Wheat - marketing

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STRATEGIC TRADE THEORY AND AGRICULTURAL MARKETS: AN APPLICATION TO CANADIAN AND U.S. WHEAT EXPORTS TO JAPAN

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In this paper we address two issues: the competitiveness of United States and Canadian wheat exports to Japan and the impact of potential trade liberalization on U.S. and Canadian wheat exports to Japan.

The first issue is one of market structure. We specify an imperfectly competitive model of trade in wheat, which explicitly incorporates the behavior of the Canadian Wheat Board and U.S. exporters. The model is flexible in that it includes conjectural variations parameters, which can reflect either Cournot or Bertrand competition. The model is calibrated to market data for the period 1976/77-1984/85. For all years, the implied conjectural parameters are significantly different from Cournot. They are significantly different from Bertrand in only about half of the cases. These combined results suggest that the market is more competitive than Cournot.

We used this market model to simulate the effects of potential GATT reductions in Canadian and U.S. agricultural support, as well as elimination of restrictive actions by the Japanese Food Agency. The JFA limits imports by a combination of import licenses and high resale prices. In our simulations, we capture this effect by an implicit tariff given by the wedge between the cif import price and the resale price. We conducted five experiments: elimination of Japanese import restrictions, elimination of Canadian producer subsidy equivalents, elimination of U.S. producer subsidy equivalents, elimination of producer subsidy equivalents in both exporting countries, and elimination of all producer support and trade restrictions. For marketing years 1976/77-1984/85, we calculated the trade flows and prices which would have occurred if the implicit Japanese tariffs were zero. This liberalization increases total U.S. and Canadian exports to Japan in all years. For all years except 1976/77, our model predicts a larger increase in Canadian than in U.S. exports. Because our estimates of Japanese elasticities of demand for U.S. and Canadian wheat are low, the quantity effects of liberalization are quite small, and price effects are large. For all years, zero tariffs lead to substantially higher import prices with virtually no increase in the price in Japan.

The effects of eliminating producer subsidies were calculated for 1982/83 - 1984/85. When only one country's PSE is eliminated, the exports of that country decline and its price rises. Because demand elasticities are low, price effects are larger in absolute value than are the quantity effects. When both PSE's are eliminated, exports of both countries decline slightly and import prices increase by 10 to 40 percent. The Japanese resale prices increase roughly 8 to 20 percent.

Finally, we examined the effects of eliminating all tariffs and PSE's. The total effect is little change in the quantity of U.S. exports, and Canadian exports increase 2.5 or less. Import prices increase 60-100 percent, and the Japanese prices increase roughly 7-20 percent.

2. The Theoretical Model

In this section we consider a model which endogenously determines the trade flows of Canadian and U.S. wheat to Japan. This is a simplification since Japan imports from Australia as well, but focusing on the U.S. and Canada makes the analysis of market structure issues substantially more tractable. However, as will be seen below, our empirical work controls for the presence of Australia in the Japanese market. The world we model, then, is one in which two countries export wheat to a third country.

Each of the exporting countries consumes the good, but because of restrictions outside the model, they do not import it. This could be explained by quotas, but for simplicity we abstract from them here. Wheat is competitively produced, and producers sell to distributors or marketing agents rather than directly to consumers. In practice this occurs because of technological features of transportation and marketing services, but, again, we abstract from these here. For simplicity we also abstract from inventory decisions. The competitive producer supply curve is upward sloping in both Canada and the U.S.

In an obvious notation, we call the two exporting countries C and U. In country C a statutory marketing board is the sole marketing agent. This board handles all domestic, as well as foreign, sales to consumers. In country U, distributors are private firms. There are m such firms, each assumed to maximize profits. To reflect the fact that one of the major goals of the Canadian Wheat Board is to maximize producer returns,[1] country C's marketing board is assumed to maximize the joint returns of its competitive producers plus export revenue.

The marketing board and exporting firms are assumed to maximize their objective functions, given their assumptions about each others behavior. Rather than specify the assumptions they make, we use conjectural variation parameters which include as special cases Cournot (quantity) and Bertrand (price) competition. This will allow us to

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1 Just, et al. (1979), Markusen (1984), and Thursby (1988) have also analyzed marketing board behavior based on this assumption.

calibrate the model to market data to solve for values of these conjectures.

The board and exporting firms take as given the competitive supply curves, any taxes or subsidies of their respective governments, and any import tariffs levied by the government in the third market. Throughout the paper the analysis will be partial equilibrium.

All wheat produced in country C is homogeneous, as is all wheat in country U. However, the wheat of the two countries need not be perfect substitutes. We denote the import country, Japan, by J.

Let P^{ri} refer to the consumer price in country J of wheat from country i. In the absence of a tariff, this equals the cif price of country i's wheat, P^{ji}. With an ad valorem tariff, $P^{ri} = (1 + t)P^{ji}$, while a specific tariff gives $P^{ri} = P^{ji} + t$, where t denotes the tariff. This will allow us to incorporate the fact that the Japanese Food Agency resells wheat, usually for a premium in the domestic market.

Marketing Board's Problem

The marketing board maximizes the joint returns of competitive producers in its country plus export revenue. The board's returns include the sum of revenues from all export markets, but for ease of exposition, we abstract from its exports to countries other than J. Thus we can express the board's objective function as

$$\left(P^{cc}(Y^c) + cs^c \right)Y^c + \left(P^{jc}(X^c,X^u) + es^c - c^c \right)X^c - F$$

$$- \int_0^{Y^c+X^c} [s^c(q) - ps^c]dq \qquad (2.1)$$

where X^i denotes the quantity of wheat exported by country i to J, Y^c is the quantity of wheat sold domestically, $P^{cc}(Y^c)$ is C's demand in inverse form, $P^{jc}(X^c, X^u)$ is J's inverse demand for C's wheat, $s^c(Y^c + X^c)$ is the competitive producer supply price, cs^c is a consumer subsidy, es^c is an export subsidy, ps^c is a producer subsidy, c^c is transport cost for export sales, and F is fixed cost. We shall presume that operating and domestic marketing costs are included in F.

In the absence of any other regulations, the board's domestic and export sales to J would be determined by the following first order conditions:

$$P^{cc}(1 + e_c^{cc}) = s^c - (ps^c + cs^c) \tag{2.2}$$

and

$$P^{jc}\left(1 + e_c^{jc} + e_u^{jc} v^{cu} X^c / X^u\right) = s^c + c^c - (ps^c + es^c) \tag{2.3}$$

where e_c^{cc} is the domestic inverse demand elasticity (price flexibility), e_c^{jc} is the own inverse import demand elasticity in country j, e_u^{jc} is the cross elasticity of inverse demand for imports from C with respect to X^u, and v^{cu} is the board's conjecture about the response of X^u to a change in the board's exports. Throughout the paper elasticities will carry their natural sign. Under the assumption of Cournot competition, the board considers U.S. exports as given, or $v^{cu} = 0$. With Bertrand competition, the board would take the U.S. export price as given.

Notice that if we were to endogenize Australian exports to Japan, the Japanese inverse demand would contain an additional argument and the first order condition for the Canadian board's exports would include a conjectural term about the way in which the Australian board competes. In addition, we would have to consider the Australian board's decision problem (where conjectures about Canadian and U.S. behavior would be relevant).

Regulation of Canadian Marketing Board

An alternative specification can be used to incorporate the fact that the Canadian wheat board is regulated in its domestic pricing. Just, et.al. (1979), Markusen (1984), Thursby (1988), Krishna and Thursby (1988) have pointed out in several contexts that such regulation will affect export decisions.

