

An Evaluation of the Canada-U.S. Wheat Agreement of 1994

Colin A. Carter and Donald MacLaren

The U.S. government notified the GATT in 1994 that it intended to increase tariff rates on wheat and barley imported from Canada. This threat of increased permanent protection resulted in Canada voluntarily agreeing to restrict wheat sales to the United States. Why would Canada agree to this outcome which would lead to a welfare loss? The payoffs to each country associated with alternative trade war outcomes are estimated. We find that welfare, as measured by equivalent variation, falls in both countries, although Canada was better off limiting exports than becoming engaged in a trade war with the United States.

Key words: bargaining game, Canada, GATT, trade war, United States, wheat

Canada and the United States have a long history of agricultural trade disputes (Lerner and Klein). The Canadian-United States Free Trade Agreement (CUSTA), which came into effect in 1989, lowered trade barriers for some agricultural products. However, CUSTA also resulted in numerous bilateral trade controversies. A recent disagreement was over increased Canadian exports of wheat to the United States during crop year 1993/94. During the period 1989/90 to 1993/94, total wheat exports (i.e., milling, feed, and durum) from Canada to the United States rose from 0.4 million metric tons (mt) to 2.8 million mt, with exports of durum wheat increasing over the same period from 0.2 million mt to 0.6 million mt (Alberta Grain Commission). In Canada, this increased flow of south-bound wheat was attributed to the formation of the CUSTA, to the price-raising effects of the U.S. Export Enhancement Program (EEP) on U.S. domestic prices of wheat, to a weakening of the Canadian dollar, and to less durum wheat production in the United States.

However, in the United States this expanded

trade was seen as the consequence of two allegedly "unfair" trade practices pursued by Canada, namely, rail transportation subsidies on grain shipped to export position and the secretive pricing policies of the Canadian Wheat Board (CWB) and its export monopoly. This sense of injustice and frustration in the United States was heightened by the unwillingness of Canada to reduce, by any appreciable degree, the protectionist effects of its supply management programs and, thereby, to permit the expansion of U.S. exports to that market for dairy and poultry products. Implicitly there are trade-offs between grains and supply managed products and the U.S. side did not wish to give up any chance of opening up these latter markets.¹

U.S. wheat farmers were opposed to the North American Free Trade Agreement (NAFTA), which was signed in 1993. The U.S. National Association of Wheat Growers (NAWG) took a contentious approach toward NAFTA and it sought either elimination of Canadian subsidies or quantitative limits on U.S. wheat imports from Canada (Orden). NAWG's opposition was largely due to increased imports of wheat from Canada in the post-CUSTA period. Even though peak imports from Canada totaled less than 3% of U.S. wheat supplies,

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The authors wish to acknowledge the helpful comments of Joe Rosario, Bob MacGregor, and participants at a seminar given at the University of British Columbia.

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¹ For further discussion of this point, see Larue.

they represented a major trade irritant. The U.S. administration promised congressmen from the wheat-growing states that an investigation of Canadian wheat imports would take place. In return, these same congressmen eventually supported the passage of NAFTA.

The U.S. farmers viewed the Canadian transport subsidies as an unfair export subsidy because the Western Grain Transportation Act (WGTA) provided a per unit rail transport subsidy on all Canadian grain shipped to export position (i.e., the West Coast ports in British Columbia; Churchill, Manitoba; and Thunder Bay, Ontario) and thus encouraged grain shipments to these locations. Over the 1988/89–1994/95 time period the Canadian rail freight subsidy averaged about \$13/mt (Can\$). Under CUSTA, Canadian grain exports to the United States via the West Coast became ineligible for the WGTA subsidy. However, the subsidy on shipments to Thunder Bay was treated differently and continued to apply to grain which was eventually destined for the United States. Rail movement of grain from western Canada to Thunder Bay serves both domestic Canadian users in the east and foreign customers. Given that domestic users procure grain out of Thunder Bay, the WGTA subsidy to that point was viewed as a domestic subsidy and the United States remained an eligible destination for subsidized shipment through Thunder Bay.

However, for a number of reasons, e.g., fiscal restraint and the Uruguay Round Agreement on Agriculture, the WGTA subsidy was eliminated in August 1995 and there was a lump-sum payment of Can\$1.6 billion to farmers to compensate for removal of the subsidy. Ironically, removal of the transportation subsidy will probably lead to additional exports of Canadian grain to the United States because the WGTA was a disincentive for Canadian exports shipped directly south into the United States. This is because the WGTA encouraged east-west shipments in Canada.

The U.S. farmers also focused on the nontransparent pricing policies of the CWB and the CWB's monopoly over exports to the United States (Orden). Removal of that monopoly conceivably would have the same effect of boosting southbound exports. For instance, the CWB's control over barley exports to the United States was removed for forty days in 1993 and Canadian exports to the United States surged (Carter). Therefore, if Canada concedes to the U.S. position, there most likely will be increased exports to the United States; thus the controversy will go unresolved.

