Endogenous Protection in the Mexican Corn and Sorghum Market

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Introduction

The interdependence between Mexico and the United States increased when these two countries ratified the North American Free Trade Agreement on January 1, 1994. With the advent of NAFTA, tariffs on many agricultural products were lowered or are in the process of being lowered by 2009. Corn is a commodity for which Mexico has until 2009 to completely eliminate its tariff. Until then, Mexico uses a tariff-rate quota which is divided among the various Mexican corn importers through import permits called "cupos".

Josling (1997), states that free trade is the absence of deliberate tariff barriers, non-tariff barriers such as quotas, and any discriminatory policy against imported goods. However, he goes on to state that governments are unlikely to allow such an ideal situation to arise. Mexico uses an administrative trade barrier (import permit) to protect its producers from U.S. corn imports deliberately inhibiting the trade flow between the two countries. The issuance of these import permits is a highly political process in which different lobbying groups put pressure on the Mexican government to either issue import permits or stop the issuance of import permits.

In this study a structural model of international marketing margins for an agricultural commodity and trade uncertainty is developed that links behavioral processes from the private market to political factors influencing administrative trade barriers. In doing so, this systematically links trade models specified by Gallagher (1998) and, which characterize private markets under uncertainty but ignore direct influences from political markets, to work by Trefler (1993),Gawande and Bandyopadhyay (2000), and Grossman and Helpman (1994), which focus on endogenous trade protection. In other words, instead of modeling trade uncertainty induced in part by political processes in a purely probabilistic manner, the behavioral processes that determine the likelihood of trade are identified using concepts of trade protection and public

choice analysis. The intent is that a trade model with endogenous protection can help better explain uncertainty in trade of agricultural commodities between Mexico and the U.S.

Background Information

Many barriers to free trade can be attributed to the political process. In their 1995 article, Grossman and Helpman added that politically motivated governments tilt negotiations in trade talks with other governments toward their most organized interest groups. This can be seen clearly in the NAFTA negotiations between the U.S. and Mexico concerning the sugar and corn policies. Tariff rates will reflect the strength of both the domestic and foreign interest groups. Protection will be particularly high when the domestic interest group is strong and the foreign interest group is weak, in relative strength in each country. An example is the corn agreement between the U.S. and Mexico, where Mexico administers a tariff rate quota where the amount of the quota increases until the tariff is completely abolished in 2009. It is assumed that exporter interest groups in the U.S. have more relative strength than producer groups in Mexico by the outcome of this agreement.

There have been few models that have empirically tested the effect of trade uncertainty on agricultural trade especially due to technical barriers to trade. Many models such as the one by Gallagher (1998) are theoretical in nature. Those that are empirical in nature seem to be concerned with changes in tariff rates or quotas and not technical or administrative barriers. Roberts and DeRemer (1997) and Ndayisenga and Kinsey (1994) have written case studies regarding technical barriers to trade. Roberts and DeRemer give an overview of the technical trade barriers encounters in agricultural trade and describe the challenges faced when trying to establish the costs and benefits of these barriers as opposed to the traditional trade barriers.

Ndayisenga and Kinsey (1994) studied the cause of growth of non-tariff trade measures on agricultural products.

In his article Pick (1990), analyzes the effects of exchange rate risk on U.S. agricultural exports to ten different countries including Mexico. Pick assumes that the demand for imports is a derived demand, where the imports are used in the domestic production of the final goods. He found that exchange rate risk did have an adverse affect on U.S. agricultural exports to Mexico.

In contrast, Gallagher (1998) considered marketing margins and trade determination in the presence of trade uncertainty due to administrative trade barriers. Where administrative (technical) trade barriers are classified as licenses, health restrictions, exchange rate risk, and import classifications, or any import procedure that appears or disappears when market conditions change.

Therefore, by combining politics, uncertainty, and administrative trade barriers the current study is adding to the lack of literature concerning technical barriers to trade. The Mexican corn import license is a combination of all of these trade barriers. Politicians decide to whom and when the licenses are issued. The uncertainty caused by these arbitrary decisions according to the literature should have an adverse affect on U.S. exports to Mexico, thereby increasing import price and decreasing export quantity.

Mexican Agricultural Policy under NAFTA

The Mexican government's policy on trade has changed significantly in the last 20 years. Before NAFTA, Mexico followed a policy of import substitution and severe import restrictions. With the advent of NAFTA, Mexico shifted to a more open economy by opening its borders (in a cautious way) to foreign imports.

Trade Policy

With NAFTA, tariffs on many agricultural products were lowered. Although corn will have restricted access into the Mexican market until 2009, with Mexico having to allow an increasing amount of corn into the country every two years from ratification (Josling 1997). The Mexican government controls agricultural imports through licensing requirements, tariffs, and export duties (Smith 1984; Mielke 1984). Although the overall controls are determined by a committee of public and private officials, issuance of import licenses is done by the Secretariat of Commerce and Industrial Development (SECOFI) and none are issued until the domestic crop has been purchased (Mielke 1989). The Mexican government's aim of using import licenses is to avoid displacing domestic production. One of the main problems of this licensing policy and the basis of this study is that the terms of the import license are subject to change without notice, thereby adding uncertainty to the trade flow of white corn between the U.S. and Mexico.

Despite the economic cost, the political price of an open border policy in corn would be excessive because of its central role as a subsistence crop for most of Mexico's peasants. Although, ending government intervention in the market would affect all consumers it may disproportionately affect the poor. According to Garcia (1990) tortillas and flour may be subsidized by as much as 40 percent. Small tortilla shops sell to low-income consumers and supply 60 percent of the market while industrial tortilla producers sell to high-income consumers in urban areas.

Interest Groups

Several groups have been on opposing sides for the liberalization of the corn market. Since the ratification of NAFTA in 1994, these groups can be placed into two general categories,

those opposing the issuance of import permits because of fear that corn imports will damage domestic producers and those for the issuance of import permits because of a need for low cost inputs of consistent quality. The different groups that have been historically for and against import permits can be characterized as three distinct groups: (1) producer groups and peasant associations, (2) industrial processors, and (3) sugar manufacturers.

Beginning with producer groups, they have historically been against the issuance of import permits as they regard lower priced U.S. corn as a rival in their market. It has been shown that completely liberalizing a commodity market does have a detrimental affect on Mexican producers. For example, Bivings (1997) showed that the liberalization of the sorghum market in Mexico hurt Mexican producers who could not compete with U.S. sorghum imports. The Mexican government did not re-instate import permits in this case but did put in place seasonal tariffs on imports, domestic price controls, and a storage subsidy scheme (Bivings 1997). Therefore, producers are very wary of U.S. imports. However, Mexico as stated previously is a net importer of corn so the government has not choice but to allow imports (especially after its became a member of NAFTA). In its effort to appease the producers the government has tried to institute a policy of not issuing permits during the domestic harvest in an attempt to avoid displacing domestic production and keeping prices high.

Second, producer groups have continuously protested the issuance of import permits and the distribution of those permits. Producer groups led by the Consejo Agrario Permanente (CAP), have lobbied for the inclusion of producers in the decision making process for when, how, and how many import permits will be issued. They have continually protested that SECOFI and the Cupo (import permit) Committee have always consulted with industrial groups

but leave producers out of the process. The import permit committee is made up of SECOFI officials, industry representatives, and CONASUPO.

The group more consistently consulted about import permits has been the industrial users of corn. This group includes the livestock industry, the industrial producers of tortillas, the corn flour industry, and the starch industry. These groups have historically lobbied for import permits to be issued in a consistent manner. Of the four industrial groups mentioned the starch industry is the group that always gets their import permits issued. The starch industry includes large companies such as Almidones Mexicanos (ALMEX) that have ties to companies in the U.S such as Archer Daniels Midland Company (ADM) and A.E. Staley Manufacturing Company. The starch industry is the only industry to be issued import permits consistently, quarter after quarter. This may be because it usually imports yellow corn and is not a direct competitor in the white corn market. Another heavy hitter in this group is Gruma, which has a 70% share of the corn flour market in Mexico. Gruma is also a 22% owner of ADM.

The third group that has historically expressed an interest in corn import permits is the sugar group. One industry in the sugar group consists of manufactures of high fructose corn syrup (HFCS) in Mexico, which normally lobby for corn import permits. Another industry that is part of the sugar group is sugar producers in Mexico that normally lobby against import permits. Sugar manufactures in Mexico have claimed that the NAFTA negotiations worked against them since the U.S. restricts sugar imports and although sugar imports will increase they do so only if the Mexican demand for sugar increases (including demand for HFCS) but Mexico has an obligation to increase its corn imports significantly. They claim that not only is their export market restricted but also a low cost competitor has entered their market (Mena 1997).

Devadoss, Kropf, and Wahl (1995) concur that the establishment of a corn sweetener market and the substitution of HFCS for sugar in Mexico will decrease Mexican sugar consumption. Like the industrial manufacturers of corn tortillas, the manufacturers of corn sweetener, and HFCS lobby for the issuance of import permits. They claim that in order to compete in the market they must be allowed to import high quality low-cost inputs that include corn.

