U.S.-MEXICO FREE TRADE AGREEMENT IMPACT: EFFECTS OF ALTERNATIVE TARIFF LEVELS ON TEXAS SPRING DRY ONION PRODUCERS

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U.S.-Mexico Free Trade Impact on Agriculture Series
TAMRC International Market
Research Report No. IM-1-92
January 1992

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Texas Agricultural Market Research Center (TAMRC) U.S.-Mexico Free Trade Impact on Agriculture Series, TAMRC International Market Research Report No. IM-1-92, by Dr. Stephen J. Fuller, Dr. Oral Capps, Jr., Mr. Haruna Bello, Dr. Charles R. Hall, and Mr. B. Kris Schulthies, Texas Agricultural Market Research Center, Department of Agricultural Economics, Texas A&M University, January 1992.

ABSTRACT: This paper examines the likely effects of a U.S.-Mexico Free Trade Agreement (FTA) on the Texas spring dry onion industry. Specifically, the possible effects of alternative U.S. dry onion tariff levels on producer prices and production of spring dry onions in Texas are analyzed. The likely impacts on dry onion prices and production in Mexico are also considered. Dry onions are the most valuable vegetable crop produced by Texas farmers. Imports from Mexico commence in November and extend through July, with peak imports in March and April. Currently, the duty on dry onion imports is fixed year-round at 1.75 cents/lb. Results indicate that a reduction in the tariff would unfavorably affect Texas producers through a modest decline in onion prices and shipments (production). On the other hand the tariff reduction leads to a substantial increase in Mexican dry onion prices, production, and exports to the United States.

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EXECUTIVE SUMMARY

This paper examines the likely effects of a U.S.-Mexico Free Trade Agreement (FTA) on the Texas spring dry onion industry. In particular, the effects of alternative U.S. dry onion tariff levels on producer prices and production of spring dry onions in Texas are analyzed. The likely impacts on dry onion prices and production in Mexico are also considered. The analysis is carried out with a previously documented model of the U.S./Mexico onion economies. The following summarizes essential points of the paper:

- Dry onion imports from Mexico commence in November and extend through July, with peak imports in March and April. About two-thirds of Mexican dry onion exports to the U.S. occur in the March-April period. In March, about two-thirds of the fresh onions available to U.S. consumers originate from U.S. storage stocks, about 20% are imported from Mexico, and the remainder are supplied by Texas producers. However, in April, Texas supplies about two-thirds of the domestic demand while 20% comes from storage stocks with the remainder originating in Mexico. Currently, the tariff on Mexican onions is 1.75 cents/pound.

- The quantity of dry onions marketed by south Texas producers in the spring was found to have a significant negative influence on Texas price as did shipments from U.S. onion storage stocks. Shipments in the spring by other new-crop onion producers in Arizona, California, and New Mexico have a negative but marginally significant effect on the Texas price while the impact of Mexican imports on the Texas onion price was not found to be statistically significant.

- Imports of Mexican onions during the spring season are affected by the price of Texas dry onions, the price of Mexican dry onions at Mexican/U.S. crossing locations, and the real tariff levied on dry onion imports entering the U.S. In particular, a relatively high Texas dry onion price and a relatively low Mexican price enhances the flow of dry onions from Mexico.

- The impact of a 30% decrease in the U.S. tariff would have a modest effect on Texas onion price and production. Conversely, the Mexican onion market is comparatively sensitive to changes in the U.S. tariff. For example, a 30% decrease in the tariff was projected to increase Mexican spring onion exports to the U..S. from an average of .7 million cwt to 1.3 million cwt. The corresponding increases in Mexican dry onion prices and production were projected at about 19% ($4.69 to $5.56) and 12% (8.1 million cwt to 9.1 million cwt), respectively.

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Texas is a leading supplier of fresh onions during the spring season with a national market share of about 30%. Onions are the most valuable vegetable crop produced by Texas farmers with sales comprising nearly a fifth of the total vegetable revenues in the state. Since 1989, the annual value of dry onion production has averaged about $55 million with spring crop onions comprising about 70% of the total.