In addition to direct negotiation, there were three alternative avenues open to the United States administration in effecting a reduction in imports of wheat from Canada: first, to make use of its own domestic Section 22 legislation; second, to use the provisions of the GATT (e.g., Articles XIX or XXVIII); or third, to use the provisions of Article 701 of the NAFTA.² With political pressure mounting in the northern wheat-growing regions of the United States during crop year 1993/94, President Clinton decided to use Section 22 legislation to request the International Trade Commission (ITC) to investigate the effects of wheat imports from Canada on the costs and benefits of the U.S. wheat program. In July 1994, the ITC reported with a split decision. Three commissioners found that imports from Canada materially had affected the costs of the U.S. wheat program through lowering domestic prices and increasing the value of deficiency payments, thereby potentially triggering the use of import quotas under Section 22 to protect the program. The other three commissioners found that these imports had not materially affected the cost of the U.S. wheat program, but that they did have some effects on particular regions and classes of wheat.

Testimony before the ITC regarding the effects of Canadian wheat imports on the U.S. wheat program are summarized by Alston, Gray, and Sumner. During the ITC hearings, the U.S. Department of Agriculture (USDA) testified that Canadian imports lowered U.S. wheat prices and thus raised the size of deficiency payments. For 1994/95, the USDA predicted

² Section 22 legislation refers to Section 22 of the Agricultural Adjustment Act of 1933 as re-enacted and amended. Under this legislation, if the secretary for agriculture has reason to believe that imports are materially interfering with domestic programs, including the processing of the product, then he has to advise the president and the latter has then to initiate an immediate investigation by the International Trade Commission (see Hillman, p. 165, for further details).

Article XIX of the GATT is the so-called safeguards article which permits contracting parties to take temporary emergency action to restrict imports of particular products which are causing injury to a domestic sector. However, equivalent concessions to trading partners should accompany these restrictions (see McGovern, appendix 3, for further detail).

Article XXVIII of the GATT relates to the procedures to be followed for the modification of tariff schedules. These may include bilateral negotiations. Of importance in the context of this paper is the following: "the contracting parties concerned shall endeavor to maintain a general level of reciprocal and mutually advantageous concessions not less favorable to trade than that provided for in this Agreement prior to such negotiations" (McGovern, p. 575).

Article 701.3 of CUSTA and now of NAFTA states, "neither party, including any public entity that it establishes or maintains, shall sell agricultural goods for export to the territory of the other party at a price below the acquisition price of the goods plus storage, handling or other costs incurred by it with respect to those goods."

that Canadian imports would raise the total cost of the wheat program by 15%, which is a substantial impact. However, Alston, Gray, and Sumner argue that this USDA estimate vastly overstates the effects of Canadian imports on U.S. farm program costs. They suggest that Canadian imports would raise the total cost of the U.S. program by less than 1%, much less than the USDA figure.

All six ITC commissioners supported the recommendation that higher import barriers should be introduced. Hence, action under Section 22 seemed to be justified, and import quotas could have been imposed. These would have remained valid until the Uruguay Round Agreement on Agriculture came into force, at which time they would have become invalid because they had not been in place during the base period of 1986–88.

Even before the ITC had reported on the 1994 wheat case, in April 1994 the United States government notified the GATT under Article XXVIII that it intended to amend its tariff rates on wheat and barley imports from Canada (Simone). It can be inferred from this preemptive action that the United States was not seeking temporary protection from perceived injury; otherwise, Article XIX should have been used as a temporary safeguard until the implementation of the Uruguay Round Agreement on Agriculture took effect.

Article 701 of the CUSTA also could have been invoked. However, it did not hold out much promise for the United States as that path had been tried earlier in 1992 for durum wheat through the establishment of a CUSTA Dispute Panel under Chapter 19, and the panel had failed to find in favor of the United States (see Alston and Carter).

It may be concluded that in the presence of determination on the part of the United States to restrict imports and in the absence of a negotiated settlement with Canada, Article XXVIII offered the best long-term alternative for the United States, despite the risk that Canada would use the provisions of the Article to seek compensation or to retaliate. Thus, the threat of a trade war produced the conditions conducive to a negotiated outcome.

In August 1994, after protracted negotiations, an agreement between the two countries was reached. There were a number of elements to this agreement, which included schedules of tariff-rate quotas on durum and nondurum wheat imports by the United States from Canada; the establishment of a Joint Commission to examine each country's price support

systems for grains and their effects for each country's competitiveness in third country markets, the recommendations of which were not to be binding on either government;³ and a peace clause which limited for one year actions on grains and grain products that were inconsistent with either the NAFTA or the GATT (Alberta Grain Commission). While the United States withdrew its proposed actions under Article XXVIII and agreed not to take action under Section 22, Canada maintained the right to challenge U.S. actions under both the NAFTA and the GATT but consented for one year from September 1994 not to use the dispute settlements procedures of either agreement.