With a regulation that the board equate domestic demand and supply prices, it's maximization problem would be constrained by

$$P^{cc}(Y^c) + cs^c = s^c(Y^c+X^c) - ps^c. \qquad (2.4)$$

Given this constraint and the board's conjecture about the affect of its sales on exports of firms in country U, the first order conditions for the marketing board are (2.4) and

$$P^{cc}e_c^{cc} + P^{jc}\phi \left(1 + e_c^{jc} + e_u^{jc}v^{cu}X^c/X^u \right)$$

$$= \phi(s^c + c^c - es^c - ps^c) \qquad (2.5)$$

where $\phi = [(\partial P^{cc}/\partial Y) \div \partial s^c/\partial(X^c + Y^c)] - 1.$

Notice from (2.2) and (2.3) that without the domestic price regulation, the board equates perceived marginal revenue in each market with the competitive supply price net of taxes and subsidies. The term "perceived" is used because of the conjectural variation parameter. From (2.4) and (2.5) it is apparent that the regulation prevents the board from equating these two.

Export Industry of Country U

Modelling country U's export industry poses more problems than does the marketing board. In a conjectural variations framework, each firm in U's industry will have a conjecture about the board's behavior, a conjecture about other firms' behavior in the export market, and a conjecture about rival firms' behavior at home. A priori, there is no reason for these conjectures to be the same. One way to avoid this type of problem is to assume no domestic sales by exporters, but that is clearly unrealistic in the case of U.S. wheat, for example. Another way to simplify the problem is to adopt a model similar to that of Thursby (1988) in which there are two types of marketing firms, one which exports and one which sells only in the domestic market because of a cost disadvantage. In the limit the model allows the possibility of imperfect competition in the export sector, but these firms cannot exercise oligopoly power in the domestic market if there is a competitive fringe of firms who market the good domestically.

This approach is consistent with evidence from the U.S. market. Conklin (1982) reports lower concentration ratios for domestic grain sales than for export sales. Caves and Pugel (1982) present similar evidence based on a survey of members of the North American Export Grain

Association. Their evidence points to the largest firms handling a majority of "direct" export sales, while many smaller firms purchase grain from farmers to sell domestically or to the largest exporters who then export it (the latter type of sale being classified as "indirect" exports).

Suppose there are $m = n+h$ firms, the last h of which have a cost disadvantage relative the the first n firms. Profit for the ith firm is given by

$$\pi_i = P^{uu}(Y^u)y_i^u + P^{ju}(X^c, X^u)x_i^u - s^u(Y^u+X^u)[x_i^u+y_i^u]$$

$$- F_{ix} - F_y + (ps^u+cs^u)y_i + (ps^u+es^u-c^u)x_i \qquad (2.6)$$

where $Y^u = \Sigma_{i=1}^m y_i^u$, $X^u = \Sigma_{i=1}^m x_i^u$, y_i^u is domestic sales of firm i, x_i^u is export sales of firm i, $P^{uu}(Y^u)$ and $P^{ju}(X^c, X^u)$ are domestic and Japanese inverse demands, F_{ix} is fixed cost associated with export activity, F_y is fixed cost associated with domestic operation, ps^u is a producer subsidy, cs^u is a consumer subsidy, es^u is an export subsidy, and c^u is per unit transport cost to export to J. Firms are differentiated only by the export fixed cost parameter, F_{ix}, and for simplicity we assume it takes on only two values, low (F_{1x}) or high (F_{2x}). For $i = 1,\ldots,n$, $F_{ix} = F_{1x}$ and for $i = n+1,\ldots, m$, $F_{ix} = F_{2x}$.[2]

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2 Thursby (1988) differed by assuming unit variable costs to vary among firms. Allowing different fixed costs has the same impact and is closer in spirit to the types of differentiation reported by Caves and Pugel (1982).

We assume free entry and a low enough value for F_y that there are many firms in the domestic market. Thus we assume competitive conjectures in the domestic market, so that firm's first order conditions for domestic sales give P^{uu} equal to the competitive supply price (net of producer and consumer subsidies). However, for high enough values of F_{2x}, only type 1 firms will enter the export market. Under our assumptions all type one firms are identical. We look at a symmetric equilibrium in U's exports, which makes the problem more tractable. In addition, firm level data are unavailable, and this assumption allows us to use aggregate data for the first order condition of a representative exporter. The representative firm's first order condition for exports can be written as

$$P^{ju}\left(1 + (e_u^{ju}/n)\,[1+v^{uu}] + e_c^{ju} v^{uc} x_i^u/X^c \right)$$

$$= s^u + c^u - ps^u - es^u + \Psi x_i^u(1 + v^{uu}) \qquad (2.7)$$

where $\Psi = \partial s^u/\partial(Y^u+X^u)$, e_u^{ju} is country J's inverse demand elasticity with respect to X^u, e_c^{ju} is the cross elasticity of inverse demand for U's wheat with respect to X^c, v^{uu} is the representative firm's conjecture about responses of all other type 1 firms in the export market, v^{uc} is the representative firms's conjecture about the response of C's board in the export market. Hence each firm equates perceived marginal revenue from exports with perceived marginal cost.

Equilibrium and Policy Analysis

The Nash equilibrium to this game among country C's board and country U's firms is determined by simultaneous solution of the system of inverse demands and the relevant first order conditions. If we incorporate the effect of regulated domestic pricing, the board's relevant first order conditions are (2.4) and (2.5), and they are (2.2) and (2.3) if we do not consider the effect of domestic price regulation. There are n equations given by (2.7) for country U plus an equation for U's domestic demand equal supply. These equations plus j's import demand functions give the equilibrium levels of domestic sales and exports of each country.

Recall that the relevant first order conditions assume given levels of t, ps^j, es^i, and cs^i. The effects of trade liberalization are obtained by performing comparative statics exercises with respect to these parameters. Before doing the comparative statics, however, we need to determine values for the conjectural terms in the board and firm's first order conditions. We use regression analysis combined with a calibration exercise to estimate the conjectural variation parameters. In Section 3 we present the regression and calibration results, and in Section 4 we present the trade liberalization results.

3. Calibration of the Model

To make inferences about the nature of Canadian-U.S. rivalry in the Japanese wheat market, we use regression analysis in combination with a calibration exercise. As noted earlier, U.S. and Canada account for around 80 percent of Japan's wheat imports. Canada exports through the

Canadian Wheat Board and the U.S. export industry is largely composed of private firms. Data for the mid 70's to the present show that, depending on the year, the number of U.S. firms exporting ranges from around 30 to around 60 with the largest four U.S. firms accounting for 60 percent of U.S. wheat exports in 1974/75.

Since there is no information on market structure from the first order conditions which determine Canadian and U.S. domestic sales, we shall focus on the first order conditions for exports for both U.S. firms and the Canadian board. Since exports to Japan are a small portion of total wheat production in both countries we shall assume that both the board and U.S. exporters ignore any potential effects of exports on the domestic supply price. Our purpose is to use available data to estimate values for v^{uu}, v^{uc} and v^{cu}.

The relevant Canadian equation is (2.3) which we rewrite for convenience as

$$v^{cu} = - X^{u} \left(\mu^{c} + P^{jc} e_{c}^{jc} \right) / e_{u}^{jc} P^{jc} X^{c} \qquad (3.1)$$

where $\mu^{c} = P^{jc} - s^{c} - c^{c} + es^{c} + ps^{c}$

and X^{c} and X^{u} again denote exports of Canada and the U.S. to Japan. For any given year, μ^{c}, P^{jc}, X^{u} and X^{c} are observable. Unobserved parameters are e_{c}^{jc} and e_{u}^{jc}. Using regression analysis we can estimate these elasticities as well as their variances and covariances which can then be used in (3.1) to estimate v^{cu} as well as determine variances of the estimates.

For the U.S. there are n first-order conditions for exports given by (2.7) with $\Psi = 0$ (since U.S. exporters are assumed to ignore domestic supply price effects of their actions). Since there are two conjectures in (2.7) it will be necessary to condition on one and estimate the other. We begin by conditioning on v^{uu}. Summing over all n firms we can write v^{uc} as

$$v^{uc} = - X^{c} \left(n\mu^{u} + P^{ju}e_{u}^{ju}(1 + v^{uu}) \right) / e_{c}^{ju}P^{ju}X^{u} \qquad (3.2)$$

where $\mu^{u} = P^{ju} - s^{u} - c^{u} + ps^{u} + es^{u}$.