Considerable debate and speculation regarding the likely effects of the proposed free-trade agreement with Mexico on the Texas vegetable industry have accompanied the on-going negotiations. Several reports suggest that U.S. vegetable producers who market during the Mexican production and export window could find it difficult to compete if tariffs on imported vegetables are eliminated or reduced below current levels (U.S. International Trade Commission). Reduced vegetable tariffs would reportedly disrupt existing trade patterns due to lower vegetable production costs in Mexico. A relatively lower cost of producing onions in Mexico reportedly results from lower-priced Mexican land and labor resources. The purpose of this article is to estimate the likely effects of alternative U.S. dry onion tariff levels on Texas dry onion producer prices and production in the spring as well as on dry onion prices and production in Mexico. The analysis is accomplished with a previously documented model of the U.S./Mexico onion economies (Fuller, Capps, Bello, and Shafer).

Although there is a pattern of complementary production for many Mexican vegetable exports to the United States, there is significant overlap in the harvest and marketing seasons for other commodities (Cottrell and Lucier). Consequently, the United States has often utilized a seasonal tariff structure to preserve the complementary nature of horticultural trade between the two countries (Table 1). The duty for dry onion imports is fixed year-round at 1.75 cents/lb. Duties on many other vegetable imports, however, vary throughout the year and are often lowest during the fall and winter months and highest in the late spring and summer, coinciding with the peak harvest period in the United States.

BACKGROUND ON U.S./MEXICO TRADE IN DRY ONIONS

During the past decade, per capita consumption of fresh vegetables in the United States has increased 15-20%. Much of the increase in U.S. demand for fresh vegetables has been satisfied by imports from Mexico. The U.S. currently imports about 90% of the horticultural exports from Mexico. In 1990, the U.S. imported about $850 million of fresh vegetables from Mexico. Fresh tomatoes were the leading vegetable import with an estimated value of $370.5 million. Other important vegetable imports include bell peppers ($104.6 m), onions ($67.1 m), cucumbers ($64.3 m), cantaloupe ($53.2 m), squash ($43.7 m) and watermelon ($17.3 m) (Cottrell and Lucier).

Dry onion imports from Mexico increased 82% over the last decade from an average of 1.15 million cwt in 1978-80 to 2.1 million cwt in 1988-90 (Agricultural Marketing Service). Dry onion imports from Mexico commence in November and extend through July, with peak imports in March and April. Normally, about two-thirds of Mexican dry onion exports to the U.S. occur in the March-April period (Cottrell and Lucier).

The dry onion shipping season in south Texas commences in mid-March and extends into June. Early in the Texas March/April window, late-summer producers in Colorado, Idaho, New York, Oregon, and Washington ship onions from storage stocks while new-crop onions are imported from Mexico (Agricultural Marketing Service). About two-thirds of all fresh onions available to U.S. consumers during March originate from U.S. storage stocks (Figure 1). Slightly over 20% of onions marketed in the U.S. during March are imported from Mexico, with the remainder supplied by Texas. During April, however, the situation is reversed with about two-thirds of all onion shipments originating in Texas and 20% from storage stocks in other states. The remaining April onion supplies originate in Mexico (10%) and new-crop producers in other U.S. states (5%) (Figure 1). New-crop production in Arizona, California, and New Mexico provide competition for Texas onions in May and June. The market shares held by these new-crop producers average about 45% and 80%, respectively, in May and June with respective monthly shares averaging about 52% and 18% for Texas producers. The monthly share for Mexican producers during May and June is generally less than 3% (Fuller, Goodwin, and Shafer).

Competitiveness of Mexican Vegetable Production

Zepp and Simmons argued that Mexican growers have a comparative advantage in production of fresh winter vegetables over Florida producers. The increasing market share held by Mexican producers in the late 1960s and early 1970s led Florida growers to seek protection through non-tariff trade barriers and to file an antidumping petition with the U.S. Federal Trade Commission in 1978. Both attempts were unsuccessful, however. Nevertheless, Florida producers have generally retained or increased their share of the U.S. winter vegetable market since the early 1980s. More recent research concludes that technical change in Florida rejuvenated the vegetable industry (Bredahl, et. al.). Taylor and Wilkowske rigorously examined productivity growth in the two regions and came to similar conclusions.

