AN ANALYSIS OF NAFTA AND OTHER FACTORS IMPACTING

THE U.S.-MEXICO FRESH WINTER TOMATO MARKET

by

MAWAR ANDROMEDA TRESNA

(Under the Direction of Lewell F. Gunter)

ABSTRACT

The market for winter tomatoes in the U.S. is very important to Florida and Mexican producers. In 1995, Florida producers filed a petition with the U.S. International Trade Commission (ITC) to seek protection because of a Mexican tomato import surge to the U.S. market. Florida producers also claimed that Mexican producers were dumping tomatoes in the U.S. market. In this study, we examined factors that may have affected Florida and Mexico shares of the U.S. fresh winter tomato market. Three-stage least squares were used to estimate supply, demand, and excess supply equations. The results suggest that Mexican exports were responsive to the peso devaluation and prices in the U.S. and Mexican markets and that U.S. producers reacted to the passage of NAFTA and the suspension agreement of late 1996, which suspended the ITC anti-dumping investigation and set a minimum price for imported Mexican tomatoes.

INDEX WORDS: Fresh winter tomatoes, NAFTA, Peso devaluation, Trade model, Excess supply, Suspension agreement, Dumping.

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MAWAR ANDROMEDA TRESNA

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MAWAR ANDROMEDA TRESNA

Major Professor:	Lewell F. Gunter
Committee:	Glenn C.W. Ames Jack E. Houston

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
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Dedicated to my parents, ‘Mamah’ Elly Julia and ‘Bapak’ Hadi Tresna

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CHAPTER I

INTRODUCTION

1. Background

Fresh vegetable markets are important to the United States and Mexico, especially the winter fresh market. In Mexico they generate foreign exchange and employment. U.S. imports of fresh winter vegetables from Mexico in 2001 were $1,046 million, and tomatoes represented about 46 percent ($485 million) of this value (Vegetables and Melons Situation and Yearbook, July 2002). In production season 2000/2001, the value of Florida winter vegetables production was $ 1,076 million. Tomatoes accounted for roughly 55 percent ($588 million) of this value (Florida Agricultural Facts, NASS, USDA, 2002).

Florida and the Mexican State of Sinaloa supply most winter fresh vegetables to U.S. consumers (VanSickle, *et al*., 1994). Among all the fresh winter vegetables, tomatoes account for the highest value. The most important competition between these two areas is during the December through April period.

Under NAFTA, the competition between U.S. and Mexican fresh vegetables has intensified. Between 1994 and 1998, U.S. fresh vegetable production averaged nearly $7 billion in cash receipts annually, while U.S. fresh vegetable imports averaged about $1.4 billion with $0.70 billion in fresh tomatoes (Malaga, Williams and Fuller, 2000). Mexico supplies about 96% of U.S. tomato imports and 80-90% of U.S. cucumber, onion, bell pepper, and squash imports (Calvin and Lucier, 1997). These facts show that tomatoes are one of the leading Mexican agricultural export commodities to the United States.

Because of the surge in Mexican tomato imports in 1995, a 58% increase in volume and 29% in value over 1994, Florida growers filed petitions with the U.S. International Trade commission (USITC) to seek protection. They mainly blamed the reduction in trade barriers due to NAFTA for this Mexican tomato import surge that allegedly depressed domestic prices and profits and reduced Florida's market share. Florida growers also claimed that Mexican producers were dumping tomatoes in the U.S. market, resulting in a large increase in Mexican tomato imports to the U.S. in 1995.

There are many other factors that could have affected the Mexican export surge to the United States. According to the Economic Research Service (USDA, 1999), the development of trade between NAFTA partners was primarily due to factors other than NAFTA, including changing consumer preferences, strong U.S. demand, adverse weather conditions, and the peso devaluation and subsequent Mexican recession in late 1994 and 1995.

Increased imports of Mexican tomatoes are partly due to increased U.S. tomato consumption. According to per capita disappearance data compiled by USDA Economic Research Service, U.S. consumption of both fresh and processed tomatoes has generally trended higher over the past two decades. During a recent 3 year period (1997-1999), average fresh use increased 40 percent over the 1977-1979 period (Lucier, Lin, Allshouse and Kantor, 2000). There are many factors that have contributed to the increased per capita tomato use. Immigration trends and changes in consumer tastes and preferences have likely contributed to the increase in U.S. tomato consumption. Consumption of fresh tomatoes has increased along with the increased popularity of salads and sandwiches, the introduction of improved tomatoes varieties, and an increased emphasis on health and nutrition.