Why did Canada agree to this outcome which would lead to a loss of sales in the U.S. market? Could the Canadian government have forced the United States to use Article XXVIII of the GATT by refusing to negotiate, and then, legitimately, could it have imposed its own bilateral import restrictions or sought compensation in the form of lower tariffs on other products from the United States? Because Canada had maintained that GATT obligations took precedence over obligations under the NAFTA, it was infeasible to claim as a negotiating ploy, although perfectly legal, that the United States was violating Article 401 of the CUSTA by raising tariffs.⁴ Moreover, there was some evidence, despite the 1993 Dispute Panel ruling to the contrary, that Canada, through the pricing policies of the CWB, was from time to time violating Article 701 (Simone, p. 29). At the same time, although Canada fulfilled the letter of the Uruguay Round Agreement on Agriculture, it hardly embraced the spirit with respect to the tariffification process of nontariff barriers. Out-of-quota tariff rates for Canada's supply-managed products were established at prohibitive levels (Miner, table 6.1).

In order to investigate the negotiated outcome more fully and to assess alternative strategies for Canada in the face of trade threats from the United States, a number of negotiating sce-

The Canada-United States Joint Commission on Grains reported in October 1995. With regard to policy, the key recommendations were that the U.S. eliminate EEP, the U.S. eliminate the trade distorting effects of its domestic policies including target price/deticiency payments and marketing loans programs, Canada place the Canadian Wheat Board at risk of profit or loss in the marketplace, and Canada eliminate the trade distorting effects of its domestic policies including the Gross Revenue Insurance Program and the CWB initial payment guarantee.

⁴ Article 401 removes tariffs on most agricultural products over a ten-year period and prevents either country from increasing or introducing any new tariffs on goods originating in the other country (Simone, p. 29).

narios are defined and evaluated. A theoretical framework for the evaluation of a negotiating process is presented in the next section. The payoffs to each country that are associated with the alternative outcomes are obtained from simulation experiments using a computable general equilibrium model. A brief description of the model is presented in the third section. Using two different measures of welfare as payoffs, a number of payoffs for the bargaining game are obtained and the results are discussed in the fourth section. Some conclusions are then drawn about the economic rationale of the negotiated settlement agreed to in 1994.

Theoretical Framework

In order to assess the economic benefits and costs of some of the responses available to Canada and to investigate the economic rationality of the negotiated outcome, concepts from bargaining theory are used to provide a suitable framework. Bargaining theory can be viewed as belonging to the class of cooperative games, i.e., games in which there exist binding agreements. In what follows, it is assumed that there are only two players. The players are faced with a set of attainable payoffs and they have preferences given by von Neumann-Morgenstern utility functions over this set of alternative outcomes. In the general case, each player's utility function over monetary outcomes (payoffs) is nonlinear, reflecting considerations such as risk aversion and concern for justice. Should they agree upon a particular element of the set, then that is the element chosen for the binding agreement. However, should they be unable to agree, then a prespecified element, the disagreement or threat point, is the outcome.

The way in which the players agree on the bargained outcome, (i.e., the process by which the outcome is selected) is ignored in the standard, axiomatic approach; the focus instead is on the properties which the solution should possess. There exist many solutions in bargaining theory, although the best known is that due to Nash.⁵ Nash derived the Nash solution based on axioms reflecting individual rationality, the independence of equivalent utility representations (scale invariance), the independence of irrelevant alternatives (contraction independence), and symmetry. The axiom of individual

rationality is based on the assumption that all the potential gains from a bargaining situation will be exploited, (i.e., any agreed outcome will be on the boundary of the set of outcomes). The axiom of scale invariance implies that the particular choice of cardinal utility function is not important for the solution of the bargaining game; it is only the strength of preferences, not the calibration that matters. The axiom of the independence of irrelevant alternatives implies that if an option which was not previously chosen now becomes infeasible, then that does not alter the solution. And finally, the axiom of symmetry means that if all relevant information about all utility valuations is known to each player, then the players' strategies will be identical if their utility functions are identical. The implication of this axiom is that any optimal solution which is asymmetric arises only because of differences in utility functions.⁶

Specifically, let the convex, closed, and bounded bargaining set be

$$S = \{(u_1, u_2) \in R^2 | u_2 \leq f(u_1)\},$$

where f is a continuous and decreasing function which associates with any payoff for player 1, u_1 , the maximum possible payoff of player 2, u_2 . The disagreement or threat point is denoted by $d = (d_1, d_2) \in S$ (figure 1).

The Nash solution for the two-player, fixed threat-point game is given by the Nash product

$$\max_{\substack{u \in S \\ u \geq d}} (u_1 - d_1)(u_2 - d_2),$$

where the subscripts refer to the players. This solution is shown at the point $s = (u_1^*, u_2^*)$ in figure 1. As specified, the bargaining strengths are assumed to be equal as reflected by the indices of unity in the Nash product. In the general case, if $\alpha_i \geq 0$ is the bargaining strength of player i , with $\sum \alpha_i = 1$ then the generalized Nash product is given by $(u_1 - d_1)^{\alpha_1} (u_2 - d_2)^{\alpha_2}$ (Binmore, p. 189). The effect is to alter the slope of the tangent to $f(u_1)$, moving the point s (figure 1) toward the u_1 axis for $\alpha_1 > \alpha_2$, thereby favoring player 1, or toward the u_2 axis for $\alpha_1 < \alpha_2$, thus benefiting player 2.

