

**U.S. - Canada Wheat Trade and its  
Effects on U.S. Price and Income**

**Won W. Koo  
Jeremy W. Mattson**



**Center for Agricultural Policy and Trade Studies  
Department of Agribusiness and Applied Economics  
North Dakota State University  
Fargo, North Dakota 58105-5636**

## ACKNOWLEDGMENTS

The authors extend appreciation to Dr. George Flaskerud, Mr. Richard Taylor, Dr. Cheryl Wachenheim and Dr. Cole Gustafson for their constructive comments and suggestions. Special thanks go to Ms. Beth Ambrosio, who helped prepare the manuscript.

The research was conducted under the U.S. agricultural trade policy and trade research program funded by the U.S. Department of the Treasury/U.S. Customs Service (Grant No. TC-01-002G, ND1301).

We would be happy to provide a single copy of this publication free of charge. You can address your inquiry to: Beth Ambrosio, Department of Agribusiness and Applied Economics, North Dakota State University, P.O. Box 5636, Fargo, ND, 58105-5636, Ph. 701-231-7334, Fax 701-231-7400, e-mail [beth.ambrosio@ndsuxt.nodak.edu](mailto:beth.ambrosio@ndsuxt.nodak.edu) . This publication is also available electronically at this web site: <http://agecon.lib.umn.edu/>.

NDSU is an equal opportunity institution.

### NOTICE:

The analyses and views reported in this paper are those of the author(s). They are not necessarily endorsed by the Department of Agribusiness and Applied Economics or by North Dakota State University.

North Dakota State University is committed to the policy that all persons shall have equal access to its programs, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

Information on other titles in this series may be obtained from: Department of Agribusiness and Applied Economics, North Dakota State University, P.O. Box 5636, Fargo, ND 58105. Telephone: 701-231-7441, Fax: 701-231-7400, or e-mail: [cjensen@ndsuxt.nodak.edu](mailto:cjensen@ndsuxt.nodak.edu).

Copyright © 2002 by Won W. Koo and Jeremy W. Mattson. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

## TABLE OF CONTENTS

List of Tables .....	ii
List of Figures .....	ii
Abstract .....	iii
Highlights .....	iv
Introduction .....	1
Previous Studies .....	2
U.S. - Canada Wheat Trade .....	4
Development of an Empirical Model .....	7
Price Equation .....	7
Export Supply Equation .....	8
Estimation Procedure for the Simultaneous Equation System .....	9
Effect of Imports from Canada on U.S. Farm Income .....	9
Data .....	11
Results .....	12
Canadian Export Supply Equation .....	12
Price Equation .....	13
Effect on U.S. Farm Prices and Income .....	14
Conclusions and Policy Implications .....	18
References .....	20

## List of Tables

<u>No.</u>		<u>Page</u>
1	Estimation Results from Simultaneously Estimated Canadian Export and U.S. Price Equations .....	13
2	Effects of Increased Imports on Farm Price and Income .....	15
3	Estimation of Acres Planted .....	17

## List of Figures

<u>No.</u>		<u>Page</u>
1	U.S. Wheat Imports Including Wheat Flour .....	4
2	U.S. Wheat Imports from Canada .....	5
3	U.S. Wheat Exports to Canada .....	6
4	U.S. Wheat Exports .....	6
5	Effect of Supply Shift on Supply and Income .....	10

## **Abstract**

The objectives of this study are to analyze the factors causing an increase in wheat imports from Canada and to estimate the effect of increased wheat imports on U.S. prices and farm income. An econometric model is developed and estimated to determine these factors and effects. Canadian exports to the United States are estimated as a function of U.S. price, the U.S. - Canada exchange rate, and other variables, while U.S. price is estimated as a function of imports from Canada, U.S. domestic supply and consumption, and exports. The two equations are estimated simultaneously. Results from this model are used to estimate the effect of imports from Canada on U.S. farm prices and income. Results indicate that imports from Canada have a significant negative effect on U.S. hard red spring and durum wheat prices and consequently decrease farm income for U.S. producers. However, while the effect is significant, it is still only a small portion of the total decrease in price in recent years. Some portion of the increased wheat imports is due to the elimination of import restrictions under the Canada - U.S. Free Trade Agreement, but other factors such as the exchange rate are also important.

**Keywords:** Canada, bilateral trade, hard red spring wheat, durum wheat, farm price, farm income

## Highlights

Canadian wheat exports to the United States have increased considerably under the Canada - U.S. Free Trade Agreement (CUSTA), while increases in U.S. wheat exports to Canada have been minimal. In fact, total U.S. exports of hard red wheat have declined. The increase in imports and decrease in U.S. prices have led U.S. producers to believe they are being unfairly harmed. Numerous trade disputes have arisen between the United States and Canada under CUSTA. In the latest wheat trade dispute, U.S. producers have accused the Canadian Wheat Board of using unfair trading practices that disadvantage U.S. farmers. The objectives of this study are to analyze the factors causing an increase in imports from Canada and to estimate the effect of increased imports on U.S. prices and farm income.

An econometric model is developed and estimated to determine factors affecting imports from Canada and effects on U.S. prices. Canadian exports to the United States are estimated as a function of U.S. price, the U.S. - Canada exchange rate, and other variables, while U.S. price is estimated as a function of imports from Canada, U.S. domestic supply and consumption, and exports. Canadian exports to the United States and U.S. price are assumed to be endogenous, while other variables are exogenous. The two equations are estimated simultaneously. Results from this model are used to estimate the effect of imports from Canada on U.S. farm prices and income.

Results from the econometric model indicate that imports from Canada have a significant negative effect on U.S. farm prices. A 1 percent increase in imports from Canada causes a 0.086 percent decrease in the hard red spring wheat price and a 0.163 percent decrease in the durum price. In real 1989/90 terms, the hard red spring wheat farm price decreased from \$3.61 per bushel in 1989/90 to \$2.09 in 2000/01, and the durum wheat farm price decreased from \$3.46 in 1989/90 to \$1.97 in 2000/01. If imports in 2000/01 were restricted to 1989/90 import levels, the HRS wheat farm price would have been \$0.23 higher in 2000/01, at \$2.32, and the durum wheat farm price would have been \$0.18 higher, at \$2.15. The impact of increased imports on prices seems rather large, yet it accounts for only a small percentage of the total decrease in price.

The reduction of farm income for U.S. producers is a combination of reductions due to the price effect and reductions due to the substitution effect. The price effect shows the reduction in income due to lower prices. The substitution effect shows the reduction in income due to imports from Canada replacing U.S. production. Imports from Canada could have a positive effect on U.S. exports, thereby negating some of the negative effect of the increased imports, if the United States could take advantage of Canada's export by acting as a substitute for Canadian wheat in other foreign import markets. Results from this analysis, however, show that U.S. exports have not been positively affected. In nominal terms, U.S. hard red spring wheat producer income declined \$129.9 million in 2000/01 and an average of \$89.2 million per year during the 1990/91 - 2000/01 period due to increased imports from Canada under CUSTA. U.S. durum producer income declined an average of \$23.6 million per year during the 1990/91 - 2000/01 period and \$20.7 million in 2000/01.

The negative effect on the U.S. wheat industry suggests that a policy mechanism to prevent such income losses should be established. Farmers hurt by imports should be eligible for trade adjustment assistance. Other policy alternatives could stabilize Canadian exports of hard red spring and durum wheat to the United States at a level agreeable to both countries.

# U.S. - Canada Wheat Trade and its Effects on U.S. Price and Income

Won W. Koo and Jeremy W. Mattson\*

## Introduction

Since the Canada - United States Free Trade Agreement (CUSTA) was implemented in 1989, there have been a number of disputes between the two countries over agricultural trade. An increase in imports from Canada, coupled with low U.S. prices, has created an environment where U.S. producers believe they are being unfairly harmed. This situation is especially true for the wheat trade. Wheat imports from Canada have increased substantially since 1989. Conversely, total U.S. exports have been stagnant, and exports to Canada are still minimal. U.S. producers allege that Canada is using unfair trade practices and that imports from Canada decrease U.S. prices and harm net farm income. Because of the increase in Canadian exports to the United States, U.S. producers have sought protection through trade remedy laws (Koo and Uhm, 2000). The rapid increase in wheat imports from Canada during the early 1990s led to an investigation by the U.S. International Trade Commission (USITC). A negotiated settlement (known as the Wheat Peace Agreement) restricted wheat imports from Canada for the 1994/95 crop year. Canadian wheat exports to the United States did decrease significantly in late 1994 and 1995 as a result of this agreement, and remained lower throughout most of 1996, but have since rebounded.

The latest dispute has come as a result of a petition from the North Dakota Wheat Commission. In September 2000, the North Dakota Wheat Commission filed a petition under section 301 of the Trade Act of 1974 requesting an investigation of the wheat marketing practices used by the Canadian Wheat Board. The United States Trade Representative (USTR) undertook a 16-month investigation and requested that the USITC examine the competitive practices of the Canadian Wheat Board in the U.S. market and overseas. In February 2002, the USTR released the findings of their investigation. They found that the Canadian Wheat Board has used special monopoly rights and privileges which disadvantage U.S. farmers and are unfair to trade; they determined the Canadian Wheat Board has, in effect, been taking sales from U.S. farmers. As a result of these findings, the USTR decided to aggressively attempt to level the playing field for U.S. farmers. They stated that they would examine the possibility of filing U.S. countervailing duty and antidumping petitions with the U.S. Department of Commerce and the USITC. However, the USTR has not decided to respond with tariffs. They stated in an April 19, 2002 press release that the "USTR has decided not to impose a tariff rate quota (TRQ) at this time since such an action would violate our NAFTA and WTO commitments, could result in Canadian retaliation against U.S. agriculture, and would not achieve a durable solution or a permanent change to the market distortions caused by the monopoly of the Canadian Wheat Board" (USTR 2002). They did, however, confirm the Administration's commitment to aggressively pursue a remedy to the CWB's unfair trade advantages.

