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The Impact of Reforming Wheat Importing State-Trading Enterprises on the Quality of Wheat Imported

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Keywords: State-trading enterprises, vertical differentiation, deregulation, wheat trade.

JEL Classification: D40, F13, L13, L15, L32, L33, Q17.

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1. Introduction and Motivation

As people's income increases they do not demand more food, but safe food of better quality and that closely meets their needs. These trends are apparent in the wheat industry where exporters have observed a shift in the demand profile of many importers towards purchasing better quality grains (Agnet, 2001). For large wheat exporters like the United States, Canada, and Australia, the ability to meet those requirements has a direct impact on the welfare of domestic producers.

The increasing demand for better quality wheat is also reinforced by the rapid reform of wheat-importing state-trading enterprises (STEs).[1] Two recent surveys of major wheat importers (Mercier, 1993 and Stephens and Rowan, 1996) found that countries that import wheat via a state trader are less sensitive to quality issues in import decision-making than countries that import wheat through private traders. Moreover, when STEs are reformed or eliminated, the quality and diversity of wheat imported increases because mills tend to secure specific wheat required for specific end-uses (Stephens and Rowan, 1996). The difference in the importance of wheat quality for state traders relative to private firms is the result of their different objectives. Importing STEs have various mandates, which generally involve achieving domestic agricultural policy objectives such as price stability, low prices for consumers and high prices or incomes for producers. Because these objectives have priority, end-users have little influence in determining the quality specifications of the wheat they receive. However, private importers, which are typically multinational traders, large-scale mills, or buying groups, re-sell wheat to the various end-users with the intent of maximizing profits (Mercier, 1993).

STEs will be challenged under the current round of WTO negotiations. More specifically, the United States hopes to end the exclusive import and export rights of STEs (Miner, 2001). In the last five years, the countries that have been the top importers of U.S. wheat are: Egypt, Japan, China, Phillipines, Pakistan, South Korea, and Mexico. Of those countries, two have a STE that controls the imports of wheat (Japan and China) and two have imports that are largely dominated by STEs (Egypt and Pakistan) (Abbott

[1] According to the World Trade Organization (WTO), STEs are "… governmental and nongovernmental enterprises, including marketing board, which have been granted exclusive or special rights or privileges, including statutory or constitutional powers, in the exercise of which they influence through their purchases or sales the level or direction of imports or exports." (Ackerman and Dixit, 1999, p.2).

and Young, 1999).[2] Thus, reforming importing STEs could seriously affect the pattern of export of U.S. wheat.

Moreover, recent surveys of importers (Mercier, 1993 and Stephens and Rowan, 1996) indicate that Canadian and Australian wheat are generally recognized to be of higher quality than U.S. wheat by many importers in terms of protein quantity and quality, as well as consistency of quality within and among shipments.[3] Consistency in wheat shipment is an important cost saving factor in milling. When wheat is consistent in quality, millers do not have to readjust machine settings. The presence of a strict variety licensing system in Canada is the primary reason for the higher quality of Canadian wheat relative to U.S. wheat.

It is therefore important to understand the impact of reforming state-trading importers on the quality and diversity of wheat imported, as well as on the source of imports, to ascertain the ability of the United States to compete in those markets after the reform. Examining the effect of the import deregulation in countries where STEs have been eliminated will contribute to this understanding.

The trend for the reform of wheat-importing STEs is particularly apparent in Latin America with Brazil, Colombia, Mexico, and Venezuela eliminating their STE at the end of the 1980s or the beginning of 1990s. The elimination or reform of STEs in those countries is the result of economic reforms during the second half of the 1980s. South Korea also completely deregulated wheat imports in 1990.

The objective of this study is to determine whether countries that have reformed their STEs at the end of the 1980s and beginning of the 1990s have increased the quality of wheat imported. A conceptual model is developed showing the circumstances under which reform of STEs results in an increase in the quantity of high-quality of wheat imported. Using data on exports by major exporters and detailed data on U.S. wheat export shipments to Brazil, Colombia, Mexico, Venezuela, and South Korea, I then examine how the quality of wheat imports has been affected by STE reforms.

[2] The other major importers have had their STE replaced by private traders (in 1983 for South Korea, 1986 for the Philippines, and 1992 for Mexico).

[3] Brazil, Venezuela, and South Korea were among the countries surveyed by the USDA, ERS (Mercier, 1993). Stephens and Rowan (1996) surveyed Brazil, Colombia, Mexico, and South Korea.

2. Conceptual Model

Both importing and exporting STEs have been criticized for distorting trade. McCorriston and MacLaren (2002) argue that in examining the trade-distorting effect of STEs, the counterfactual is not a perfectly competitive market, as is typically assumed, but an imperfectly competitive market. Moreover, Fulton, Larue and Veeman (1999) show that while an exporting STE may be trade distorting and welfare reducing when the counterfactual is perfect competition, with oligopolistic traders, the presence of STEs can improve welfare. Thus, the impact of reforming STEs depends on the degree of departure from competition after the reform and the specific objective function of the STE. Both McCorriston and MacLaren and Fulton, Larue and Veeman examine the trade impact of STEs by considering the commodity traded to be homogeneous. In this paper, I take their work further and examine the impact of the reform of wheat importing STE on the quality of wheat import when oligopolists replace a STE and wheat is a vertically differentiated product.

Consider a country that imports wheat for processing into an end product, e.g., flour. Wheat imports are differentiated by quality, i.e., low- (k_L) and high-quality (k_H) wheat. Wheat is also produced domestically and is of lower quality (k_D) than foreign wheat, i.e., $k_D < k_L < k_H$. Importing countries typically produce wheat that must be blended with higher quality foreign wheat to achieve the desired characteristics. For example, in Latin American markets, the primary competitors to U.S. wheat are Canadian, Argentinean and domestic wheat. Due to agronomic conditions, Argentinean and domestic wheat are usually considered to be of lower quality (primarily lower protein content) than U.S. or Canadian wheat. Therefore, those importers will typically blend domestic and Argentinean wheat with either U.S. or Canadian wheat to achieve the desired end-product characteristics. For example, for bread making, wheat of high-protein level is desired because it is the protein (gluten) that allows the dough to rise.

Domestic millers are differentiated on the basis of the quality (k_m) of the output they produce, with $k_m \in [0;1]$ and k_m being uniformly distributed. A typical miller, miller *i*, maximizes the profit from transforming one unit of wheat into one unit (measured in input adjusted units) of an end-product. Profit corresponds to

$\Pi_i\left(k_m, k_q\right) = P\left(k_m\right) - p_q - c\left(k_q, k_m\right)$, where $P(k_m)$ is the price of the output and is directly related to the quality produced $\left(\partial P / \partial k_m > 0\right)$, p_q is the price of wheat of quality q where $q \in [D, L, H]$, and $c\left(k_q, k_m\right)$ is the cost of processing wheat q into an output of quality k_m. The processing cost increases with higher quality end products and decreases in a convex fashion with higher quality wheat input, i.e., $\partial c / \partial k_m > 0$, $\partial c / \partial k_q < 0$, and $\partial^2 c / \partial k_q^2 > 0$. Higher quality end product results in higher processing cost because it requires, for example, more labor input to monitor the various steps of processing and insure that the quality standard is met. Moreover, greater wheat quality, such as wheat with lower dockage or foreign material content, results in flour with lower mixing time and therefore a lower processing cost. However, decrease in processing cost occurs at a decreasing rate.

For tractability purposes, assume that $c\left(k_q, k_m\right) = k_m / k_q$ and $P\left(k_m\right) = pk_m$, where p is the premium for end-product quality. Millers are assumed to be price takers in the output market. Thus, a typical miller faces the following profit function:

$$\Pi_i\left(k_m, k_q\right) = \begin{cases} pk_m - p_H - \dfrac{k_m}{k_H} & \text{if uses high-quality imported wheat,} \\ pk_m - p_L - \dfrac{k_m}{k_L} & \text{if uses low-quality imported wheat,} \\ pk_m - p_D - \dfrac{k_m}{k_D} & \text{if uses domestic wheat,} \\ 0 & \text{if uses nothing.} \end{cases} \tag{1}$$

This formulation is in the spirit of the Mussa and Rosen (1978) model of vertical differentiation.