The payoffs achieved as the Nash solution to the bargaining game also are affected by the position of the disagreement point. In a fixed-

⁵ For a survey of the many alternatives and their properties, see Thomson

⁶ For a discussion of additional axioms and the solutions to which they give rise see Thomson, and for a critique of them, see Hargreave Heaps and Varoufakis (pp 125-26)

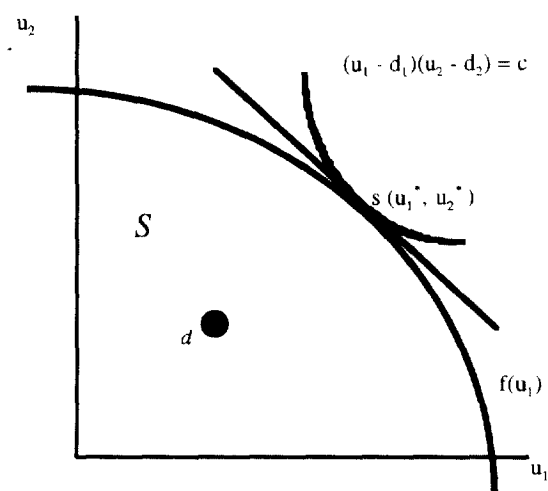


Figure 1. The Nash bargaining solution

threat game, the players have no opportunity to manipulate the bargained outcome through their choice of d . However, when d is variable and determined by the decisions of the players prior to an agreed outcome, if there is one, then the solution to the bargaining game is more complicated. One possibility is for the players to behave noncooperatively and to choose the disagreement point using, for example, the Nash-Cournot equilibrium concept.

In the empirical part of the paper, only five elements of the set S are obtained. There is no attempt made to apply solution concepts to the resulting simulated outcomes or to identify the optimal choice of the disagreement point through a noncooperative game. Nevertheless, these elements of bargaining theory are useful in helping to interpret the outcome which was observed in 1994. The establishment of the Joint Commission can be interpreted as point s in figure 1, while point d would have been a trade war between the two countries.

Empirical Framework

Using the theoretical framework outlined above, a limited number of bargaining positions are defined for the United States and Canada and the corresponding payoffs obtained. The disagreement point is taken to be the payoff pair generated by actions under Article XXVIII of the GATT initiated by the United States and

responded to by Canada. Article XXVIII of GATT (1947) states, in summary form, that if the contracting parties cannot agree on a proposed modification of tariff schedules, then the contracting party proposing to remove a concession is free to do so, but the other contracting party(ies) involved is (are) then free to withdraw its (their) "substantially equivalent concessions" toward the first contracting party (McGovern, p. 575). The choice for Canada, in the absence of compensation, was to retaliate by removing tariff concessions on an equivalent value of trade that had been granted in earlier rounds in the GATT. This is the response permitted by Article XXVIII, although it is not specified in the Article whether there should be some relationship between the two sets of traded goods.

The payoff corresponding to each bargaining outcome is derived from simulations of the Global Trade Analysis Project (GTAP) computable general equilibrium model.⁷ These payoffs are measured using two different criteria: in the first, they are analyzed from the national perspective using equivalent variation (EV) as the welfare measure; in the second, to reflect the rent-seeking thrust of wheat farmers in the United States, the welfare measure used is producer surplus, the change in wheat land values being used here as a proxy.⁸ A general equilibrium model is appropriate for estimating the bilateral payoffs because the dispute and the threat points covered a number of commodities besides wheat (see table 1 for the possibilities).⁹ In addition, a general equilibrium model imposes factor adjustment conditions not found in partial equilibrium, multicommodity models, although these would likely be small in the context of the simulations being run here (Peterson, Hertel, and Stout).

The GTAP model (version 2) contains twenty-four regions and thirty-seven industries but, for the purposes of this exercise, it has been aggregated into the following four regions and eight industries or commodities (table 1). The choice of regions was determined on the

⁷ A general description of this model is given in Hertel (chap. 2).

⁸ In the model, land is restricted to the agricultural sector, and within that sector, it adjusts sluggishly to changes in relative product prices. Therefore, it is reasonable to assume that the change in land prices approximates producer surplus.

⁹ A referee pointed out that during the development of the trade dispute, pasta manufacturers in the U.S. were lobbying against restrictions on durum wheat imports from Canada. This feature of the dispute clearly has a general equilibrium aspect but one which cannot be captured in the model because of the degree of aggregation in the underlying input-output tables.

Table 1. Regions and Commodities Identified for the GTAP Simulations

Region	Commodities
Canada	Wheat
United States	Other grains
Mexico	Other crops
Rest of World	Other livestock
	Meat products
	Milk products
	Other food and agricultural products
	Manufacturing and services

basis of the two protagonists, with Mexico an assumed passive bystander but a member of NAFTA, and the Rest of the World is also assumed to play a passive role. The commodities or industries were chosen on the basis of their being agricultural and important in the trade flows between Canada and the United States. Nonagricultural sectors and some agricultural sectors (e.g., rice) were aggregated into a manufacturing and services sector. There is no stockholding in the model.