Sanderson concludes that Mexico does not represent a significant threat to the U.S. fresh vegetable industry. He argues that much of the increasing Mexican role in the winter market can be attributed to increasing per capita consumption of fresh vegetables in the United States and not to absolute declines in U.S. production. Furthermore, except for Florida, no region in the United States has a winter climate which permits competing vegetable production. Because Mexico generally serves western U.S. markets, it does not represent significant competition for Florida. In addition, Sanderson argues that the U.S. tariff along with an inefficient marketing system in Mexico, in particular the transportation system, make Mexico a marginal producer that must continually monitor U.S. markets to find periods when it is cost effective to export. Sanderson finds that vegetable imports from Mexico have a significant effect on U.S. price when there is a short U.S. crop and prices are abnormally high.

The competitiveness of Mexico as a vegetable producer is influenced by vegetable production cost, vegetable handling/packing costs, brokerage fees, and transportation costs to the United States. The share of the total cost or sale price of Mexican horticultural products accounted for by transport and marketing costs in the United States is high. About 50% of the total cost of marketing Mexican fresh vegetables in the United States is attributable to production, harvesting and handling, about 30% to internal transport and marketing in Mexico, and the remaining 20% to transport and handling in the United States.

Production/Marketing of Mexican Vegetable Exports to the U.S.

Vegetable producer unions in Mexico have controlled the production and export of vegetables since 1961. These unions collaborate with the Mexican government in development of an annual plan of production and export. The principal producer union, Confederation of Horticultural Producers (Confederacion Nacional de Productores de Hortalizas (CNPH)), is comprised of 13 regional unions and 35 local associations of growers covering most of Mexico. The CNPH allocates acreage and export permits to regional affiliates which subsequently distribute allotments to producers. By specifying planting dates and allocating acreage among regions, the CNPH attempts to stabilize export shipments (Sanderson). In addition, Mexican producer groups have established quality requirements to further control the volume of produce entering the U.S. market.

Selected vegetable distributors in the United States, typically located in Texas and Arizona border communities, act as consignment brokers or contract purchasers of Mexican vegetables. Mexican producers send their products to U.S. distributors on consignment in amounts requested by the distributors. Some contracts are simple purchase agreements based on quality, delivery dates, sizes, and other criteria, while other contracts specify production methods and extend credit to Mexican producers (Sanderson).

Historically, Mexico has exported about 8% to 15% of its annual onion production with the majority going to the United States. More than 75% of Mexican dry onion exports to the United States are produced in Tamaulipas. Chihuahua supplies another 5% while the states of Sinaloa, Baja California South, and Sonora each supply 2% to 3% of the total. The remainder of Mexican dry onion exports to the U.S. are produced in small amounts in various other Mexican states. Most dry onions enter the United States from Mexico at south Texas border crossings. The principal crossing location is Reynosa, Tamaulipas where about three-fourths of the Mexican dry onion exports enter the United States. Other important crossing locations, including Nuevo Progresso, Camargo, Nuevo Laredo, and Matamoros, are also located in Tamaulipas (CNPH).

Section 980.117 of U.S. onion import regulations requires imported onions competing with domestic production to meet the same regulations as applied to domestic onions. Because the South Texas Onion Order (959) regulates grade, size, maturity, and quality, onion imports from Mexico must also meet these standards (U.S. Department of Agriculture (USDA 1981)). The import regulations (initiated in September 1979) are effective from March through May of each year.

TEXAS/MEXICO DRY ONION MODEL AND STATISTICAL RELATIONSHIPS

The economic model of Texas/Mexico trade in dry onions used in this study was adapted from an existing simultaneous equation model that was used to evaluate the influence of various economic forces on the Texas dry onion economy during the spring season (Fuller, Capps, Bello, and Shafer). A Mexican dimension was added to the model to offer at least a limited perspective on the effect of the U.S. dry onion tariff in the spring season on the Mexican dry onion market. Appendix A provides a more detailed discussion of the model, structural equations, and associated definition of variables.

The Texas/Mexico Dry Onion Model has several limitations, however, which must be considered when evaluating the model projections. Data for model construction were only available for the period of 1976 to 1985, thus limiting the findings to that period. Clearly, an extended sample period would be required if more definite conclusions are to be made. In addition, during the decade of the study, the nominal tariff was unchanged at $1.75/cwt. Consequently, the estimated model accounts for the behavior of relevant business firms and consumers to changes in only the real tariff over time as the rate of inflation increased and not to changes in the nominal tariff.