The nature of the relationship between Canadian exports and U.S. price is an important concern, but it is one that is not easily resolved. During the years of lowered imports (1995 and 1996), U.S. prices were higher. The U.S. farm price of durum wheat increased from \$4.92 in 1994 to \$5.18 in 1995 and then to \$5.20 in 1996. The U.S. hard red spring (HRS) wheat farm price also increased from \$3.52 in 1994 to \$3.96 in 1995 and then to \$4.78 in 1996. Prices have

---

\*Professor and Director of the Center for Agricultural Policy and Trade Studies, and Research Associate, respectively, North Dakota State University, Fargo.

dropped since 1996, following an increased level of imports from Canada. The correlation between U.S. farm prices and imports from Canada, however, is not perfectly clear. HRS wheat imports from Canada were highest in calendar year 1994, yet the price in 1994 was higher than it has been in recent years, and the real price was also higher in 1994 than in 1990 and 1991 when spring wheat imports from Canada were substantially lower.

This study revisits the issue of Canadian exports and U.S. prices, which has been the subject of many studies, by analyzing new data. The objectives of this study are: 1) to analyze U.S. - Canada wheat trade data under CUSTA, 2) to determine factors affecting wheat imports from Canada, and 3) to determine effects of wheat imports on U.S. prices and farm income. An econometric model is developed and estimated to determine factors affecting imports from Canada and their effects on U.S. prices and farm income. The next section of this paper will provide a review of previous literature, after which is an examination of U.S. - Canada wheat trade data. The subsequent section presents the empirical model used for the study, and results and conclusions are presented in the last two sections of the paper.

### Previous Studies

Previous studies have analyzed the effect of imports from Canada on U.S. prices. A USITC investigation in 1994 focused on the impact of U.S. imports of Canadian wheat, wheat flour, and semolina on the U.S. farm program, in relation to Section 22 of the U.S. Agricultural Adjustment Act of 1933 (as amended). As part of the investigation, the USITC staff conducted its own study, and studies were submitted to the USITC from four parties, including the USDA and the Canadian Wheat Board. Alston et al. (1994) conducted the study on behalf of the Canadian Wheat Board. The USITC (1994) staff study was later discussed by its authors in Babula et al. (1996). The purpose of these studies was to determine the effect of Canadian imports on wheat program costs; in determining effects on program costs, these studies estimated the effect of imports on U.S. price. The results of the studies submitted for the investigation varied widely and were bounded by Alston et al. on the low end and the USDA on the high end.

The USDA study, as described by Babula et al. (1996) and Alston et al. (1994), suggested that imposing a quota over the 1991/92 to 1994/95 period by which imports are restricted to half of the average levels over the 1987/88 to 1991/92 period would increase the average market price from 4 to 12 cents/bushel per year, or by an average 9-cent rise annually, and would lessen added deficiency payment outlays by an average of \$171 million annually. Babula et al. and Alston et al. both dismissed the USDA study, claiming that it overestimated the effects of wheat imports and criticizing it for its lack of an empirical model.

The study by Alston et al. (1994) imposed on its model a restriction of Canadian exports to the United States equal to 50 percent of the 1993/94 level. Their results suggested that such a decrease in exports from Canada to the United States would induce an increase in the annual U.S. market price of 0.5 cents/bushel. This increase in price could have led to \$9.9 million in savings in federal wheat program outlays as a result of reduced deficiency payments in 1993/94, implying that Canadian wheat exports to the United States contributed to an increase in government outlays by the same amount. This result was considerably less than that estimated by the USDA study. Alston et al. noted that the USDA simulated restricting total imports to 22.4 percent of the base in 1993/94, rather than 50 percent. Alston et al. simulated a reduction in imports to 22.4 percent of the base; the results of this simulation led to a 0.8 cent/bushel increase in the wheat price and a

savings in U.S. wheat deficiency payments of \$15.8 million in 1993/94, which is still substantially different than that estimated by the USDA.

The USITC staff (1994) suggested that annual declines in prices due to imports from Canada grew from 1.34 cents/bushel in 1989/90 to 4.41 cents/bushel in 1993/94. Further, deficiency payment increases averaged \$44 million per year over this 5-year period and \$73 million over the last two years.

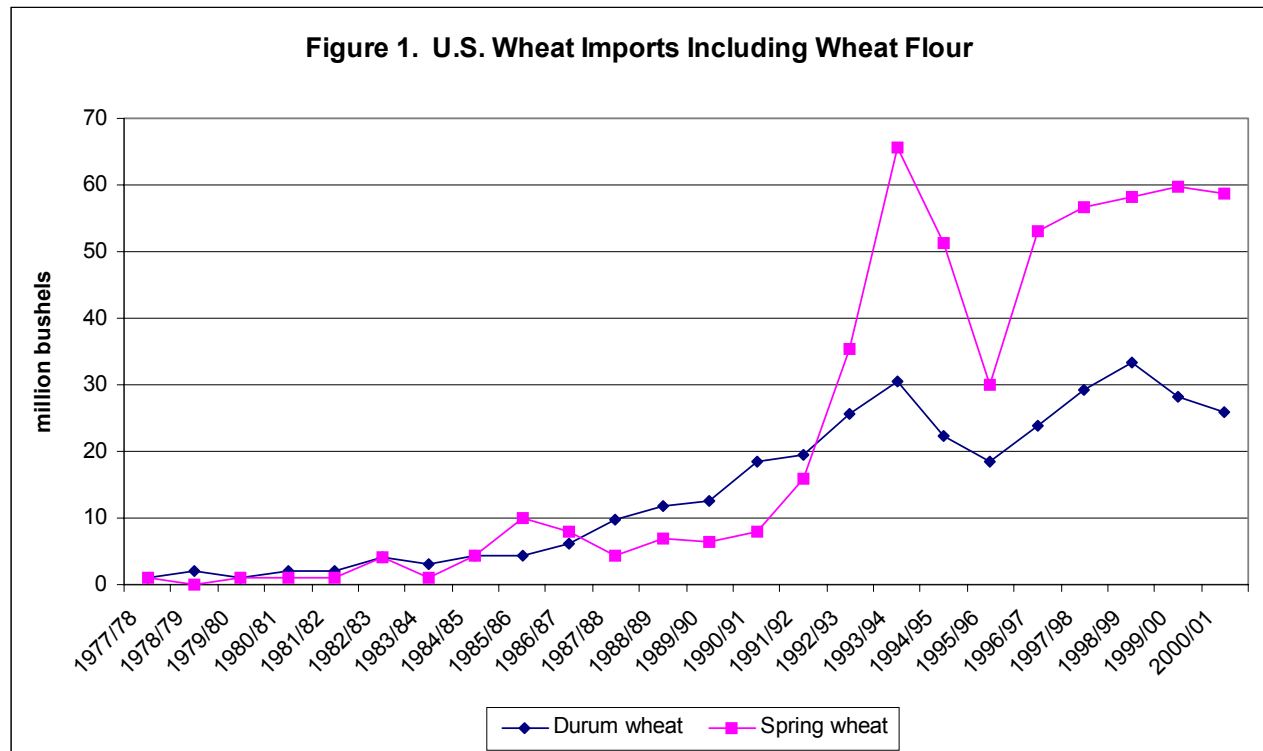
A considerable amount of disagreement exists among the studies (Alston et al. 1994; Babula et al. 1996; Babula and Jabara 1999; Alston et al. 1999) because of the different assumptions made and models used. Babula et al. believed that Alston et al. and the USDA relied primarily on expert opinion without giving data and evidence adequate roles in the analyses. Alston et al. used elasticities that Babula et al. thought to be either too high or too low.

Alston et al. (1994 and 1999) agreed with Babula et al.'s criticism of the USDA study, but defended their study and criticized the USITC study, noting that Canadian and U.S. wheat compete in offshore markets. When Canadian wheat is shipped to the United States, less wheat is shipped to other markets, which could result in an increase in offshore wheat prices and an increase in U.S. exports to offshore markets. In this way, the negative effect of Canadian imports on U.S. price can partially be negated by an increase in U.S. exports. Babula et al. did not consider these third-market effects, claiming that a multi-flow trade model capable of capturing third-market effects on U.S. price is unnecessary because the volume of U.S. - Canada wheat trade is insubstantial relative to the U.S. and world wheat markets. They argued that U.S. - Canada wheat trade is too small to generate third-market effects on U.S. prices.

In a related study, Koo (1998) evaluated the impacts of Canadian exports of durum wheat and barley to the United States on the U.S. domestic prices of these commodities and on farm income in durum wheat and barley growing regions in the United States. Koo found that increases in Canadian exports of durum wheat and barley to the United States lowered the domestic prices of the two commodities in the United States. Average price reductions were found to range between 6.5 and 15.3 percent for durum wheat and between 1.3 and 4.4 percent for barley. The results of Koo's (1998) analysis showed that increased imports from Canada for the 1993-1995 period reduced U.S. domestic prices and caused average reductions of farm income ranging between \$47 million/year and \$64 million/year for durum wheat producers in the United States and between \$73 million/year and \$128 million/year for barley producers, compared to long-run average imports.