To derive millers demand for the domestic and the two qualities of imported wheat, millers indifferent between buying the high- and low-quality wheat $\left(k_m = k_{HL}\right)$, the low-quality and domestic wheat $\left(k_m = k_{LD}\right)$, and the miller indifferent between buying the domestic wheat or nothing $\left(k_m = k_{D0}\right)$ must be found. For that, k_{HL}, k_{LD}, k_{D0}, must satisfy the following equations respectively:

$$\Pi_i\left(k_{HL}, k_H\right) = \Pi_i\left(k_{HL}, k_L\right) \tag{2}$$

$$\Pi_i\left(k_{LD},k_L\right)=\Pi_i\left(k_{LD},k_D\right) \tag{3}$$

$$\Pi_i\left(k_{D0},k_D\right)=0 \tag{4}$$

Using (1) and solving equations (2)-(4) for the indifferent millers yields:

$$k_{HL}=\left(\frac{p_H-p_L}{k_H-k_L}\right)k_Hk_L,$$

$$k_{LD}=\left(\frac{p_L-p_D}{k_L-k_D}\right)k_Lk_D,$$

$$k_{D0}=\frac{p_Dk_D}{pk_D-1}.$$

Thus, millers with $k_{HL}<k_m\le 1$ buy the high-quality imported wheat, millers with $k_{LD}<k_m<k_{HL}$ buy the low-quality imported wheat, millers with $k_{D0}<k_m\le k_{LD}$ buy the domestic wheat, and millers with $0\le k_m\le k_{D0}$ do not purchase wheat. Accordingly, the demands for the three wheat qualities facing the wheat intermediary are:

$$Q_H\left(p_H,p_L;k_H,k_L\right)=1-k_{HL}=\left(1-\frac{p_H-p_L}{k_H-k_L}k_Hk_L\right), \tag{5}$$

$$Q_L\left(p_H,p_L,p_D;k_H,k_L,k_D\right)=k_{HL}-k_{LD}=k_L\left(\frac{p_H-p_L}{k_H-k_L}k_H-\frac{p_L-p_D}{k_L-k_D}k_D\right), \text{ and} \tag{6}$$

$$Q_D\left(p_L,p_D;k_L,k_D,p\right)=k_{LD}-k_{D0}=k_D\left(\frac{p_L-p_D}{k_L-k_D}k_L-\frac{p_D}{pk_D-1}\right). \tag{7}$$

Two scenarios of market intermediaries are examined. In the first scenario, the intermediary between domestic millers and domestic producers and foreign exporters is a STE. In the second scenario, the STE is replaced with *m* Cournot profit-maximizing private intermediaries as in McCorriston and MacLaren (2002). An important aspect of modeling STEs is to specify correctly the objective function (Sexton and Lavoie, 2001). Importing STEs are known to have a variety of objective functions especially in developing countries where they may be used to generate revenue for the treasury, provide cheap food to domestic consumers, and stabilize prices (Sexton and Lavoie, 2001). Importing STEs may also regulate trade for the purpose of generating high prices and incomes for domestic producers (Abbott and Young, 1999). Finally, they may also be used to countervail the market power of large exporters (STEs or multinational firms).

When modeling importing STEs, previous authors have assumed that these entities use their market power to maximize either producer surplus plus rent from imports (McCorriston and MacLaren, 2002), or producer surplus plus rent from exports (Larue, Fulton, and Veeman, 1999). Love and Murniningtyas (1992) modeled the Japanese Food Agency as maximizing profit, where the JFA is in a position to exercise monopsony power in the purchase of domestic and foreign wheat, and exercise monopoly power in domestic wheat resale. I follow McCorriston and MacLaren (2002) and assume the importing STE maximizes domestic producer surplus plus rents from imports.

In what follows, I derive the equilibrium quantity of domestic, and imported wheat and compare those quantities under the two scenarios. To examine and compare the two scenarios, the demand equations given by equations (5)-(7) must be expressed in their inverse form, i.e.,

$p_H\left(Q_H,Q_L,Q_D;k_H,k_L,k_D,p\right)$, $p_L\left(Q_H,Q_L,Q_D;k_H,k_L,k_D,p\right)$, and

$p_D\left(Q_H,Q_L,Q_D;k_H,k_L,k_D,p\right)$. See appendix I for the expressions.

2.1 Equilibrium with a STE

Following, MacLaren and McCorriston (2002), I assume that the cost function arises solely from the purchase of products from the domestic sector or the world market. Essentially, the STE faces a residual supply on the world market. The functional forms are:

$$p_D^s = k_D Q_D,$$
$$p_L^s = k_L Q_L,$$
$$p_H^s = k_H Q_H.$$

The STE is assumed to maximize domestic producer welfare plus the rent from imports by choosing the quantity of domestic and imported wheat to buy and re-sell:

$$\max_{Q_H,Q_L,Q_D} W = p_D(Q_H,Q_L,Q_D;\alpha)Q_D - \int_0^{Q_D} p_D^s(x;k_D)dx + \left[p_H\left(Q_H,Q_L,Q_D;\alpha\right) - p_H^s(Q_H;k_H)\right]Q_H$$
$$+\left[p_L\left(Q_H,Q_L,Q_D;\alpha\right) - p_L^s(Q_L;k_L)\right]Q_L$$

where α represents the vector of exogenous variables, i.e., (k_H, k_L, k_D, p). Solving simultaneously for the first-order conditions with respect to Q_H, Q_L, and Q_D gives the equilibrium quantity of wheat imported (Q_H^{STE} and Q_L^{STE}) and the quantity of domestic

wheat purchased (Q_D^{STE}) by the STE. The expressions for the first-order conditions and the equilibrium values are shown in appendix I.

2.2 Equilibrium with m Cournot private traders

Under the reform of wheat imports, the STE is replaced by private importers. It is assumed here for simplicity that the private importers would act as intermediary between millers and the domestic producers and foreign exporters. A typical Cournot firm (firm *i*) maximizes profit in the purchase and sale of the three wheat qualities according to:

$$\max_{q_{Hi},q_{Li},q_{Di}} \prod_i = \left[p_D(Q_H, Q_L, Q_D; \alpha) - p_D^s(Q_D; k_D) \right] q_{Di} + \left[p_H\left(Q_H, Q_L, Q_D; \alpha\right) - p_H^s(Q_H; k_H) \right] q_{Hi}$$
$$+ \left[p_L\left(Q_H, Q_L, Q_D; \alpha\right) - p_L^s(Q_L; k_L) \right] q_{Li}$$

Solving simultaneously for the first-order conditions and aggregating the equilibrium quantities of the three qualities of wheat over *m* private firms gives the equilibrium quantities, i.e., Q_H^P, Q_L^P, and Q_D^P. The expressions for the first-order conditions and the equilibrium values are shown in appendix I.

2.3 Does the Quantity of High-Quality Wheat Imported Increase when STE are Reformed?

To examine the change in the mix of wheat qualities imported when *m* Cournot traders replace the STE, I compare the difference in the equilibrium quantity of the three wheat qualities under the two scenarios using a numerical analysis. Figure 1, 2, and 3 show the change in the equilibrium quantity of high-quality, low-quality, and domestic wheat respectively when private traders replace a STE. The change in quantity is examined in relation to the quality of the high-quality wheat and under the assumptions that k_D=0.7, k_L=1, and p=1.5.[4] Table 1 show the magnitude of the impact of the reform when k_H=1.5.

[4] It is assumed that the market is not covered, i.e., some millers do not buy the differentiated input or k_{D0}>0, because with this formulation, the demand functions can be inverted and an equilibrium with Cournot interaction between private firms can be examined (Motta, 1993). The market is not fully covered if and only if $p > 1/k_D$. This condition explains the choice of p=1.5.

Table 1. Percentage increase or decrease in the equilibrium quantity after the reform (for k_D=0.7, k_L=1, p=1.5, and k_H=1.5)

	m=1	m=2	m=5
Q_H	0.26%	33.68%	67.10%
Q_L	0.64%	34.19%	67.73%
Q_D	-45.63%	-27.51%	-9.39%

Figures 1, 2, and 3, reveal that imports of both high- and low-quality wheat increase and the quantity of domestic wheat decreases when private firms replace the STE. This result is consistent with McCorriston and MacLaren (2002) who show that the concern for market access is valid when producer surplus maximizing STEs are responsible for imports. Table 1 shows that the percentage increase is similar for the high- and low-quality wheat regardless of the number of private firms. The increase in imports becomes important when two or more private firms replace the STE.

The increase in imports and decrease in the use of domestic wheat after the reform of a STE is the outcome two effects, 1) an increase in vertical market power in the domestic supply chain with the replacement of a STE exerting market power in domestic wheat sales with private firms with market power both in buying and selling domestic wheat, 2) an horizontal competitive effect when more than one firm compete for the purchase and sales of both domestic and foreign wheat. The first effect results in a decrease in the quantity of domestic wheat bought and sold, an increase in the price of domestic wheat to millers, and thus the substitution of domestic wheat for foreign wheat. The second effect results in a downward pressure on wheat prices, thus a positive effect in the purchase of all three wheat qualities. Only the first effect is present when m=1. With m>1 both effects support an increase in wheat imports. However, the net impact on the equilibrium quantity of domestic wheat depends on the number of Cournot firms. With a large enough number of firms (m=12 in the current numerical scenario), the competitive effect offsets the vertical market power effect on the domestic market and the quantity of domestic wheat bought and sold increases when private traders replace the STE. In other words, with a large enough number of private traders, the overall effect of the reform of an STE would be to increase competition and increase the quantity of wheat

processed domestically through an increase in the purchase of both foreign and domestic wheat.