The payoff pairs which define the bargaining set to be evaluated are identified in table 2. It must be emphasized that any bargaining solution ultimately obtained is dependent on the elements of the bargaining set which have been chosen, together with the disagreement point. Clearly, the number of possible elements is large and some would not be legal under GATT. The identification of the particular elements chosen has been determined partly on the basis of what Canada's likely response would have been under GATT, partly on ignoring any actions under CUSTA (e.g., taking action under Article 401 or Chapters 18 and 19—the establishment of dispute panels), and partly on omitting those payoffs which would have occurred had the United States chosen to use Section 22 import quotas instead of GATT Article XXVIII. Hence, there are only three basic bargaining positions evaluated. These are the status quo, the use of Article XXVIII of the GATT, and the 1994 Memorandum of Understanding, hereafter referred to as the Agreement.

It is plausible that, in practice, Canada would have retaliated using poultry meat because of its importance in the state of Arkansas, hence the choice of the commodity aggregate, meat products. Canada is a net importer of poultry from the United States and under CUSTA, Canada agreed to import a fixed amount of poultry each year—up to 5% of Canadian con-

sumption. This trade is particularly valuable to U.S. producers because some of them share a portion of the quota rents associated with the fixed market access. However, fruit and vegetables is another possible commodity group which would have hurt United States producers as trade in fruits and vegetables was also liberalized under CUSTA. Therefore, the disagreement outcome corresponds to the payoff when the United States uses Article XXVIII and Canada responds by limiting imports from the United States of either meat products or other crops.

In experiment 1 (E1), Canada does not respond to the use of GATT Article XXVIII by the United States through which the tariff rate increase is applied on imports of wheat from Canada only. Thus, there are no changes in any other policies. The new ad valorem rate for this simulation is set at 50%. Although there is some uncertainty surrounding the exact rate which the United States would have stipulated had it proceeded with the GATT action, the circumstantial evidence is that the rate would have been prohibitive. In the GTAP data base, the ad valorem rate is approximately 10%; i.e., the power of the tariff is 1.10 and in this experiment it is reset to 1.50.¹⁰

In experiment 2 (E2), it is assumed that Canada retaliates against the loss of market access for wheat by raising the import tariff on fruits and vegetables exported by the United States to 50%. It was considered necessary, as far as possible, to reflect the letter of GATT Article XXVIII on retaliation, while accepting that Canada was determined to retaliate sufficiently to force the United States to back down (i.e., avoid choosing the disagreement point). The existing implicit tariff rate for other crops in the data base is 36%, implying a shock of 10.3%.¹¹ However, because the value of Canadian exports of wheat to the United States in 1992 was U.S.\$187 million and the value of Canadian imports from the United States of

¹⁰ In CGE models, ad valorem trade taxes are often written into the equations as the power of the tax, i.e., $(1 + t)$, where t is the tariff rate expressed to the base of unity. This procedure is necessary to avoid zeros which appear if only t were used and if t took the value zero in the initial equilibrium. Hence, a 10% tariff, for example, would be entered as 1.10 rather than 0.10. See Dixon et al. (p. 95) for further details.

¹¹ "Other crops" are referred to in the GTAP classification of commodities as "non-grain crops." From the input-output tables for the U.S., this category includes *inter alia* vegetables and potatoes, fruits, pulses, sugar, tobacco, for Canada, it includes *inter alia* fruits and vegetables, hay, seeds, nursery stock, oilseeds and tobacco (Hambley, tables A7 and A6, respectively).

Table 2. The Feasible Set of Payoffs Evaluated

Canada				
Status Quo	GATT Article XXVIII:	GATT Article XXVIII:	1994 Agreement	
	Other Crops	Meat Products		
United States				
Status Quo	Simulation base			
GATT Article XXVIII: Wheat	Experiment 1 (E1)	Experiment 2 (E2)	Experiment 3 (E3)	
1994 Agreement				Experiment 4 (E4)

other crops was U.S.\$1.281 million, the shock that is applied by Canada through a higher tariff is adjusted downwards to 1.5% to reflect this difference in the value of trade in wheat and in other crops.

In experiment 3 (E3), retaliation takes place in meat products.¹² The existing tariff rate in the GTAP data base is 23% and this is raised to 50% in the simulation but, again, the size of the shock is adjusted downwards from 23% to 8.1% to reflect the value of Canadian imports of meat products from the United States of U.S.\$532 million relative to that of Canadian exports of wheat to the United States.