The results of estimating the structural parameters of the model indicate that the quantity of dry onions marketed by south Texas producers in the spring has a significant and negative influence on Texas price as do shipments from onion storage stocks. Shipments in the spring by other new-crop onion producers in Arizona, California, and New Mexico have a negative but marginally significant effect on the Texas price. Changes in the level of Mexican imports were not found to have a statistically significant effect on the Texas onion price (at the 10% level of significance). Furthermore, the quantity of dry onions produced and marketed by Texas farmers in a particular spring season is positively related to onion prices during the previous spring. The anticipated size of the storage onion crop negatively influences the planting of Texas onions and the subsequent size of the Texas crop.

The parameters for the model indicate that imports of Mexican onions during the spring season are affected by the price of Texas dry onions, the price of Mexican dry onions at Mexican/U.S. crossing locations, and the real tariff levied on dry onion imports entering the United States. In particular, a relatively high Texas dry onion price and a relatively low Mexican price increase the flow of dry onions from Mexico. Similarly, a decline in the real tariff rate over time has encouraged dry onion imports from Mexico.

The model includes structural supply and demand equations for Mexico that show Mexican onion price to be negatively related to its own production level but positively influenced by that portion of production that is exported (Appendix A). Mexican exports of dry onions to the United States in the previous year and the Mexican prices in the previous year have a positive effect on the quantity of onions produced by Mexico in the current year.

In summary, this study found no statistical evidence indicating that imports of Mexican onions during the spring season had an unfavorable impact on Texas spring onion price during the study period (1976-1985). The analysis suggests that the U.S. tends to import more dry onions from Mexico when the Texas price is high, i.e., a 1% increase in Texas price is associated with a 0.68% increase in Mexican imports. Finally, the modest market share held by Mexico over the sample period along with the efforts of their producer unions to stabilize exports to the United States by acreage and export permits generated few price disruptions in the domestic dry onion market during the sample period.

SIMULATED IMPACT OF ALTERNATIVE TARIFF LEVELS

Baseline estimates of the model variables were first generated with the model (Table 2). Changes in those variables were then simulated with the model under four scenarios. The four scenarios involve increases in the baseline tariff by 30% and then 50% and decreases in the baseline tariff by 30% and 50%. The simulated changes in the model variables represent averages for the 1976-1985 study period and indicate what the likely impact of the respective alternative tariff levels might have been during that period. If the tariff during the study period, for example, had been 50% higher than the baseline tariff ($1.75/cwt), the model indicates that the real Texas onion price would have averaged $8.95/cwt rather than $8.82/cwt (Table 2). On the other hand, if the tariff had been reduced by 50% the estimated price during the study period would have averaged $8.58/cwt rather than $8.82/cwt (Table 2).

The simulated effects of changes in the U.S. tariff level on dry onion imports from Mexico generally agree with economic theory. In particular, lowering the tariff on dry onion imports results in a lower Texas price, decreased Texas shipments (production), increased imports from Mexico, a higher Mexican price and higher Mexican production (Table 2). Conversely, if the tariff is increased, the selected variables move in the opposite directions (Table 2). For example, when the tariff is increased 50% above the baseline value, the quantity of onions imported from Mexico is projected to decline to zero.

Based on model projections, a 30% change (up or down) in the U.S. tariff would have a comparatively modest effect on the Texas onion price and production (Table 2). In particular, a 30% reduction in tariff would have likely lowered the average Texas price about 2% ($0.17/cwt) and average shipments about 3% (94.8 thousand cwt) during the sample period. Conversely, the Mexican onion economy appears comparatively sensitive to changes in the U.S. tariff. For example, a 30% decrease in the tariff would have increased Mexican spring onion exports to the U.S. from an average of .7 million cwt to 1.3 million cwt. The corresponding increases in Mexican dry onion prices and production would have been about 19% ($4.69/cwt to $5.56/cwt) and 12% (8.1 million cwt to 9.1 million cwt), respectively.

SUMMARY

A previously-developed economic model of the U.S./Mexico dry onion economies was adapted to simulate the effects of alternative tariff levels on dry onion prices, production, and trade in both Texas and Mexico. The model is based on the period 1976-1985 due to the limitations of some of the data for Mexico. Because dry onion imports from Mexico have increased about 70% since 1985, the model may not accurately simulate current conditions and likely impacts from changes in U.S. tariff levels on the dry onion markets in Texas and Mexico.