While the overall quantity of wheat imported increases when private traders replace the STE, it is of interest to determine how the relative mix of quality is affected. Particularly, I examine the circumstance under which there would be an increase in the quantity of high-quality wheat imported relative to the low-quality wheat. Figure 4 and 5 show the change in quantity of high-quality wheat imported relative to low-quality wheat. Figure 4 expresses the relative change as the ratio of the absolute change in quantities, i.e., $\left(Q_H^P - Q_H^{STE}\right)/\left(Q_L^P - Q_L^{STE}\right)$. A ratio greater than one indicates that imports of the high-quality wheat increase relatively more than imports of low-quality wheat. The result differs depending on the number of private firms replacing the STE. If only one firm replaces the STE, the increase in the quantity of high-quality wheat imported is smaller than the increase in the low-quality wheat. However, when $m>1$, imports of high-quality wheat increase by more than imports of low-quality wheat. When $m=1$, only one effect explains the change in equilibrium, i.e., an increase in vertical market power due to a change in the objective function of the market intermediary. As mentioned earlier, the impact of the change in objective function is a decrease in the quantity of domestic wheat purchased. The resulting increase in price of domestic wheat to millers makes foreign wheat relatively more attractive. Thus, some millers buying domestic wheat in the STE regime will find the low-quality wheat relatively more attractive under the private firm regime. Given that low-quality wheat is a better substitute for domestic wheat, the impact of the reform of a STE when it is replaced by one firm is larger on the domestic wheat market and its closest substitute, i.e., the low-quality wheat.

Note also that with more than one private firms, the increase in imports in the high-quality wheat relative to the increase in the low-quality wheat is maximized when $k_H=1.5$, that is when the high-quality wheat of 50 percent higher quality than the low-quality wheat in the current numerical scenario. This outcome makes sense given the convex nature of the millers' processing costs with respect to wheat quality. In other words, because a higher quality wheat decreases processing cost at a decreasing rate, the high-quality wheat becomes less and less attractive relative to the low-quality wheat the higher k_H is. Given the chosen functional forms, this result indicates that the greatest

benefit for countries exporting high-quality wheat from the reform of STE may not accrue to the country with the highest quality wheat, but the country with the optimal quality wheat given the quality of the domestic wheat, and willingness to pay of consumers for the quality of the end-product (p).

Finally, figure 5 shows the difference in the share of the high-quality wheat of total imports, i.e., $\left[Q_H^P / \left(Q_H^P + Q_L^P \right) - Q_H^{STE} / \left(Q_H^{STE} + Q_L^{STE} \right) \right] \cdot 100\%$. The figure shows that there is a small decrease in market share of the high-quality wheat when private traders replace a STE and that the decrease in market share is more important the greater is the quality of the high-quality wheat.

Thus, what is learned from figure 1 through 5 regarding wheat imports can be summarized as follows. A country imports less wheat with a wheat-importing STE maximizing producer surplus than with private traders. High-quality wheat occupies a larger share of imports under the STE regime. The import of both high- and low-quality wheat increases when private traders replace the STE. The increase in import is greater for the high-quality than the low-quality wheat when more than one private trader replaces the STE.

3. Empirical Evidence

Using yearly data from FAOSTAT on wheat exports from 1980 to 2000, I examine the pattern of imports of countries that reformed their wheat-importing STE at the end of the 1980s and beginning of 1990s. Table 2 lists those countries, the name of the STE, and the year of reform.

The objective of this analysis is to make observations on the trade pattern and quality of wheat imported before and after the reform. A more rigorous analysis will be required to examine whether the predictions of the conceptual model hold for those countries, as many factors may explain the changes in trade patterns. In this analysis, high-quality wheat is defined as wheat from Canada and Australia, and low-quality wheat refers to wheat from other exporters. This classification corresponds to outcomes of surveys of importers, who recognized Canada and Australia as having greater wheat quality. Important wheat quality characteristics differ by importing countries and importers. However, consistency in quality and intrinsic quality, especially the level and

consistency of protein quantity and quality, emerged as important characteristics for importers in general and those for which Canada and Australia ranked the highest (Mercier, 1983; Stephens and Rowan, 1996).

Table 2. Countries, STE, and Year of Reform

Country	STE	Year of Reform
Brazil	CTRIN	1991
Colombia	IDEMA	1992
Mexico	CONASUPO	1992
Venezuela	CORPOMERCADEO	1989
South Korea	KOFMIA	1990

Source: Adapted from Abbott and Young (1999) and KOFMIA (2000).

As shown in figures 7 to 10 and in table 3, all countries increased their imports of wheat after reforming their STEs. Mexico has the largest percentage increase in quantity and Venezuela, the smallest increase. Imports of higher quality wheat, i.e., Canadian and Australian wheat, also increase after the reform by more than 100 percent for all countries except for Brazil. The other exporters lose after the reform in Colombia and in Venezuela. Canada and Australia were able to increase their market share of imports in Colombia, Venezuela, and South Korea as shown in table 4. However, their market share decreased in Brazil and Mexico.

Table 3. Average exports before and after the reform of the STE ('000 Metric Tons)

	By All Exporters			By Canada and Australia			By Rest of Exporters		
To:	Before Reform	After Reform	% Change	Before Reform	After Reform	% Change	Before Reform	After Reform	% Change
Brazil	3,041	6,012	98%	876	872	0%	2,166	5,140	137%
Colombia	647	985	52%	114	483	324%	533	502	-6%
Mexico	569	1,979	248%	209	690	230%	360	1,289	258%
Venezuela	952	1,123	18%	189	460	143%	763	663	-13%
South Korea	2,538	3,864	52%	587	1,848	215%	1,951	2,016	3%

Table 4. Share of exports by Canada and Australia

	Before Reform	After Reform
Brazil	29%	14%
Colombia	18%	49%
Mexico	37%	35%
Venezuela	20%	41%
South Korea	23%	48%

Such increase in imports in the 1990s by all importers could also be due to other factors such as a decrease in the price of wheat. However, figure 11 shows that the nominal price of wheat for major exporters increased in the first part of the 1990s to a peak in 1996 and then decreased. Thus, a price explanation can be ruled out. In what follows I provide some information on the liberalization of imports in the five countries of interest to help understand the nature of the change in import quantity and sources.

3.1. Brazil

In Brazil, the government took total control over the wheat market in 1967. According to Monteiro da Silva and Grennes (1999) the objectives of the government was to a) give priority to national wheat; b) regulate marketing activities through the monopoly power of the government in buying domestic and imported wheat; c) guarantee domestic supply and improve storage capacity; and d) regulate the expansion of mills. Self-sufficiency in production was behind those objectives. With the liberalization of the wheat market in 1989, all direct subsidies to producers and consumers were eliminated. Private sector imports were legalized by 1991 and tariffs were set on imported wheat.

According to Stephens and Rowan (1996), soon after imports were privatized buying groups evolved to reduce risk exposure and take advantage of lower freight costs associated with larger vessels. Moreover, there was a sharp decline in domestic production after the deregulation, which may explain some of the increase in imports observed in figure 6. The prevalence of imports from Argentina after the deregulation can be explained by the creation of preferential tariffs between Brazil and Argentina and the Mercosur Agreement, which was signed in 1991. Moreover, imports of Argentine wheat are relatively more attractive for Brazilian mills because they are not assessed a maritime import tax of 25% on freight costs.

3.2. Colombia

According to Garcia Garcia (1991), the role of the STE Instituto de Mercadeo Agropecuario (IDEMA) was to facilitate agricultural production and imports and exports of agricultural and food products. It collected customs revenue that would have otherwise gone to the Central Government and thus suffered from import bias in its operation. This perhaps explains why the rise in imports after the liberalization of imports was not as

dramatic as in Brazil. Until 1992, IDEMA was the sole importer of wheat and was exempt from import taxes.

3.3. Mexico

According to Flores (1999), before the reforms in the late 1980s, Mexico was among the most protected economies. CONASUPO was the sole buyer of wheat until 1992 and handled pricing decision and trade activities. CONASUPO was also in charge of implementing price support schemes for wheat and other agricultural products. After the reform of imports, many mills starting purchasing foreign wheat through buying groups.

As a result of joining NAFTA in 1994, Mexico abolished an import licensing requirements and imposed a 15 percent tariff on wheat imports, which are to be phased out in 2004. Other trade barriers were also to be phased out over a period of 15 years (Flores, 1999). Finally, the continued strong growth in wheat imports through the 1990s observed in figure 8 may be due to a decrease in wheat production. According to the Economist (October 2000), with the disappearance of price guarantees, wheat growers have been shifting to other crops such as nuts, peaches, and chillies, because they cannot compete with cheap imports from across the borders.