Linking Political and Private Markets

This section proceeds systematically by first conceptualizing a trade protection model. Then, the trade model is extended by recognizing the simultaneous relationships between import demand and trade protection in Mexico.

Market for Trade Protection

The Mexican government's aim of using import permits is to avoid displacing domestic production (Personal interviews; Mielke 1989; Garcia 1990). Therefore, the issuance of import permits is a highly political process. The concept of endogenous protection is discussed and used to link political market factors to the structural trade equilibrium model through the import demand functions.

For illustrative purposes consider isolating a simple market model of trade protection for the *i*th commodity (*i* = *w* for white corn, *y* for yellow corn, and *s* for sorghum). This can be conceptualized as an equilibrium model in the form:

(1) $$Q_{EPi}^{d} = f_{EPi}^{d}(P_{EPi}, Z_{EPi}^{d})$$

(2) $$Q_{EPi}^{s} = f_{EPi}^{s}(P_{EPi}, Z_{EPi}^{s})$$

(3) $$Q_{EPi}^{d} = Q_{EPi}^{s} = Q_{EPi}$$

Here, Q^d_{EPi} is the quantity demanded of protection for the ith commodity, Q^s_{EPi} is the quantity supplied of protection, P_{EPi} is the price of protection, and $Z^d_{EPi}(Z^s_{EPi})$ is a matrix of exogenous factors of demand (supply). The last equation (3) is a simple market clearing condition.

In the case above the Mexican government is the supplier of protection from corn and sorghum imports. Its use of corn import permit to avoid displacing domestic production demonstrates how it provides protection to its producers. The demanders of import protection are the peasant associations, producer groups, and sugar manufacturers. However, there is another group that has a vested interest in this market. This group can be called the industrial users of corn and is made up primarily by the starch industry, tortilla industry, livestock industry, corn flour industry, and cereal industry. The industrial users of corn lobby to have import permits issued in a consistent and timely manner. Domestic producers of corn and sugar, lobby for import permits not to be issued at all and especially not during harvest. Meanwhile, the Mexican government is trying to maximize its political support by placating both groups.

From the equilibrium model of trade protection, it is possible to employ the implicit function theorem (under appropriate conditions) to solve the system for the endogenous variables in terms of the exogenous variables. This yields the reduced form equations for Q_{EPi} and P_{EPi}:

(4) $$Q_{EPi} = h_q(Z^d_{EPi}, Z^s_{EPi})$$

(5) $$P_{EPi} = h_p(Z^d_{EPi}, Z^s_{EPi})$$

Equation (4) is the reduced form equation for quantity of trade protection and equation (5) is the reduced form equation for the price of trade protection.

We hypothesize that quantity and price of protection are a function exogenous factors such as macroeconomic, political, and production variables. An example of a political variable

that can affect the level of protection is producer pressure on government officials to halt the issuance of import permits. As pressure from producer associations in Mexico increases, the level of protection will increase as the number of import permits issued decreases. In contrast, Mexican importers lobby to get import permits issued in a timely and consistent manner. Historically importers have had more influence on SECOFI since they were normally consulted when plans for import permits were being made. Therefore, one would expect that as pressure from importers mounts the level of protection decreases as the amount of import permits increases.

Protection and Import Demand Models

The concept of endogenous protection hypothesizes that markets of imports are simultaneously determined with markets for trade protection (see Magee, Brock, and Young 1989; Trefler 1993; Gawande and Bandyopadhyay 2000). Under this assumption, a generalized simultaneous equation model of import demands can be defined as follows:

(6) $$Q_i^d = g_i(P_i, \mathbf{P}_{(i)}, \mathbf{Q}_{(i)}, Z_i) \text{ for } i = wr, yr, sr$$

where $\mathbf{P}_{(i)}, \mathbf{Q}_{(i)}$ are right hand side endogenous protection variables. In equation (6) the quantity demanded of the *i*th import commodity is a function of the endogenous import variables, endogenous protection variables, and exogenous variables. Similarly, each demand and supply function of protection for the *i*th commodity could be re-specified to be simultaneously determined with quantity demanded and prices of imports. In this manner, the level of trade protection is not treated as given. Rather, as Trefler (1993) states "the theory of endogenous protection predicts that in response to increased import competition, private domestic interests

will intensify their lobby activity for protection: higher levels of import penetration will lead to greater protection."

Figure 1 shows the link between the import market and the market for trade protection. As the demand for protection increases in Panel A, the protection market, due, for example, to an increase in the lobbying efforts by corn producers in Mexico, there is an increase in the quantity of protection. This increase in the quantity of protection causes less import permits to be issued, that is, it causes a leftward shift in import supply. This decrease in import supply results in a decrease in the quantity imported and an increase in the import price.

In Mexico, the Secretariat of Commerce and Industrial Development (SECOFI) issues the import license permits through a Tariff Commission (import permit committee). The import permit committee is made up government officials and industry leaders. The government in order to avoid displacing domestic production does not begin issuing import permits until the domestic crop has been purchased (Mielke 1989). The Mexican government identifies the industries that will need to import corn and ensures that they buy domestic corn. In order for these firms to be assured an import permit they must participate in the domestic market. In other words, they must buy a certain amount of domestic corn in order to be assured of getting an import permit and for that import permit to be for a desired amount.

Linking Import Demand to Trade Protection

Because the quantity and price of trade protection are not observable for Mexican corn and sorghum, the reduced form equations will become useful in linking import demand equations to political market variables. Zellner (1970) and Goldberger (1972) both discuss simultaneous equation models where endogenous dependent variables are not observable. Zellner points out,

that functional relationships containing unobservable variables can be compensated by using an instrumental variable approach. As a result, substituting the reduced form relationships from the trade protection market into the simultaneous import demand equations in equation (6) yields:

(7) $Q_{wr}^{d} = g_{wr}(P_{wr}, P_{yr}, P_{sr}, \mathbf{Z}_{p}, Z_{wr})$

(8) $Q_{yr}^{d} = g_{yr}(P_{yr}, P_{wr}, P_{sr}, \mathbf{Z}_{p}, Z_{yr})$

(9) $Q_{sr}^{d} = g_{sr}(P_{sr}, P_{wr}, P_{yr}, \mathbf{Z}_{p}, Z_{sr})$

where the $\mathbf{Z}_{p}$ are exogenous factors influencing trade protection. The specification in equations (7)-(9) indicates that import quantities are functions of endogenous prices and quantities, as well as political and other exogenous variables. Econometric issues associated with estimating these equations are discussed in later.

As stated previously, the factors hypothesized to influence the quantity of Mexican trade protection include macroeconomic variables, political factors, and production variables. Macroeconomic variables could be exchange rates, political factors could be producer pressure on government officials, and production variables could be domestic yield.

Data

The data were collected from various sources, including the United States Department of Agriculture's (USDA) Federal Grain Inspection Service (FGIS) and the Food and Agricultural Organization (FAO) of the United Nations. Data was collected monthly from 1994 to 2000. Table 1 and Table 2 contain definitions of data variables for and the descriptive statistics respectively.

The quantity of white corn, yellow corn, and sorghum inspected for export to Mexico per month from 1994 to 2000 was obtained from United States Department of Agriculture (USDA),

Federal Grain Inspection Service (FGIS). All grain exported from the U.S. must be inspected by the Federal Grain Inspection Service of the USDA and the inspections are done when the grain is loaded on either the vessel or the railcar. FGIS keeps a record of all commodities inspected for export by U.S. region and destination in metric tons. Therefore, if no inspections of white corn, yellow corn, or sorghum took place in a certain month then those grains were not exported during that month.

The yellow corn data demonstrates that there are few months were yellow corn is not inspected for export. In fact the only two months when yellow corn inspection did not take place were January and February 1994. Those months however, coincide with a higher quantity of sorghum being inspected for export to Mexico. It seems that there is an inverse relationship between sorghum and yellow corn inspections.

There are many months that the quantity of white corn export inspections is zero. That is, no export inspection of white corn took place during those months, i.e. no white corn was exported during those months. It seems that the period when quantity inspected is at its highest is during the later part of the year (July to December) for all three commodities.

Total U.S. monthly exports to Mexico, which include agricultural and nonagricultural goods, were obtained from the U.S. Department of Commerce. The export variables should also capture other reasons why exports would not occur such as currency devaluations and exchange rates. Total exports from the U.S. to Mexico can indicate the import penetration of U.S. products into Mexico. This variable shows an increasing trend for the period between January 1994 and December 2000 with the exception of 1995. Total exports exhibited a downward trend in 1995 when Mexico suffered another economic crisis and peso devaluation.

