" *Choices* (1st Quarter 1997):36–42.

Schmitz, A., R. Gray, T. G. Schmitz, and G. Storey. "The CWB and Barley Marketing: Price Pooling and Single-Desk Selling." Canadian Wheat Board, Winnipeg, Manitoba, January 1997.

Schmitz A., R. Gray, and A. Ulrich. "A Continental Barley Market: Where Are the Gains?" Dept. of Agr. Econ., University of Saskatchewan, April 1993.

Schmitz, A., and T. G. Schmitz. "State Trading Enterprises, Price Discrimination, and the WTO." Paper presented at "Globalization and New Agricultural Trade Rules for the 21st Century" conference, Saskatoon, Saskatchewan, 12–14 February 2000.

Schmitz, T. G., and W. W. Koo. "An Economic Analysis of International Feed and Malting Barley Markets: An Econometric Spatial Oligopolistic Approach." Agr. Econ. Rep. No. 375, Dept. of Agr. Econ., North Dakota State University, September 1996.

United Grain Growers. Unpub. UGG Harvest Quality Survey data for 1985–94. Winnipeg, Manitoba, Canada.

U.S. Department of Agriculture, Foreign Agricultural Service. "U.S. and Canada Form Consultative Committee on Agriculture." FAS Press Release No. 0172.99, Washington DC, April 1999.

U.S. General Accounting Office. "State Trading Enterprises." Report to Congressional Requesters. Pub. No. GAO/GGD-25-208, Washington DC, August 1995.

———. "Canada, Australia, and New Zealand: Potential Ability of Agricultural State Trading Enterprises to Distort Trade." Report to Congressional Requesters. Pub. No. GAO/NSIAD 96-94, Washington DC, June 1996.

———. "U.S. Agricultural Trade: Canadian Wheat Issues." Report to Congressional Requesters. Pub. No. GAO/NSIAD 99-21, Washington DC, November 1998.

U.S. Trade Representative's Office. "United States-Canada Record of Understanding." USTR Press Release No. 98-107, Washington DC, December 1998.

Veeman, M. "A Comment on the Continental Barley Market Debate." *Can. J. Agr. Econ.* 41(1993): 238–87.

Western Grain Marketing Panel. "Grain Marketing." Report examining possible future directions for the CWB, submitted by the Panel of the Honourable Ralph Goodale, Agriculture and Agri-Food Canada, Ottawa, July 1996.

Wilson, W. W., and D. D. Johnson. "North American Malting Barley Trade: Impacts of Differences in Quality and Marketing Costs." *Can. J. Agr. Econ.* 43(1995):335–52.