3.4. Venezuela

Venezuela has always been dependent on imports to meet domestic demand for wheat. Prior to the economic reform in 1989, the government controlled trade by requiring wheat importers to obtain import licenses. The goal of the reform was to reduce government intervention in the economy. As part of the reform, quantitative controls were replaced by a variable tariff levied on imports to maintain a minimum import price floor. With accession to GATT in 1990, Venezuela has been revising its tariff schedule. According to Setia and Dusch (1993), the increase in the market share of Canada in the 1990s as seen in figure 9 was due to aggressive Canadian marketing strategies.

3.5. South Korea

Prior to 1983, the Korea Flour Millers Industry Association (KOFMIA) operated a government mandated import monopoly for wheat and controlled the price of wheat flour. In 1983, the government began a series of deregulation to progressively turn import decisions over to the private sector. KOFMIA's import monopoly was eliminated then, but the Ministry of Agriculture, Forestry and Fisheries (MAFF) remained involved in

establishing import requirements and allocated import quotas among member companies. In 1990, the quota system was abolished and imports, thus, fully liberalized. Since then Korean mills have been able to import wheat according to their specific needs. Four buying groups were formed based to obtain efficiencies in ocean freight and reduce port costs (Stephens and Rowan, 1996)

Other than its location, South Korea differs from the previous countries with higher per capita GDP. With a population with greater purchasing power, Korean millers have had to adapt their milling facilities to meet growing and changing consumer demands. The level of milling technology in South Korea is now fairly sophisticated. According to Stephens and Rowan, while food wheat imports have risen by a relatively small amount relative to feed wheat, floor millers have increased the number of individual flours produced from 10-12 in 1982 to as many as 70 different flours in the mid 1990s.[5] "Bakeries and noodle manufacturers are demanding more specific flour specifications to meet consumer demands for an increasingly wider range of products" (Stephens and Rowan, 1996, p. 94).

Figure 10 reveals that, prior to 1983, the United States had a 100 percent share of the South Korean market. However, its share dropped with the deregulation of imports. According to Raney and Morgan (1993), the primary reason is that Australian wheat provides specific and more consistent intrinsic characteristics, such as protein quantity and gluten strength. However, despite the variability in protein quality and quantity, U.S. DNS wheat is preferred to Canadian CWRS wheat.

Disaggregated data on U.S. exports shipments obtained from the U.S. Grain Inspection, Packers and Stockyards Administration (GIPSA) reveals a change in the mix of wheat imports from the United States after the deregulation in 1990. Such a clear effect may be due to a combination of a lack of other trade and domestic policies affecting imports after the deregulation and the higher per capita income of the South Korean population, which demand greater standards and variety in the wheat products consumed.

Figure 12 shows an overall increase in Hard Red Spring (HRS) wheat imports by South Korea after the complete liberalization of imports in 1990. HRS has the highest

[5] Note that figure 10 contains exports of both food and feed wheat.

protein content (from 13 to 16 percent). It is mostly used for blending with lower-protein wheats, and for specialty products such as bagels and frozen doughs that require high protein content with strong gluten properties. It is divided into subclasses, Dark North Spring (DNS) being the highest quality subclass, followed by Northern Spring (NS). Each subclass is further divided in grades, which also reflect different quality level, related to the purity of the wheat. In order of higher quality are grade 1, grade 2 or better (o/b), and grade 2. Figure 12 shows that by 1994, almost all imports of HRS wheat by South Korea were of the highest quality.

Figure 13 shows an overall decrease in imports of Hard Red Winter (HRW) wheat. HRW is a medium protein wheat, ranging between 10 and 12 percent protein content. It is used mainly to produce bread and rolls. Notice a similar transition to the highest grade immediately after the full liberalization of imports in 1990. These figures present strong support for an increase in wheat quality after import deregulation.

4. Conclusion

This paper examined conceptually and empirically whether the quality of wheat imported increases when importing STEs are reformed and replaced by private traders. The conceptual model shows that after the reform of a STE maximizing producer surplus, imports of both high- and low-quality wheat increases. The increase in imports is the result of two effects. First, there is an increase in market power in the wheat supply chain when private firms with market power both in purchase and sale of wheat replace the STE. The increase in market power causes an increase in the price of domestic wheat that makes imported wheat relatively more attractive. Second, when more than one private firm replace the STE, competition among firms bring the price of all wheat qualities down, which has a positive impact on wheat imports. Imports of high-quality wheat increase relatively more than imports of low-quality wheat when more than one firm replace the STE. Post-reform observations in the markets considered in this study reveals that, in many instances, more than one buying groups form after the demise of a STE.

The examination of trade data for five countries (Brazil, Colombia, Mexico, Venezuela, and South Korea) that reformed their wheat imports in the late 1980s or early 1990s supports the predictions of the conceptual model. The average quantity of imports

before and after the reform increased for all five countries. Moreover, imports of Canadian and Australian wheat – considered being of higher quality in recent importers' survey – increased for all countries except Brazil. Canada and Australia gained market share in Colombia, Venezuela, and South Korea. More disaggregated data on U.S. wheat exports to South Korea revealed a marked transition to higher grades of Hard Red Spring and Hard Red Winter wheat after the complete deregulation of imports in 1990.

The conceptual and empirical analyses of this paper support an increase in market access and more specifically an increase in imports of high-quality wheat after the reform of STEs. These results have important policy implications for U.S. policy makers who have demanded the elimination of all state traders under the current round of WTO negotiations. First, while removing importing STEs may increase market access, the boost on U.S. exports may not be significant if it results in the importation of higher quality wheat. In other words, importers may turn to countries like Canada and Australia, which are recognized for their higher quality wheat (Mercier, 1993, and Stephens and Rowan, 1996). Second, it raises the questions of whether the United States can adequately meet additional demand for high-quality wheat and whether an alternative approach to support U.S. farmers is to develop stricter variety standards like those existing in Canada. Future work will investigate those questions.

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Appendix I

The models below were solved using Mathematica 4.

Inverse Demands

$$p_H\left(Q_H,Q_L,Q_D;\alpha\right)=\frac{Q_D}{k_D}+\frac{Q_H-1}{k_H}+\frac{Q_L}{k_L}-p\left(Q_H+Q_L+Q_D-1\right)$$

$$p_L\left(Q_H,Q_L,Q_D;\alpha\right)=\frac{k_LQ_D+k_D\left[Q_H+Q_L-1-k_Lp\left(Q_H+Q_L+Q_D-1\right)\right]}{k_Dk_L}$$

$$p_D\left(Q_H,Q_L,Q_D;\alpha\right)=\frac{\left(k_Lp-1\right)\left(Q_H+Q_L+Q_D-1\right)}{k_D}$$

Equilibrium with a STE

Maximization problem:

$$\max_{Q_H,Q_L,Q_D} W = p_D(Q_H,Q_L,Q_D;\alpha)Q_D-\int_0^{Q_D}p_D^s(x;k_D)dx+\left[p_H\left(Q_H,Q_L,Q_D;\alpha\right)-p_H^s(Q_H;k_H)\right]Q_H$$
$$+\left[p_L\left(Q_H,Q_L,Q_D;\alpha\right)-p_L^s(Q_L;k_L)\right]Q_L$$

First-Order Conditions:

$$\frac{\partial W}{\partial Q_H}=0\rightarrow p+\frac{2Q_D}{k_D}-2pQ_D+\frac{2Q_L}{k_L}-\frac{1+2\left[k_H\left(k_H+p\right)-1\right]Q_H+2k_HpQ_L}{k_H}=0$$

$$\frac{\partial W}{\partial Q_L}=0\rightarrow\frac{2k_LQ_D+k_D\left[2Q_H-1-k_Lp\left(2Q_D+2Q_H-1\right)+2Q_L-2k_L\left(k_L+p\right)Q_L\right]}{k_Lk_D}=0$$

$$\frac{\partial W}{\partial Q_D}=0\rightarrow\frac{2Q_D+2Q_H+2Q_L-1-k_D\left[k_DQ_D+p\left(2Q_D+2Q_H+2Q_L-1\right)\right]}{k_D}=0$$