Articles in the medial concerning the use and allocation of import permits were collected from Lexis-Nexis and the USDA, Foreign Agricultural Service (FAS). These articles are used as a proxy for producer pressure to stop the use of import permits and therefore halt duty-free imports similar to methods used by The articles are from the period between 1994 and 2000 and range from having no articles in one month to having several in another month. The articles in the media include Mexican government officials discussing the use of import permits with the Secretariat of Agriculture, producer groups protesting imports at the border, and producer associations protesting the allocation of import permits. Most of the negative articles were referencing corn and sorghum producers pressuring the government to halt grain imports. Some articles also dealt with sugar producers unhappy with corn imports coming into the country duty-free.

Import permit allocations were obtained from FAS from 1994 to 2000. The allocations tell the quantity that each industry received in each quarter. If an import permit was issued to an industry for a certain quarter a 1 was placed for all three months in that quarter and 0 otherwise. The industries to which corn import permits are allocated are the starch industry, the livestock industry, the cereal industry, the corn flour industry, the tortilla industry, and CONASUPO.

The cash prices in U.S. dollars for yellow corn and sorghum were obtained from National Agricultural Statistics Service (NASS), USDA. Cash prices were obtained on a monthly basis from January 1994 to December 2000.

The cash price for white corn was obtained from Chris Morely from Global Risk Management Corporation (GMRC). However, the GMRC data for white corn was not complete and only covered the period from September 1997 to April 2000. This three year data set was in

daily terms so the average for each month was used. In order to have a complete data set for white corn, yellow corn cash price was used to estimate white corn cash price using Ordinary Least Squares (OLS) and the results are shown in Table 3. Two other OLS models were estimated, which also had the lagged yellow corn cash price and the corn futures price added as regressors, but those models showed no improvement from just having the present yellow corn cash price. The estimated values for white corn were then used for the missing values. The nominal daily exchange rate between the U.S. dollar and the Mexican peso was obtained from the Bank of Canada. The daily values were then averaged for the each month for the period from January 1994 to December 2000.

The trend in the cash prices for white corn, yellow corn, and sorghum is shown in Figure 2. The prices for white corn and sorghum follow very closely the trend in the yellow corn price. This is to be expected since white corn and sorghum are traded off yellow corn. This trend is shown in Figure 2 where the white corn price is consistently higher and the sorghum price lower, respectively from the yellow corn price.

Data for monthly corn and sorghum imports was obtained from FGIS for the period between January 1994 and December 2000 in metric tons and shown in Figure 3. One can see that when sorghum imports are high yellow corn import are low and vice versa. There are very few months were imports of yellow corn or sorghum did not take place. However, there are many months especially before July 1998 that imports of white corn did not take place. The times when imports of white corn did not take place coincides with decreased allocation of import permits to white corn importing industries such as the tortilla industry.

Empirical Analysis

Import demand equations were derived by conceptualizing a restricted normalized quadratic profit function and by following Diewert and Morrison's (1986) approach. The Mexican import demand models are estimated simultaneously with the demand for protection using an instrumental variables approach used by Zellner (1970), when estimating regression relationships with unobservable independent variables. Import demand is linked to trade protection by specifying equations (7)-(9). The import demand equations were estimated using a simultaneous tobit model with monthly data from January 1994 and December 2000. Goodwin and Featherstone (1995) and others have used simultaneous tobit models in the agricultural economics literature.

Specifying the Import Demand Model

Consider, for example, the white corn import demand model represented in equation (10) which is a function of quantity of yellow corn imported (Q_{yr}^{d}), quantity of sorghum imported (Q_{sr}^{d}), the quantity of import protection (Q_{EPw}), exogenous variables associated with the import demand of white corn X_{wr}, price of white corn $\left(P_{wr}\right)$, price of yellow corn $\left(P_{yr}\right)$, price of sorghum $\left(P_{sr}\right)$, and an error term e_{wr}:

(10) $$Q_{wr}^{d} = \beta_1 Q_{yr}^{d} + \beta_2 Q_{sr}^{d} + \beta_3 Q_{EPw} + \beta_4 X_{wr} + \beta_5 P_{wr} + \beta_6 P_{yr} + \beta_7 P_{sr} + e_{wr}$$

Equations (11-13) represent reduced form functions of the import demand for yellow corn, import demand for sorghum, and quantity of import protection for white corn, respectively:

(11) $$Q_{yr}^{d} = \alpha_{yr}\Pi_{yr} + v_{yr}$$

(12) $$Q_{sr}^{d} = \alpha_{sr}\Pi_{sr} + v_{sr}$$

(13) $Q_{EPw} = \alpha_{EPw}\Pi_{EPw} + v_{EPw}$

As stated previously the quantity of import protection for white corn is not observable, therefore the reduced form relationships in equation (13) are substituted into equation (10).

(10') $Q^d_{wr} = \beta_1 Q^d_{yr} + \beta_2 Q^d_{sr} + (\beta_3\alpha_{EPw})\Pi_{EPw} + \beta_5 X_{wr} + \beta_6 P_{wr} + \beta_7 P_{yr} + \beta_8 P_{sr} + u_{wr}$

where, $u_{wr}=bv_{EPw}+e_{wr}$. In effect this is analogous to Theil's (1971) approach to achieving consistent estimates for two stage least squares, which is a reduced form representation of the structural form model in equation (10). A limitation of this process of dealing with unobservable independent variables is the inability to identify α_{EPw} from β_3 in the estimation process, since the quantity of import protection is not known. However, the model still yields consistent estimates of $(\beta_3\alpha_{EPw})$, which are particularly valuable for prediction and simulation purposes. The above white corn model, as well as the models for yellow corn and sorghum are explicitly expressed in the next section.

In order to determine if the quantities of white corn, yellow corn, and sorghum are jointly determined a test for exogeneity in a simultaneous equation tobit model is performed using the approach by Smith and Blundell (1986). First, three separate OLS regressions are performed for white corn, yellow corn and sorghum inspections. The residuals of these regressions are then used in the tobit models for in the respective commodities.

A t-test can be used to test the single null hypothesis H_o:b=0. We reject the null hypothesis of weak exogeneity if the coefficient on the residual $\hat{v}_{EP_w}$, an estimate of b, is significantly different from zero. This t-test is preformed for the simultaneous models for white corn, yellow corn, and sorghum.

Import Demand Models with Endogenous Protection

The import demand models with endogenous protection are specified from the conceptual models. The import demand for white corn, yellow corn, and sorghum are specified in equations (14) – (16), respectively. The equations estimated for white corn import demand are as follows:

$$(14) \quad Q_{wri}^{d*} = \beta_1 Q_{yri}^{d} + \beta_2 Q_{sri}^{d} + Z_{wri}\gamma + X_{wri}\tau + \beta_3 P_{wri} + \beta_4 P_{yri} + \beta_5 P_{sri} + \alpha_1 v_{yri} + \alpha_2 v_{sri} + u_{wri}$$

$$Q_{wri}^{d} = Q_{wri}^{d*} \quad \text{if } Q_{wri}^{d*} > 0$$
$$Q_{wri}^{d} = 0 \qquad \text{otherwise}$$

Where, the parameters to be estimated are β, γ, and τ. The variables Q_{yri}^{d} and Q_{sri}^{d} denote import quantities of yellow corn and sorghum, respectively. The variable Z_{wri} is a matrix of import protection variables and the variable X_{wri} is a matrix of exogenous variables associated with the import demand of white corn. The variable X_{wri1} is a linear trend variable and X_{wri2} is a quadratic trend variable. A quadratic time trend is used because with the implementation of NAFTA imports increased rapidly in 1994 and 1995 and then began to plateau beginning in 1998. The variable X_{wri3} is total import demand in Mexico for agricultural and non-agricultural products; X_{wri4} and X_{wri5} denote the Mexican production of corn and sorghum, respectively; and X_{wri6} is the constant. Further, P_{wri} is the U.S. cash price for white corn, P_{yri} is the U.S. cash price for yellow corn, P_{sri} is the U.S. cash price for sorghum. U.S. cash prices are used because the import price for corn and sorghum in Mexico is based on the futures price of the Chicago Board of Trade and are multiplied by the exchange rate.

The variable Z_{wri1} denotes the news on producer pressure and Z_{wri2} - Z_{wri7} denote industry allocations of import permits starting with the corn flour industry, the tortilla industry, the starch industry, the livestock industry, CONASUPO, and the cereal industry. Lagged variables for

protection are also added. It is assumed that having an import permit last month will have an effect on import demand for this month. Therefore, Z_{wri8} is lagged producer pressure, Z_{wri9} is lagged import permit allocation to the livestock industry, Z_{wri10} is lagged import permit allocation to the cereal industry, Z_{wri11} is lagged import permit allocation to the corn flour industry, Z_{wri12} is lagged import permit allocation to CONASUPO, Z_{wri13} is lagged import permit allocation to the tortilla industry, and Z_{wri14} is lagged import permit allocation to the starch industry.