## U.S. - Canada Wheat Trade

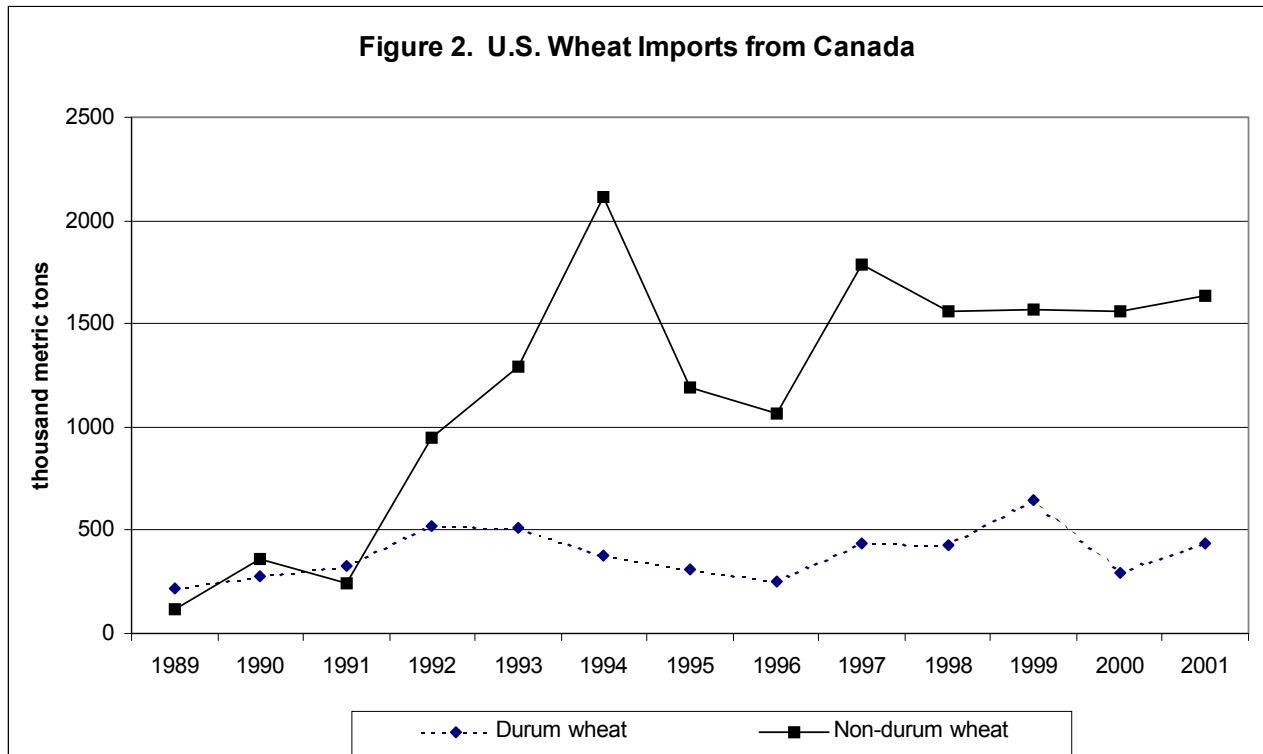
U.S. wheat imports prior to 1989 were quite small but increased substantially during the 1990s, especially spring wheat imports (USDA 2001). Figure 1 illustrates this dramatic increase in spring wheat imports starting in the 1990/91 marketing year and shows that durum imports actually started to increase in the mid-1980s. These data, however, include flour and wheat products in a wheat equivalent. Data from the Department of Commerce from 1989 to the present use the Harmonized Tariff System for classification to distinguish imports of wheat which do not include wheat products. These data are divided into durum and non-durum wheat. More specific data including imports of HRS wheat are available for more recent years. Since most of the non-durum wheat imports from Canada are HRS wheat (some white wheat is imported), and since the data specification and classification has been changing nearly every year, data will be presented for durum and non-durum wheat categories.



Source: Economic Research Service, USDA, *Wheat Yearbook* 2001.

Since 1989, over 99 percent of U.S. wheat imports have come from Canada. Figure 2 shows durum and non-durum wheat imports from Canada for calendar years 1989 to 2001. Both durum and non-durum wheat (mostly HRS wheat) imports increased substantially in the early 1990s. Durum wheat imports increased 139 percent from 216 thousand metric tons in 1989 to 518 thousand metric tons in 1992. The figures for non-durum wheat imports were even more dramatic: from 119 thousand metric tons in 1989 to 947 thousand metric tons in 1992 to 2.11 million metric tons in 1994, for an increase of 18-fold over five years.

Imports from Canada slowed in the mid-1990s, around the time of the temporary Wheat Peace Agreement. Non-durum wheat imports dropped by half from the high in 1994 to 1.06 million metric tons in 1996, while durum wheat imports fell to 250 thousand metric tons. Imports rebounded in 1997; however, non-durum wheat imports have not returned to the high levels of



Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics

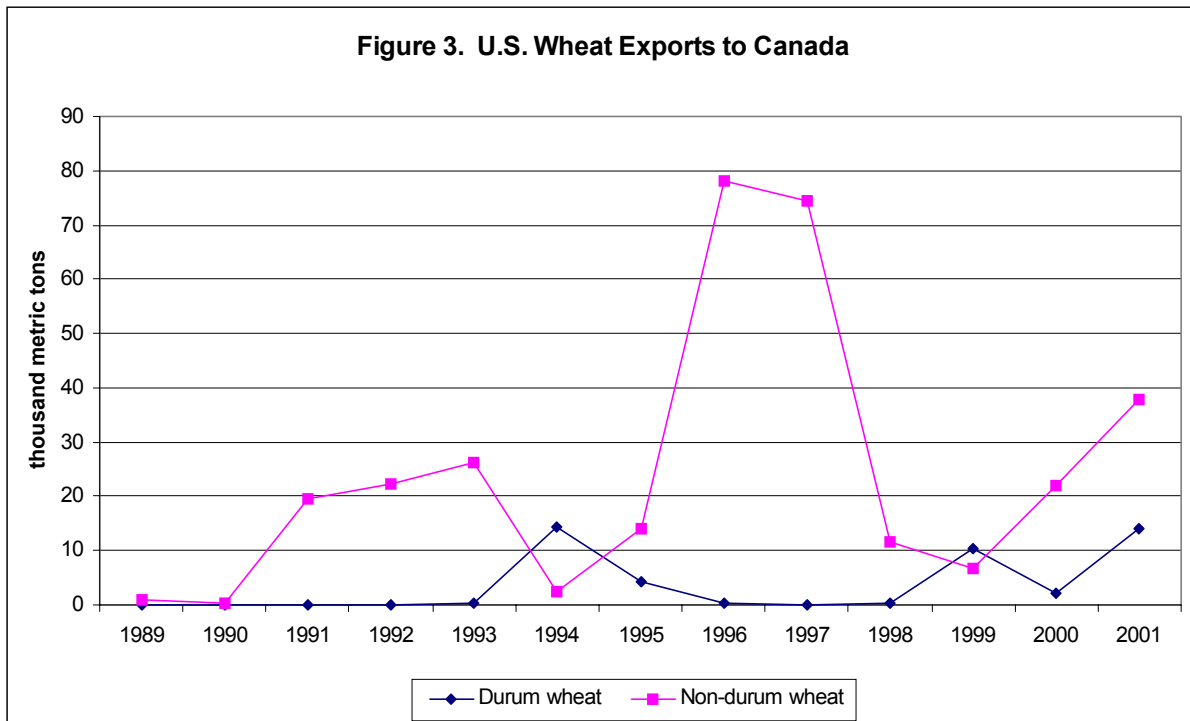
1994 and have remained steady during the 1997-2001 period, averaging about 1.6 million metric tons annually. Durum wheat imports reached a high of 644 thousand metric tons in 1999, then dropped by more than half in 2000 before increasing to 437 thousand metric tons in 2001.

Imports of durum wheat from Canada equaled, on average, 17 percent of U.S. durum wheat consumption during the 1989/90 to 2000/01 period, ranging from 32 percent in 1993/94 to 9 percent in 1995/96. Imports equaled 12 percent of U.S. durum consumption in 2000/01. Imports of non-durum wheat from Canada equaled, on average, 16 percent of U.S. HRS wheat consumption during the 1989/90 to 2000/01 period, ranging from 3 percent in 1989/90 to 25 percent in 1993/94; imports equaled 17 percent of consumption in 2000/01. Imports of non-durum wheat from Canada equaled 5 percent of total U.S. hard red wheat—including HRS and hard red winter (HRW) wheat—consumption during this period. Imports of non-durum wheat as a percentage of domestic hard red wheat consumption ranged from 1 percent in 1989/90 to 8 percent in 1993/94 and equaled 6 percent in 2000/01.

