

## **The Welfare Effects of State Trading Enterprises: the Case of US-Canada Malting Barley Trade**

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## **The Welfare Effects of State Trading Enterprises: the Case of US-Canada Malting Barley Trade**

Although advances in WTO led efforts toward free trade agreements have reduced explicit policy induced distortions in globally traded commodities, the potential for policy shifts toward implicit distortions certainly remains quite viable. For example, State Trading Enterprises (STEs) maintain internationally legal and internal strategies that several countries use to obtain an advantageous position in world markets. As early as 1947, the General Agreement on Tariffs and Trade (GATT) acknowledged State Trading Enterprises (STEs) as legitimate participants in international trade. The World Trade Organization (WTO) defines STEs as “government and nongovernmental enterprises, including marketing boards, which have been granted exclusive or special rights or privileges, including statutory or constitutional powers, in the exercise of which they influence through purchases or sales the level or direction of imports or exports.(citation)” In 1995/96, there were about 100 STEs reported to WTO by 32 countries. State trading is more prevalent in agriculture than in any other industries. STEs operate in a broad range of agricultural commodities and mostly traded in grains and dairy products.

Normally, STEs have single desk marketing functions and engage in price pooling. With these privileges, which are unavailable to commercial firms, STEs may exert influence on world grain market. The Canadian Wheat Board (CWB) is a single-desk state trading agency responsible for the marketing of all wheat and barley sold for human domestic consumption and for export. The U.S. is the biggest importer of Canadian six-row malting barley and its imports of malting barley from Canada have

increased in recent years due to the reduced size and quality of the U.S. crop. Two interesting questions arise as a result of the CWB position in this market. First, is Canada utilizing the STE as a strategy to exploit the U.S. malting barley market and second, what are the welfare effects resulting from the STE?

The role of the CWB has been the subject of many investigations. Several studies test the market power of the CWB (such as Schmitz et al, 1997; Schmitz and Gray, 2000; and Carter, 1993; etc), some studies examine the price discrimination of the CWB (such as Brooks and Schmitz, 1999; etc), and some studies compare the CWB against multiple sellers (Gray et al, 1993; Schmitz and Gray, 2000; and Clark 1995). Although there have been a few studies on comparing the CWB and multiple sellers, most of them concentrates on the wheat market or feed barley market. The U.S. is the largest importer of Canadian six-row malting barley and almost all the malting barley imported by the U.S comes from Canada. Therefore, the operation of the CWB has direct and potentially great impact on U.S. malting barley market.

This study aims to analyze the welfare effects of STEs as it applies to the US-Canada malting barley trade. A policy simulation was developed to determine the redistributive efficiency of single STE, a competitive structure, and a structure with oligopolistic processors. The modeling effort is of the type used by Huang and Sexton (1996). It adopts the perspective of the CWB, seeking to maximize pool returns of malting barley within a single market year.

### *Background*

The CWB is a single-desk state trading agency responsible for the marketing of all wheat and barley sold for human domestic consumption and for export with the

jurisdiction over Alberta, Saskatchewan, Manitoba, and a small section of British Columbia. Those areas typically produce 95 percent of the Canadian barley crop.

One of the major responsibilities of the CWB is to market wheat and barley in order to maximize returns to prairie producers. At the beginning of each crop year, the government establishes initial producer payments for grain sold to the CWB. The initial payment is a type of down-payment and, though not a guarantee, is often considered a price floor that has been supported by Canadian tax revenue. While it is not the full acquisition price if the pool generates a surplus on annual sales, further payments are not guaranteed. To avoid a deficit in the pool, the initial payment is set low enough. Usually, the initial payment is well below the final pooled price, normally set at 70 to 85 percent of the total estimated pool return. The farmers get an initial payment upon delivery, which is guaranteed by the government. Once the CWB has marketed all the grain in a particular pool, the revenue is pooled, and freight and handling charges are deducted. If returns to pool exceed the sum of initial payment, then a final payment is distributed to each individual producer based on the relative producer share of grain in that particular pool. Should returns fall short, the federal government will make up the difference.

The practice of price pooling makes the final price paid to producers a blended price based on net revenue of all sales in foreign and domestic markets. The STEs pay producers a same return regardless of the time of delivery during the marketing year. Through delayed payments to producers, STEs could have greater flexibility in pricing which is not available to private exporters who have to compete in acquiring exportable products.

Demand for malting barley is derived from the demand for malt, which in turn is driven by the demand for beer. A small amount of barley is also used directly for human consumption. For marketing purposes, barley is classified into feed and malting varieties. Malting barley is simply high-quality barley that has the appropriate characteristics to produce good malt. The malting barley is further divided into two-row (2R) and six-row white (6RW) aleurone barley and six-row blue aleurone (6RB) varieties, for which brewer demands differ.