For any given year, n, μ^{u}, P^{ju}, X^{u} and X^{c} are observable and we condition on v^{uu}. e_{u}^{ju} and e_{c}^{ju} are unobserved but estimable parameters, hence v^{uc} can be estimated.

Conversely, we can condition on v^{cu} which gives

$$v^{uu} = - \left(n\mu^{u} + P^{ju}[\, e_{u}^{ju} + e_{c}^{ju}v^{uc}X^{u}/X^{c} \,] \right) / P^{ju}e_{u}^{ju}. \qquad (3.3)$$

Conditioning on v^{cu} and using estimates of e_{u}^{ju} and e_{c}^{ju} we can estimate v^{uu}.

Notice that the number of U.S. firms enters the equations for v^{uu} and v^{uc}. Depending on the year, between 30 and 60 U.S. firms export wheat. However, using these numbers for n would be inappropriate, since our equations implicitly assume the export industry is composed of symmetric firms. The industry is clearly not symmetric, and ideally one would adopt a model which endogenized the size distribution of firms. Since that is not a tractable problem, we follow current best practice and compute the Herfindahl equivalent number of symmetric firms. That is, $n = 1/H$ where $H = \Sigma_{i=1}^{N} s_i^2$, N is the actual number of firms, and s_i is the share in exports of the ith firm.[3] For the years we consider, the Herfindahl ranged between .07 and .11, which implies equivalent numbers of firms between 9 and 14. We should note that our results are not sensitive to changes in this range.

Referring to equations (3.1), (3.2) and (3.3), the unknown parameters are e_c^{jc}, e_u^{jc}, e_u^{ju} and e_c^{ju}. We obtain estimates by estimating demand in its indirect form

$$P_t^{ru} = \alpha_0^u + \alpha_1^u X_t^u/POP_t + \alpha_2 X_t^c/POP_t + \alpha_3^u X_t^a/POP_t + \alpha_4^u Inc_t$$

$$+ \alpha_5^u Stks + \alpha_6^u t + \alpha_6^u Strike_t + \alpha_8^u D_t + v_t^u \qquad (3.4)$$

$$P_t^{rc} = \alpha_0^c + \alpha_1^c X_t^c/POP_t + \alpha_2 X_t^u/POP_t + \alpha_3^c X_t^a/POP_t + \alpha_4^c Inc_t$$

$$+ \alpha_5^c Stks_t + \alpha_7^u t + \alpha_6^u Strike_t + \alpha_8^u D_t + v_t^c \qquad (3.5)$$

where

X^u = Japanese imports of U.S. wheat,

X^c = Japanese imports of Canadian wheat,

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3 If the industry were symmetric, the Herfindahl would be $\Sigma_1^N (1/N)^2$, so that 1/H would be the number of firms in the industry.

X^a = Japanese imports of Australian wheat,

P^{ru} = real Japanese resale price of U.S. wheat in yen

P^{rc} = real Japanese resale price of Canadian wheat in yen

POP = Japanese population

Inc = real per capita Japanese income,

Stks = Japanese per capita beginning stocks + production - exports,

t = time trend,

Strike = variable to reflect US west coast dock strike activity,

D = dummy variable equal to 1 if the marketing year is 1973/74, 1974/75 or 1975/76, equal to 0 otherwise.

Note that while we abstract in our model from the presence of Australia in the Japanese market, we control for the Australian price in our estimated demand equations.

Data are annual for the marketing years 1960/61 to 1984/85. Data sources are available from the authors. Five specifications of the demand equations are used; the specifications differ according to whether the time trend, dummy variable for 973/74 - 1975/76, or dummy variable for dock strikes are included in the equations. To account for possible correlation of disturbances between the two regression regimes we use the seemingly unrelated regression procedure. Note that we impose equality of cross-price effects.

Results are in Table 1. Note that the adjusted R^2's are above .9 for all models and that they are slightly higher for the U.S. and for Model 5. There are no surprises in the signs of coefficients. All quantity coefficients have a negative sign. Hence the direct own-price elasticities implied by the two equation system are negative and the cross-price elasticities are positive. There is no theoretical reason to expect particular signs for the other coefficients. A striking result, but one consistent with common perceptions of the Japanese Food Agency's behavior (Carter (1986)), is that all of these demands are inelastic. This can be seen from Table 2, where we report the direct own and cross price elasticities of demand for all models. Since our calibration is done for the marketing years 1976/77 through 1984/85, we only report the elasticities for those years. Notice that there is little variation in the own elasticity estimates for U.S. wheat either across models or years The own-price elasticity of demand for Canadian wheat varies more among models, but within a given model it does not vary a great deal from year to year. Finally, note the cross-price elasticities imply tha U.S. and Canadian wheat are imperfect substitutes in the Japanese market.

We estimated conjectural variations and effects of trade liberalization for all models, and the full set of results are in available from the authors. For ease of exposition and because there are no large differences across models, we report on one set of results in the text. We shall focus on Model 5 since it includes all regressors and has a slightly better fit. Hence the results we discuss are based on the inverse demand elasticities,

$$e_u^{ju} = \alpha_1^u X^u / P^{ju}$$

$$e_c^{jc} = \alpha_1^c X^c / P^{jc}$$

$$e_c^{ju} = \alpha_2 X^c / P^{ju}$$

$$e_u^{jc} = \alpha_2 X^u / P^{jc}$$

where α_1^u, α_1^c, and α_2 are estimates from Model 5. Substituting these elasticity estimates into equations (3.1), (3.2) and (3.3) gives the estimated conjectures.

A major criticism of past calibration studies is the failure to provide variances for estimated conjectures. This failure stems from the somewhat nonstandard (at least for economists) method of estimation. However, to the extent that variances and covariances of the estimated parameters used in the calibration exercise are available, variances for the estimated conjectures can be derived. Define Σ as the covariance matrix of the seemingly unrelated system (3.4) and (3.5). Under mild regularity conditions each of the estimated conjectures is consistent and asymptotically normal with covariance matrix given by $\Delta'\Sigma\Delta$ where Δ is the gradient of v^{cu}, v^{uc} or v^{uu} with respect to the estimated parameters of the demand system (3.4) and (3.5). Substituting estimated coefficients, variances and covariances of (3.4) and (3.5) into $\Lambda'\Sigma\Lambda$ gives estimated variances for the estimated conjectures.

Table 3 contains the conjectural results for marketing years 1976/77 - 1984/85. We restricted the conjectural analysis to these years since our data for the Herfindahl index correspond to that period. For ease we also repeat the elasticities in the tables. The implied conjectures are remarkably constant across years; this is not surprising given the relative constancy of the elasticities across years. The Canadian conjectures about U.S. firms are around -1.23. The Canadian Bertrand conjectures are around -.54 in each year. Cournot conjectures would be zero. The Canadian conjectures are never significantly different from Bertrand, but in every case they are different from Cournot at the 10% level.

Interpretation of results for v^{uu} and v^{uc} is somewhat trickier. As should be the case, point estimates are the same whether we condition on v^{uu} or v^{uc}; however, variances are different. We begin with the results conditional on v^{uu}. When v^{uu} is set to -.9 (this is the value we choose to represent Bertrand conjectures), the implied value of v^{uc} is around -.15. These values are significantly different from both Cournot (at the 2% level) and Bertrand (at the 1% level - the Bertrand value for v^{uc} is around -.82). When v^{uu} is set to -.5 we get an implied conjecture about Canada of around -.9. Here again the values are significantly different from Cournot (at the 2% level); however, they are not significantly different from Bertrand. When we allow U.S. firms to have Cournot conjectures about other U.S. firms, the implied value of v^{uc} is around -1.8. These are again significantly different from Cournot (at the 2% level) but not from Bertrand. Turning to the results conditional on v^{uc}, we find that Bertrand conjectures about Canada (i.e., a value of v^{uc} of around -.82) imply conjectures of U.S. firms about each other of around -.54. These are significantly different from both Cournot (at the 2%) level and Bertrand conjectures (at the 10% level). When v^{uc} is set to -.5, the implied v^{uu} is around -.71. These are again significantly different from Cournot (at the 1% level) and Bertrand conjectures (at the 10% level). Finally, when v^{uc} is the Cournot value, v^{uu} is just slightly larger than -1.0. These values are not significantly different from Bertrand but are very different from Cournot (the test statistics are all larger than 150 in absolute value).