The equations estimated for the import demand for yellow corn are as follows:

$$(15) \quad Q_{yri}^{d*} = \beta_1 Q_{wri}^{d} + \beta_2 Q_{sri}^{d} + Z_{yri}\gamma + X_{yri}\tau + \beta_3 P_{wri} + \beta_4 P_{yri} + \beta_5 P_{sri} + \alpha_1 v_{wri} + \alpha_2 v_{sri} + u_{yri}$$

$$Q_{yri}^{d} = Q_{yri}^{d*} \quad \text{if } Q_{yri}^{d*} > 0$$
$$Q_{yri}^{d} = 0 \qquad \text{otherwise}$$

Where, the parameters to be estimated are β, γ, and τ. The variables Q_{wri}^{d} and Q_{sri}^{d} denote import quantities of yellow corn and sorghum, respectively. The variable Z_{wri} is a matrix of import protection variables and the variable X_{wri} is a matrix of exogenous variables associated with the import demand of white corn. Further, P_{wri} is the U.S. cash price for white corn, P_{yri} is the U.S. cash price for yellow corn, P_{sri} is the U.S. cash price for sorghum. U.S. cash prices are used because the import price for corn and sorghum in Mexico is based on the futures price of the Chicago Board of Trade and are multiplied by the exchange rate.

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The variable Z_{wri1} denotes the news on producer pressure and Z_{wri2} - Z_{wri7} denote industry allocations of import permits starting with the corn flour industry, the tortilla industry, the starch industry, the livestock industry, CONASUPO, and the cereal industry. Lagged variables for protection are also added. It is assumed that having an import permit last month will have an effect on import demand for this month. Therefore, Z_{wri8} is lagged producer pressure, Z_{wri9} is lagged import permit allocation to the livestock industry, Z_{wri10} is lagged import permit allocation to the cereal industry, Z_{wri11} is lagged import permit allocation to the corn flour industry, Z_{wri12} is lagged import permit allocation to CONASUPO, Z_{wri13} is lagged import permit allocation to the tortilla industry, and Z_{wri14} is lagged import permit allocation to the starch industry

The equations estimated for the import demand for sorghum are as follows:

$$(16) \qquad Q_{sri}^{d*} = \beta_1 Q_{wri}^{d} + \beta_2 Q_{yri}^{d} + Z_{sri}\gamma + X_{sri}\tau + \beta_3 P_{wri} + \beta_4 P_{yri} + \beta_5 P_{sri} + \alpha_1 v_{wri} + \alpha_2 v_{yri} + u_{sri}$$

$$Q_{sri}^{d} = Q_{sri}^{d*} \quad \text{if } Q_{sri}^{d*} > 0$$
$$Q_{sri}^{d} = 0 \qquad \text{otherwise}$$

Where, the parameters to be estimated are β, γ, and τ. The variables Q_{wri}^{d} and Q_{yri}^{d} denote import quantities of yellow corn and sorghum, respectively. The variable Z_{wri} is a matrix of import protection variables and the variable X_{wri} is a matrix of exogenous variables associated with the import demand of white corn. Further, P_{wri} is the U.S. cash price for white corn, P_{yri} is the U.S. cash price for yellow corn, P_{sri} is the U.S. cash price for sorghum. U.S. cash prices are used because the import price for corn and sorghum in Mexico is based on the futures price of the Chicago Board of Trade and are multiplied by the exchange rate.

The variable X_{wri1} is a linear trend variable and X_{wri2} is a quadratic trend variable. A quadratic time trend is used because with the implementation of NAFTA imports increased

rapidly in 1994 and 1995 and then began to plateau beginning in 1998. The variable X_{wri3} is total import demand in Mexico for agricultural and non-agricultural products; X_{wri4} and X_{wri5} denote the Mexican production of corn and sorghum, respectively; and X_{wri6} is the constant.

The variable Z_{wri1} denotes the news on producer pressure and Z_{wri2} - Z_{wri7} denote industry allocations of import permits starting with the corn flour industry, the tortilla industry, the starch industry, the livestock industry, CONASUPO, and the cereal industry. Lagged variables for protection are also added. It is assumed that having an import permit last month will have an effect on import demand for this month. Therefore, Z_{wri8} is lagged producer pressure, Z_{wri9} is lagged import permit allocation to the livestock industry, Z_{wri10} is lagged import permit allocation to the cereal industry, Z_{wri11} is lagged import permit allocation to the corn flour industry, Z_{wri12} is lagged import permit allocation to CONASUPO, Z_{wri13} is lagged import permit allocation to the tortilla industry, and Z_{wri14} is lagged import permit allocation to the starch industry

Hypothesis Tests

The single null hypothesis H_o: $\beta_i=0$ is tested using an asymptotic z-value. A joint null hypothesis H_o: β_i, β_j =0 is tested using a likelihood ratio test statistic that is asymptotically chi-squared distributed with degrees of freedom equal to the number of parameter restrictions (Griffiths et al 1993).

The import demands for white corn, yellow corn, and sorghum are a function of prices, production variables, and political variables. One can state a priori what the expected effects of the price and production variables will be on the quantity demanded of corn and sorghum. According to the marginal effects in the next section one would expect that as the supply of

protection increases, import demand decreases and that as the demand for protection decreases, import demand increases.

One would expect that if yellow corn and sorghum are being imported that the quantity imported of white corn will also increase. If total imports increases then the one would expect that imports of white corn will also increase. One expects that the domestic production of corn and sorghum will have a negative effect on the import demand for white corn. One also expects that if the price of yellow corn increases the import demand for white corn will decrease since white corn price is at a premium to yellow corn price. If the tortilla industry increases its lobbying efforts one would expect that the import demand for white corn will increase. In contrast, if the starch industry increases its lobbying efforts one would expect that the import demand for white corn will decrease. Also, if the cereal industry receives an import permit one would expect that the import demand for white corn will increase and if producer pressure increases then import demand for white corn will decrease.

When import demand for yellow corn is the dependent variable and the imports of white corn increase, one expects that yellow corn imports will also increase. In contrast, if the imports of sorghum increase it is expected that the import demand for yellow corn will decrease since yellow corn and sorghum are substitutes. Total imports are expected to have a positive effect on the import demand for yellow corn. If the production of corn increases one expects that the import demand for yellow corn will decrease and as the production of sorghum increases one expects that the import demand for yellow corn will also decrease. As the price for yellow corn increases the import demand for yellow corn should decrease, following the law of demand. One expects that if the prices of white corn and sorghum increase that the import demand for yellow

corn will increase. If the yellow corn importing industries (i.e. starch and livestock industries) receive import permits then it is expected that import demand for yellow corn will increase. However, if the tortilla, cereal, corn flour, and CONASUPO receive import permits then import demand for yellow corn should decrease as they will want import permits for white corn not yellow corn. Import demand will also decrease if producer pressure decreases.

When estimating the import demand for sorghum, one expects that as the import of white corn and yellow corn increase that the imports of sorghum increase. One also expects that if total imports increase then imports of sorghum will also increase. In contrast, it is expected that if the production of corn and sorghum increase then the import demand for sorghum will decrease. It is expected that if the price of sorghum increases then the import demand for sorghum will decrease and if the price of corn increases, then the import demand for sorghum should also increase. One would expect that if the starch and livestock industries receive import permits that import demand for sorghum will decrease. If the livestock industry receives import permits for corn they will not import sorghum unless the price of sorghum is low enough to make up for the difference in protein. If producer pressure to halt imports increases then one would expect that import demand for sorghum will decrease.

Marginal Effects

In equation (7), import demand for white corn is a function, among others, of import prices and quantities, production variables, and political factors. The same is true for the import demand of yellow corn and sorghum. In this section changes in these variables and their a priori affect on import demand are discussed.

According to public choice literature different industries will lobby for and against import protection depending on whether they consumers of a products or producers of a product. Grossman and Helpman (1994) and Gawande and Bandyopadhyay (2000) show how different industries form a lobby to interact with the government in order to order to maximize protection. In this study each industry is its own lobby which seeks to increase or decrease the level of import protection. The hypothesized results of these lobbying efforts are shown in the marginal effects discussed in this section:

$$(17) \qquad \frac{\partial Q_{wr}^{d}}{\partial Z_{TORT}} = \frac{\partial Q_{wr}^{d}}{\partial Z_{EPw}^{s}} \frac{\partial Z_{EPw}^{s}}{\partial Z_{TORT}} \geq 0$$

where, Z_{TORT} measures the lobbying effort by the tortilla industry. Equation (17) shows how a change in the lobbying efforts by the tortilla industry will have a positive impact on the import demand for white corn. In other words, if the tortilla industry increases its lobbying efforts to get more import permits issued, then the supply of protection will decrease and import demand will increase. Next, consider:

$$(18) \qquad \frac{\partial Q_{wr}^{d}}{\partial Z_{STCH}} = \frac{\partial Q_{wr}^{d}}{\partial Z_{EPw}^{s}} \frac{\partial Z_{EPw}^{s}}{\partial Z_{STCH}} \leq 0$$

where Z_{STCH} measures the lobbying effort of the starch industry. In equation (18) the opposite is true. As the starch industry, which imports only yellow corn, increases its lobbying efforts to get import permits, the level of protection in the white corn market increases and that causes a decrease in the import demand for white corn. However, as equation (19) shows it would cause an increase in the import demand for yellow corn, or

$$(19) \qquad \frac{\partial Q_{yr}^{d}}{\partial Z_{STCH}} = \frac{\partial Q_{yr}^{d}}{\partial Z_{EPy}^{s}} \frac{\partial Z_{EPy}^{s}}{\partial Z_{STCH}} \geq 0$$

An increase in the production of corn in Mexico would cause a decrease in the import demand for white corn, yellow corn and sorghum. This is shown in equations (20)-(22):

(20) $$\frac{\partial Q_{wr}^{d}}{\partial (MXMZ)} \leq 0$$

(21) $$\frac{\partial Q_{yr}^{d}}{\partial (MXMZ)} \leq 0$$

(22) $$\frac{\partial Q_{sr}^{d}}{\partial (MXMZ)} \leq 0$$

where *MXMZ* is production of corn in Mexico. In other words, if the production of corn in Mexico increases there is less need for imports of corn. Since sorghum is imported as a substitute for corn, then if corn is not imported, neither will sorghum be imported.