Farmers in Canada grow both 2-row and 6-row varieties of barley. Since 1991, plantings of 6-row white varieties have increased much due to the contracts for the U.S. market. In general, in the world market, malt demand consists almost entirely of two-row varieties, except U.S. and some North American brewers make extensive use of malt produced with six-row white aleurone barley. The U.S. has been Canada's largest market for six-row malting barley. The United States also exports malting barley, but due to large population and high per capita beer consumption, it is also a large net importer of malting barley. The United States and China are the top two importers of Canadian malting barley and they account for about one-half of the world's malting barley imports in recent years.

### *Analytical Model*

A firm that charges different consumers different prices for the same good is said to engage in price discrimination. Three conditions are necessary for price discrimination: (1) the seller must have enough monopoly power to set prices, (2) the firm must be able to divide customers into different groups with demand curves, and (3) consumers must not be able to engage in arbitrage. The following model of the CWB

behavior incorporates price discrimination across international malting barley markets. The objective of the CWB is to allocate the total quantity of malting barley it receives from producers in a given crop year across international malting barley markets in order to maximize the return to the pool. Mathematically, the objective function can be written as follows:

$$\max_{q_i} \pi = \sum_{i=1}^n P_i(Q_i)q_i - w(R)r - \sum_{i=1}^n c_i q_i \quad (1)$$

where  $P_i(Q_i)$  denotes the inverse demand curve for malting barley in market  $i$ ;  $Q_i$  denotes aggregate quantity supplied to the market  $i$ ;  $q_i$  is the CWB's sales of malting barley in market  $i$ ;  $w(R)$  denotes the inverse supply curve of malting barley facing the CWB;  $R$  denotes aggregate purchase of malting barley;  $r$  is the purchase level of malting barley by the CWB; and  $c_i$  is the unit marketing cost in market  $i$ . Assume that the CWB markets all malting barley delivered by producers in a crop year, then  $\sum_i q_i = r$ . Maximization of equation (1) can be expressed as

$$P_i + \frac{\partial P_i}{\partial Q_i} \frac{\partial Q_i}{\partial q_i} q_i - w - \frac{\partial w}{\partial R} \frac{\partial R}{\partial r} r - c_i = 0 \quad (2)$$

Equation (2) can be expressed in elasticity form as follows,

$$P_i \left(1 + \frac{\xi_i}{\varepsilon_i}\right) = w \left(1 + \frac{\theta}{\eta}\right) + c_i \quad (3)$$

where  $\xi_i = \frac{\partial Q_i}{\partial q_i} \frac{q_i}{Q_i}$ ,

$\varepsilon_i = \frac{\partial Q_i}{\partial P_i} \frac{P_i}{Q_i}$  = price elasticity of demand for malting barley in market  $i$ ,

$\theta = \frac{\partial R}{\partial r} \frac{r}{R}$ ,

$\eta = \frac{\partial R}{\partial w} \frac{w}{R}$  = price elasticity of supply of malting barley under CWB jurisdiction.

$\xi_i$  is an index of oligopoly power and  $\theta$  is an index of oligopsony power. They range in the unit interval with values of zero referring to perfectly competitive behavior and values of 1 denoting monopoly or monopsony behavior. They are also known as “conjectural elasticities”. The same equation can be written alternatively as

$$(1 - \xi_i)P_i + \xi_i MR_i(Q) = \theta MC(R) + (1 - \theta)w + c_i \quad (4)$$

where  $MR_i(Q_i) = P_i + Q_i(\partial P_i / \partial Q_i)$  is the marginal revenue curve in market  $i$ ; and  $MC = w + R(\partial w / \partial R)$  is the marginal cost curve.

Figure 1 illustrates the supply curve and demand curve under competition, imperfect competition, and monopoly/monopsony. To make the illustration clear, the graph is separated into two parts, (a) and (b). When monopoly and monopsony power parameter is less than 1, the supply curve lies between the inverse supply curve  $w(R)$  and the associated marginal cost curve  $MC(R)$ , and the inverse demand curve lies between the inverse demand curve  $P(R)$  and the associated marginal revenue curve  $MR(R)$ . The competitive equilibrium is given by the point of  $S^0/D^0$ , and the monopoly/monopsony equilibrium is given by the point  $S^1/D^1$ .

The CWB has the single desk marketing function for all malting barley, which implies directly that  $r=R$ . However, the CWB is better classified as producer-agent and not as a processor with monopsony power (Schmitz and Furtan, 2000).

### *The Simulations*

The simulation requires several parametric inputs: a demand elasticity ( $\epsilon_i$ ) for the domestic market and for each of the importing countries, a supply elasticity ( $\eta$ ) for

Canada and conjectural elasticities for each market supplied by Canada. If supply and demand equations are specified as simple linear functions, the supply and demand elasticities will allow the specification of the linear model given initial market data on prices and quantities under competition. It is assumed that the elasticity of demand for Canadian malting barley in the U.S. market was -2.74, as estimated by Schmitz and Gray (2000). By assuming that price discrimination reflects revenue-maximizing behavior, we are able to calculate an implicit linear demand curve the CWB faced in each market by taking equal marginal revenue in each market.