In experiment 4 (E4), the essence of the 1994 Agreement is simulated. The details of this Agreement are such that they cannot be modeled exactly using the GTAP model. The model specifies total wheat, whereas in the Agreement durum and other wheat are separated, with a further distinction made between other wheat from Ontario and that from CWB designated areas in western Canada. Moreover, the tariff rate quotas (TRQ) which were agreed to are different for these two types of wheat. For durum wheat the TRQs are the NAFTA rate on 0 to 300,000 mt, U.S.\$23/mt on 300,000 to 450,000 mt, and U.S.\$50/mt on import volumes above 450,000. For ordinary wheat the TRQs were the NAFTA rate on 0 to 1,050,000 mt and U.S.\$50/mt above that (Alberta Grain Commission). As a compromise for this experiment, the specific tariff rate quota on wheat exported by Canada

to the United States was calculated as follows. For 1994, the implicit price of that wheat in the data base was U.S.\$208/mt and the specific NAFTA tariff rate was U.S.\$3.08/mt. The quota volume was set at 1.35 million mt by adding together the volume on which the NAFTA rate applied (i.e., 0.3 million mt for durum wheat and 1.05 million mt for ordinary wheat) and by ignoring the middle range of the TRQ on durum wheat. Hence, the power of the tariff on within-quota wheat was $(1 + 3.08/208) = 1.015$ and the power of the tariff on above-quota wheat was $(1 + 50/208) = 1.240$. When the TRQ binds, as it does, the tariff shock becomes 22.2% in order to implement the Agreement.

Results

Before running the simulation experiments, the GTAP data base for 1992 was modified by introducing the agreed tariff reductions under CUSTA/NAFTA for agricultural products to bring the trade flows to a 1994 base. Specifically, these reductions were introduced for bilateral trade flows in wheat, other grains, other crops, and imports of meat products by the United States. No reductions in tariff rates were included for Canadian imports of meat products from the United States, or for bilateral trade flows on other livestock, milk products, other food and agriculture or manufactures and services. The resulting bilateral trade flows for wheat in 1994 at 1992 prices are shown in table 3. For Canada, the value of wheat exports to the United States represents around 5% of total wheat exports.

¹² "Meat products" for Canada and the U.S. include red meat and meat products, and poultry meat and meat products (Hambley, tables A6 and A7, respectively)

Experiment 1

In the first experiment, the tariff rate on U.S. imports of Canadian wheat is raised to 50%. The Canadian wheat producer price falls by 0.21% and in the United States the price rises by 0.08%, leading to a 1.69% fall in Canadian wheat output, (i.e., U.S.\$81.0 million at 1992 prices, hereafter referred to as a volume change, table 4). There is a rise in U.S. wheat output of 0.63% or a volume change of U.S.\$108.3 million. The implicit general equilibrium elasticity of wheat supply, i.e., the price elasticity of supply based upon simultaneous adjustments in all markets (Hertel, chap. 5), is approximately eight in each country. The effects on bilateral trade flows in wheat are shown in table 5. The export volume of Canadian wheat to the United States falls by 49.84% and is diverted to Mexico and ROW. Additional Canadian exports displace U.S. exports to these regions which fall by 0.51% and 0.41%, respectively. The corresponding changes in volumes are minus U.S.\$112.4 million for Canadian exports to the United States, U.S.\$30.7 million for Canadian exports to ROW, and minus U.S.\$20.4 million for U.S. exports to ROW (table 5).

The welfare effects are shown in table 6. Both Canada and the United States experience a

loss of welfare as measured by equivalent variation (EV), with Canada losing U.S.\$11.2 million and the United States losing U.S.\$26.4 million. However, wheat farmers in the United States gain from this policy with producer surplus (PS) rising by U.S.\$8.7 million, with producer surplus to Canadian wheat farmers falling by U.S.\$11.0 million.

Experiment 2

In the second experiment, Canada retaliates by raising its own tariff rate on imports of other crops from the United States. In Canada, the producer price for wheat falls by 0.15% relative to the base while the producer price for wheat rises by 0.07% in the United States. In both countries these percentage changes are slightly less than those found in experiment 1 (table 4). These price effects reduce wheat output in Canada by 1.85% and increase it by 0.66% in the United States. The additional reduction in Canadian wheat output, relative to that in experiment 1, occurs because resources move out of wheat production into the other crops sector as a result of the higher domestic supply price of 0.10% for the latter (not shown). In the United States, the additional output of wheat comes at the expense of output in all of the

Table 3. The Value of Wheat Exports, 1994 (Million U.S.\$, 1992)

To	Canada	United States	Mexico	ROW
From				
Canada		209	85	3,734
United States	4		73	4,131

Source: GTAP data base

Note: These data are from the GTAP data base for 1992 updated through incorporation of the CUSTA bilateral tariff reductions on wheat, other grains, other crops, and meat products (U.S.) only

Table 4. Changes in Producer Prices of Wheat and Quantities Supplied

	E1 ^a	E2	E3	E4	EEP
Canada					
Price (%)	-0.21	-0.15	-0.14	-0.07	1.45
Quantity (%)	-1.69	-1.85	-1.84	-0.54	11.96
Volume (million U.S.\$)	-81.0	-81.0	-88.6		574.6
U.S.					
Price (%)	0.08	0.07	0.07	0.02	-0.77
Quantity (%)	0.63	0.66	0.60	0.181	-11.78
Volume (million U.S.\$)	108.2	108.2	102.6		-2,011.5