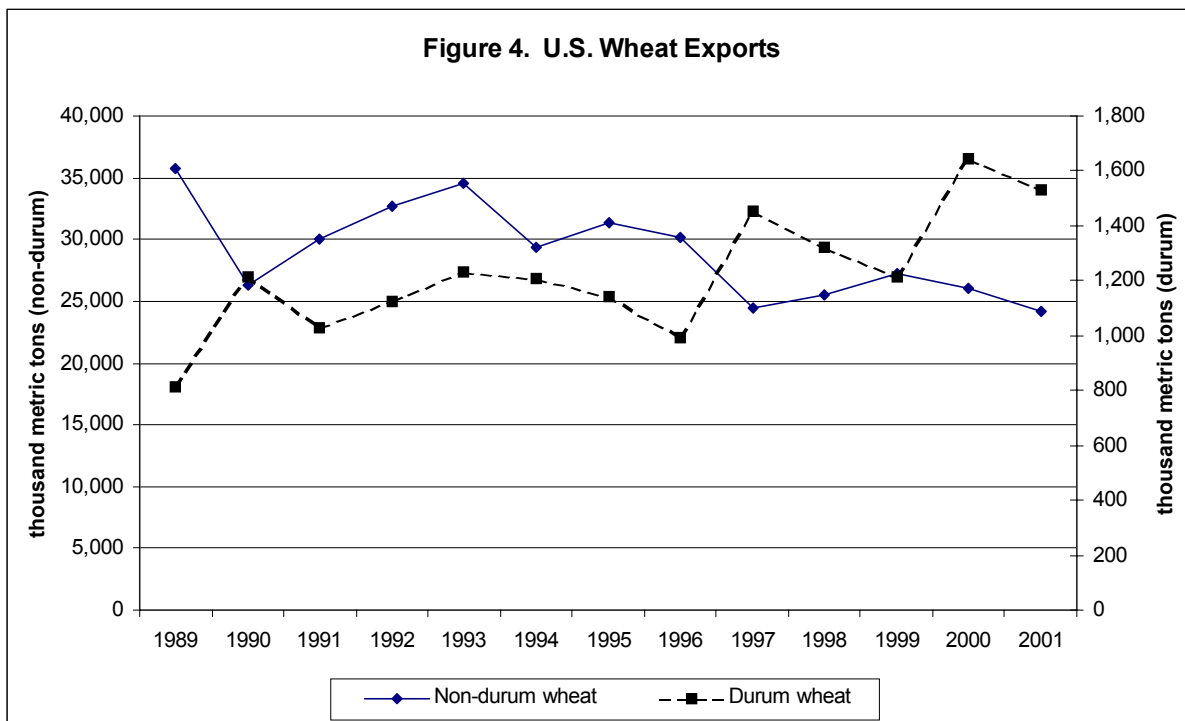
While imports from Canada have increased considerably under CUSTA, U.S. wheat exports to Canada still remain minimal. Total exports have not been increasing, with the exception of durum wheat. Figure 3 shows U.S. durum and non-durum wheat exports to Canada. Durum exports to Canada were highest in 1994 and 2001 when they reached 14 thousand metric tons, and non-durum wheat exports to Canada were highest in 1996 when they reached 78 thousand metric tons.

U.S. wheat exports to Canada are much smaller than imports from Canada and are insignificant when compared to total U.S. exports. Figure 4 shows total U.S. durum and non-durum wheat exports from 1989 to 2001. While imports from Canada have increased, total U.S. exports have decreased. Non-durum wheat exports during this time have declined from 35.7

million metric tons in 1989 to 24.2 million metric tons in 2001. HRW wheat makes up the largest portion of these exports. Data from the Wheat Yearbook (USDA, 2001) suggest that a decrease in winter wheat exports make up the majority of the total decrease in non-durum exports, but that HRS wheat exports have also declined. Total durum exports, on the other hand, have increased from 811 thousand metric tons in 1989 to 1.5 million metric tons in 2001.



Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics



Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics

## Development of an Empirical Model

An econometric model is developed to determine factors affecting U.S. domestic prices, Canadian exports to the United States, and the effects of Canadian exports on U.S. prices and farm income. Separate models are estimated for HRS wheat and durum wheat. Quarterly data from 1989 through 2001 are used in the models.

### Price Equation

U.S. domestic price is specified as a function of total supply and total consumption as follows:

$$P_{mt} = f(TS_t, TC_t) \quad (1)$$

where  $P_{mt}$  is the U.S. market cash price of wheat in time  $t$ ,  $TS_t$  is total supply of wheat in time  $t$ , and  $TC_t$  is total consumption of wheat in time  $t$ . Total supply of wheat is expected to have a negative effect on domestic market price and total consumption is expected to have a positive effect on domestic market price. Total supply is divided into beginning stocks, production, and imports, while total consumption is divided into domestic consumption and exports. Equation 1 is re-written as

$$P_{mt} = f(M_t, DS_t, USX_t) \quad (2)$$

where  $M_t$  is U.S. imports;  $DS_t$  is domestic stocks, which equals beginning stocks plus production minus domestic consumption; and  $USX_t$  is U.S. exports.  $M_t$  and  $DS_t$  are expected to have a negative effect on price, while  $USX_t$  should have a positive effect. The price used in these equations is the cash market price for No. 1 spring wheat or durum wheat at Minneapolis. The price equations are specified for HRS wheat and durum wheat.

Since HRW wheat is a close substitute for HRS wheat, domestic HRW wheat supplies could have a significant effect on HRS wheat price. For HRS wheat, Equation 2 is re-written as follows:

$$P_{mt}^s = f(M_t^s, DS_t^s, USX_t^s, S_t^{HRW}, P_{mt-1}^s) \quad (3)$$

where superscript  $s$  represents HRS wheat and  $S_t^{HRW}$  is the domestic supply of HRW wheat.  $P_{mt-1}^s$  is added to capture dynamic effects.

HRW wheat, however, is not a substitute for durum wheat. Durum wheat does not have any close substitutes in consumption because it is mainly used to produce pasta, while other types of wheat are used to produce wheat products such as bread. Wheat quality could have an effect on the price of No. 1 wheat. The percentage of wheat graded No. 1 would be expected to have a negative effect on the price of No. 1 wheat; that is, a high percentage of No. 1 wheat could lower price, and vice versa. Quality is especially important for durum due to a lack of substitutes. Data for percentage of durum wheat graded No. 1 are available, and Equation 2 is re-written for durum wheat as follows:

$$P_{mt}^d = f(M_t^d, DS_t^d, USX_t^d, QLTY_t^d, TR_t) \quad (4)$$

where superscript d represents durum wheat,  $QLTY_t$  is a quality variable measured as the percent of U.S. durum wheat graded No. 1, and  $TR_t$  is a trend variable added because durum price may be trending downward even when all other variables are held constant.

In Equations 3 and 4, imports ( $M^s$  and  $M^d$ ) are assumed to be endogenous, while all the other independent variables are exogenous. Thus, we introduce U.S. import demand (Canadian export supply) equations for durum and non-durum wheat to estimate Equations 3 and 4 more efficiently.

### Export Supply Equation

Factors that may influence Canada's supply of exports to the United States include U.S. price, the exchange rate, Canadian rail subsidies, the Wheat Peace Agreement, and the U.S. Export Enhancement Program (EEP). A Canadian export supply equation is specified as

$$CX_t = f(P_{mt}, RER_t, RAIL_t, EEP_t, WPA_t, CX_{t-1}) \quad (5)$$

where  $CX_t$  = Canadian exports to the United States in time t

$P_{mt}$  = U.S. market price in time t

$RER_t$  = Canada - U.S. real exchange rate in time t

$RAIL_t$  = Dummy variable for Canadian rail subsidy

$EEP_t$  = U.S. EEP payments in time t

$WPA_t$  = Dummy variable for Wheat Peace Agreement in late 1994 and 1995.

The U.S. market price is expected to have a positive effect on Canadian exports. *Ceteris paribus*, Canada is expected to increase exports to the United States when the U.S. price increases.

The real exchange rate is also expected to have a positive effect on Canadian exports to the United States. The real exchange rate is measured as Canadian dollars per U.S. dollar, so an increase in this variable indicates an appreciation of the U.S. dollar relative to the Canada dollar. An appreciation of the U.S. dollar makes U.S. goods more expensive in the foreign market and foreign goods less expensive in the U.S. market. Therefore, an appreciation of the U.S. dollar is expected to have a positive effect on Canada's exports to the United States. The value of the U.S. dollar has been appreciating relative to the Canadian dollar throughout most of the period that CUSTA has been in effect. The free trade agreement may have contributed to the increase in Canadian exports to the United States, but the appreciating U.S. dollar may also be an important contributing factor.

The Canadian rail subsidy was an indirect subsidy provided by the Canadian government under the Western Grain Transportation Act (WGTA) to farmers for shipments of grains from producing regions to export ports. Canada eliminated the rail subsidy in 1995 after complaints from U.S. producers that Canadian grains were more competitive in offshore markets because of the subsidies. While the elimination of the rail subsidy has made Canadian exports less competitive in offshore markets, it has ultimately made the U.S. market more attractive for Canadian producers because transportation costs from the Canadian prairies to the United States are lower than those from the Canadian prairies to most offshore markets (Johnson and Wilson, 1995). The rail subsidy in this model is a dummy variable equal to 1 prior to 1995 when the

subsidy was in effect and 0 afterwards. It is hypothesized that the Canadian rail subsidy had a negative effect on Canadian exports to the United States.

The EEP is hypothesized to have a positive effect on Canadian exports to the United States. The purpose of the EEP, which was created under the 1985 farm bill, is to provide U.S. agricultural exporters with bonuses that allow them to lower their export prices in selected markets characterized by unfair competition. Several studies have indicated, however, that the EEP has had adverse effects on bilateral trade between the United States and Canada (Johnson and Wilson 1995; Mao et al. 1996). The EEP raised U.S. domestic prices relative to world prices, which made the U.S. market more attractive to Canadian exporters. The U.S. government has not used the EEP on wheat since 1995.