In summary, the estimated conjectures of the Canadian board about U.S. firms, of U.S. firms about the Canadian board, and of U.S. firms about each other are always significantly different from Cournot. However, these conjectures are significantly different from Bertrand in only about half of the cases. These combined results suggest that the market is more competitive than Cournot. To see this more clearly, we conducted a series of experiments in which we solved for the trade flows and prices which would occur if competition were either all Cournot or all Bertrand. For the Cournot experiments we substituted zero for all conjectures (recall that Cournot competition would be the result if $v^{uu} = v^{uc} = v^{cu} = 0$) in equations (2.3) and (2.7). The resulting equations in combination with the inverse demand equations allow for solution of the equilibrium values of imports and prices. We again use the marketing years 1976/77 through 1984/85 and the results are in Table 4. Notice that the prices implied by Cournot competition are dramatically higher than actual prices. In Table 5 are the trade flows and prices when Bertrand values are substituted for v^{uu}, v^{uc}, and v^{cu}. As expected the price of U.S. wheat would be lower than is actually the case. The implied Canadian price is higher than actual prices. This result most likely holds because the Japanese demand for Canadian wheat is more elastic than their demand for U.S. wheat. In addition, the actual values for v^{cu} suggest that the Canadian Board assumes the U.S. industry is more competitive than Bertrand.

4. Trade Liberalization

In this section we consider the effects of trade liberalization. Because the Uruguay Round has focused on all forms of government intervention, we consider the implications of reducing domestic agricultural support, as well as trade barriers. In the case of Canadian and U.S. wheat exports to Japan, the relevant policies are support policies in the two exporting countries and the restrictive actions of the Japanese Food Agency. Our information on Canadian and U.S. producer support comes from Economic Research Service, Estimates of Producer and Consumer Subsidy Equivalents. JFA wheat policy is an integral part of Japanese rice policy, and is summarized in a number of sources (Japan Flour Millers Assocition (1978), Carter (1986), and Australian Bureau of Agricultural and Resource Economics (1989)). Essentially, the JFA limits imports by a combination of import licenses and high resale prices. In our simulations, we capture this effect by an implicit tariff given by the wedge between the cif import price and the resale price. In Table 6 we present the levels of producer subsidy equivalents in Canada and U.S. as well as the implicit tariffs imposed by the JFA.

Producer subsidy equivalents are not available for the years prior to 1982/83.

We conducted five experiments: elimination of Japanese import restrictions, elimination of Canadian producer subsidy equivalents, elimination of U.S. producer subsidy equivalents, elimination of producer subsidy equivalents in both exporting countries, and elimination of all producer support and trade restrictions. These experiments are comparative statics exercises in the context of the model presented in Sections 2 and 3. The inverse demand equations are given by (3.4) and (3.5) and the supply relations are given by equations (2.3) and the sum of n equations given by (2.7). The conjectural variation parameters used in the supply relations are those estimated in Section 3.

Since they are useful in interpreting results, we first present comparative statics effects of marginal changes in policies. For notational convenience we restate the first order conditions as

$$X^c V^c = P^{rc} - t^c - (c^c + s^c) + es^c + ps^c \tag{4.1}$$

where $V^c = -[\alpha_1^c + \alpha_2 v^{cu}]$ and t^c is the difference between the Japanese resale price of Canadian wheat and its cif price. Similarly, the sum of the n equations given by (2.7) can be written as

$$X^u V^u = P^{ru} - t^u - (c^u + s^u) + es^u + ps^u \tag{4.2}$$

where $V^u = -[\alpha_1^u(1 + v^{uu}) + \alpha_2 v^{uc}]/n$ and t^u is the difference between the Japanese resale price of U.S. wheat and its cif price. V^c represents the Canadian board's conjecture about the effect of a change in its exports on its cif price (i.e., the board's conjecture about $-dP^{jc}/dX^{c}$). V^{u} represents the conjecture about the effect of a change in exports of all U.S. exporters on the cif price of U.S. exports to Japan (i.e., the aggregate conjecture of U.S. firms about $-dP^{ju}/dX^{u}$). These can be interpreted, as in Dixit (1988), as aggregate conjectures. Their use allows us to state comparative statics effects in a simple way:

$$dX^{c}/dps^{c} = -dX^{c}/dt^{c}$$

$$= (V^{u} - \alpha_{1}^{u})/\Delta > 0, \qquad (4.3)$$

$$dX^{u}/dps^{u} = -dX^{u}/dt^{u}$$

$$= (V^{c} - \alpha_{1}^{c})/\Delta > 0 \qquad (4.4)$$

and

$$dX^{c}/dt^{u} = dX^{u}/dt^{c}$$

$$= -dX^{c}/dps^{u}$$

$$= -dX^{u}/dps^{c}$$

$$= \alpha_{2}/\Delta < 0 , \qquad (4.5)$$

where $\Delta = (V^{c} - \alpha_{1}^{c})(V^{u} - \alpha_{1}^{u}) - \alpha_{2}^{2} > 0.$

All comparative statics have the intuitively expected signs. A reduction in either country's producer subsidy reduces its equilibrium exports. A decrease in t^i (i.e., the Japanese wedge between the resale and import price of country i's wheat) increases i's exports to Japan and reduces j's exports. The latter effect occurs because we have not restricted U.S. and Canadian wheat to be homogeneous, nor have we imposed most favored nation treatment on the price wedge. This is important since the Japanese price wedge does, in fact, differ by type of wheat and year. Also our demand estimates imply that U.S. and Canadian wheat are imperfect substitutes.

Tables 7-11 contain the results of our policy experiments for model 5. As before, results for other models are available on request. Notice that we obtain one set of results for each year, rather than several sets which depend on conjectures. The reason is that a unique pair of V^u and V^c solve (4.1) and (4.2) for any year. All of the combinations of v^{uu} and v^{uc} given in Table 3 solve (4.2). Hence, the liberalization results do not depend of which of the pairs of v^{uu} and v^{uc} in Table 3 are used.

Table 7 presents the results of setting both t^u and t^c equal to zero for the period 1976/77-1984/85. As expected, liberalization increases total U.S. and Canadian exports to Japan in all years. However, in all years but 1976/77, Canadian exports increase more (in both percentage and absolute terms) than do U.S. exports. This is not surprising since the Japanese demand for Canadian wheat is more elastic than the demand for U.S. wheat. In addition, the implied tariff reduction is higher for Canadian wheat for all but four years (1976/77 being one of them).

As would be expected with low price elasticities, the quantity effects of liberalization are quite small, and price effects are large.

For all years, zero tariffs lead to substantially higher import prices with virtually no increase in the price in Japan. These results are consistent with the view Japanese trade restrictions reflect optimal tariff policy (Carter and Schmitz (1979)).

Tables 8-10 contain the results of eliminating producer subsidies. Since PSE data are available for 1982/83 - 1984/85, results are for those years only. The results are consistent with comparative statics given above. When only one country's PSE is eliminated, the exports of that country decline and its price rises. Because demand elasticities are low, price effects are larger in absolute value than are the quantity effects. When both PSE's are eliminated, it is possible for one country's exports to Japan to increase (because of cross price effects), but total Japanese imports should decline. As shown in Table 10, exports of both countries decline slightly and import prices increase by 10 to 40 percent. The Japanese resale prices increase roughly 8 to 20 percent.

Finally, we present the results of eliminating all tariffs and PSE's. As shown in Table 11, there is little change in the quantity of U.S. exports, and Canadian exports increase 2.5 or less. Import prices increase 60-100 percent, and the Japanese prices increase roughly 7-20 percent.