Equilibrium Quantities:

$$Q_H^{STE}=\frac{-2k_L\left[k_H-k_L+k_H\left(k_L\right)^2\right]-2\left(k_D\right)^2\left\{k_H+k_Hk_Lp\left[1+\left(k_L\right)^2\right]+k_L\left[\left(k_L\right)^2-k_Lp-1\right]+\left(k_D\right)^3\left\{k_H\left[k_Lp+\left(k_L\right)^3p-1\right]-k_L\left[k_L\left(k_L+p\right)-1\right]\right\}\right\}}{A}$$

$$Q_L^{STE}=\frac{\left(k_H\right)^2k_L\left\{-2k_L+k_D\left[2-2k_Dp+2k_Lp+\left(k_D\right)^2\left(k_Lp-1\right)\right]\right\}}{A}$$

$$Q_D^{STE}=\frac{k_D\left(k_H\right)^2\left(k_L\right)^3\left(k_Lp-1\right)}{A}$$

where:

$$\begin{aligned}A=&-2k_L\left\{-k_L+k_H\left[1+k_L\left(k_H+k_L\right)\right]\right\}+2\left(k_D\right)^2p\left\{-k_H+k_L-\left(k_H\right)^2k_L+\left(k_L\right)^3\left[\left(k_H\right)^2-1\right]\right\}+\\&2k_D\left\{k_H+k_Hk_Lp\left[1+\left(k_L\right)^2\right]+k_L\left[\left(k_L\right)^2-k_Lp-1\right]+\left(k_H\right)^2k_L\left[1-\left(k_L\right)^2+k_Lp\right]\right\}+\\&\left(k_D\right)^3\left\{k_L-\left(k_L\right)^2\left(k_L+p\right)+k_H\left[k_Lp+\left(k_L\right)^3p-1\right]+\left(k_H\right)^2k_L\left[k_L\left(k_L+p\right)-1\right]\right\}\end{aligned}$$

Equilibrium with *m* Private Traders

Maximization problem of trader *i*:

$$\max_{q_{Hi},q_{Li},q_{Di}} \prod_i = \left[p_D(Q_H, Q_L, Q_D; \alpha) - p_D^s(Q_D; k_D) \right] q_{Di} + \left[p_H\left(Q_H, Q_L, Q_D; \alpha\right) - p_H^s(Q_H; k_H) \right] q_{Hi}$$
$$+ \left[p_L\left(Q_H, Q_L, Q_D; \alpha\right) - p_L^s(Q_L; k_L) \right] q_{Li}$$

First-Order Conditions:

$$\frac{\partial \Pi_i}{\partial q_{Hi}} = 0 \rightarrow -\frac{1}{k_L} + p + \frac{(1+m)(1-k_D p) q_{Hi}}{k_D} + \frac{(1+m)(1-k_L p) q_{Hi}}{k_L} + \frac{(1+m)\left[1-(k_L)^2 - k_L p\right] q_{Li}}{k_L} = 0$$

$$\frac{\partial \Pi_i}{\partial q_{Li}} = 0 \rightarrow -\frac{1}{k_H} + p + \frac{(1+m)(1-k_D p) q_{Di}}{k_D} + \frac{(1+m)(1-k_L p) q_{Li}}{k_L} + \frac{(1+m)\left[1-(k_H)^2 - k_H p\right] q_{Hi}}{k_H} = 0$$

$$\frac{\partial \Pi_i}{\partial q_{Di}} = 0 \rightarrow -\frac{1}{k_D} + p + \frac{(1+m)(1-k_D p) q_{Hi}}{k_D} + \frac{(1+m)(1-k_D p) q_{Li}}{k_D} + \frac{(1+m)\left[1-(k_D)^2 - k_D p\right] q_{Di}}{k_D} = 0$$

Equilibrium Quantities:

$$Q_H^P = m\left\{-k_L\left[k_H - k_L + k_H (k_L)^2\right] - (k_D)^2 p\left[k_H - k_L + (k_L)^3\right] + k_D\left\{k_H + k_H k_L p\left[1+(k_L)^2\right] + k_L\left[(k_L)^2 - k_L p - 1\right]\right\} + \right.$$
$$\left. (k_D)^3\left\{k_H\left[k_L p + (k_L)^3 p - 1\right] - k_L\left[k_L(k_L + p) - 1\right]\right\}\right\} / B$$

$$Q_L^P = m \cdot \frac{(k_H)^2 k_L \left\{k_D - (k_D)^3 - k_L + k_D p\left[k_L + k_D (k_L k_D - 1)\right]\right\}}{B}$$

$$Q_D^P = m \cdot \frac{k_D (k_H)^2 (k_L)^3 (k_L p - 1)}{B}$$

where:

$$\begin{aligned} B = (1+m)\Big\{ & -k_L \left\{k_H \left[1 + k_L (k_H + k_L)\right] - k_L\right\} + 2(k_D)^2 p\left\{-k_H + k_L - (k_H)^2 k_L + (k_L)^3\left[(k_H)^2 - 1\right]\right\} + \\ & k_D \left\{k_H + k_H k_L p\left[1 + (k_L)^2\right] + k_L\left[(k_L)^2 - k_L p - 1\right] + (k_H)^2 k_L\left[1 - (k_L)^2 + k_L p\right]\right\} + \\ & (k_D)^3 \left\{k_L - (k_L)^2 (k_L + p) + k_H\left[k_L p + (k_L)^3 p - 1\right] + (k_H)^2 k_L\left[k_L (k_L + p) - 1\right]\right\}\Big\} \end{aligned}$$

Figures

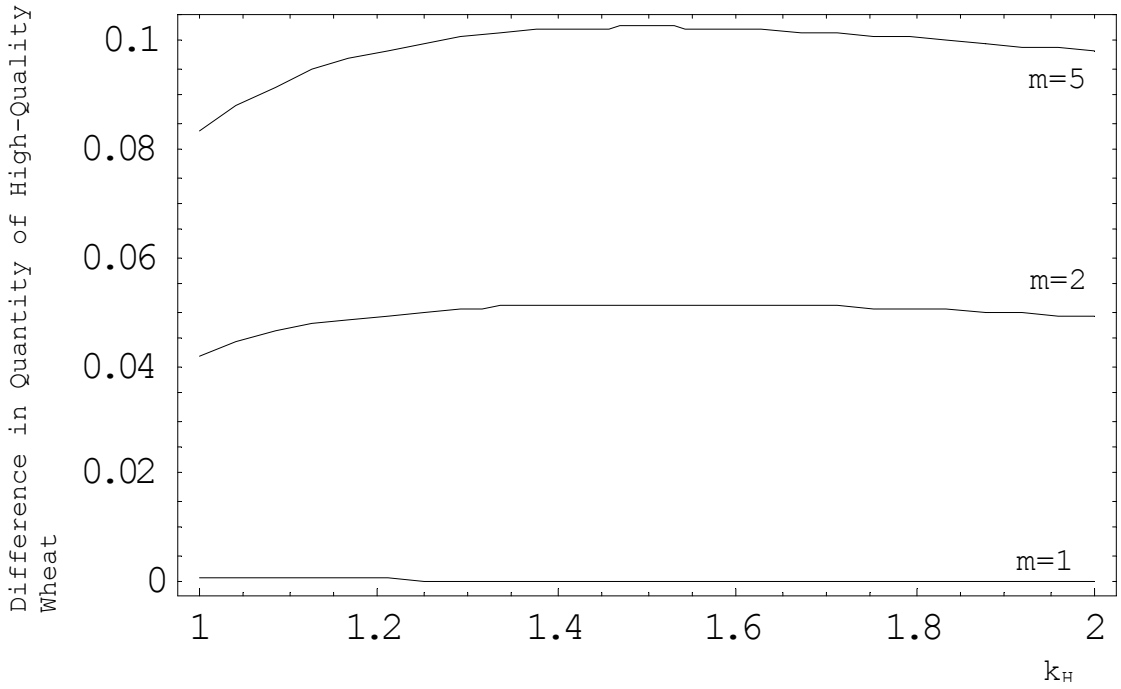


Figure 1. Difference in the quantity of high-quality wheat imported when *m* Cournot private traders replace a STE $\left(Q_H^P - Q_H^{STE}\right)$ (with k_D=0.7, k_L=1, and p=1.5).

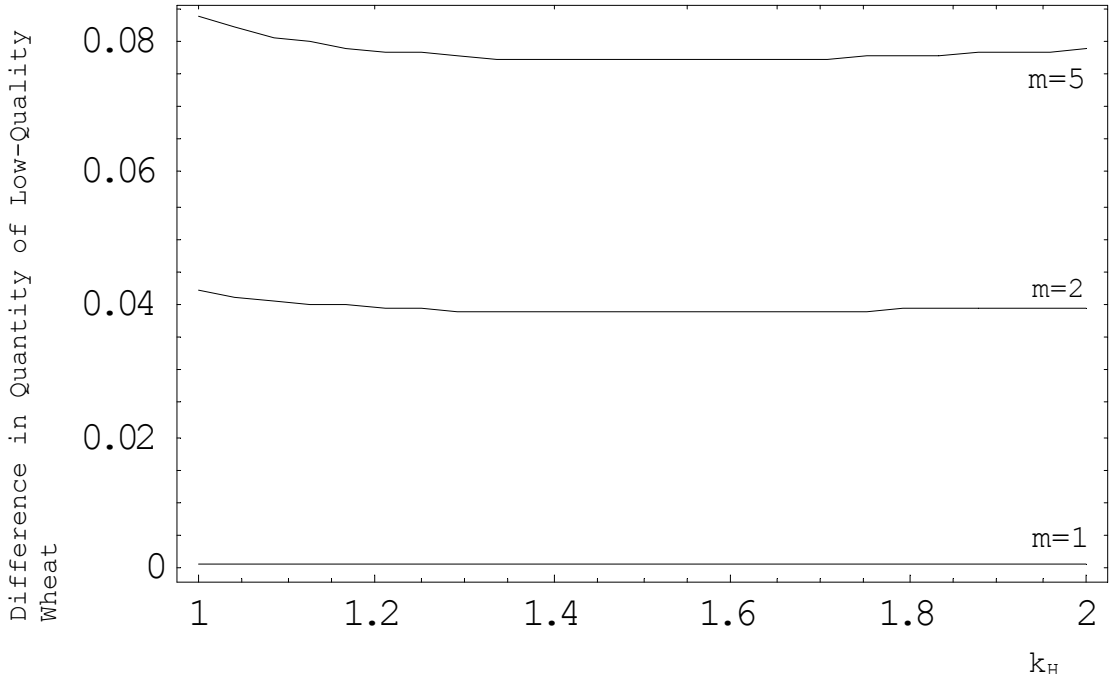


Figure 2. Difference in the quantity of low-quality wheat imported when *m* Cournot private traders replace a STE $\left(Q_L^P - Q_L^{STE}\right)$ (with k_D=0.7, k_L=1, and p=1.5).