The Wheat Peace Agreement, in effect from September 1994 to September 1995, is expected to have a negative effect on Canadian exports to the United States since it restricted Canadian exports during that period. This agreement is represented in the model with a dummy variable equal to 1 during the time it was in effect and 0 otherwise. A lagged dependent variable is added to the model to capture dynamic effects. Canada's wheat production levels may also positively influence their exports to the United States, but preliminary results showed no significant relationship between production and exports to the United States.

#### Estimation Procedure for the Simultaneous Equation System

Since Canadian exports and U.S. domestic price are endogenous, the two equations are estimated simultaneously. Coefficients of the two equations in the system are estimated using the three-stage least squares (3SLS) estimator. 3SLS can be more efficient than 2SLS in estimating parameters when the disturbance terms are correlated among equations. Since  $M_t = CX_t$ , Equations 3 and 4 are re-written and estimated as follows:

$$P_{mt}^s = \alpha_0 + \alpha_1 CX_t^s + \alpha_2 DS_t^s + \alpha_3 USX_t^s + \alpha_4 S_t^{HRW} + \alpha_5 P_{mt-1}^s + \varepsilon_t \quad (6)$$

$$P_{mt}^d = \beta_0 + \beta_1 CX_t^d + \beta_2 DS_t^d + \beta_3 USX_t^d + \beta_4 QLTY_t^d + \beta_5 TR_t + \varepsilon_t \quad (7)$$

The Canadian export supply equation for HRS and durum wheat is estimated as follows:

$$CX_t^s = \gamma_0 + \gamma_1 P_{mt}^s + \gamma_2 RER_t + \gamma_3 RAIL_t + \gamma_4 EEP_t + \gamma_5 WPA_t + \gamma_6 CX_{t-1}^s + e_t \quad (8)$$

$$CX_t^d = \gamma_0 + \gamma_1 P_{mt}^d + \gamma_2 RER_t + \gamma_3 RAIL_t + \gamma_4 EEP_t + \gamma_5 WPA_t + \gamma_6 CX_{t-1}^d + e_t \quad (9)$$

In the HRS wheat model, Equations 6 and 8 are estimated simultaneously; and in the durum model, Equations 7 and 9 are estimated simultaneously. Quarterly dummy variables are tested in each equation to determine if there are significant seasonal changes in price or imports, everything else held constant. The quarterly dummies were jointly significant only in the export equation in the durum model.

#### Effect of Imports from Canada on U.S. Farm Income

It is hypothesized that imports from Canada have a negative effect on U.S. price. Results from the price equation will show the size and significance of the effect of imports from Canada

on U.S. market prices. Figure 5 demonstrates the price and income effects of increased supply. This graph shows domestic demand and the supply of wheat in the United States.  $S_1$  is the supply of wheat in the United States before Canada exports to the United States. At this supply level, the equilibrium market price is  $P_1$ , and the quantity of domestic consumption supplied by U.S. producers is  $Q_1^{US}$ . When Canada exports to the United States, supply shifts out to  $S_2$ . The increase in supply causes price to decrease to  $P_2$ , and domestic consumption increases to  $Q^d$ . When price decreases to  $P_2$ , the quantity supplied by U.S. producers will decrease to  $Q_2^{US}$ , as determined by the original supply schedule. Domestic consumption ( $Q^d$ ) is now made up of domestic supply ( $Q_2^{US}$ ) and imports from Canada ( $Q^d - Q_2^{US}$ ). The effect on U.S. income is due to both a price effect (i.e., price falls due to increased supply of wheat from Canada) and a substitution effect (i.e., U.S. producers produce less, and domestic sales are lost due to the increased imports). Prior to imports from Canada, total revenue for U.S. producers equaled  $0P_1 \cdot 0Q_1^{US}$ , which is equal to area  $P_1 e Q_1^{US} 0$ . After supply shifts to  $S_2$ , total revenue for U.S. producers equals  $0P_2 \cdot 0Q_2^{US}$ , which is area  $P_2 b Q_2^{US} 0$ . The reduction in revenue, represented by the shaded area in Figure 5, is area  $P_1 a b P_2 [(P_1 - P_2) \cdot Q_2^{US}] + \text{area } a e Q_1^{US} Q_2^{US} [(Q_1^{US} - Q_2^{US}) \cdot P_1]$ .

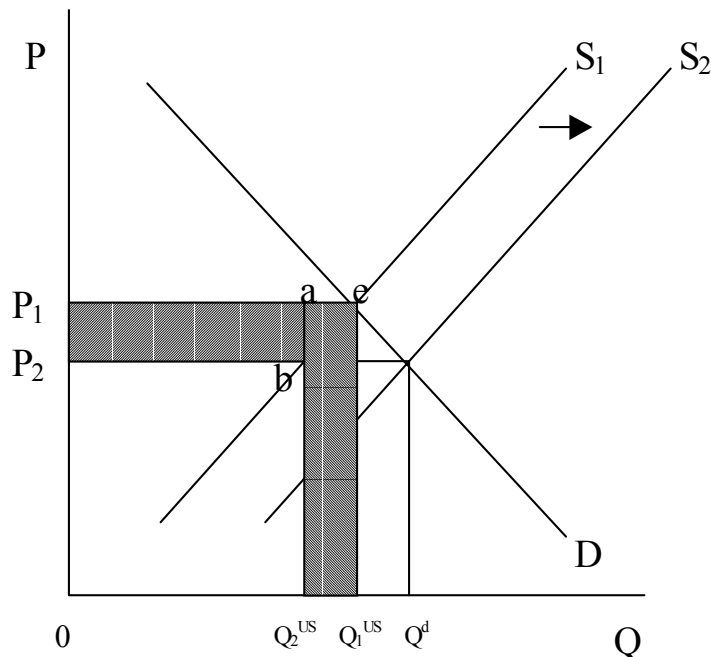


Figure 5. Effect of Supply Shift on Supply and Income

To determine the effect of imports on prices received by farmers, the market cash price at Minneapolis is converted to the farm price as follows:

$$P_{ft} = \lambda_0 + \lambda_1 P_{mt} + \varepsilon_t \quad (10)$$

where  $P_{ft}$  is the price received by farmers in time  $t$ .

$Q_1^{US}$  is the estimated quantity supplied by U.S. producers if price was  $P_1$ . To estimate  $Q_1^{US}$ , price elasticities of supply for both wheat types are estimated. For this, acres of HRS or durum wheat planted is first estimated as a function of price, price of substitutes, and acres planted in the previous year as follows:

$$A_{it} = \alpha_0 + \alpha_1 P_{it-1} + \alpha_2 P_{jt-1} + \alpha_3 A_{it-1} + \alpha_4 G_t + \varepsilon_{it} \quad (11)$$

where  $A_{it}$  = planted acres of commodity  $i$  in time  $t$   
 $P_{it-1}$  = price of commodity  $i$  in time  $t-1$   
 $P_{jt-1}$  = price of substitute commodity  $j$  in time  $t-1$   
 $A_{it-1}$  = planted acres of commodity  $i$  in time  $t-1$   
 $G_t$  = government policy variables in time  $t$ .

HRS wheat is assumed to be a substitute in production for durum wheat, and durum wheat is included as a substitute in production for HRS wheat. The estimated coefficients for prices in Equation 11 are used to estimate the planted acreage of HRS wheat and durum wheat if prices had been at  $P_1$  instead of  $P_2$ . Projected U.S. production data is then estimated using given yields and the percentage of planted acres that were harvested in each year. The result is an estimation of what production in the United States would have been if imports from Canada had not increased under CUSTA, and it is used to calculate  $Q_1^{US}$ . Equation 11 is estimated using annual data from 1982 to 2001. Changes in government policy that could affect the amount of planted acres include the FAIR Act of 1996, the EEP, and set-aside policies in the 1980s. The FAIR Act should have had an important influence because the producer no longer had to maintain their wheat base.

An increase in imports from Canada could have a positive effect on U.S. exports to offshore markets. Alston et al. (1994) argued that while Canadian exports to the United States may decrease the U.S. price, third-market effects may diminish the price effect. If Canada increases exports to the United States, Canadian exports to other markets decrease, which may allow the United States to increase exports to these markets. The increase in U.S. exports could cause U.S. price to increase and negate some of the negative effect of imports from Canada. Babula et al. (1996), however, dismissed the third-market effect as small and unimportant. To determine if imports from Canada have an effect on U.S. exports, U.S. exports to offshore markets ( $USX_t$ ) are estimated as a function of Canadian exports to the United States ( $CX_t$ ) and domestic supply ( $DS_t$ ) as follows:

$$USX_t = \lambda_0 + \lambda_1 CX_t + \lambda_2 DS_t + \varepsilon_t \quad (12)$$

Thus, total reduction in income due to imports from Canada is calculated by adding increases in farm income resulting from increased exports to offshore markets ( $Q^x \cdot P^x$ ) as follows:

$$\Delta Y = (P_1 - P_2) \cdot Q_2^{US} + (Q_1^{US} - Q_2^{US}) \cdot P_1 - Q^x \cdot P^x \quad (13)$$

where  $\Delta Y$  is the reduction in income,  $Q^x$  is the increase in U.S. exports due to imports from Canada, and  $P^x$  is the export price. The first term on the right-hand side of Equation 13 represents income loss due to changes in price, and the second term represents income loss due to increased imports replacing domestic production.