Table 1. Regression Results

Part a. Model 1

Regressor	Estimated Coefficient (t-Statistic)			
	U.S. Equation		Canadian Equation	
Constant	1437.330	(6.544)	1399.850	(4.258)
U.S. Imports	-9.655	(-2.212)	-2.136	(-.371)
Canadian Imports	-2.136	(-.371)	-5.124	(-.532)
Australian Imports	-7.684	(-1.167)	-9.718	(-1.042)
Income	-23.915	(-5.315)	-30.409	(-5.051)
Japanese Stocks	5.467	(1.254)	8.649	(1.392)
Time Trend	...		...	
Dummy for 73-75	...		...	
Dock Strike Dummy	-15.956	(-1.804)	...	
$\bar{R}^2$	.959		.910	

Table 1. Regression Results (Continued)

Part b. Model 2

Regressor	Estimated Coefficient (t-Statistic)			
	U.S. Equation		Canadian Equation	
Constant	1934.970	(6.806)	2005.98	(4.707)
U.S. Imports	-13.948	(-3.217)	-6.768	(-1.212)
Canadian Imports	-6.768	(-1.212)	-10.535	(-1.111)
Australian Imports	-10.091	(-1.681)	-12.317	(-1.443)
Income	-46.875	(-4.454)	-60.321	(-3.741)
Japanese Stocks	-4.832	(-.837)	-3.935	(-.473)
Time Trend	16.323	(2.394)	20.755	(2.021)
Dummy for 73-75	...		...	
Dock Strike Dummy	-17.026	(-1.938)	...	
$\bar{R}^2$	.966		.923	

Table 1. Regression Results (Continued)

Part c. Model 3

Regressor	Estimated Coefficient (t-Statistic)			
	U.S. Equation		Canadian Equation	
Constant	1935.060	(6.821)	1999.040	(4.698)
U.S. Imports	-13.983	(-3.242)	-6.661	(-1.199)
Canadian Imports	-6.661	(-1.199)	-10.397	(-1.094)
Australian Imports	-10.150	(-1.654)	-12.208	(-1.432)
Income	-46.797	(-4.476)	-60.294	(-3.739)
Japanese Stocks	-4.893	(-.836)	-3.819	(-.460)
Time Trend	16.311	(2.413)	20.6855	(2.015)
Dummy for 73-75	-.984	(-.054)	...	
Dock Strike Dummy	-16.934	(-1.875)	...	
$\bar{R}^2$	.966		.923	

Table 1. Regression Results (Continued)

Part d. Model 4

Regressor	Estimated Coefficient (t-Statistic)			
	U.S. Equation		Canadian Equation	
Constant	2079.980	(8.104)	2120.090	(5.914)
U.S. Imports	-15.458	(-3.830)	-8.295	(-1.728)
Canadian Imports	-8.295	(-1.728)	-8.197	(-1.026)
Australian Imports	-14.177	(-2.476)	-17.114	(-2.328)
Income	-46.319	(-4.925)	-57.847	(-4.284)
Japanese Stocks	-8.860	(-1.618)	-9.393	(-1.297)
Time Trend	16.858	(2.769)	20.486	(2.386)
Dummy for 73-75	-49.022	(-1.865)	-94.394	(-2.566)
Dock Strike Dummy	-15.291	(-1.696)	...	
$\bar{R}^2$	.970		.940	

Table 1. Regression Results (Continued)

Part e. Model 5

Regressor	Estimated Coefficient (t-Statistic)			
	U.S. Equation		Canadian Equation	
Constant	2094.790	(8.181)	2209.650	(6.109)
U.S. Imports	-15.196	(-3.767)	-8.269	(-1.729)
Canadian Imports	-8.269	(-1.729)	-10.203	(-1.265)
Australian Imports	-17.259	(-2.844)	-24.118	(-2.774)
Income	-44.554	(-4.713)	-55.051	(-4.058)
Japanese Stocks	-9.628	(-1.756)	-11.665	(-1.584)
Time Trend	15.989	(2.620)	19.309	(2.251)
Dummy for 73-75	-58.594	(-2.171)	-111.925	(-2.911)
Dock Strike Dummy	-1.635	(-.127)	27.374	(1.468)
$\bar{R}^2$	.971		.943	

Table 2. Direct Demand Elasticities

Part a. Model 1

ε_u^{ju}		ε_c^{ju}		ε_c^{jc}		ε_u^{jc}	
-0.026	(0.082)	0.011	(0.018)	-0.113	(0.018)	0.025	(0.042)
-0.022	(0.069)	0.010	(0.017)	-0.124	(0.019)	0.024	(0.040)
-0.023	(0.074)	0.011	(0.019)	-0.131	(0.021)	0.025	(0.043)
-0.022	(0.071)	0.011	(0.018)	-0.118	(0.019)	0.023	(0.038)
-0.022	(0.068)	0.010	(0.017)	-0.114	(0.018)	0.022	(0.037)
-0.023	(0.073)	0.011	(0.018)	-0.127	(0.020)	0.024	(0.041)
-0.022	(0.069)	0.010	(0.018)	-0.126	(0.020)	0.024	(0.040)
-0.023	(0.074)	0.011	(0.019)	-0.129	(0.020)	0.025	(0.041)
-0.024	(0.077)	0.010	(0.018)	-0.115	(0.018)	0.025	(0.041)

Part b. Model 2

-0.024	(0.027)	0.015	(0.012)	-0.072	(0.018)	0.035	(0.028)
-0.020	(0.023)	0.015	(0.012)	-0.080	(0.020)	0.034	(0.027)
-0.021	(0.025)	0.016	(0.012)	-0.084	(0.021)	0.036	(0.028)
-0.021	(0.024)	0.015	(0.012)	-0.076	(0.019)	0.032	(0.025)
-0.020	(0.023)	0.014	(0.011)	-0.073	(0.019)	0.031	(0.025)
-0.021	(0.024)	0.015	(0.012)	-0.081	(0.021)	0.034	(0.027)
-0.020	(0.023)	0.015	(0.012)	-0.081	(0.020)	0.034	(0.027)
-0.021	(0.025)	0.016	(0.012)	-0.082	(0.021)	0.035	(0.027)
-0.022	(0.026)	0.015	(0.012)	-0.074	(0.019)	0.035	(0.027)

* Standard errors in parentheses

** $\varepsilon_u^{ju} = (\partial X^u/\partial P^u)(P^u/X^u)$ $\qquad$ $\varepsilon_c^{jc} = (\partial X^c/\partial P^c)(P^c/X^c)$

$\varepsilon_c^{ju} = (\partial X^u/\partial P^c)(P^c/X^u)$ $\qquad$ $\varepsilon_u^{jc} = (\partial X^c/\partial P^u)(P^u/X^c)$

Table 2. Direct Demand Elasticities (Continued)

Part c. Model 3

ε_u^{ju}		ε_c^{ju}		ε_c^{jc}		ε_u^{jc}	
-0.023	(0.028)	0.015	(0.012)	-0.073	(0.018)	0.035	(0.028)
-0.020	(0.023)	0.014	(0.012)	-0.080	(0.020)	0.033	(0.027)
-0.021	(0.025)	0.015	(0.012)	-0.085	(0.021)	0.035	(0.028)
-0.020	(0.024)	0.015	(0.012)	-0.076	(0.019)	0.032	(0.026)
-0.020	(0.023)	0.014	(0.011)	-0.074	(0.019)	0.031	(0.025)
-0.021	(0.025)	0.015	(0.012)	-0.082	(0.021)	0.034	(0.027)
-0.020	(0.024)	0.015	(0.012)	-0.081	(0.020)	0.034	(0.027)
-0.021	(0.025)	0.016	(0.012)	-0.083	(0.021)	0.034	(0.027)
-0.022	(0.026)	0.015	(0.012)	-0.074	(0.019)	0.034	(0.027)