The alternative tariff level simulation results indicate that a reduction in the U.S. tariff unfavorably affects Texas producers through a moderate decline in dry onion prices and shipments (production) while leading to substantial increases in Mexican dry onion prices, production, and exports to the United States. In general, onion production in Mexico appear to be more sensitive to changes in the U.S. dry onion tariff than is the case for onion production in Texas.

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Table 1: U.S. Tariffs on Selected Vegetable and Melon Imports, 1989-90

Commodity	Import Period	Tariff
Cantaloupe	January 1 - May 15	Free
	May 15 - July 31	35% ad valorem
	August 1 - September 15	20% ad valorem
	September 16 - December 31	35% ad valorem
Cucumbers	December 1 - February 29	2.2 cents/lb.
	March 1 - June 30	3.0 cents/lb.
	July 1 - August 31	1.5 cents/lb.
	September 1 - November 30	3.0 cents/lb.
Dry Onions	year-round	1.75 cents/lb.
Green Peppers	year-round	2.5 cents/lb.
Honeydews	June 1 - November 30	35% ad valorem
	December 1 - May 31	8.5% ad valorem
Squash	year-round	1.1 cents/lb.
Watermelon	December 1 - March 31	Free
	April 1 - November 30	2% ad valorem

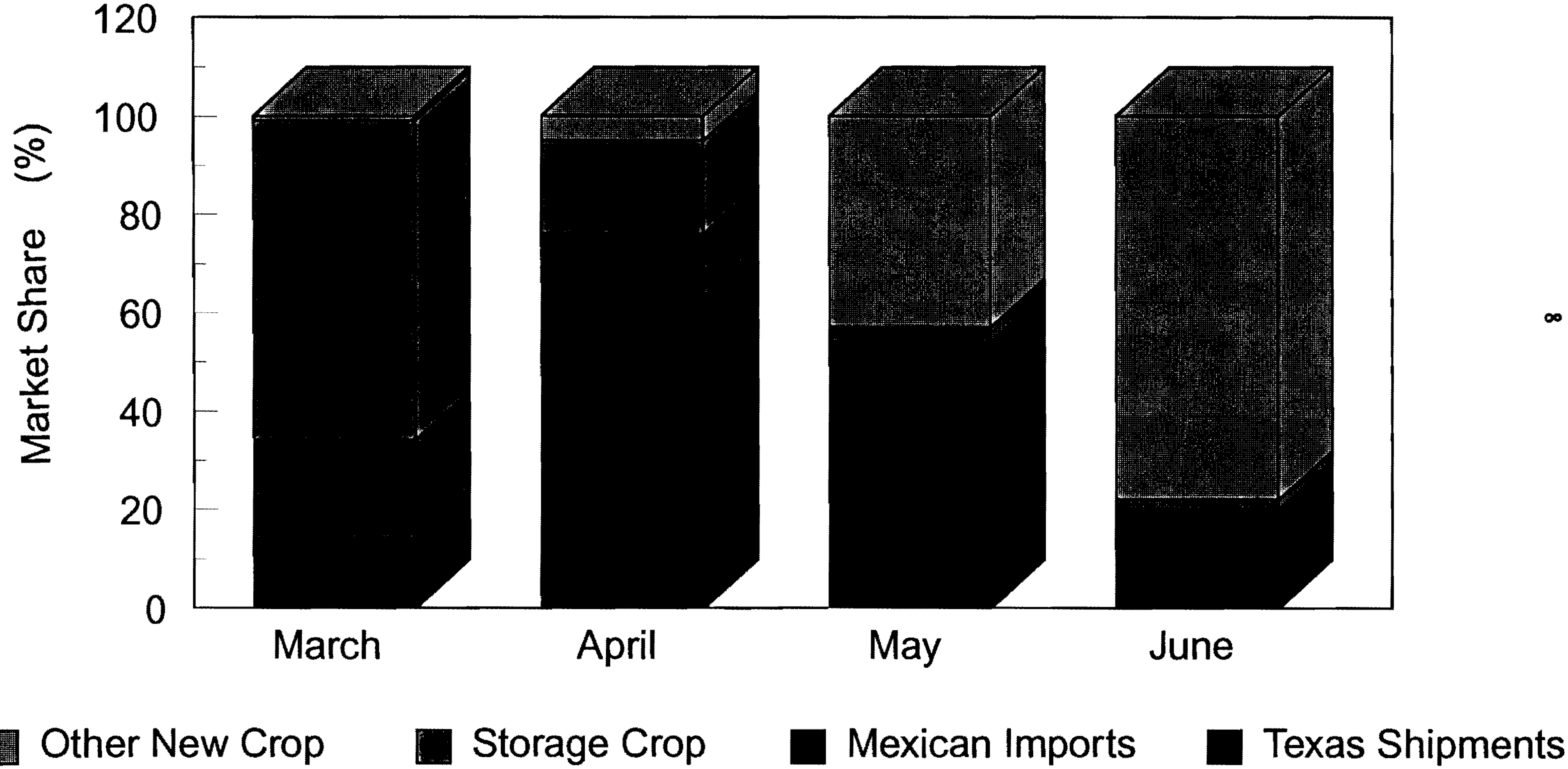
Source: U.S. Department of Agriculture (1990).