### Data

Export and import data for durum and import data for non-durum wheat were obtained from the Foreign Agricultural Service, USDA website. The original source of these data is the

U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics. Data for beginning stocks and production of durum and HRS wheat and exports of HRS wheat were obtained from the *Wheat Yearbook* (March 2001) and *Wheat Outlook* (April 2002) published by the Economic Research Service (ERS), USDA.

U.S. market prices and farm prices were also obtained from the *Wheat Yearbook* and *Wheat Outlook*. The durum market price used in the model is the Minneapolis No. 1 Hard Amber Durum price, and the spring wheat market price used is the Minneapolis No. 1 Dark Northern Spring (14 percent protein) price. These prices are converted to real prices using the consumer price index obtained from the Bureau of Labor Statistics, U.S. Department of Labor. Real exchange rate data were obtained from the ERS.

The EEP is measured as the average of the low payment and the high payment for the commodity during the time period. These data were obtained from the *World Grain Statistics* 1992, 1995/96, International Grains Council.

Durum quality is measured as the percent of the Midwest crop that graded No. 1. These data were obtained from the *U.S. Northern Grown Durum Wheat Regional Quality Report* (2001) and data published by the North Dakota State University Agricultural Experiment Station (Moore et al.).

All the data used in the analysis are quarterly data except when only annual data were available. Data for wheat quality, domestic stocks for durum and HRS wheat, and HRS wheat exports are annual, so the values for each of these variables are constant throughout the four quarters of the year.

## Results

### Canadian Export Supply Equation

Results from the simultaneously estimated Canadian export and U.S. price equations for HRS wheat and durum are presented in Table 1. The linear model is used, and elasticities are calculated for certain variables. U.S. price has a positive and significant effect on Canadian HRS wheat exports to the United States, but Canadian durum exports are not significantly affected by U.S. durum price.

The real exchange rate has a positive and significant effect on Canadian exports of both HRS wheat and durum wheat to the United States. The calculated elasticities indicate that a 1 percent increase in the real exchange rate leads to a 3.6 percent increase in HRS wheat exports to the United States and a 1.6 percent increase in durum exports to the United States. Since the real exchange rate increased by 43 percent from 1989 to 2001, these results suggest that U.S. dollar appreciation caused non-durum wheat imports to increase by 153 percent and durum imports to increase by 71 percent during this period. (Non-durum wheat imports from Canada actually increased by 1280 percent from 1989 to 2001, while durum imports increased by 102 percent.) The exchange rate may have such a significant effect because U.S. and Canadian prices tend to move together while changes in the exchange rate differentiate the prices between the two countries.

**Table 1. Estimation Results from Simultaneously Estimated Canadian Export and U.S. Price Equations***HRS Wheat*

Dependent variable: Canadian Exports to United States				Dependent variable: U.S. price			
Variable	Parameter estimate	p-value	elasticity	Variable	Parameter estimate	p-value	price flexibility coefficient
Intercept	-41.243	0.0026		Intercept	3.044	0.0004	
U.S. price	2.973	0.0237	0.759	U.S. imports	-0.022	0.0213	-0.086
Real exchange rate	28.633	0.0014	3.534	Domestic stock	-0.005	0.0003	-0.834
Rail subsidy	-1.555	0.5651		U.S. exports	0.004	0.0003	0.381
WPA	-0.423	0.8596		HRW stock	-0.001	0.0407	-0.119
EEP	0.247	0.0043	0.233	Lagged price	0.555	0.0001	
Lagged exports	0.355	0.0104					
System Weighted R <sup>2</sup> = 0.7854							

*Durum Wheat*

Dependent variable: Canadian Exports to United States				Dependent variable: U.S. price			
Variable	Parameter estimate	p-value	elasticity	Variable	Parameter estimate	p-value	price flexibility coefficient
Intercept	-5.364	0.1808		Intercept	7.201	0.0001	
U.S. price	0.446	0.3048	0.408	U.S. imports	-0.149	0.0364	-0.163
Real exchange rate	4.303	0.0760	1.635	Domestic stock	-0.032	0.0001	-0.637
Rail subsidy	-0.617	0.4680		Exports	0.011	0.5851	0.039
WPA	-0.483	0.5732		Wheat quality	-1.934	0.0019	-0.200
EEP	0.080	0.0118	0.226	Trend	-0.124	0.0001	
Q1	-1.381	0.0089					
Q2	0.359	0.4634					
Q3	-0.984	0.0627					
Lagged exports	0.500	0.0004					
System Weighted R <sup>2</sup> = 0.6293							

The rail subsidy had a negative effect on Canadian exports to the United States, as expected. That is, Canadian exports to the United States increased when the rail subsidy was eliminated. However, this result is statistically insignificant. The Wheat Peace Agreement of 1994/95 also had the expected negative effect but is also insignificant. EEP has a positive and significant effect in both the HRS and durum wheat models, supporting the theory that EEP raised U.S. domestic price and attracted Canadian exports to the United States.

*Price Equation*

U.S. imports from Canada have a negative and significant effect on U.S. prices of both HRS wheat and durum wheat. The estimated coefficient indicates that a 1 million bushel increase in non-durum imports during a 3-month period causes the spring wheat price to decrease by \$0.02 (in 1982-84 dollars), while a 1 million bushel increase in durum imports during a 3-month period causes a \$0.15 decrease in the durum price (in 1982-84 dollars). The calculated price flexibility coefficients indicate that a 1 percent increase in imports from Canada causes a 0.086 percent decrease in the spring wheat price and a 0.163 percent decrease in the durum price. These results indicate that the effect of imports from Canada on U.S. prices is greater for durum wheat than it is for HRS wheat. The effect on durum prices may be greater because the durum market is smaller

than the hard red wheat market (HRS wheat and HRW wheat are fairly close substitutes). Also, imports of durum from Canada average about 15-20 percent of U.S. domestic durum consumption, while imports of non-durum wheat equal 6-7 percent of U.S. hard red wheat consumption.

Results also show that domestic stock (including beginning stock, production, and domestic consumption) has a negative and significant effect on HRS wheat and durum wheat prices, and exports have a positive effect on prices (though it is significant only for HRS wheat). HRW wheat stock is shown to have a negative effect on HRS wheat price, indicating a substitute relationship. Durum quality is shown to have a negative effect on durum price, as expected.

### Effect on U.S. Farm Prices and Income

U.S. farm prices of durum and HRS wheat are estimated from the estimated market prices of these wheats. For this price convergence, the relationships between farm and market prices of HRS and durum wheat are estimated as follows (p-values are in parentheses):

$$P_{ft}^s = 0.323 + 0.707 P_{mt}^s + \varepsilon_t$$

(0.014) (0.0001)

$$R^2 = 0.966$$

$$P_{ft}^d = -0.038 + 0.775 P_{mt}^d + \varepsilon_t$$

(0.836) (0.0001)

$$R^2 = 0.964$$

These results show that a 1 cent change in the HRS wheat market price results in a 0.707 cent change in the HRS wheat price received by farmers, and a 1 cent change in the durum wheat market price results in a 0.775 cent change in the durum wheat price received by farmers.

Alston et al. (1994) claimed that Canadian exports of wheat to the United States result in increases in U.S. exports of wheat to offshore markets. To test this claim, Equation 12 is estimated; the results for HRS wheat and durum wheat are as follows (p-values are in parentheses):

$$USX_t^s = -147.035 - 0.791 CX_t^s + 0.617 DS_t^s + \varepsilon_t$$

(0.141) (0.506) (0.0001)

$$R^2 = 0.749$$

$$USX_t^d = 6.298 + 0.544 CX_t^d + 0.021 DS_t^d + \varepsilon_t$$

(0.192) (0.124) (0.514)

$$R^2 = 0.096$$

Estimated results show that imports from Canada do not have any significant effect on either U.S. HRS wheat exports or durum wheat exports to offshore markets. Third-market effects, therefore, are not considered.

Table 2 shows projected changes in farm price and income due to increased imports from Canada under CUSTA.  $S_1$  in Figure 5 is quantity supplied by U.S. producers plus 1989/90 imports levels, and  $S_2$  is  $S_1$  plus the increase in imports. Imports from Canada in 1989/90 (when