Finally, turn to the marginal effects of sugar producers or

(23) $$\frac{\partial Q_{sr}^{d}}{\partial Z_{SUGAR}} = \frac{\partial Q_{sr}^{d}}{\partial Z_{EPy}^{d}} \frac{\partial Z_{EPy}^{d}}{\partial Z_{SUGAR}} \geq 0$$

where Z_{SUGAR} measures the lobbying effort of sugar producers. In the sorghum market, if the demand for protection from imports of yellow corn increases then the import demand for sorghum increases. For example, in equation (23) if sugar producers increase their lobbying efforts so that the Mexican government decrease the amount of import permits given for yellow corn, then the industries that can substitute sorghum for yellow corn such as the livestock industry will increase their imports of sorghum.

Results

Smith-Blundell Exogeneity Tests

The Smith-Blundell exogeneity test results are analyzed and the estimated results for the import demand structural models with endogenous protection are presented. The estimated results pertain to the simultaneous tobit models in equations (14)-(16) using monthly data for the period between January 1994 and December 2000.

In the white corn model the null hypothesis is that the yellow corn residual coefficient and the sorghum residual coefficient, estimates of α_1 and α_2, respectively, will be zero. In other words, that yellow corn and sorghum are weakly exogenous in the white corn import demand model. The t-statistic for the yellow corn residuals is 0.171 and the t-statistic for the sorghum residuals is 0.079. Therefore, we fail to reject the null hypothesis of weak exogeneity. Therefore, yellow corn inspections and sorghum inspections are not jointly determined with white corn inspections.

The null hypothesis for the yellow corn model is that the white corn and sorghum residuals coefficients are zero. The t-statistic for white corn residuals is -0.010 and the t-statistic for sorghum residuals is 0.084. The results indicate that neither white corn residuals nor sorghum residuals are statistically significant from zero so we fail to reject the null hypothesis of weak exogeneity. This indicates that yellow corn export inspections are not jointly determined with white corn or sorghum inspections.

The null hypothesis for the sorghum import demand model is that the white corn and yellow corn residual coefficients are zero. The t-statistics for white corn and yellow corn residuals are -0.013 and -0.017, respectively. Therefore, we fail to reject the null hypothesis that

the coefficients are statistically significant from zero. In other words we fail to reject the null hypothesis that white corn inspections and yellow corn inspections are weakly exogenous in the sorghum import demand model. Hence, according to the results sorghum inspections are not jointly determined with white corn inspections or yellow corn inspections.

Model Results

In this section the estimated results for equations (14)-(16) are interpreted. These are import demand structural models with demand for protection estimated simultaneously. The import demand models were estimated using a tobit model and monthly data from January 1994 to December 2000.

White Corn

The parameter estimates, standard errors, and p-values are presented in Table 4 and marginal effects are presented in Table 5. Yellow corn and sorghum imports are statistically significant at the 1% level. Mexican production of sorghum is statistically significant at the 10% level. Import permit allocations to CONASUPO and the tortilla and starch industries are statistically significant at the 1%, 10%, and 5% levels, respectively.

The estimated results from the model provide some interesting insights into the import demand for white corn. For example, the results indicate that if yellow corn or sorghum imports increase then the import demand for white corn will also increase. Import permit allocation to the tortilla industry has a positive effect on the import demand for white corn. In contrast the import permit allocation to the starch industry has a negative effect on the import demand for white corn. CONASUPO, the government agency that imports white corn for the small tortilla makers and its own distribution centers has a positive effect on white corn import demand.

Mexican production of sorghum has a negative effect on the import demand for white corn. The prices of white corn, yellow corn, and sorghum are not statistically significant indicating that prices do not drive the import demand for white corn. The results indicate that what drives import demand for white corn are the importing industries and imports of yellow corn and sorghum.

Yellow corn

The parameter estimates, standard errors, and p-values are provided in Table 6 for the yellow corn import demand model. Marginal effects are presented in Table 7. White corn imports and total (agricultural and non-agricultural) imports are statistically significant at the 1% and 5% levels, respectively. Mexican production of sorghum is statistically significant at the 1% level. Import permit allocations to CONASUPO and the starch industry are statistically significant at the 10% level and the cereal industry receiving import permits is statistically significant at the 1% level. The price of yellow corn and the price of sorghum are statistically significant at the 1% level and the price of white corn is statistically significant at the 5% level. Import permits issued to CONASUPO and to the corn flour industry in the previous period are statistically significant at the 10%.

The estimated coefficient for white corn imports has a positive effect on yellow corn import demand while sorghum imports have a negative affect. Total imports have a negative effect on the import demand for yellow corn. This would indicate that as imports from the U.S. increase there is a decrease in the import demand for yellow corn (i.e. less imports allowed). Hence, as stated by Trefler (1993), increased import penetration increases import protection. The production of sorghum in Mexico also has a positive effect on the import demand for yellow

corn. The import permit allocations to the starch industry and CONASUPO have a positive effect on the import demand for yellow corn. The cereal industry receiving import permits has a negative effect on the import demand for yellow corn.

The cash price of yellow corn is negative indicating that as price increases quantity demanded decreases. In other words, as the price of yellow corn increases the demand for yellow corn decreases. The price of sorghum and the price for white corn have a positive effect on the import demand for yellow corn. Therefore, as the price of white corn or sorghum increases the import demand for yellow corn also increases. This indicates that sorghum and white corn are substitutes for yellow corn.

Import permit allocation to the corn flour industry in the previous period has a positive effect on the import demand for yellow corn. In contrast, import permit allocation in the previous period to CONASUPO has a negative effect on import demand in the current period.

Sorghum

The results for the import demand for sorghum with endogenous protection are shown in Table 8 and marginal effects are presented in Table 9. The table provides the parameter estimates, standard errors, and p-values. White corn imports are statistically significant at the 1% level. Producer pressure and import permits issued to CONASUPO are statistically significant at the 10% level. The price of sorghum is statistically significant at the 1% level even as the price of white corn and yellow corn are statistically significant at the 10% and 1% levels, respectively.

The cash price of sorghum is negative as expected from the law of demand indicating that as the price of sorghum increases the import demand for sorghum decreases. The quantity

of white corn imported is positive therefore, as the quantity of white corn imports increases so does the import demand for sorghum. An increase in the price of yellow corn will increase the import demand for sorghum as expected with substitutes. Producer pressure has a negative effect on sorghum import demand. Therefore, if producer pressure increases then import demand for sorghum decreases. Import permits issued to CONASUPO have a negative effect on the import demand for sorghum. Import permits issued to the livestock industry in the previous period has a negative effect on the import demand for sorghum. If the livestock industry has an import permit then it will not need to import sorghum when it can import corn.

Import Price Simulations

Expected import prices for the monthly structural models were found using the parameter values and the predicted probabilities from the white corn, yellow corn, and sorghum tobit models in equations (14)-(16). The expected import prices were constructed for each month from January 1994 to December 2000. Figure 4 through Figure 6 show the expected import price and the actual export price. The difference between the two prices is the marketing margin associated with the import permit. The average import price for white corn over the sample time period is $121.90 and the average import prices for yellow corn and sorghum are $101.50 and 110.94, respectively. The average marketing margins for white corn, yellow corn, and sorghum are $5.40, $5.53, and $25.07, respectively.

Conclusions

This study specified a conceptual structural model of international marketing margins and trade uncertainty that links the private market to political factors influencing administrative trade barriers. In doing so, this systematically links trade models specified by Gallagher (1998) and

others, which characterize private markets under uncertainty but ignore direct influences from political markets, to work by Trefler (1993) and others, which focus on endogenous trade protection. Behavioral processes that determine the likelihood of trade are identified using concepts of trade protection and public choice analysis. The intent was to provide a trade model with endogenous protection that can help explain uncertainty in trade of agricultural commodities due to technical trade barriers. This provided a framework to identify factors that determine the likelihood of issuing import permits for corn exported from the U.S. to Mexico and to determine its impact on international marketing margins.