We are now ready to define the conjectural variation structure for Canadian malting barley through an oligopoly power parameter  $\xi_i$  for each of the importing countries. Because the CWB is the single desk for marketing malting barley domestically, the oligopoly power parameter  $\xi$  for Canada domestic market is presumed to be of unitary value.

With the objective to maximize the returns to producers through a pooling mechanism, the CWB equates its marginal revenue in the domestic market with its marginal revenue in each other market. A market under CWB is used as the benchmark. Since grain trade might be highly concentrated even without STEs, different scenarios are defined in terms of market power exerted by a group of oligopolistic processors instead of the CWB. In particular, 4 structures were defined: (a) market with a single STE that maximizes the pooled returns of its suppliers (b) a competitive scenario; (c) non-competitive scenario with modest market power; and (c) non-competitive oligopolistic scenario with greater market power of processors. In the base scenario, although the CWB is the single-desk buyer of malting barley, the index of monopsony power  $\theta$  is set as 0 because the CWB will return all surplus to producers after the



marketing process. The index of monopoly power  $\xi$  in the U.S. market is set as 0.2. In the competitive case, the market power indexes are zero, and the supply price and the selling price are equal. In the non-competitive case with modest processor market power, the market power indexes are set as  $\theta=\xi=0.05$ . In the non-competitive case with greater processor market power, the market power indexes are set as  $\theta=\xi=0.1$ . This reflects an increase in market power exerted by a group of processors but is less than what CWB would have with the single desk selling right of Canadian malting barley.

The prices and quantities of malting barley sold to Canadian domestic and U.S. market in 1991/92, which were obtained from Schmitz and Gray (2000), were used to do the simulation. We calculated the marginal revenue as well as the slope and intercept of the demand curve in the U.S. market using the price, quantity, and the demand elasticity in the U.S. market. Then assuming the same marginal revenue in every other market, given the prices and quantities, we could then derive the elasticity, slope, and intercept of Canadian domestic demand curve. The results are reported in Table 1.

The economic effects of the STE and implied oligopoly processor structures are analyzed using measures of domestic producer surplus, consumer surplus, marketing firm profits, and deadweight loss.

### *The Simulation Results*

The simulation results are reported in Table 2. Complete mathematical specifications are omitted for space reasons, but are available from the authors upon request. The first block of the table shows the producer surplus under the four simulated cases described earlier (CWB, competition, oligopoly processors with modest

and greater market power). The second block shows the consumer surplus in Canadian and the U.S market under each market scenario. And the third block shows the middle profit under each market scenario. Not surprising, we show that single-desk selling generates the largest producer surplus, with at least 9.7 million dollars more than the next best case. With oligopolistic processors, profits are not transmitted upstream and therefore, producer surplus in Canada decreases relative to the presence of a producer-agent STE. Canadian consumer is worse off under the CWB and there is a very large increase in consumer surplus with a change to oligopolistic processing. The total surplus of Canada will be increased with a change from the CWB marketing to a competitive market by 3.3 million dollars. If the marketing function is carried out by oligopolistic processors with modest market power, the total surplus of Canada will still be increased by 0.5 million dollars. But if the processors have greater market power, the total surplus will be lower than that with the CWB marketing by roughly 2 million dollars.

Because the U.S. welfare is derived from import demand, it does not convey the impact of Canadian barley marketing on U.S. producers and U.S. producer surplus cannot be measured in the context of the present simulation. However, the simulation does provide information relevant for an assessment of effects on U.S. market, such as import prices and volumes. This information is provided in table 3. The negative relationship between the import volume and market power of sellers is expected. At the same time, as shown in the table 3, U.S. malting barley prices are higher as a result of Canada's single-desk selling than observed in a multiple environment, which suggests that the CWB withholds malting barley from the U.S. market. One of the interesting results of this study relates to the political economy that is driving the debate regarding