Mexican tomato exports to the U.S. also respond to macroeconomic conditions. A major peso devaluation in Mexico started in December 1994. This caused a decrease in domestic demand due to a sharp loss of consumer purchasing power. The export market became more attractive to Mexican producers since they could gain more profit by getting paid in dollars. According to Agricultural Outlook (June 1996), Mexican exporters earned twice as many as pesos per dollar, increasing the incentive to sell fresh vegetables to the U.S. Another effect of the devaluation was the increase of input cost. For imported inputs, dollar costs went up as much as 23 percent (Agricultural Outlook, June 1996). Irrigation equipment, tomato seed, fertilizers, and most other inputs are normally bought in dollars (Agricultural Outlook, June 1996).

Production technology has also impacted U.S.-Mexico tomato trade. Most of Mexico's export producers use drip irrigation, fertigation, plastic mulch, planed stakes, and most important, extended shelf life (ESL) varieties (Plunkett, 1996, p.26). The same technology package has been used in Florida for more than 20 years. However, ESL varieties grow better in Mexico than in Florida. Mexican ESL tomatoes, which are vine ripened, are increasing in U.S. wholesale and retail markets. With these new varieties, Mexico has increased market share of sales in U.S. supermarkets (Plunkett, 1996).

Although some observers consider NAFTA as the major reason for the decline in market share experienced by Florida growers of fresh winter tomatoes, it is clear that there have been many additional factors that have affected this market. Sufficient time has passed since the signing of NAFTA that it may now be possible to statistically evaluate the impact of NAFTA and other factors on the U.S.-Mexico market for fresh winter tomatoes.

2. Objectives

The objective of this study is to analyze factors that may have impacted Florida and Mexico shares of the U.S. fresh winter tomato market. Factors that are examined include NAFTA, the devaluation of the peso, the deterioration of the Mexican economy after devaluation, shifts in consumer preferences, and the suspension agreement that was reached in 1996 regarding Florida growers' complaints to the USITC.

3. Organization

The thesis includes five chapters. Chapter 1 introduces the problem of the fresh winter tomato market between the U.S. and Mexico. Chapter 2 describes the U.S.-Mexico fresh tomato trends and the U.S.-Mexico fresh tomato dispute. Chapter 3 presents a review of literature related to tomato markets, tomato consumption and production, marketing, NAFTA, and exchange rate and prices. Chapter 4 describes the theoretical framework for the analysis, the estimated models, econometrics background, and hypotheses. Chapter 5 presents the data, estimation results of the models, summary and conclusion.

CHAPTER II

U.S.- MEXICO FRESH MARKET TOMATO TRENDS AND THE U.S.- MEXICO FRESH TOMATO DISPUTE

This chapter contains two sections. In the first section, fresh market tomato trends in the United States and Mexico, including trends in production, consumption, imports, and market share are discussed. Data are reported in current/nominal value. In the second section, the U.S. and Mexico fresh tomato dispute is examined.

1. Fresh Market Tomato Trends in the United States and Mexico

1.1 U.S. Production and Consumption of Fresh-market Tomatoes

1.1.1. U.S. Production and Consumption by Quantity

Overall U.S. production of fresh market tomatoes from 1991-2000 was relatively stable (Figure 2.1). In 1992, U.S. production reached its highest level, about 3.90 billion pounds, in quantity (Table 2.1). In 1994, NAFTA's first year, U.S. production of fresh market tomatoes was 3.76 billion pounds. U.S. production decreased in each of the three following years: 3.45 billion pounds in 1995, 3.36 billion pounds in 1996, and 3.28 billion pounds in 1997. In 1998, U.S. production was in its lowest level of about 3.26 billion pounds. U.S. production began to rebound in 1999 and increased to 3.70 billion pounds by 2000.

From 1991 until 1996, U.S. consumption had an upward trend, increasing from 3.88 billion pounds in 1991 to 4.69 billion pounds in 1996 (Table 2.1). Two years in a row after NAFTA, 1995 and 1996, U.S. consumption rose by 6 percent and 9 percent, respectively (Figure 2.1). Consumption fell slightly in 1997, then increased again in 1998, and showed upward trends since through 2000 (Figure 2.1).