Mexican import demand models are estimated simultaneously with the demand for protection using an instrumental variables approach used by Zellner (1970) when estimating regression relationships with unobservable independent variables. In this case import demand equations are estimated using simultaneous tobit model with monthly data from January 1994 to December 2000. Some interesting insights are provided by the import demand structural models with endogenous protection. Producer pressure has a negative affect on the import demand for corn and sorghum although it is only statistically significant for the import demand for sorghum. The results are consistent with public choice analysis which indicates that increased import penetration will increase lobbying efforts from domestic firms to decrease imports. The results indicate that as grain producers lobby for a decrease in import permit allocation the import demand for these grains decreases, meaning that they have succeeded in their efforts to reduce import competition. Marketing margins associated with the corn import permit range form $5 for corn and $25 for sorghum. An interesting insight is that although the import permit restricts corn imports, sorghum import prices are also affected and an administrative trade barrier has also

been captured for that commodity. A conclusion drawn from the results is that trade uncertainty caused higher prices in the import market.

The removal of the import permit in Mexico would increase U.S. exports to Mexico. This leads us to believe that the import permit regime in Mexico is having a detrimental affect on U.S. exports of corn to Mexico. Without the import permit, the U.S. would expect a higher demand for corn from Mexico since prices would no longer be kept artificially high by the import permit. Producers in the U.S. would be better able to predict not only when Mexican importers would come into the market but also write long term contracts.

It is apparent that this research has practical implications. One could forecast the effect a possible change in policy, be it political or macroeconomic, might have on the import price. Underlying the model is the fundamental idea that one is linking political and private market processes to better understand the implications of administrative trade barriers. Conceptually and empirically this methodology could be extended to other commodities and other countries that have administrative trade barriers in place, such as the U.S. sugary policy or the E.U. hormone treated beef policy.

Table 1 Abbreviations for Monthly Data

YCORN	Quantity of U.S. yellow corn inspected for export to Mexico in metric tons.
WCORN	Quantity of U.S. white corn inspected for export to Mexico in metric tons.
SORG	Quantity of U.S. sorghum inspected for export to Mexico in metric tons.
TTLEXP	Total agricultural and non-agricultural export from U.S. to Mexico in million metric tons.
MXMZ	Total production of corn in Mexico in metric tons
MXSG	Total production of sorghum in Mexico in metric tons.
NEWS	News articles detailing producer protests against imports of corn
CPYC	Yellow corn cash price in U.S. dollars (USD) per metric ton.
CPSG	Sorghum cash price in USD per metric ton.
CPWC	White corn cash price in USD per metric ton.
FLOUR	Import permit allocation to the corn flour industry: 0=no, 1=yes.
TORT	Import permit allocation to the tortilla industry: 0=no, 1=yes.
STCH	Import permit allocation to the starch industry: 0=no, 1=yes.
LIVE	Import permit allocation to the livestock industry: 0=no, 1=yes.
SUPO	Import permit allocation to CONASUPO: 0=no, 1=yes.
CEREAL	Import permit allocation to the cereal industry: 0=no, 1=yes.
LNEWS	News articles detailing producer protests against imports of corn in the previous period (t-1).
LFLOUR	Import permit allocation to the corn flour industry in t-1.
LTORT	Import permit allocation to the tortilla industry in t-1.
LSTCH	Import permit allocation to the starch industry in t-1.
LLIVE	Import permit allocation to the livestock industry in t-1.
LSUPO	Import permit allocation to CONASUPO in t-1.
LCEREAL	Import permit allocation to the cereal industry in t-1.
EXRT	USD to Peso conversion rate.

Table 2 Monthly Data Descriptive Statistics

Variable	Mean	Std Dev	Minimum	Maximum	Observations
MNTH	6.5000	3.4728	1.00	12.00	84
YCORN	264894.092	167057.856	0.00	677152.390	84
WCORN	47217.0992	51838.9869	0.00	255691.200	84
SORG	169989.965	102399.647	0.00	472086.320	84
TTLEXP	5980.3119	1861.9859	3382.500	10448.800	84
MXCRN	1516094.81	1245618.05	0.00	3075785.00	84
MXSG	457494.823	88947.4255	308426.670	567457.500	84
NEWS	1.5833	2.0780	0.00	8.00	84
STARCH	0.7500	0.4356	0.00	1.00	84
LIVESTOCK	0.5952	0.4938	0.00	1.00	84
CEREAL	0.5119	0.5029	0.00	1.00	84
CORN FLR	0.6548	0.4783	0.00	1.00	84
CONASUPO	0.3571	0.4820	0.00	1.00	84
TORTILLA	0.4405	0.4994	0.00	1.00	84
FPRICE	104.209	24.2158	70.68	188.97	84
CPYC	95.9781	24.3395	59.84	174.40	84
CPSG	85.0348	23.7567	53.36	162.63	84
CPWC	116.5033	29.9183	72.63	211.69	84
EXRT	0.1477	0.0645	0.1002	0.3220	84

Table 3 OLS Results for White Corn Cash Price

Variable	Coefficient	Standard Error	T-ratio
Cash Price Ycorn	1.2138	0.0166	73.008*

*Statistically Significant at the 1% level
$R^2 = 0.755$

Table 4 Mexican Import Demand for White Corn with Endogenous Protection

Variable	Coefficient	Standard Error	P[|Z|>z]
Linear Trend	-829.1422	2450.6067	0.7351
Quadratic Trend	3.1659	23.7132	0.8939
YCORN (metric ton)	0.1441***	0.0353	0.0000
SORG (metric ton)	0.2016***	0.0669	0.0026
TTLEXP (metric ton)	14.0373	10.6995	0.1895
MXMZ (metric ton)	-0.0008	0.0041	0.9849
MXSG (metric ton)	-0.2112*	0.1267	0.0956
NEWS (# of articles)	-500.176	2925.8800	0.8643
FLOUR (1=yes,0=no)	17430.7541	17089.422	0.3077
TORT (1=yes,0=no)	20757.2765*	11328.159	0.0669
STCH (1=yes,0=no)	-42946.7609**	17063.804	0.0118
LIVE (1=yes,0=no)	15834.9561	15131.808	0.2935
SUPO (1=yes,0=no)	36704.94712***	12172.549	0.0026
CEREAL (1=yes,0=no)	4859.6716	15361.010	0.7517
CPWC (Peso/MT)	6852.4405	10416.015	0.5106
CPYC (Peso/MT)	-4041.6612	15514.733	0.7945
CPSG (Peso/MT)	-6853.5395	6778.0766	0.3120
LNEWS(1=yes,0=no)	2770.3754	4953.7948	0.5760
LSTCH (1=yes,0=no)	33419.0378	31697.671	0.2917
LLIVE (1=yes,0=no)	-24941.4931	33139.612	0.4517
LCEREAL (1=yes,0=no)	21870.4834	28712.044	0.4462
LFLOUR (1=yes,0=no)	-46044.5486	39335.579	0.2418
LSUPO (1=yes,0=no)	31252.6749	31203.706	0.3166
LTORT (1=yes,0=no)	-18328.3569	22246.428	0.4100
Constant	24533.9111	61973.135	0.6922

*** Indicates statistically significant at the 1% level
** Indicates statistically significant at the 5% level
* Indicates statistically significant at the 10% level
Log Likelihood = -820.3907 Restricted Log Likelihood -1030.5833

Table 5 Import Demand for White Corn with Endogenous Protection Marginal Effects

Variable	Coefficient	Standard Error	P[|Z|>z]
Linear Trend	-729.1813	2153.7052	0.7349
Quadratic Trend	2.7842	20.8461	0.8938
YCORN (metric ton)	0.1268***	0.0310	0.0000
SORG (metric ton)	0.1773***	0.0587	0.0025
TTLEXP (metric ton)	12.3450	9.4522	0.1915
MXMZ (metric ton)	-0.0007	0.0041	0.9849
MXSG (metric ton)	0.1744	0.1069	0.1027
NEWS (# of articles)	-439.8754	2573.3248	0.8643
CPWC (Peso/MT)	6026.3144	9169.2195	0.5110
CPYC (Peso/MT)	-3554.4013	13648.893	0.7945
CPSG (Peso/MT)	-6027.2809	5958.8066	0.3118
Constant	21576.1176	54515.886	0.6923
LNEWS (# of articles)	2436.3086	4360.2778	0.5763