^a Ej stands for experiment number j as defined in the third section of the text

Table 5. Change in the Volume of Wheat Trade Flows

To	Canada	United States	Mexico	ROW
Experiment 1				
From				
Canada (%)		-49.84	0.67	0.76
(Million U.S.\$)		-112.4	0.6	30.7
United States (%)	-0.57		-0.51	-0.41
(Million U.S.\$)	-0.0		-0.4	-20.3
Experiment 2				
From				
Canada (%)		-49.99	0.51	0.58
(Million U.S.\$)		-112.5	0.5	23.3
United States (%)	-0.48		-0.40	-0.33
(Million U.S.\$)	-0.0		-0.4	-16.4
Experiment 3				
From				
Canada (%)		-49.92	0.49	0.56
(Million U.S.\$)		-112.5	0.4	22.3
United States (%)	-0.27		-0.40	-0.32
(Million U.S.\$)	-0.0		-0.3	-16.1
Experiment 4				
From				
Canada (%)		-15.88	0.21	0.24
(Million U.S.\$)		-33.3	0.2	8.9
United States (%)	-0.17		-0.15	-0.12
(Million U.S.\$)	-0.0		-0.1	-4.8
EEP				
From				
Canada (%)		-5.01	-4.82	14.69
(Million U.S.\$)		-11.3	-4.4	590.6
United States (%)	4.59		4.31	-40.94
(Million U.S.\$)	0.2		3.8	-2,030.3

other agricultural sectors, the largest percentage fall occurring in the output of other crops which falls by 0.17% (not shown). These production changes in each country alter the pattern of trade relative to the base, but the directions of changes in trade patterns are similar to those generated in experiment 1 (table 5).

The welfare effects are shown in table 6. Retaliation by Canada leads to an additional welfare loss (EV) of U.S.\$3.6 million in Canada (U.S.\$14.8 million - U.S.\$11.2 million) and imposes an additional loss in the United States of U.S.\$20 million (U.S.\$56.4 million - U.S.\$26.4 million). This retaliation reduces the loss of producer surplus for Canadian wheat growers from U.S.\$11.0 million to U.S.\$8.9 million because of the smaller fall in the price of wheat, and it reduces the gains for U.S. producers from U.S.\$8.7 million to U.S.\$7.2 million because of

the smaller increase in the supply price of wheat in the United States.

Experiment 3

In experiment 3, Canada retaliates by raising the import tariff rate on meat products, rather than on other crops. The effect is to reduce the Canadian wheat producer price by 0.14% and to raise the United States price by 0.07% relative to the base (table 4). Relative to experiment 1, these price changes are moderated but are similar to those found in experiment 2. The change in the output of Canadian wheat relative to that found in experiment 1 can be explained by the increased use of feedgrains as an intermediate input in meat production, the output of which increases by 1.69%. In the United States, the increase in wheat

Table 6. Changes in Welfare (Million U.S.\$, 1992)

	E1	E2	E3	E4	EEP
Canada					
EV	-11.2	-14.8	-36.0	-3.6	86.0
PS	-11.0	-8.9	-8.2	-3.5	80.2
United States					
EV	-26.4	-56.4	-58.4	-2.5	1,142.2
PS	8.7	7.2	7.4	2.5	-164.4

Notes: EV is equivalent variation. Wheat PS is producer surplus for wheat growers, measured by the change in the value of wheat land.

production is less than that found in experiment 1 because of the smaller increase in the supply price of wheat. The trade effects in experiment 3 are similar to those in experiment 2 (table 5).

The welfare effects are different as compared with those in experiment 2. Retaliation by Canada reduces its EV by a further U.S.\$24.8 million relative to that in experiment 1, although it reduces the size of the loss of PS from U.S.\$11.0 million to U.S.\$8.2 million. For the United States, the retaliation induces a more than doubling of the welfare loss from U.S.\$26.4 million to U.S.\$58.4 million and reduces the gains in PS for U.S. wheat producers from U.S.\$8.7 million to U.S.\$7.4 million. Nevertheless, these producers gain. If that outcome were the objective of U.S. policy, then it would have been successful.

Experiment 4

In experiment 4, Canada accepts the imposition of a TRQ on exports of wheat to the United States at an above-quota rate of 24%.¹³ Relative to the base period, the Canadian producer price of wheat falls by 0.07% with a corresponding reduction in output of wheat by 0.54% (table 4). In the United States, there is a rise in the producer price of wheat of 0.02% and an increase of 0.181% in output. The effect of the TRQ is to reduce exports of wheat by Canada to the United States by 15.88%, a loss of U.S.\$33.3 million (table 5). Exports are diverted to Mexico and ROW, a change in the volume to ROW of U.S.\$8.9 million. In the United States, the reduction in imports leads to a reduction in exports to all destinations. In Canada, there is a welfare loss of U.S.\$3.6 mil-

lion measured by EV or U.S.\$3.5 million measured by PS (table 6). In the United States, the corresponding figures are U.S.-\$2.5 million and U.S.\$2.5 million, respectively.