Part d. Model 4

ε_u^{ju}		ε_c^{ju}		ε_c^{jc}		ε_u^{jc}	
-0.032	(0.089)	0.032	(0.045)	-0.140	(0.059)	0.076	(0.106)
-0.027	(0.075)	0.031	(0.044)	-0.154	(0.065)	0.072	(0.101)
-0.029	(0.080)	0.033	(0.047)	-0.163	(0.069)	0.077	(0.107)
-0.028	(0.077)	0.032	(0.045)	-0.147	(0.062)	0.069	(0.097)
-0.027	(0.074)	0.031	(0.043)	-0.142	(0.060)	0.067	(0.094)
-0.029	(0.079)	0.033	(0.046)	-0.158	(0.067)	0.074	(0.103)
-0.027	(0.075)	0.032	(0.044)	-0.156	(0.066)	0.073	(0.102)
-0.029	(0.080)	0.034	(0.047)	-0.160	(0.068)	0.075	(0.104)
-0.030	(0.083)	0.032	(0.044)	-0.143	(0.061)	0.074	(0.104)

* Standard errors in parentheses

** $\varepsilon_u^{ju} = (\partial X^u/\partial P^u)(P^u/X^u)$ $\qquad \varepsilon_c^{jc} = (\partial X^c/\partial P^c)(P^c/X^c)$

$\varepsilon_c^{ju} = (\partial X^u/\partial P^c)(P^c/X^u)$ $\qquad \varepsilon_u^{jc} = (\partial X^c/\partial P^u)(P^u/X^c)$

Table 2. Direct Demand Elasticities (Continued)

Part e. Model 5

ε_u^{ju}		ε_c^{ju}		ε_c^{jc}		ε_u^{jc}	
-0.027	(0.039)	0.021	(0.021)	-0.092	(0.030)	0.050	(0.048)
-0.023	(0.033)	0.021	(0.020)	-0.101	(0.033)	0.048	(0.046)
-0.024	(0.035)	0.022	(0.021)	-0.107	(0.035)	0.051	(0.049)
-0.023	(0.034)	0.021	(0.020)	-0.096	(0.032)	0.046	(0.044)
-0.022	(0.033)	0.020	(0.020)	-0.093	(0.031)	0.045	(0.043)
-0.024	(0.035)	0.022	(0.021)	-0.104	(0.034)	0.049	(0.047)
-0.023	(0.033)	0.021	(0.020)	-0.102	(0.034)	0.049	(0.047)
-0.024	(0.035)	0.022	(0.022)	-0.105	(0.035)	0.050	(0.048)
-0.025	(0.037)	0.021	(0.020)	-0.094	(0.031)	0.049	(0.047)

* Standard errors in parentheses

** $\varepsilon_u^{ju} = (\partial X^u/\partial P^u)(P^u/X^u)$ $\varepsilon_c^{jc} = (\partial X^c/\partial P^c)(P^c/X^c)$

$\varepsilon_c^{ju} = (\partial X^u/\partial P^c)(P^c/X^u)$ $\varepsilon_u^{jc} = (\partial X^c/\partial P^u)(P^u/X^c)$

Table 3. Conjectural Results for Model 5*

1976/77		1977/78		1978/79	
Canadian Results - v^{cu}					
-1.227 (0.672)		-1.228 (0.672)		-1.229 (0.672)	
US Results - v^{uc} Conditional on v^{uu}					
v^{uu}	v^{uc}	v^{uu}	v^{uc}	v^{uu}	v^{uc}
-0.900	-0.176 (0.075)	-0.900	-0.171 (0.072)	-0.900	-0.172 (0.073)
-0.500	-0.911 (0.391)	-0.500	-0.906 (0.388)	-0.500	-0.907 (0.388)
0.000	-1.830 (0.785)	0.000	-1.825 (0.782)	0.000	-1.826 (0.783)
US Results - v^{uu} Conditional on v^{uc}					
v^{uc}	v^{uu}	v^{uc}	v^{uu}	v^{uc}	v^{uu}
-0.836	-0.541 (0.195)	-0.811	-0.552 (0.189)	-0.806	-0.555 (0.188)
-0.500	-0.724 (0.116)	-0.500	-0.721 (0.116)	-0.500	-0.721 (0.116)
0.000	-0.996 (0.001)	0.000	-0.993 (0.002)	0.000	-0.994 (0.002)

Elasticities

	1976/77	1977/78	1978/79
ε_u^{ju}	-0.027 (0.039)	-0.023 (0.033)	-0.024 (0.035)
ε_c^{jc}	-0.092 (0.030)	-0.101 (0.033)	-0.107 (0.035)
ε_c^{ju}	0.021 (0.021)	0.021 (0.020)	0.022 (0.021)
ε_u^{jc}	0.050 (0.048)	0.048 (0.046)	0.051 (0.049)

* Standard errors in parentheses

Table 3. Conjectural Results for Model 5 (Continued)*

1979/80			1980/81			1981/82		
Canadian Results - v^{cu}								
-1.226 (0.672)			-1.226 (0.672)			-1.225 (0.672)		
US Results - v^{uc} Conditional on v^{uu}								
v^{uu}	v^{uc}		v^{uu}	v^{uc}		v^{uu}	v^{uc}	
-0.900	-0.166	(0.070)	-0.900	-0.162	(0.068)	-0.900	-0.159	(0.066)
-0.500	-0.901	(0.386)	-0.500	-0.897	(0.383)	-0.500	-0.894	(0.381)
0.000	-1.820	(0.780)	0.000	-1.816	(0.778)	0.000	-1.813	(0.776)
US Results - v^{uu} Conditional on v^{uc}								
v^{uc}	v^{uu}		v^{uc}	v^{uu}		v^{uc}	v^{uu}	
-0.853	-0.526	(0.199)	-0.817	-0.544	(0.190)	-0.810	-0.545	(0.188)
-0.500	-0.718	(0.116)	-0.500	-0.716	(0.116)	-0.500	-0.714	(0.116)
0.000	-0.991	(0.003)	0.000	-0.988	(0.003)	0.000	-0.986	(0.004)

Elasticities

	1979/80	1980/81	1981/82
ε_u^{ju}	-0.023 (0.034)	-0.022 (0.033)	-0.024 (0.035)
ε_c^{jc}	-0.096 (0.032)	-0.093 (0.031)	-0.104 (0.034)
ε_c^{ju}	0.021 (0.020)	0.020 (0.020)	0.022 (0.021)
ε_u^{jc}	0.046 (0.044)	0.045 (0.043)	0.049 (0.047)

* Standard errors in parentheses

Table 3. Conjectural Results for Model 5 (Continued)*

1982/83			1983/84			1984/85		
Canadian Results - v^{cu}								
-1.223 (0.672)			-1.224 (0.672)			-1.223 (0.672)		
US Results - v^{uc} Conditional on v^{uu}								
v^{uu}	v^{uc}		v^{uu}	v^{uc}		v^{uu}	v^{uc}	
-0.900	-0.145	(0.059)	-0.900	-0.152	(0.063)	-0.900	-0.160	(0.067)
-0.500	-0.880	(0.374)	-0.500	-0.887	(0.378)	-0.500	-0.895	(0.382)
0.000	-1.799	(0.769)	0.000	-1.806	(0.772)	0.000	-1.814	(0.777)
US Results - v^{uu} Conditional on v^{uc}								
v^{uc}	v^{uu}		v^{uc}	v^{uu}		v^{uc}	v^{uu}	
-0.838	-0.523	(0.194)	-0.810	-0.542	(0.188)	-0.810	-0.546	(0.188)
-0.500	-0.707	(0.115)	-0.500	-0.711	(0.115)	-0.500	-0.715	(0.116)
0.000	-0.979	(0.006)	0.000	-0.983	(0.005)	0.000	-0.987	(0.003)