*** Indicates statistically significant at the 1% level
Marginal effects are calculated at the mean

Table 6 Mexican Import Demand for Yellow Corn with Endogenous Protection

Variable	Coefficient	Standard Error	P[|Z|>z]
Linear Trend	6107.9850	6842.0677	0.3720
Quadratic Trend	-7.7827	64.8379	0.9045
WCORN (metric ton)	1.3613***	0.3402	0.0001
SORG (metric ton)	-0.01933	0.1998	0.9229
TTLEXP (metric ton)	-66.0449**	29.5573	0.0255
MXMZ (metric ton)	-0.0043	0.0119	0.7145
MXSG (metric ton)	1.0343***	0.3340	0.0020
NEWS (# of articles)	5304.2964	8268.1109	0.5212
FLOUR (1=yes,0=no)	-29050.4558	48196.9080	0.5467
TORT (1=yes,0=no)	-27843.1388	35520.970	0.4331
STCH (1=yes,0=no)	88284.5074*	49160.383	0.0725
LIVE (1=yes,0=no)	31295.8766	44416.180	0.4811
SUPO (1=yes,0=no)	78003.1386*	47383.751	0.0997
CEREAL (1=yes,0=no)	-129955.9037***	42303.033	0.0021
CPWC (Peso/MT)	60268.6929**	29242.355	0.0393
CPYC (Peso/MT)	-132253.5260***	41918.040	0.0016
CPSG (Peso/MT)	75141.6411***	17455.557	0.0000
LNEWS(1=yes,0=no)	-15053.8047	13942.820	0.2803
LSTCH (1=yes,0=no)	12718.5010	90468.787	0.8882
LLIVE (1=yes,0=no)	68210.1332	97129.149	0.4825
LCEREAL (1=yes,0=no)	-90147.0965	82986.866	0.2774
LFLOUR (1=yes,0=no)	208618.6885**	105931.980	0.0489
LSUPO (1=yes,0=no)	-161061.0593*	85482.0224	0.0595
LTORT (1=yes,0=no)	-7555.0026	65027.557	0.9075
Constant	-267563.3304	167412.67	0.1100

*** Indicates statistically significant at the 1% level
** Indicates statistically significant at the 5% level
* Indicates statistically significant at the 10% level
Log Likelihood = -1077.328 Restricted Log Likelihood = 1128.8799

Table 7 Import Demand for Yellow Corn with Endogenous Protection Marginal Effects

Variable	Coefficient	Standard Error	P[|Z|>z]
Linear Trend	4763.5376	8381.1804	0.5698
Quadratic Trend	-6.0696	51.0039	0.9053
YCORN (metric ton)	1.6016	1.4855	0.4748
SORG (metric ton)	-0.0151	0.1579	0.9239
TTLEXP (metric ton)	-51.5075	75.0434	0.4925
MXMZ (metric ton)	-0.0034	0.0105	0.7474
MXSG (metric ton)	0.8067	1.1412	0.4797
NEWS (# of articles)	4136.7513	8637.2215	0.6320
CPWC (Peso/MT)	47002.7646	68777.229	0.4944
CPYC (Peso/MT)	-103142.7935	144884.65	0.4765
CPSG (Peso/MT)	58601.9822	80693.167	0.4677
Constant	-208669.1385	309294.22	0.4999
LNEWS (# of articles)	-11740.2652	20640.107	0.5695

Marginal effects are calculated at the mean.

Table 8 Mexican Import Demand for Sorghum with Endogenous Protection

Variable	Coefficient	Standard Error	P[|Z|>z]
Linear Trend	2376.4478	3607.9199	0.5101
Quadratic Trend	16.7176	33.5474	0.6183
WCORN (metric ton)	0.5919***	0.1961	0.0025
YCORN (metric ton)	-0.0155	0.05816	0.7900
TTLEXP (metric ton)	-1.3849	15.2564	0.9277
MXMZ (metric ton)	-0.0045	0.0065	0.4929
MXSG (metric ton)	-0.1587	0.1916	0.4076
NEWS (# of articles)	-7996.8152*	4281.2792	0.0618
FLOUR (1=yes,0=no)	7998.7981	25623.666	0.7549
TORT (1=yes,0=no)	2363.6919	18594.973	0.8988
STCH (1=yes,0=no)	-11046.9044	24509.678	0.6522
LIVE (1=yes,0=no)	-26851.3257	21886.985	0.2199
SUPO (1=yes,0=no)	-34196.2465*	19049.761	0.0726
CEREAL (1=yes,0=no)	36160.0582	22847.933	0.1135
CPWC (Peso/MT)	-17963.6759	15282.893	0.2744
CPYC (Peso/MT)	52291.8475**	23810.466	0.0281
CPSG (Peso/MT)	-26711.9555***	10213.847	0.0089
Constant	-35712.9439	94288.193	0.7049
LNEWS (# of articles)	-517.7834	7687.3647	0.9463
LSTCH (1=yes,0=no)	-15270.4938	49668.066	0.7585
LLIVE (1=yes,0=no)	-94821.0443*	52656.927	0.0717
LCEREAL (1=yes,0=no)	17652.9390	46079.732	0.7016
LFLOUR (1=yes,0=no)	71164.7297	59311.357	0.2302
LSUPO (1=yes,0=no)	-12835.2452	47487.155	0.7869
LTORT (1=yes,0=no)	34570.7203	35307.322	0.3275

*** Indicates statistically significant at the 1% level
**Indicates statistically significant at 5% level
* Indicates statistically significant at the 10% level
Log Likelihood = -1029.295 Restricted Log Likelihood = -1087.7655

Table 9 Import Demand for Sorghum with Endogenous Protection Marginal Effects

Variable	Coefficient	Standard Error	P[|Z|>z]
Linear Trend	2653.7407	3787.5438	0.4835
Quadratic Trend	3.2183	35.7299	0.9282
WCORN (metric ton)	0.5453***	0.1959	0.0054
YCORN (metric ton)	-0.0077	0.0605	0.8989
TTLEXP (metric ton)	6.6598	16.7555	0.6910
MXMZ (metric ton)	-0.0062	0.0065	0.3435
MXSG (metric ton)	-0.1044	0.1941	0.5906
NEWS (# of articles)	-5641.6788	4536.3163	0.2136
CPWC (Peso/MT)	-17933.2053	16406.692	0.2744
CPYC (Peso/MT)	52203.1484**	23770.073	0.0281
CPSG (Peso/MT)	-26666.6458***	10196.774	0.0089
Constant	-35652.3664	94126.070	0.7049
LNEWS (# of articles)	-516.9051	7674.3293	0.9463

***Indicates statistically significant at the 1% level
**Indicates statistically significant at the 5% level
Marginal effects are calculated at the mean.