Table 2: Simulated Impacts of Indicated Changes in the U.S. Dry Onion Tariff on Selected Variables, 1976 - 1985 Averages[a]

Variables	Baseline Estimates	Change in Tariff Levels			
		-30%	-50%	+30%	+50%
Texas Dry Onion Price ($/cwt)	8.82	8.65	8.58	$8.87	$8.95
Texas Dry Onion Shipments (1,000 cwt)	3329.6	3234.8	3167.0	3428.0	3535.08
Dry Onion Imports from Mexico (1,000 cwt)	700.5	1308.2	1713.9	91.4	0
Mexico Dry Onion Price ($/cwt)	4.69	5.56	6.13	$3.82	$3.25
Mexico Dry Onion Production (1,000 cwt)	8135.1	9106.9	9756.1	7159.2	6509.9

[a] All values are in 1980 U.S. dollars.

Figure 1. Monthly Market Share in Spring Onion Market, 1976-1986



Source: Fuller, Capps, Bello, and Shafer

APPENDIX

The Texas/Mexico dry onion model includes six behavioral equations and an identity. The model is representative of the two-country trade paradigm. Table A-1 provides the estimated structural equations and Table A-2 offers a definition of the model variables.

Equation (1) is a price-dependent demand equation for Texas spring onions:

(1) $TXPR = f(TXS, SKA, NC, IM, EX, PDI, 0_1, 0_2, 0_3, TR)$.

Economic theory suggests that Texas price (TXPR) is negatively affected by the quantity of spring onions shipped by Texas producers (TXS), competing supplies from storage (SKA), competing shipments of new crop competitors (NC), and Mexican imports (IM). Additional variables expected to influence the Texas onion price include the export of U.S. onions during the spring (EX), U.S. per capita disposable income (PDI), and onion variety (white = 0_1, Granex = 0_2, Grano = 0_3). Varieties are included as binary variables. Also included is trend (TR) which is designed to measure changes in tastes and preferences for Texas onions.

The second equation is the Texas onion shipment equation:

(2) $TXS = f(LAP, ALS, LPC)$.

This equation specifies the quantity of spring onions shipped by Texas producers during the spring (TXS) to be a function of Texas average onion price during the previous year (LAP), acreage planted to late-summer onions (ALS), and a production cost index representative of the planting period (LPC). The lagged price variable (LAP) is expected to have a positive sign. The storage crop is harvested in the fall, stored for shipment through the following winter and spring, and, consequently, competes with the Texas product. Therefore, when Texas producers commence planting in September they consider the anticipated size of the storage crop. They estimate the size of the storage crop by identifying planted acreage. Consequently, a negative sign is expected on the ALS variable. A negative sign is also expected on the production cost index (LPC).

Equation (3) is the U.S. demand for Mexican onion equation:

(3) $IM = f(TXPR, MXTPR, PDI, RTF, LIM)$.

The quantity of Mexican onions demanded by U.S. consumers during the spring season (IM) is hypothesized to be a function of the U.S./Mexico border price of the imported onion less the real tariff (MXTPR), Texas spring onion price (TXPR), per capita disposable income (PDI) of U.S. consumers, the real tariff (RTF), and the import of onions during the previous spring season (LIM). The Texas price (TXPR) is expected to have a positive impact on the quantity of Mexican onions demanded (IM) by U.S. consumers. The price of the imported Mexican onions less the real tariff (MXTPR) and the real tariff rate (RTF) are expected to impact imports (IM) negatively . U.S. per capita disposable income (PDI) will likely have a positive impact on onion imports. The lagged import variable (LIM) captures the influence of contractual arrangements on onion trade.