Elasticities

	1982/83	1983/84	1984/85
ε_u^{ju}	-0.023 (0.033)	-0.024 (0.035)	-0.025 (0.037)
ε_c^{jc}	-0.102 (0.034)	-0.105 (0.035)	-0.094 (0.031)
ε_c^{ju}	0.021 (0.020)	0.022 (0.022)	0.021 (0.020)
ε_u^{jc}	0.049 (0.047)	0.050 (0.048)	0.049 (0.047)

* Standard errors in parentheses

Table 4. Cournot Results -- Model 5

V^{cu}	V^{uu}	V^{uc}		X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1976/77									
0.00	0.00	0.00	Market values	3153.0	133.7	211.8	1320.0	154.0	203.7
			Cournot	3156.0	1743.5	1821.6	662.7	2118.7	2168.3
			Difference	3.0	1609.8	1609.8	-657.3	1964.7	1964.7
			% Change	0.1	1204.3	759.9	-49.8	1275.7	964.7
Marketing Year 1977/78									
0.00	0.00	0.00	Market values	3122.0	130.7	249.7	1352.0	147.0	285.0
			Cournot	3146.1	2060.1	2179.1	669.5	2618.8	2756.8
			Difference	24.1	1929.4	1929.4	-682.5	2471.8	2471.8
			% Change	0.8	1476.6	772.7	-50.5	1681.5	867.2
Marketing Year 1978/79									
0.00	0.00	0.00	Market values	3209.0	161.4	297.1	1236.0	179.0	341.3
			Cournot	3228.3	2351.9	2487.5	612.8	2980.7	3143.0
			Difference	19.3	2190.5	2190.5	-623.2	2801.7	2801.7
			% Change	0.6	1357.0	737.4	-50.4	1565.2	820.8
Marketing Year 1979/80									
0.00	0.00	0.00	Market values	3195.0	207.9	273.4	1289.0	234.0	294.9
			Cournot	3221.3	2334.1	2399.7	637.8	2907.5	2968.4
			Difference	26.3	2126.3	2126.3	-651.2	2673.5	2673.5
			% Change	0.8	1022.9	777.8	-50.5	1142.5	906.6
Marketing Year 1980/81									
0.00	0.00	0.00	Market values	3532.0	220.9	325.5	1418.0	264.0	365.9
			Cournot	3664.3	2291.4	2396.0	659.9	3483.8	3585.7
			Difference	132.3	2070.5	2070.5	-758.1	3219.8	3219.8
			% Change	3.7	937.1	636.0	-53.5	1219.6	880.1

Table 4. Cournot Results -- Model 5 (Continued)

V^{cu}	V^{uu}	V^{uc}		X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1981/82									
0.00	0.00	0.00	Market values	3279.0	203.7	309.9	1309.0	234.0	355.2
			Cournot	3401.4	2007.3	2113.6	609.5	3049.4	3170.7
			Difference	122.4	1803.6	1803.6	-699.5	2815.4	2815.4
			% Change	3.7	885.6	582.0	-53.4	1203.2	792.5
Marketing Year 1982/83									
0.00	0.00	0.00	Market values	3326.0	201.9	301.9	1294.0	225.0	334.7
			Cournot	3456.1	1885.1	1985.2	599.1	2880.9	2990.5
			Difference	130.1	1683.3	1683.3	-694.9	2655.9	2655.9
			% Change	3.9	833.9	557.5	-53.7	1180.4	793.6
Marketing Year 1983/84									
0.00	0.00	0.00	Market values	3380.0	198.1	334.2	1345.0	227.0	384.3
			Cournot	3527.7	1997.2	2133.3	618.2	3186.5	3343.8
			Difference	147.7	1799.1	1799.1	-726.8	2959.5	2959.5
			% Change	4.4	908.0	538.2	-54.0	1303.8	770.2
Marketing Year 1984/85									
0.00	0.00	0.00	Market values	3302.0	184.7	314.0	1322.0	214.0	325.3
			Cournot	3447.4	1880.9	2010.2	608.0	3006.4	3117.7
			Difference	145.4	1696.2	1696.2	-714.0	2792.4	2792.4
			% Change	4.4	918.3	540.2	-54.0	1304.9	858.5

Table 5. Bertrand Results -- Model 5

v^{cu}	v^{uu}	v^{uc}		X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1976/77									
-0.54	-0.90	-0.82	Market values	3153.0	133.7	211.8	1320.0	154.0	203.7
			Bertrand	3504.9	127.0	205.1	666.0	1247.0	1296.7
			Difference	351.9	-6.7	-6.7	-654.0	1093.0	1093.0
			% Change	11.2	-5.0	-3.2	-49.5	709.8	536.7
Marketing Year 1977/78									
-0.54	-0.90	-0.81	Market values	3122.0	130.7	249.7	1352.0	147.0	285.0
			Bertrand	3489.9	117.2	236.2	680.0	1540.0	1678.1
			Difference	367.9	-13.5	-13.5	-672.0	1393.0	1393.0
			% Change	11.8	-10.3	-5.4	-49.7	947.7	488.7
Marketing Year 1978/79									
-0.55	-0.90	-0.81	Market values	3209.0	161.4	297.1	1236.0	179.0	341.3
			Bertrand	3546.6	147.2	282.8	621.1	1756.1	1918.4
			Difference	337.6	-14.2	-14.2	-614.9	1577.1	1577.1
			% Change	10.5	-8.8	-4.8	-49.7	881.1	462.0
Marketing Year 1979/80									
-0.53	-0.90	-0.83	Market values	3195.0	207.9	273.4	1289.0	234.0	294.9
			Bertrand	3537.0	187.7	253.3	649.9	1740.3	1801.3
			Difference	342.0	-20.1	-20.1	-639.1	1506.3	1506.3
			% Change	10.7	-9.7	-7.4	-49.6	643.7	510.8
Marketing Year 1980/81									
-0.54	-0.90	-0.81	Market values	3532.0	220.9	325.5	1418.0	264.0	365.9
			Bertrand	3916.2	197.1	301.7	715.0	2196.1	2297.9
			Difference	384.2	-23.8	-23.8	-703.0	1932.1	1932.1
			% Change	10.9	-10.8	-7.3	-49.6	731.9	528.1

Table 5. Bertrand Results -- Model 5

v^{cu}	v^{uu}	v^{uc}		X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1981/82									
-0.54	-0.90	-0.81	Market values	3279.0	203.7	309.9	1309.0	234.0	355.2
			Bertrand	3635.5	179.5	285.8	660.2	1921.8	2043.0
			Difference	356.5	-24.1	-24.1	-648.8	1687.8	1687.8
			% Change	10.9	-11.8	-7.8	-49.6	721.3	475.1
Marketing Year 1982/83									
-0.54	-0.90	-0.82	Market values	3326.0	201.9	301.9	1294.0	225.0	334.7
			Bertrand	3673.8	166.8	266.9	653.5	1823.9	1933.6
			Difference	347.8	-35.0	-35.0	-640.5	1598.9	1598.9
			% Change	10.5	-17.4	-11.6	-49.5	710.6	477.8
Marketing Year 1983/84									
-0.54	-0.90	-0.81	Market values	3380.0	198.1	334.2	1345.0	227.0	384.3
			Bertrand	3746.4	167.6	303.7	679.4	2024.2	2181.4
			Difference	366.4	-30.5	-30.5	-665.6	1797.2	1797.2
			% Change	10.8	-15.4	-9.1	-49.5	791.7	467.7
Marketing Year 1984/85									
-0.54	-0.90	-0.81	Market values	3302.0	184.7	314.0	1322.0	214.0	325.3
			Bertrand	3660.2	163.1	292.4	669.3	1911.1	2022.4
			Difference	358.2	-21.6	-21.6	-652.7	1697.1	1697.1
			% Change	10.8	-11.7	-6.9	-49.4	793.0	521.7

Table 6. Implicit Tariffs and Producer Subsidy Equivalents

Part a. Implicit Tariffs

Marketing Year	t^u	t^c	t^u/t^c
1976/77	78.16	49.66	1.57
1977/78	119.02	138.03	0.82
1978/79	135.64	162.33	0.84
1979/80	65.52	60.91	1.08
1980/81	104.60	101.85	1.03
1981/82	106.25	121.25	0.88
1982/83	100.05	109.66	0.91
1983/84	136.12	157.26	0.87
1984/85	129.27	111.28	1.16

Part b. Producer Subsidy Equivalents

Marketing Year	U.S.	Canadian
1982/83	26.60	22.10
1983/84	77.40	32.46
1984/85	49.54	53.98

* All figures in U.S. dollars.