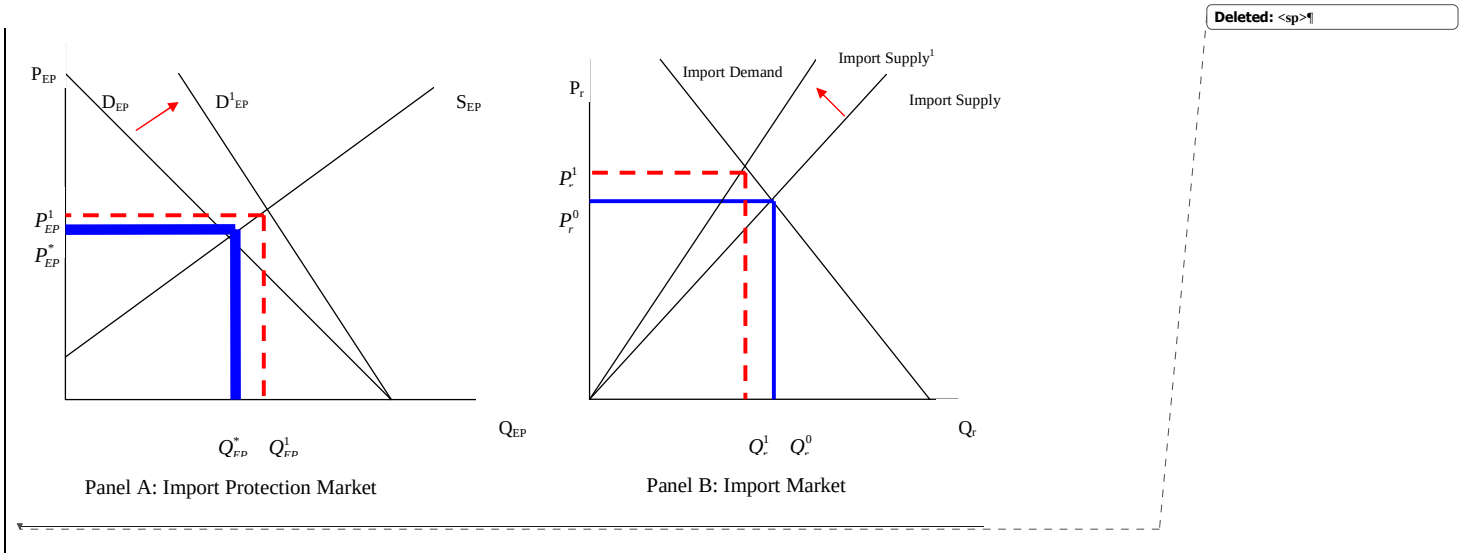

Figure 1 Import Protection Market and Import Market

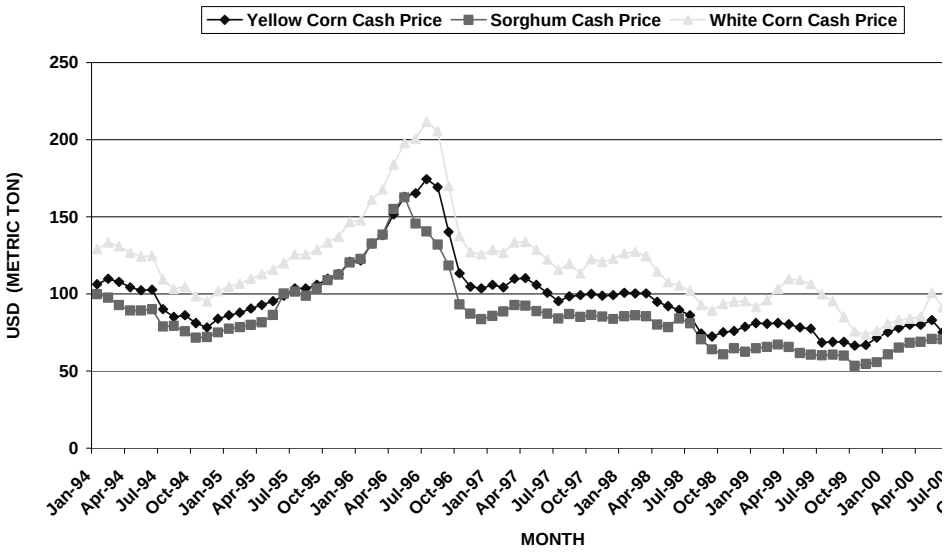

Figure 2 Cash Prices for White Corn, Yellow Corn, and Sorghum 1994-2000

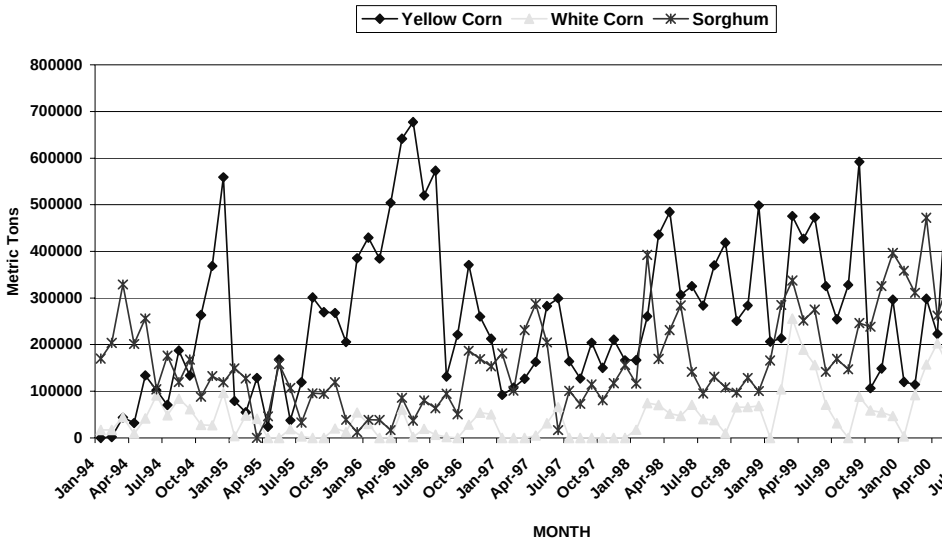

Figure 3 Monthly Mexican Corn and Sorghum Imports Jan 1994-Dec 2000

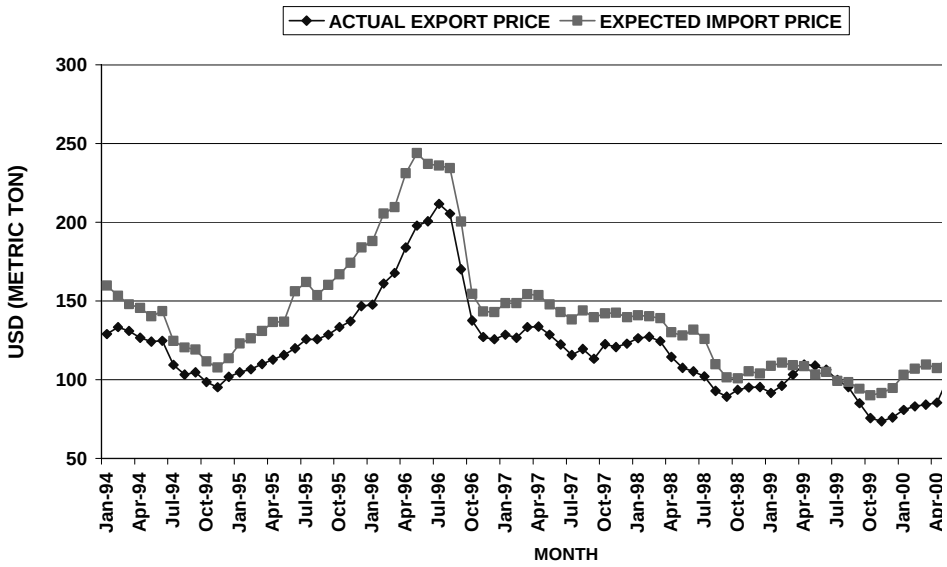

Figure 4 Expected Import Price for White Corn from Jan 1994 to Dec 2000

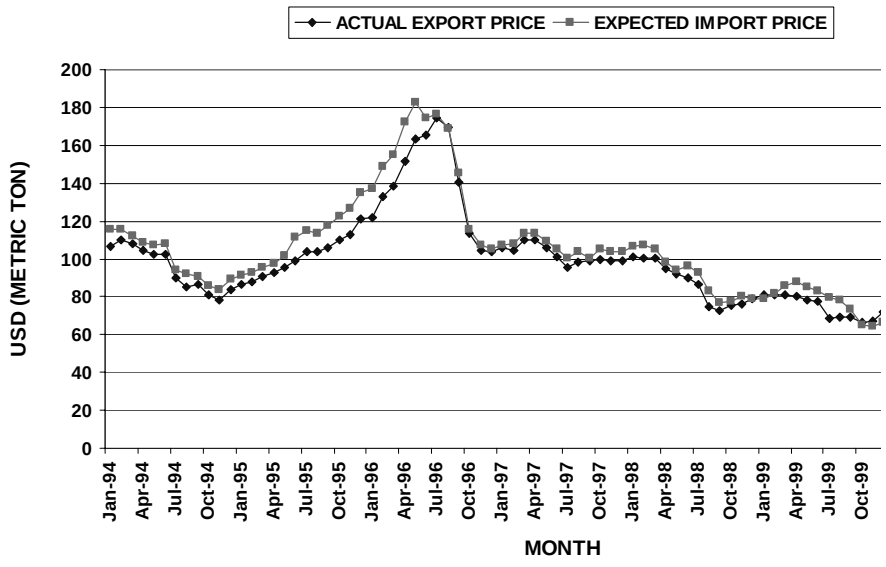

Figure 5 Expected Import Price for Yellow Corn from Jan 1994 to Dec 2000

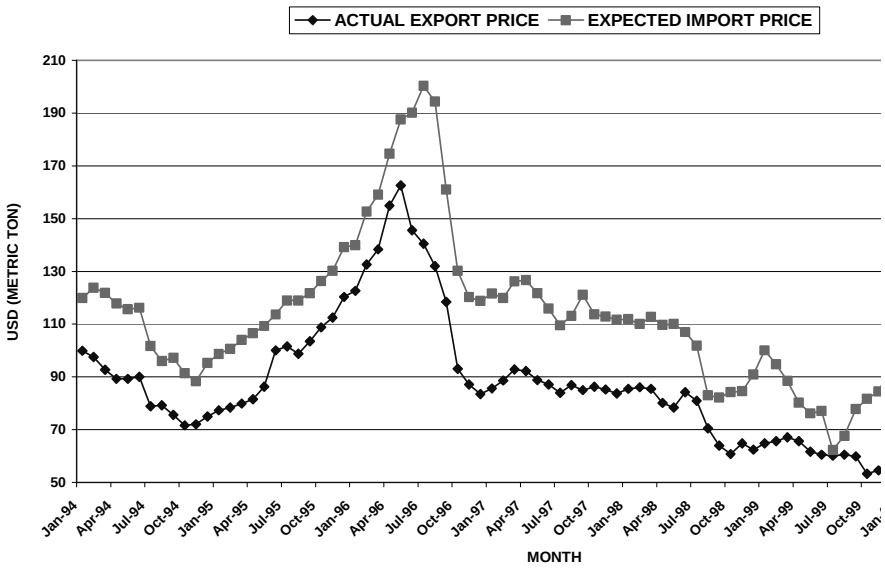

Figure 6 Expect Import Price for Sorghum from Jan 1994 to Dec 2000

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