Equation (4) is the Mexican onion price equation:

(4) MXPR = f(MXPIM, IM, MXPDI).

Economic logic suggests that the annual onion price in Mexico (MXPR) is a function of annual onion production in Mexico that is not exported during the spring season (MXPIM which is MXP-IM), onion production which is exported by Mexico to the United States in the spring (IM), and real per capita income in Mexico as measured in pesos (MXPDI). The Mexican onion price is expected to be negatively related to MXPIM but positively related to Mexican spring onion exports to the United States (IM) and to real per capita income as measured in pesos (MXPDI).

Equation (5) explains the Mexican supply of onions:

(5) MXP = f(LMXPR, LMXEXP, LMXPC).

The annual supply of onions in Mexico (MXP) is specified as a function of the annual price (LMXPR) for the previous year, lagged annual exports to the United States (LMXEXP), and a Mexican production cost index (LMXPC) applicable during the planting period. MXP is hypothesized to be positively related to LMXPR and LMXEXP but negatively related to LMXPC.

The final behavioral equation is Mexican annual exports of onions to the U.S.:

(6) MXEXP = f(MXP, TXPR, LMXEXP, RTF, LAREX, Q).

The quantity of onions annually supplied to the United States by Mexico (MXEXP) is specified as a function of Mexican onion production (MXP), the price of Texas spring onions (TXPR), Mexican onion exports to the United States in the prior year (LMXEXP), the real tariff levied by the United States on onion imports from Mexico (RTF), the real pesos/dollar exchange rate during the Mexican onion planting season (LAREX), and a binary policy variable (Q) dealing with the imposition of quality standards on Mexican onion imports in 1980. MXEXP is expected to be positively related to MXP, TXPR, and LMXEXP. The nominal tariff on onion imports was fixed at $1.75/cwt throughout the 1976-85 study period. A negative sign is expected on the RTF variable. The policy variable (Q), reflects the potential impact associated with the requirement that imported onions meet the grade, size, maturity, and quality standards specified for the Texas onion.

An identity equates the quantity of Mexican-produced onions available for consumption in Mexico and export in other than the spring season (MXPIM) to the difference between annual Mexican production (MXP) and exports to the United States in the spring (IM):

(7) MXPIM = MXP-IM.

The structural model consists of seven endogenous variables, three lagged endogenous variables, and 16 exogenous variables. Based on rank and order conditions, the model is over-identified. The technique of two-stage least squares was used to estimate the structural parameters.

Table A-1: Estimated Structural Equations for Texas/Mexico Spring Onion Model

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(1) Texas spring onion demand (price-dependent)

$$TXPR = 73.7932^{*} - 0.00789*TXS^{*} - 0.0111*SKA^{*} - 0.00597*NC - 0.00149*IM + 0.00348*EX$$
(4.258) (4.622) (3.712) (2.321) (0.329) (0.339)

$$- 0.00161*PDI^{*} - 1.6144*O_2 - 2.1678*O_3^{*} + 1.388*TR^{*}$$
(1.343) (1.603) (2.152) (1.816)

$R^2 = 0.6484$ DW = 2.297

(2) Texas spring onion shipments:

$$TXS = 7{,}486.104^{*} + 123.249*LAP^{*} - 0.0715*ALS^{*} - 8.0081*LPC$$
(2.501) (2.971) (2.990) (0.714)

$R^2 = 0.4948$ DW = 2.523

(3) U.S. import demand for Mexican onions (March-June)

$$IM = 1{,}582.627^{*} + 18.351*TXPR - 23.559*MXTPR^{*} + 0.3740*PDI^{*} - 2{,}454.831*RTF^{*}$$
(3.354) (1.436) (2.035) (4.160) (4.761)

$$- 0.4865*LIM$$
(1.739)

$R^2 = 0.6282$ DW = 0.191

(4) Mexico onion demand (price-dependent)

$$MXPR = 0.69276^{*} - 0.00187*MXPIM^{*} + 0.0025*IM^{*} + 0.001149*MXPDI^{*}$$
(4.416) (13.155) (3.650) (14.421)