Table 7. Zero Tariff Results -- Model 5

	X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1976/77						
Market values	3153.0	133.7	211.8	1320.0	154.0	203.7
Zero Tariff	3167.2	211.9	211.9	1325.0	203.7	203.7
Difference	14.2	78.2	0.0	5.0	49.7	0.1
% Change	0.5	58.5	0.0	0.4	32.3	0.0
Marketing Year 1977/78						
Market values	3122.0	130.7	249.7	1352.0	147.0	285.0
Zero Tariff	3124.4	249.7	249.7	1386.9	285.7	285.7
Difference	2.4	119.1	0.0	34.9	138.7	0.6
% Change	0.1	91.1	0.0	2.6	94.3	0.2
Marketing Year 1978/79						
Market values	3209.0	161.4	297.1	1236.0	179.0	341.3
Zero Tariff	3210.4	297.1	297.1	1269.9	342.0	342.0
Difference	1.4	135.6	0.0	33.9	163.0	0.7
% Change	0.0	84.0	0.0	2.7	91.1	0.2
Marketing Year 1979/80						
Market values	3195.0	207.9	273.4	1289.0	234.0	294.9
Zero Tariff	3198.7	273.4	273.4	1300.3	295.2	295.2
Difference	3.7	65.5	0.0	11.3	61.2	0.3
% Change	0.1	31.5	0.0	0.9	26.2	0.1
Marketing Year 1980/81						
Market values	3532.0	220.9	325.5	1418.0	264.0	365.9
Zero Tariff	3537.2	325.6	325.6	1434.2	366.4	366.4
Difference	5.2	104.6	0.0	16.2	102.4	0.5
% Change	0.1	47.4	0.0	1.1	38.8	0.1

Table 7. Zero Tariff Results -- Model 5 (Continued)

	X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
<u>Marketing Year 1981/82</u>						
Market values	3279.0	203.7	309.9	1309.0	234.0	355.2
Zero Tariff	3281.2	309.9	309.9	1332.9	356.0	356.0
Difference	2.2	106.3	0.0	23.9	122.0	0.8
% Change	0.1	52.2	0.0	1.8	52.2	0.2
<u>Marketing Year 1982/83</u>						
Market values	3326.0	201.9	301.9	1294.0	225.0	334.7
Zero Tariff	3328.3	301.9	301.9	1316.2	335.5	335.5
Difference	2.3	100.1	0.0	22.2	110.5	0.9
% Change	0.1	49.6	0.0	1.7	49.1	0.3
<u>Marketing Year 1983/84</u>						
Market values	3380.0	198.1	334.2	1345.0	227.0	384.3
Zero Tariff	3382.4	334.3	334.3	1375.1	385.5	385.5
Difference	2.4	136.1	0.0	30.1	158.5	1.2
% Change	0.1	68.7	0.0	2.2	69.8	0.3
<u>Marketing Year 1984/85</u>						
Market values	3302.0	184.7	314.0	1322.0	214.0	325.3
Zero Tariff	3312.1	314.0	314.0	1337.4	325.9	325.9
Difference	10.1	129.3	0.1	15.4	111.9	0.6
% Change	0.3	70.0	0.0	1.2	52.3	0.2

Table 8. Canadian Producer Subsidies Set to Zero -- Model 5

	X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1982/83						
Market values	3326.0	201.9	301.9	1294.0	225.0	334.7
Zero Sub.	3330.7	201.9	302.0	1285.4	246.7	356.4
Difference	4.7	0.1	0.1	-8.6	21.7	21.7
% Change	0.1	0.0	0.0	-0.7	9.7	6.5
Marketing Year 1983/84						
Market values	3380.0	198.1	334.2	1345.0	227.0	384.3
Zero Sub.	3386.4	198.2	334.3	1333.2	259.2	416.5
Difference	6.4	0.0	0.0	-11.8	32.2	32.2
% Change	0.2	0.0	0.0	-0.9	14.2	8.4
Marketing Year 1984/85						
Market values	3302.0	184.7	314.0	1322.0	214.0	325.3
Zero Sub.	3313.0	184.8	314.1	1301.8	266.9	378.2
Difference	11.0	0.1	0.1	-20.2	52.9	52.9
% Change	0.3	0.1	0.0	-1.5	24.7	16.3

Table 9. U.S. Producer Subsidy Set to Zero -- Model 5

	X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1982/83						
Market values	3326.0	201.9	301.9	1294.0	225.0	334.7
Zero Sub.	3319.2	228.4	328.5	1299.5	225.2	334.9
Difference	-6.8	26.6	26.6	5.5	0.2	0.2
% Change	-0.2	13.2	8.8	0.4	0.1	0.1
Marketing Year 1983/84						
Market values	3380.0	198.1	334.2	1345.0	227.0	384.3
Zero Sub.	3361.1	275.3	411.5	1360.1	227.8	385.1
Difference	-18.9	77.2	77.2	15.1	0.8	0.8
% Change	-0.6	39.0	23.1	1.1	0.4	0.2
Marketing Year 1984/85						
Market values	3302.0	184.7	314.0	1322.0	214.0	325.3
Zero Sub.	3289.3	234.2	363.5	1332.2	214.2	325.5
Difference	-12.7	49.5	49.5	10.2	0.2	0.2
% Change	-0.4	26.8	15.8	0.8	0.1	0.1

Table 10. Canadian and U.S. Producer Subsidies Set to Zero -- Model 5

	X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1982/83						
Market values	3326.0	201.9	301.9	1294.0	225.0	334.7
Zero Sub.	3323.9	228.5	328.5	1290.9	247.0	356.6
Difference	-2.1	26.6	26.6	-3.1	22.0	22.0
% Change	-0.1	13.2	8.8	-0.2	9.8	6.6
Marketing Year 1983/84						
Market values	3380.0	198.1	334.2	1345.0	227.0	384.3
Zero Sub.	3367.5	275.4	411.5	1348.4	259.8	417.1
Difference	-12.5	77.3	77.3	3.4	32.8	32.8
% Change	-0.4	39.0	23.1	0.3	14.5	8.5
Marketing Year 1984/85						
Market values	3302.0	184.7	314.0	1322.0	214.0	325.3
Zero Sub.	3300.4	234.3	363.6	1311.9	267.3	378.6
Difference	-1.6	49.6	49.6	-10.1	53.3	53.3
% Change	-0.0	26.8	15.8	-0.8	24.9	16.4

Table 11. Free Trade -- Model 5

	X^u	P^{ju}	P^{ru}	X^c	P^{jc}	P^{rc}
Marketing Year 1982/83						
Market values	3326.0	201.9	301.9	1 1294.0	225.0	334.7
Free Trade	3326.2	328.6	328.6	1 1313.1	357.5	357.5
Difference	0.2	126.7	26.6	19.1	132.5	22.8
% Change	0.0	62.8	8.8	1.5	58.9	6.8
Marketing Year 1983/84						
Market values	3380.0	198.1	334.2	1 1345.0	227.0	384.3
Free Trade	3369.9	411.5	411.5	1 1378.5	418.3	418.3
Difference	-10.1	213.4	77.3	33.5	191.3	34.1
% Change	-0.3	107.7	23.1	2.5	84.3	8.9
Marketing Year 1984/85						
Market values	3302.0	184.7	314.0	1 1322.0	214.0	325.3
Free Trade	3310.5	363.6	363.6	1 1327.3	379.2	379.2
Difference	8.5	178.9	49.6	5.3	165.2	54.0
% Change	0.3	96.9	15.8	0.4	77.2	16.6

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