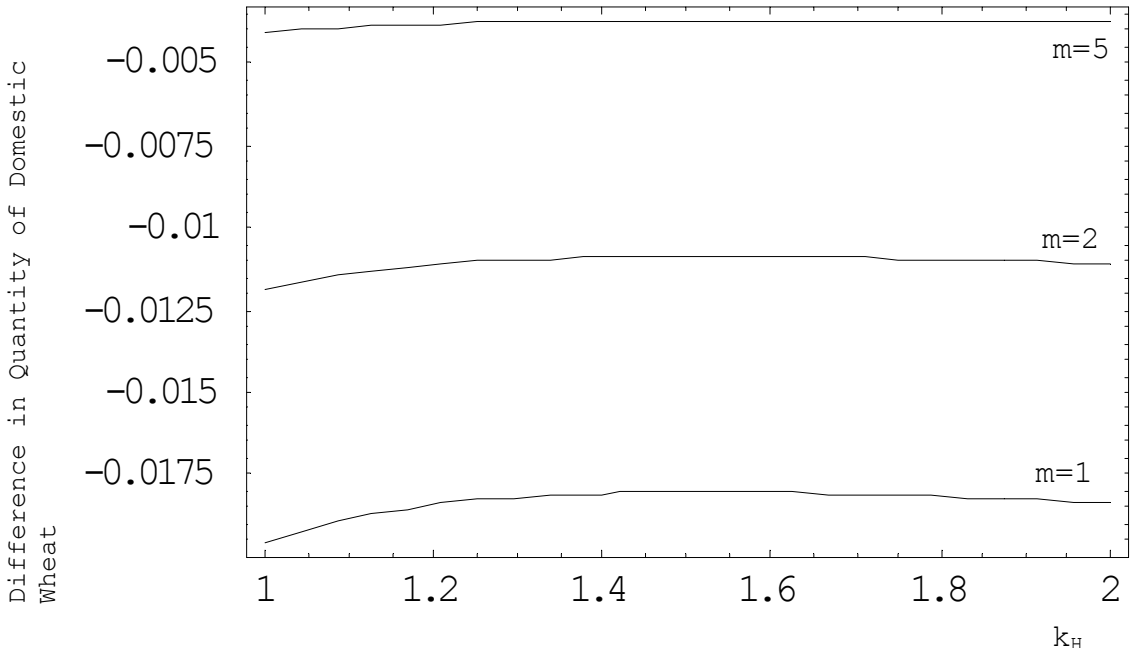


Figure 3. Difference in the equilibrium quantity of domestic wheat when *m* Cournot private traders replace a STE $\left(Q_D^P - Q_D^{STE}\right)$ (with k_D=0.7, k_L=1, and p=1.5).

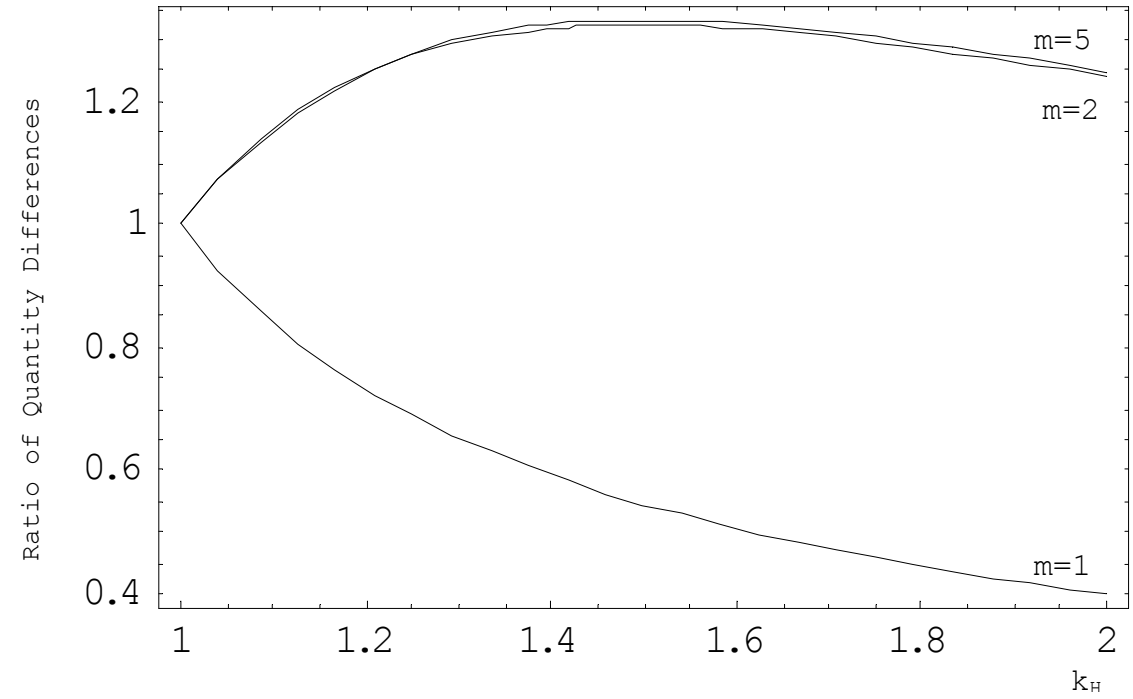


Figure 4. Ratio of the increase in high-quality relative to low-quality wheat when *m* Cournot private traders replace a STE $\left(\left(Q_H^P - Q_H^{STE}\right)/\left(Q_L^P - Q_L^{STE}\right)\right)$ (with k_D=0.7, k_L=1, and p=1.5).

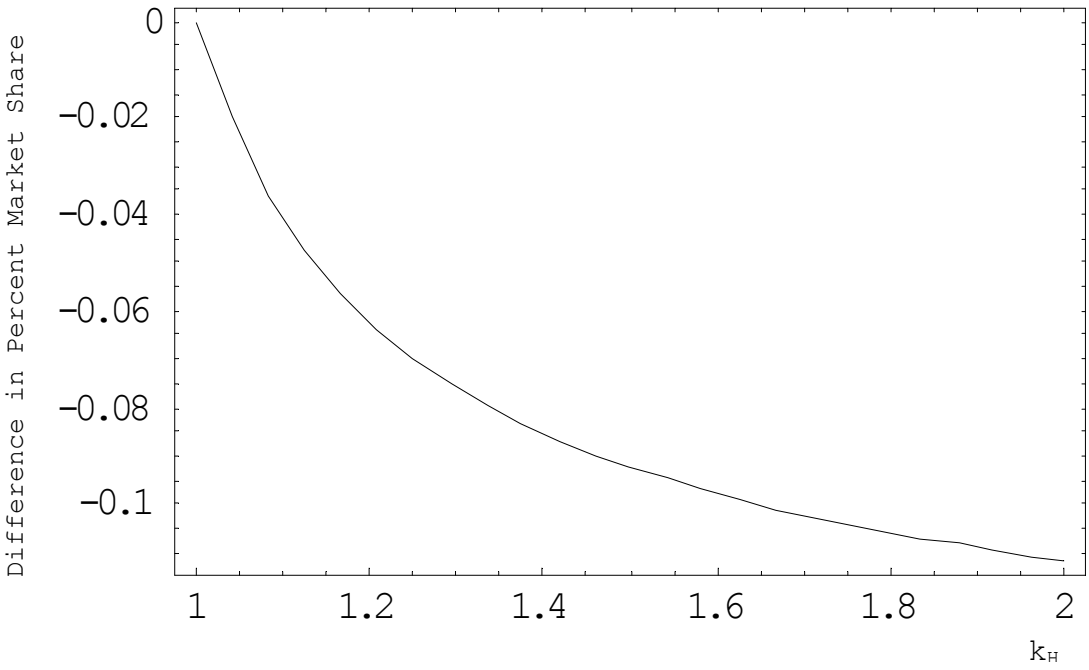


Figure 5. Difference in high-quality wheat share of imports between private traders and STE regimes (with k_D=0.7, k_L=1, and p=1.5).