Consider the results presented in table 6 in the context of figure 1. From these welfare changes, as measured by EV, it is clear that the status quo Pareto-dominates the disagreement point, whether that be the result in experiment 2 or experiment 3. It also dominates the result in experiment 4. In other words, in terms of national welfare, the move by the United States to restrict imports of Canadian wheat was harmful to both countries (and to the other regions) but less harmful under experiment 1 than under either retaliatory threat by Canada. The 1994 Agreement (experiment 4) Pareto-dominates both threat points but is not Pareto-efficient relative to the status quo. When changes in welfare are measured in terms of the producer surplus of wheat growers, all outcomes lead to a loss for Canadian wheat growers but a gain for U.S. growers. But the loss is least by a considerable margin for the former under the 1994 Agreement (experiment 4). This difference in outcomes when welfare is measured by producer surplus rather than by equivalent variation raises the interesting issue in the context of bargaining theory, namely, that the threat made by the United States was not a credible one if the Canadian government believed that the U.S. government was acting with respect to the national welfare measure, but it was credible if it was believed that the U.S. government was acting only in the interests of its wheat farmers.

Suppose instead of this bargaining game that the United States had acted on the Canadian explanation for the latter's increased exports of wheat to the former, namely, the price effects of the EEP within the U.S. market. Removal of the EEP in the GTAP model was simulated by removing the export subsidy on wheat exports from the United States to the ROW region. This simulation generated the following results. The

¹³ We are grateful to Ken Pearson for modifying the GEMPACK code in the GTAP model to allow for the introduction of the tariff rate quota policy. In a CGE model based on percentage changes, this modification is not trivial.

producer price of wheat in the United States falls by 0.77% and output falls by 11.78%, a fall of U.S.\$2,011.5 million (table 4). In Canada, the producer price of wheat increases by 1.45% and output rises by 11.96% or U.S.\$574.6 million. The reduction of wheat production in the United States and the increase in Canada lead to altered trade patterns. Canadian exports to the United States and Mexico fall but they rise by 14.69% or U.S.\$590.6 million in volume terms to ROW (table 5). For the United States, there is an insignificant diversion of exports from ROW to Canada and Mexico and a substantial reduction in exports to ROW of 40.94% or U.S.\$2,030.3 million. However, welfare in the United States, measured by EV, increases by U.S.\$1,142.2 million with the removal of EEP, although wheat producers lose by U.S.\$164.4 million (table 6). In Canada, there is a welfare gain of U.S.\$86.0 million in terms of EV and a gain in PS for wheat growers of U.S.\$80.2 million. Clearly, the removal of the EEP program would have been preferred by Canada to the outcomes under experiments 1 to 4, as well as to the status quo, but, of course, removal of EEP was not in the feasible set of the bargaining game.

Conclusions

The free trade objectives of recent bilateral and multilateral trade agreements have been challenged by the ongoing Canadian-United States dispute over trade in wheat. The United States and Canada settled the dispute temporarily in 1994, with Canada agreeing voluntarily to limit exports to the United States. In addition to wheat, trade restrictions on other commodities were discussed, as the only threat which Canada had was to retaliate in other markets.

The purpose of this paper was to evaluate the 1994 wheat trade agreement between the United States and Canada in the context of a multimarket potential trade war which could have erupted given the determination of the United States to restrict imports from Canada and the determination of Canada to resist. Using bargaining theory as a framework and the GTAP computable general equilibrium model as a way to obtain the necessary payoffs quantitatively, welfare effects were measured from the national perspective and from the rent-seeking perspective of U.S. wheat growers. It was shown that the status quo Pareto-dominated the policy interventions identified when equivalent variation was used as the welfare measure. In

particular, the 1994 Agreement was Pareto-inefficient relative to the status quo. However, when measuring the welfare effects of the policy interventions in terms of producer surplus, Canadian wheat growers consistently lose and U.S. wheat growers consistently gain.

There are two caveats to these conclusions which warrant some discussion. First, the absolute magnitudes of the price, quantity, and welfare changes generated in each of the policy simulations is dependent upon the structure and parameter values of the GTAP model. It would have been possible to undertake a systematic sensitivity analysis of a number of the key parameters (e.g., the Armington elasticity of substitution) and to obtain an indication of the possible variation in the key results. However, in the context of the bargaining game framework, it is relative rather than absolute outcomes which are important, and it is unlikely, given the similarity of the experiments, that the rankings of the outcomes would have altered. Second, there is the trade-off between the comprehensiveness and internal consistency of the applied general equilibrium model (AGE) and the specific detail possible in a partial equilibrium model. Given the nature of the policy issue being investigated, it was felt that the former had certain advantages over the latter because of the specific linkages between wheat and other grains, between grains and the livestock sector, and the more general linkages between agriculture and the rest of the economy. In adopting this approach, it is acknowledged that specific commodity detail was lost, e.g., treating wheat in total rather than as a number of differentiated products. But at the same time, the AGE approach, when based on the Armington assumption for trade flows, does allow gross flows to be modeled, and this feature was also important in deciding which approach to adopt.

From the viewpoint of the Canadian government and its search for an outcome which minimized the welfare loss to Canadian wheat growers in the face of determination on the part of the United States to threaten, the 1994 Agreement appears to have been a success. It has been a success in the sense that it averted a potentially damaging agricultural trade war. Nevertheless, it allowed for one year a new trade restriction to be imposed by the United States, a restriction which created a small economic cost for both countries.

*[Received June 1995;
final revision received April 1997.]*

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