**Table 2. Effects of Increased Imports on Farm Price and Income**

*HRS Wheat*

	Domestic			Estimated Dom. Supply with 1989/90 Import Levels		Estimated Farm Price with 1989/90 Import Levels		Change in U.S. Exports		Reduction in Farm Income (million dollars)		
	Consumption (Q <sup>d</sup> )	Imports (Q <sup>c</sup> )	Domestic Supply (Q <sub>2</sub> <sup>us</sup> )	Domestic Supply Import Levels (Q <sub>1</sub> <sup>us</sup> )	Farm Price (P <sub>2</sub> )	Farm Price Import Levels (P <sub>1</sub> )	(Q <sup>x</sup> )	(Q <sup>x</sup> )	Price Effect (P <sub>1</sub> - P <sub>2</sub> ) * Q <sub>2</sub> <sup>us</sup>	Substitution Effect (Q <sub>1</sub> <sup>us</sup> - Q <sub>2</sub> <sup>us</sup> ) * P <sub>1</sub>	Total Reduction	Total Reduction in Nominal Value
1989/90	224.2	5.9	218.3	218.3	3.61	3.61	0	0	0	0	0	0
1990/91	237.6	12.6	225.0	224.7	2.47	2.50	0	2.47	7.4	-0.9	6.4	6.8
1991/92	215.0	17.9	197.1	197.2	2.98	3.04	0	2.98	11.6	0.1	11.7	12.7
1992/93	263.8	38.6	225.2	225.0	2.97	3.13	0	2.97	36.0	-0.6	35.4	39.8
1993/94	282.1	69.3	212.8	217.1	3.09	3.41	0	3.09	66.1	14.7	80.8	93.2
1994/95	282.0	57.9	224.1	236.1	2.89	3.14	0	2.89	57.1	37.7	94.7	112.4
1995/96	262.1	39.9	222.2	234.7	3.80	3.96	0	3.80	37.0	49.7	86.6	105.6
1996/97	323.7	59.4	264.3	274.7	3.44	3.70	0	3.44	69.2	38.3	107.6	134.9
1997/98	253.4	56.9	196.5	209.4	2.76	3.01	0	2.76	49.1	38.9	88.0	112.4
1998/99	284.3	58.7	225.6	238.1	2.32	2.58	0	2.32	58.4	32.1	90.5	117.6
1999/00	292.6	56.7	235.8	247.5	2.16	2.41	0	2.16	58.7	28.1	86.8	115.8
2000/01	322.0	53.4	268.6	282.2	2.09	2.32	0	2.09	62.5	31.6	94.1	129.9
average	274.4	47.4	227.0	235.1	2.81	3.02	0	2.81	46.6	24.5	71.2	89.2
1990/91 - 2000/01												

*Durum Wheat*

	Domestic			Estimated Dom. Supply with 1989/90 Import Levels		Estimated Farm Price with 1989/90 Import Levels		Change in U.S. Exports		Reduction in Farm Income (million dollars)		
	Consumption (Q <sup>d</sup> )	Imports (Q <sup>c</sup> )	Domestic Supply (Q <sub>2</sub> <sup>us</sup> )	Domestic Supply Import Levels (Q <sub>1</sub> <sup>us</sup> )	Farm Price (P <sub>2</sub> )	Farm Price Import Levels (P <sub>1</sub> )	(Q <sup>x</sup> )	(Q <sup>x</sup> )	Price Effect (P <sub>1</sub> - P <sub>2</sub> ) * Q <sub>2</sub> <sup>us</sup>	Substitution Effect (Q <sub>1</sub> <sup>us</sup> - Q <sub>2</sub> <sup>us</sup> ) * P <sub>1</sub>	Total Reduction	Total Reduction in Nominal Value
1989/90	59.6	7.6	52.0	52.0	3.46	3.46	0	0	0	0	0	0
1990/91	75.9	12.9	62.9	64.4	2.49	2.69	0	2.49	12.2	3.8	16.0	16.9
1991/92	85.7	13.5	72.2	76.6	2.59	2.80	0	2.59	15.5	12.2	27.8	30.3
1992/93	84.5	18.7	65.8	67.7	2.71	3.12	0	2.71	26.6	5.8	32.4	36.4
1993/94	68.2	21.5	46.6	49.7	3.88	4.39	0	3.88	23.7	13.4	37.1	42.8
1994/95	80.5	11.6	68.9	71.9	3.90	4.04	0	3.90	10.0	12.1	22.1	26.2
1995/96	82.2	7.3	74.9	72.0	4.64	4.63	0	4.63	-0.8	-13.4	-14.1	-17.2
1996/97	96.2	12.3	84.0	79.9	3.55	3.72	0	3.55	14.3	-14.9	-0.7	-0.8
1997/98	69.3	16.3	53.0	51.7	3.85	4.17	0	3.85	16.8	-5.3	11.5	14.7
1998/99	103.1	20.5	82.6	82.5	2.43	2.89	0	2.43	38.8	-0.2	38.6	50.1
1999/00	88.7	15.6	73.0	76.7	2.05	2.34	0	2.05	21.4	8.6	30.0	40.1
2000/01	101.4	12.5	88.9	88.4	1.97	2.15	0	1.97	15.9	-0.9	15.0	20.7
average	85.1	14.8	70.3	71.0	3.10	3.36	0	3.10	17.7	1.9	19.6	23.6
1990/91 - 2000/01												

Notes: Except for the last column, prices and changes in income are in real 1989/90 dollars. All quantities are in millions of bushels.

Canadian exports to the United States were substantially lower) are used as a base, and changes in price and income are estimated due to the increase in imports from Canada since 1989/90.

$P_2$  is the actual farm price of wheat in the United States.  $Q^d$  is the actual U.S. domestic HRS wheat or durum consumption.  $Q_2^{US}$  is the quantity supplied by U.S. producers at  $P_2$  ( $Q_2^{US} = Q^d - Q^c$ , where  $Q^c$  equals imports from Canada,  $Q_2^{US}$  also equals beginning stocks plus production minus exports minus ending stocks).  $P_1$  is the estimated price that would exist if imports from Canada were at the 1989/90 levels.  $Q_1^{US}$  is the estimated quantity that would be supplied by U.S. producers if price was  $P_1$ .

Except for the last column in Table 2, prices and changes in income are in real terms with 1989/90 as the base year. The difference between  $P_1$  and  $P_2$  shows the effect of imports from Canada on U.S. farm prices. From 1989/90 to 2000/01, the HRS wheat farm price decreased in real terms from \$3.61 to \$2.09, while the durum farm price decreased from \$3.46 to \$1.97. If imports had remained at the 1989/90 level, the HRS wheat farm price would have been \$0.23 higher in 2000/01, at \$2.32, and the durum farm price would have been \$0.18 higher, at \$2.15. The effect of increased imports on price is significant, but is still only a small portion of the total decrease in price.

Imports of HRS wheat from Canada were only 5.9 million bushels in 1989/90. Imports surged to 69.3 million bushels in 1993/94, but have now leveled off in the 55-60 million bushel range. The imports in 1993/94, which were the largest for the period, resulted in the highest effect on price; HRS farm price would have been \$0.32 higher in 1993/94 if imports were restricted to only 5.9 million bushels. Restricting imports to 5.9 million bushels is a large decrease, since imports have averaged 47.4 million bushels a year since 1989/90. During the 1990/91 - 2000/01 period, the HRS farm price would have been, on average, \$0.21 higher if imports were restricted to 5.9 million bushels per year.

Durum imports were 7.6 million bushels in 1989/90 and have averaged 14.8 million bushels a year since 1989/90. During the 1990/91 - 2000/01 period, the durum farm price would have averaged \$0.26 higher if imports were restricted to 7.6 million bushels per year. The greatest effect was in 1993/94 when 21.5 million bushels of imports caused a \$0.51 reduction in price.

These results are not directly comparable to the results from Alston et al. (1994), the USITC (1994), or Koo (1998) because different import restrictions are used to calculate the price reductions. This study restricts imports to 1989/90 levels, whereas Alston et al. restricted imports to 50 percent of the 1993/94 level. The 1989/90 levels are substantially lower than 50 percent of the 1993/94 levels, especially for HRS wheat, which partially explains why this study shows a higher effect on HRS wheat price. The price impact results from this study, however, do appear to be greater than the results from both the Alston et al. study and the USITC study. Koo estimated changes in durum wheat and barley prices and income on the basis of restricting imports to a long-run average.

The price effect shows the reduction in income due to lower prices. This is calculated as the difference between  $P_1$  and  $P_2$  multiplied by domestic supply ( $Q_2^{US}$ ). In real terms, the reduction in farm income for U.S. HRS wheat producers was \$62.5 million in 2000/01 and averaged \$46.6 million per year during the 1990/91 - 2000/01 period due to decreased prices.

Farm income for durum producers was reduced by \$15.9 million in 2000/01 and by an average of \$17.7 million per year during the 1990/91 - 2000/01 period due to decreased prices. The negative number given for durum in 1995/96 is due to a lower level of imports from Canada that year than in 1989/90; under the U.S./Canada Wheat Peace agreement, Canadian exports of durum wheat in 1995/96 to the United States decreased below the 1989/90 level. There was actually an \$800 thousand gain to producers that year because of decreased imports.

To calculate substitution effects, we calculated supply response equations for HRS and durum wheat. Table 3 shows the estimation results of Equation 11, which illustrates the effects of price changes on farm planting decisions. Results show that HRS wheat price in the previous year has a positive effect on HRS acres planted and that durum price in the previous year has a positive effect on durum acres planted. A 1 cent increase in the HRS wheat price leads to a 24 thousand acre increase in HRS wheat, and a 1 cent increase in the durum price leads to a 7 thousand acre increase in durum wheat. These results show that HRS wheat is a close substitute in production for durum wheat because the HRS wheat price has a negative effect on durum acres planted. Durum price, on the other hand, does not have a significant effect on HRS wheat acres planted. These results are used to calculate  $Q_1^{US}$  and the substitution effect shown in Table 2.