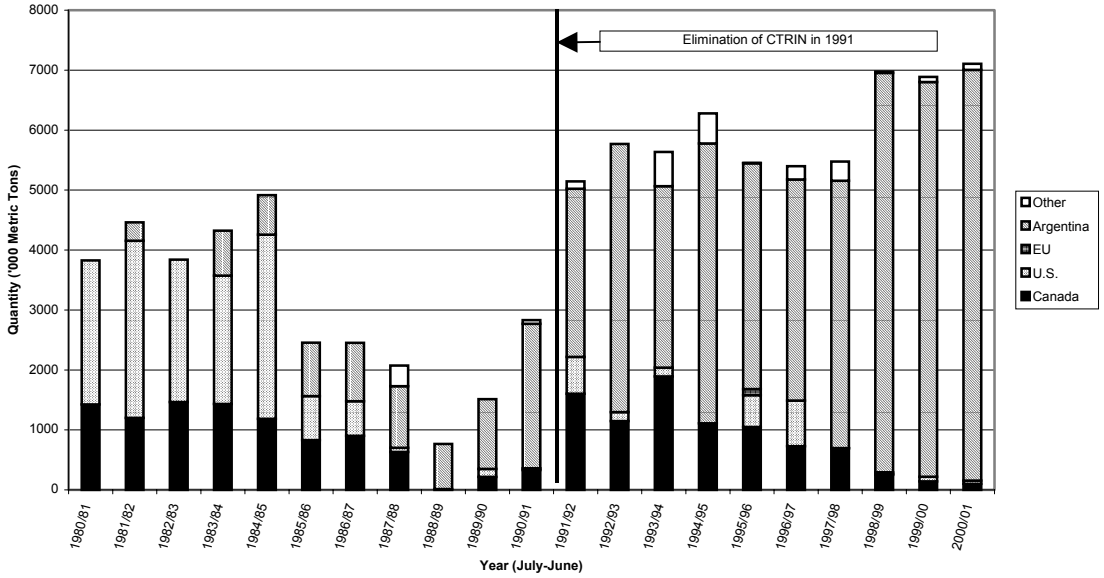


Figure 6. Exports of wheat by all exporters to Brazil. (Source: FAOSTAT)

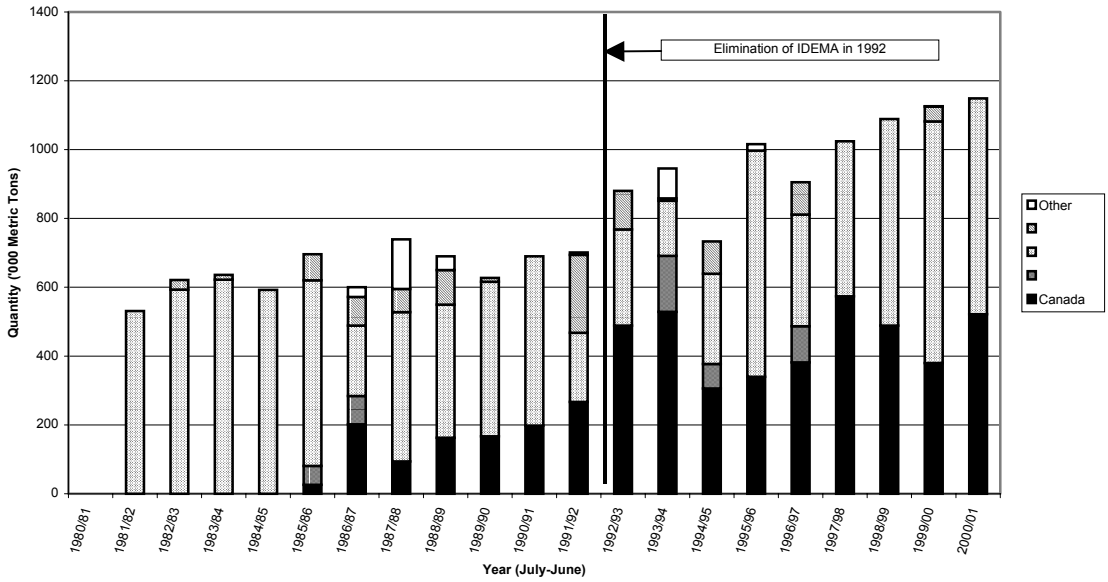


Figure 7. Exports of wheat by all exporters to Colombia. (Source: FAOSTAT)

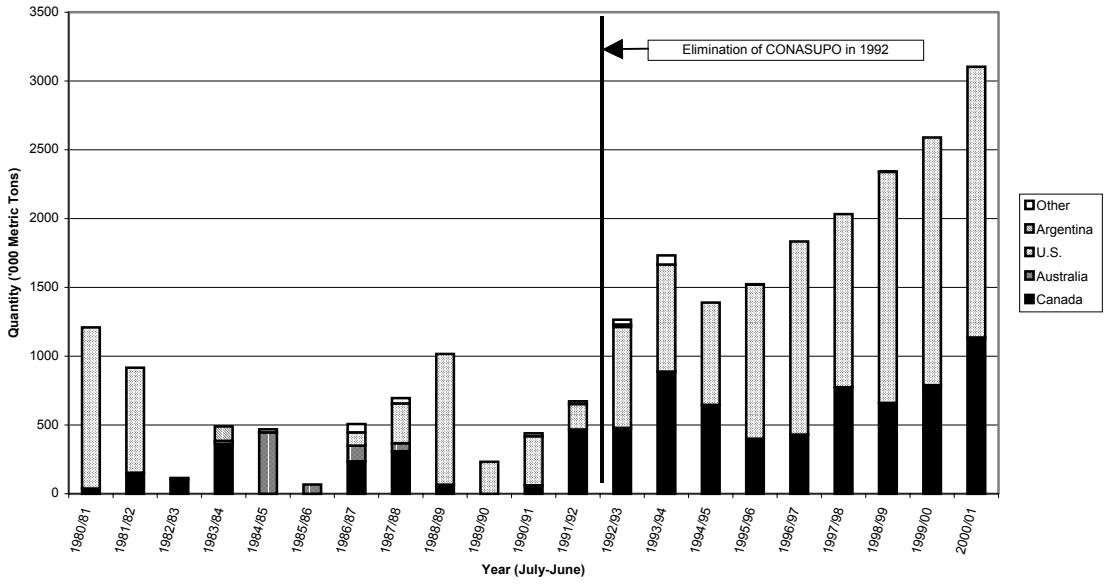


Figure 8. Exports of wheat by all exporters to Mexico. (Source: FAOSTAT)

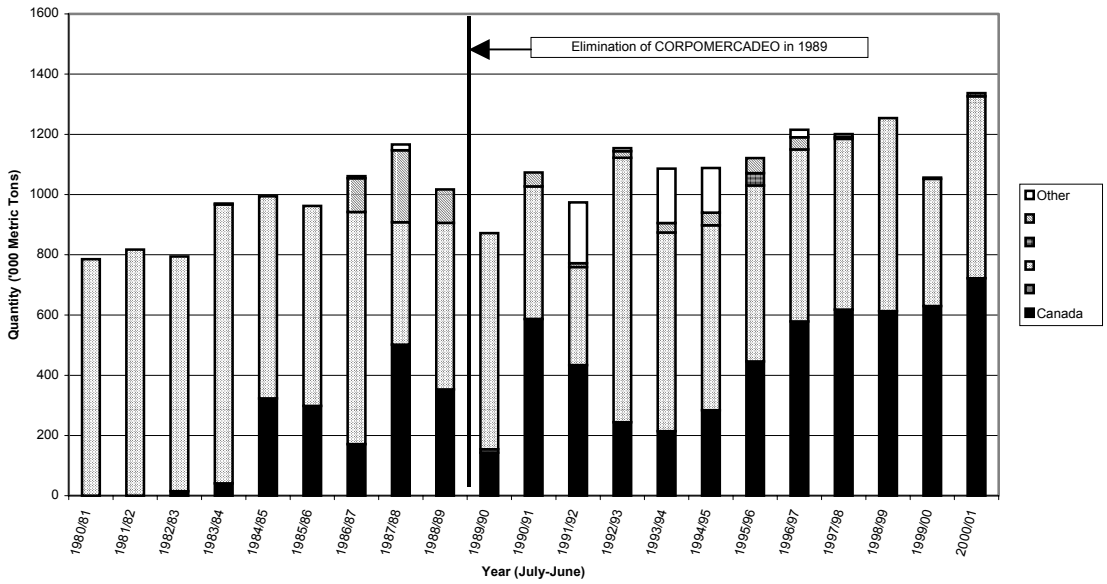


Figure 9. Exports of wheat by all exporters to Venezuela. (Source: FAOSTAT)