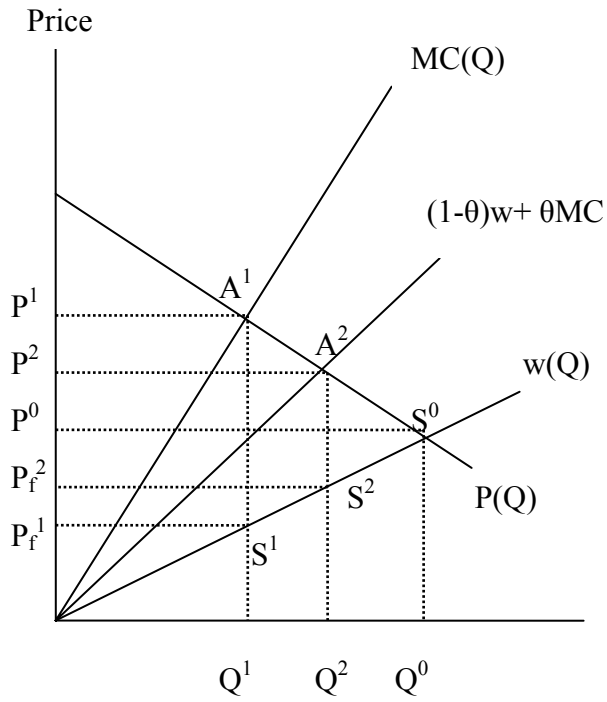
STE's. There has been no voice from consumer advocacy groups about STE distortions. Most, if not all, of the concerns have come from producer groups. The existence of STEs that have the ability to raise export prices have clearly definable benefits to not only the same-commodity producers in the importing country but also to the producers of close substitutes.

### *Conclusions*

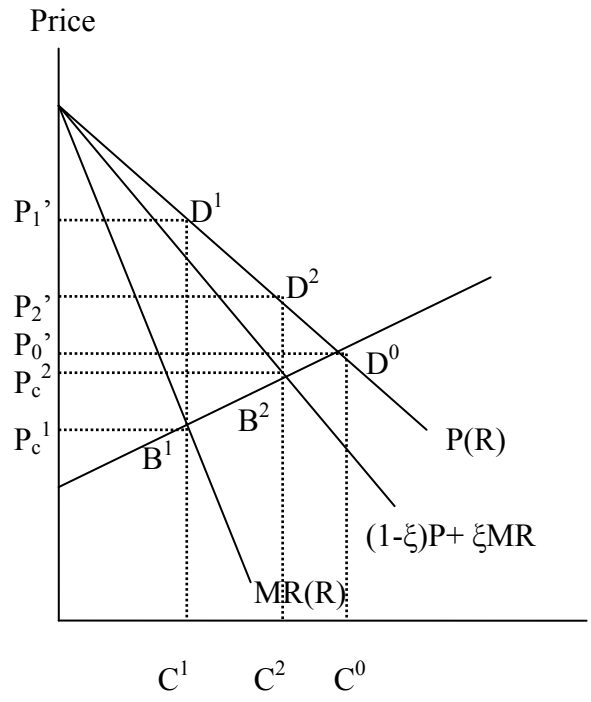
In this study, we quantified the welfare, price and volume impacts of a change from the CWB single-desk selling to a multiple seller structure. The analytic structure of the model follows from Huang and Sexton (1996), and extended to the CWB single desk selling. Results of the analysis show that shifting from the CWB single desk structure to an oligopolistic (multiple marketers), makes the Canadian producer would be much worse off, lowers the price to U.S. barley producers and generates benefits to both Canadian and U.S. consumers. The Canadian total surplus change depends on the multiple sellers' market power. In this study, it shows that if multiple sellers have modest market power, Canadian total surplus would be increased, while if multiple sellers have greater market power, Canadian total surplus would be decreased. In the meantime, the results show that with the removal of the CWB, the U.S. import price would be lower and import volume would be higher no matter the degree of market power. These outcomes would not be at all consistent with USDA objectives of raising farm prices of base commodities in the U.S.

**Figure 1. Perfect versus imperfect competition**

(a) Monopsony and Output



(b) Monopoly and Consumption



**Table 1. Parameters of Supply and Demand for CWB Malting Barley**

	Price (\$/mt)	Quantity (000s mt)	Parameters		
			Elasticity	Intercept	Slope
Demand:					
Canada	163.09	91	-1.96	246.28	-0.914
United States	125.81	288	-2.74	171.73	-0.159
Supply:	133.44	462	1	0	0.289

**Table 2. Simulation Results: Welfare Effects from Different Market Scenarios**

	Change in Producer Surplus (\$000s)	Change in Consumer Surplus (\$000s)		Change in Processor Profit (\$000s)
		Canada	U.S.	
Base Case: CWB				
Competitive	-9648.28	12971.55	1501.85	0
<u>Oligopolistic Processor replacing the CWB:</u>				
With modest market power	-11093.50	11594.99	1096.71	2906.73
With greater market power	-12418.60	10363.89	712.26	3809.38

**Table 3. Impact of Different Marketing Scenario on U.S. Malting Barley Prices and Volumes.**

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	Price Change	Volume Change
	(\$/ton)	(000s tones)
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Base Case: CWB single desk marketing		
Competitive	-4.06	25.44
<u>Oligopolistic Processor replacing the CWB:</u>		
With modest market power	-2.99	18.75
With greater market power	-1.96	13.16

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