**Table 3. Estimation of Acres Planted**

<i>HRS Wheat Acres</i>			<i>Durum Wheat Acres</i>		
Variable	Parameter estimate	p-value	Variable	Parameter estimate	p-value
Intercept	5.885	0.1338	Intercept	1.507	0.2031
HRS wheat price	2.354	0.0571	Durum wheat price	0.717	0.0306
Durum wheat price	-0.366	0.6452	HRS wheat price	-0.725	0.0998
Previous year acreage	0.082	0.6319	Previous year acreage	0.318	0.1907
EEP	5.095	0.0007	EEP	0.349	0.3920
FAIR Act	4.496	0.0078	FAIR Act	0.746	0.1646
Set Aside	-0.149	0.0034	Set Aside	0.013	0.2962
Adjusted R <sup>2</sup> = 0.716			Adjusted R <sup>2</sup> = 0.315		

The substitution effect shows the reduction in income due to decreases in domestic production caused by increases in imports. For U.S. HRS wheat producers, income decreased \$31.6 million in 2000/01 and an average of \$24.5 million per year during the 1990/91 - 2000/01 period due to the substitution effect. Durum producers lost an average of \$1.9 million per year during the 1990/91 - 2000/01 period due to the substitution effect and actually gained \$0.9 million in 2000/01. In a few of the years there is a negative number in the substitution effect column for durum, which means there was an actual gain in these years. This gain is due to HRS and durum wheat being substitutes in production, which means that durum producers consider both durum price and the HRS wheat price when making planting decisions. In 1996/97, for example, the durum price would have been \$0.17 higher if not for increased durum imports, but the HRS wheat price would have been \$0.26 higher if not for increased HRS wheat imports. If imports of both durum and HRS wheat were restricted to 1989/90 levels, durum production would actually have been lower in 1997/98, despite the higher durum price in the previous year, because some durum production would have shifted to HRS wheat production since the increase in the HRS wheat price would have been greater than the increase in the durum price.

The total reduction is the summation of the price effect and the substitution effect. For U.S. HRS producers, in real 1989/90 terms, income decreased \$94.1 million in 2000/01 and an average of \$71.2 million per year during the 1990/91 - 2000/01 period due to increased imports

from Canada under CUSTA. U.S. durum producers lost \$15.0 million in 2000/01 and an average of \$19.6 million per year during the 1990/91 - 2000/01 period. These numbers are converted to nominal values in the last column. In nominal terms, HRS wheat producer income declined \$129.9 million in 2000/01 and an average of \$89.2 million per year during the 1990/91 - 2000/01 period due to increased imports from Canada under CUSTA, while durum producer income declined \$20.7 million in 2000/01 and an average of \$23.6 million per year during the 1990/91 - 2000/01 period.

### **Conclusions and Policy Implications**

Canadian wheat exports to the United States have increased considerably under the Canada - U.S. Free Trade Agreement (CUSTA), while increases in U.S. wheat exports to Canada have been minimal, and total U.S. exports of hard red wheat have declined. The increase in imports and low U.S. prices lead U.S. producers to believe they are being unfairly harmed. Numerous trade disputes have arisen with Canada under CUSTA. In the latest wheat trade dispute, U.S. producers have accused the Canadian Wheat Board of using unfair trading practices that disadvantage U.S. farmers. The objectives of this study are to analyze the factors causing the increase in imports from Canada and to estimate the effect of increased imports on U.S. prices and farm income.

Results from an econometric model indicate that imports from Canada do have a significant negative effect on U.S. farm prices. A 1 percent increase in imports from Canada causes a 0.086 percent decrease in the HRS wheat price and a 0.163 percent decrease in the durum price. In real 1989/90 terms, the HRS wheat farm price decreased from \$3.61 in 1989/90 to \$2.09 in 2000/01, and the durum wheat farm price decreased from \$3.46 in 1989/90 to \$1.97 in 2000/01. If imports in 2000/01 were restricted to 1989/90 import levels, the HRS wheat farm price would have been \$0.23 higher in 2000/01, at \$2.32, and the durum wheat farm price would have been \$0.18 higher, at \$2.15. The impact of increased imports on prices seems rather large, yet it accounts for only a small percentage of the total decrease in price. In nominal terms, HRS wheat producer income declined \$129.9 million in 2000/01 and an average of \$89.2 million per year during the 1990/91 - 2000/01 period due to increased imports from Canada under CUSTA, while durum producer income declined \$20.7 million in 2000/01 and an average of \$23.6 million per year during the 1990/91 - 2000/01 period.

Some of the increased imports is obviously due to elimination of import restrictions, but other factors such as the exchange rate are also important. Whether the increased imports from Canada, or a portion of the imports, is unfair or not is another matter. While U.S. producers argue that they are harmed by imports from Canada and unfair trade practices by the Canadian Wheat Board, some Canadians argue that they are hurt by U.S. farm subsidies. Canada and other countries argue that the substantial U.S. farm subsidies result in the United States flooding the international market with inexpensive grain, which could lead to artificially low world prices. These disputes will likely continue as long as the United States and Canada maintain different agricultural and trade policies.

The CUSTA has been good for the overall economies of both Canada and the United States. The total trade volume between the two countries has increased by 55 percent in real terms since 1989, which has resulted in an increase in employment in certain sectors of the economy. However, segments of the U.S. agricultural sector have suffered from the agreement. The U.S. agricultural trade balance with Canada increased, in nominal terms, from a \$700 million

deficit in 1989 to a \$1.3 billion surplus in 1991. However, since 1991 this trade balance has decreased nearly every year, reaching a deficit of \$1.7 billion in 2001. Certain agricultural sectors and geographic regions have performed better than others under the trade agreement. The U.S. wheat industry and North Dakota, which is the largest HRS and durum wheat producing state in the country, have particularly been harmed.

The negative effect on the wheat industry and the North Dakota economy suggests that a policy mechanism to prevent such income losses in the state should be established. U.S. farmers receive aid under the farm bill, though it may not be enough to compensate them for what they lose due to imports. Some assistance may come from the recently passed trade bill. This bill substantially increases trade adjustment assistance, providing \$10-\$12 billion in aid over the next decade to workers who lose their jobs because of trade. Farmers hurt by imports would be eligible for this assistance. An alternative policy mechanism could be to stabilize Canadian exports of HRS and durum wheat to the United States at a level agreeable to both countries, similar to voluntary export restraints. Without some type of policy mechanism in place to protect U.S. wheat farmers from surges in imports, trade disputes between the two countries could continue and create an unpleasant environment for agricultural trade.

## References

- Alston, Julian M., Richard S. Gray, and Daniel A. Sumner. "The Wheat War of 1994," *Canadian Journal of Agricultural Economics*. Vol. 42 (3) 231-251, 1994.
- Alston, Julian M., Richard S. Gray, and Daniel A. Sumner. "The Wheat War of 1994: Reply," *Canadian Journal of Agricultural Economics*. Vol. 47 (1) 99-104, 1999.
- Babula, Ronald A., Cathy L. Jabara, and John Reeder. "Role of Empirical Evidence in U.S./Canadian Dispute on U.S. Imports of Wheat, Wheat Flour, and Semolina," *Agribusiness*. Vol. 12 (2) 183-199, 1996.
- Babula, Ronald A., and Cathy L. Jabara. "The Wheat War of 1994: Comment," *Canadian Journal of Agricultural Economics*. Vol. 47 (1) 89-98, 1999.
- International Grains Council. *World Grains Statistics*, 1992.
- International Grains Council. *World Grains Statistics*, 1995/96.
- Johnson, D. Demcey and William W. Wilson. "Competition and Policy Conflicts in Canada - U.S. Barley Trade," *Journal of Agricultural and Resource Economics*. Vol. 20 (1) 64-81, 1995.
- Koo, Won W. "Bilateral Trade of Durum Wheat and Barley Under CUSTA and Implications for Farm Price and Income," Agricultural Economics Report No. 385, Department of Agricultural Economics, North Dakota State University, Fargo, 1998.
- Koo, Won W., and Ihn H. Uhm. "U.S. - Canada Border Disputes in Grains: Dynamic Interface Between the Free Trade Agreement and Trade Remedy Laws," Agricultural Economics Report No. 436, North Dakota State University, Fargo, 2000.
- Mao, Weining, Won W. Koo, and Mark A. Krause. "World Feed Barley Trade Under Alternative Trade Policy Scenarios," Agricultural Economics Report No. 350, Department of Agricultural Economics, North Dakota State University, Fargo, 1996.
- Mohanty, Samarendu, "United States-Canada Wheat Trade Dispute: Some Additional Evidence," University of Nebraska, 1995.
- Moore, Wayne, T.C. Olson, R. Nelson, and D. Hansen. *The Quality of the Regional (Montana, North and South Dakota, Minnesota) Hard Red Spring Wheat (DNS) Crop*. North Dakota State University Agricultural Experiment Station, Fargo, Various Years.
- North Dakota Wheat Commission, Montana Wheat and Barley Committee, U.S. Wheat Associates. *U.S. Northern Grown Durum Wheat: 2001 Regional Quality Report*. 2001.
- U.S. Department of Agriculture, Economic Research Service. *Wheat Outlook*. April 12, 2002.

U.S. Department of Agriculture, Economic Research Service. *Wheat Yearbook Data*. March, 2001.

U.S. Department of Agriculture, Foreign Agricultural Service. U.S. Trade Internet System. <http://www.fas.usda.gov/ustrade/> , accessed March, 2002.

U.S. International Trade Commission. “Wheat, Wheat Flour, and Semolina,” Investigation No. 22-54, Publication No. 2794, Washington, DC, July 1994.

U.S. Trade Representative. “United States to Pursue Action Against Monopolistic Canadian Wheat Board,” Release 02-22, February, 15, 2002.

U.S. Trade Representative. “USTR Chief Ag Negotiator Tells Senate the Administration Will Aggressively Pursue Reform of Canadian Wheat Board,” Release 02-45, April 19, 2002.