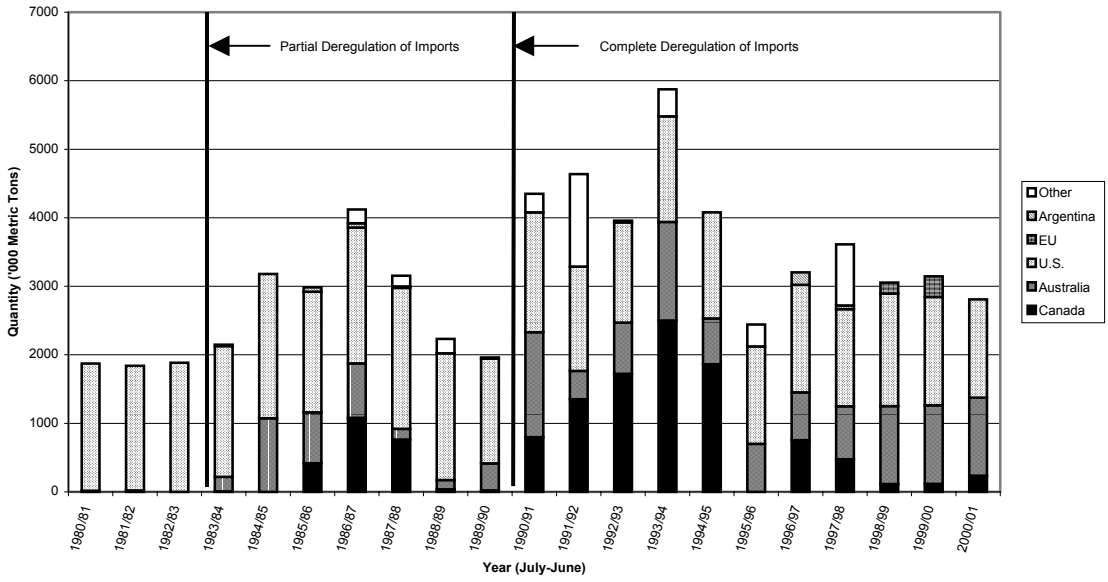
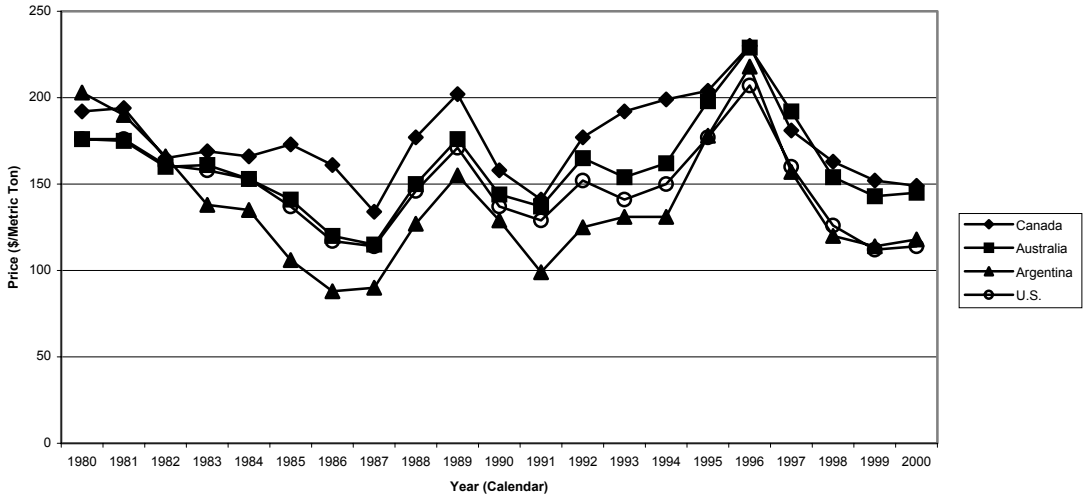


Figure 10. Exports of wheat by all exporters to South Korea. (Source: FAOSTAT)



Canada: No.1 Canada Western Red Spring 13.5%, in store St. Lawrence
Australia: Australian Standard Wheat, f.o..b.
Argentina: Argentine 2
U.S.: No.2 Hard Red Winter, Ordinary Protein, f.o.b. vessel, Gulf Port

Figure 11. Nominal export wheat prices. (Source: USDA, ERS, *Wheat Yearbook*)

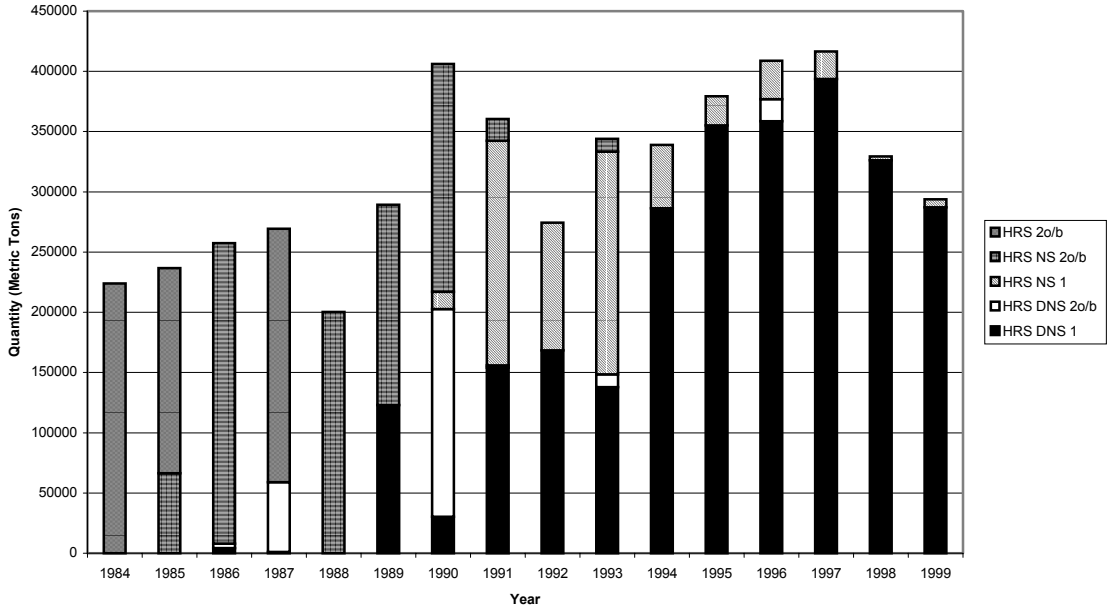


Figure 12. Exports of U.S. Hard Red Spring Wheat to South Korea. (Source: GIPSA)

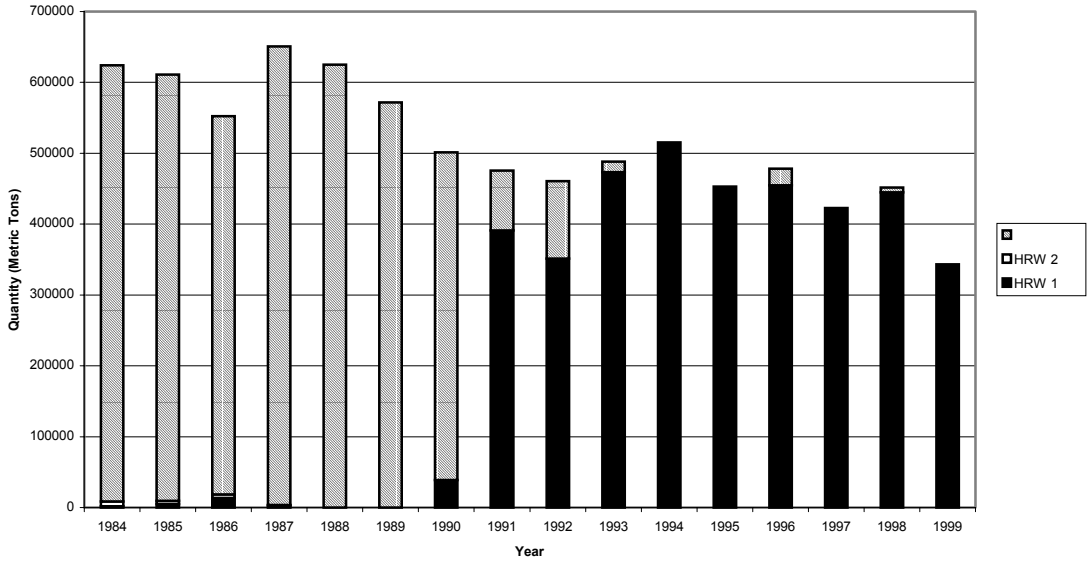


Figure 13. Exports of U.S. Hard Red Winter wheat to South Korea. (Source: GIPSA)