$R^2 = 0.9209$ DW = 1.889

(5) Mexico annual onion production

$$MXP = 8{,}182.208^{*} + 382.143*LMXPR^{*} + 1.4933*LMXEXP^{*} - 23.7358*LMXPC^{*}$$
(7.200) (7.019) (2.817) (5.330)

$R^2 = 0.8121$ DW = 1.869

(6) Mexico annual onion exports to the U.S.

$$MXEXP = - 357.6287 + 0.1629*MXP^{*} + 18.2352*TXPR^{*} + 0.0818*LMXEXP - 699.584*RTF^{*}$$
(0.984) (8.114) (3.407) (1.458) (4.165)

$$+ 34.2674*LAREX^{*} + 599.665*Q^{*}$$
(4.863) (9.144)

$R^2 = 0.9586$ DW = 1.812

Note: t-values are in parenthesis. Asterisk (*) indicates statistical significance at the 0.10 level.

Table A-2: Variable Identification, Description, and Descriptive Statistics

Variable Identification	Description	Mean	Standard Deviation	Minimum	Maximum
TXPR	Texas spring onion average price (all onion varieties), 1976-85 ($/cwt)	8.80	3.10	4.56	16.41
	Texas white onion	10.06	3.31	6.42	16.41
	Texas Granex onion	8.45	3.38	4.56	15.12
	Texas Grano onion	7.89	1.96	6.04	12.49
TXS	Texas spring onion shipments, 1976-85 (1,000 cwt)	3,329.6	688.0	2,510.0	4,875.0
SKA	Storage onion shipments in March and April, 1976-85 (1,000 cwt)	1,442.6	556.4	82.0	2,259.0
NC	Other new-crop onion shipments in spring, 1976-85 (1,000 cwt)	2,891.4	691.5	2,107.0	3,852.0
IM	U.S. onion imports from Mexico in March-June, 1976-85 (1,000 cwt)	708.6	194.2	398.0	1,019.0
LIM	Lagged U.S. onion imports from Mexico in March-June, 1975-84 (1,000 cwt)	662.9	202.6	398.0	1,019.0
EX	U.S. exports of onions in spring, 1976-85 (1,000 cwt)	111.7	66.5	37.0	208.0
PDI	U.S. per capita disposable income, 1976-85 ($)	6,900.8	1,226.2	5,696.5	8,670.3
O_2	0-1 variable, Texas Granex onion	-	-	-	-
0_3	0-1 variable, Texas Grano onion	-	-	-	-
Q	0-1 variable, quality requirements established for onion imports in 1980 (1976-79 = 1), (1980-85 = 0)	-	-	-	-
LAP	Lagged average price for all Texas spring onions, 1975-84 ($/cwt)	8.84	2.3	4.79	11.98
ALS	Acres of late-summer onions, 1975-84	54,022.0	5,138.8	45,710.0	64,530.0
LPC	Lagged Texas onion production cost index, 1976-84 (1975=100)	255.9	36.1	194.0	290.0
LMXPC	Lagged Mexico onion production cost index, 1975-84 (1975 =100)	143.2	28.1	104.8	199.4

Table A-2 continued on next page

Table A-2 continued

Variable Identification	Description	Mean	Standard Deviation	Minimum	Maximum
MXPR	Mexican average annual onion prices, 1976-85 ($/cwt)	4.72	1.94	2.83	9.99
MXP	Mexican annual onion production, 1976-85 (1,000 cwt)	8,138.6	1,128.0	6,372.0	9,415.0
RTF	Real onion tariff, 1976-85 ($/cwt)	1.22	0.25	0.99	1.67
MXTPR	Border price of imported Mexico onion net the real tariff ($/cwt)	12.70	4.05	8.79	22.41
LAREX	Real exchange rate in the Mexican onion planting season, pesos/dollar, 1975-84 (1975=100)	14.33	2.64	11.35	19.60
MXEXP	Mexican annual onion exports to the U.S., 1976-85 (1,000 cwt)	1,067.0	241.4	710.0	1,431.0
MXPDI	Mexican per capita disposable income, pesos, 1976-85	20,664.9	1,438.8	18,476.0	22,991.0
LMXPR	One-year lag in MXPR	4.82	1.88	2.83	9.99
LMXEXP	One-year lag in MXEXP	662.9	202.61	398.0	1,019.0
MXPIM	MXP - IM	7,430.0	2,266.2	5,974.0	8,710.0