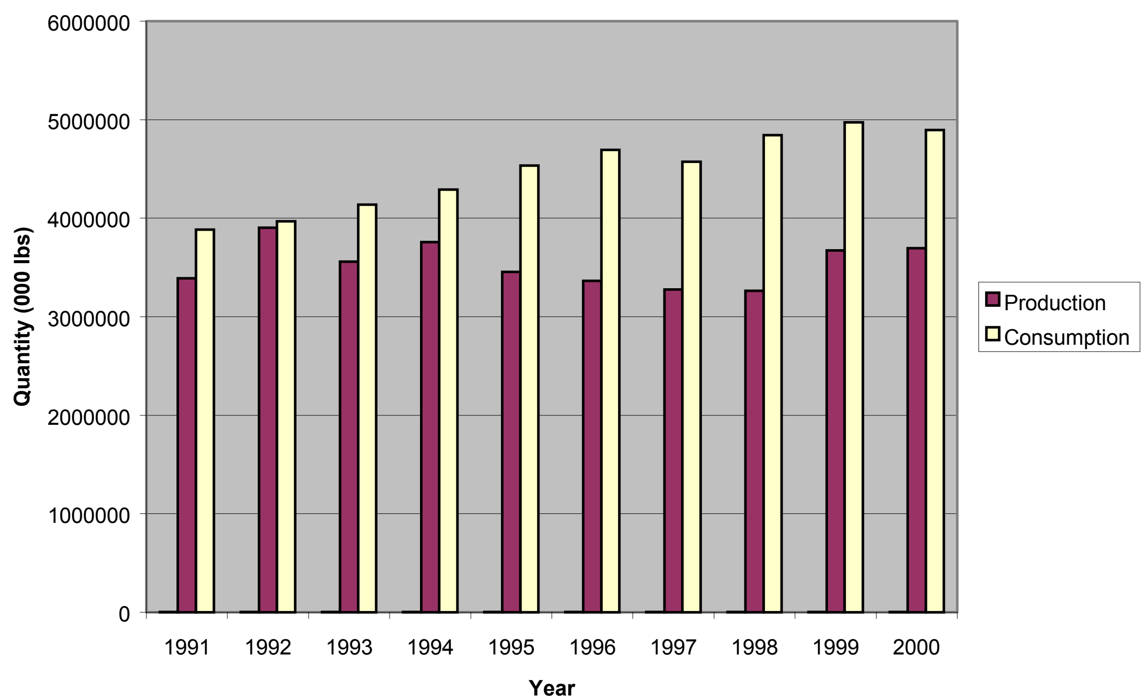

Figure 2.1. U.S. Production and Consumption of Fresh Tomatoes by Quantity

Source: Compiled from USITC Publications 2967, 3130, and 3473.

Table 2.1. Fresh-market Tomatoes: U.S. Production, Consumption, and Imports, 1991-2000

Year	U.S. Production	Apparent Consumption	U.S. Imports from: Mexico	All others	Mexican Share of U.S. Consumption
	Quantity(*1000 pounds*)				percentage
1991	3,388,700	3,883,911	779,504	15,989	20.07
1992	3,903,300	3,967,986	403,702	28,465	10.17
1993	3,559,867	4,136,431	882,929	39,462	21.35
1994	3,758,166	4,290,385	829,000	43,964	19.32
1995	3,453,468	4,533,138	1,307,467	61,429	28.84
1996	3,363,369	4,693,051	1,511,646	113,475	32.21
1997	3,277,669	4,572,821	1,456,379	180,447	31.85
1998	3,262,771	4,844,450	1,618,293	249,708	33.41
1999	3,673,468	4,971,975	1,355,970	276,880	27.27
2000	3,696,367	4,895,693	1,300,613	308,884	26.57
	Value(*1000 dollars*)				
1991	1,077,832	1,271,068	283,815	19,856	22.33
1992	1,396,950	1,431,389	148,705	25,913	10.39
1993	1,130,092	1,333,396	304,079	21,480	22.80
1994	1,029,282	1,253,443	315,448	28,485	25.17
1995	891,343	1,239,872	406,081	44,437	32.75
1996	947,031	1,519,785	580,349	92,119	38.19
1997	1,040,382	1,557,952	517,049	131,619	33.19
1998	1,149,713	1,787,087	567,443	190,452	31.75
1999	951,046	1,517,693	489,588	199,734	32.26
2000	1,160,130	1,638,130	411,796	228,485	25.14

Source: Compiled from USITC Publication 2967, 3130, and 3473, and USDA, ERS, Vegetables and Melon Situations Yearbook, 2002.

1.1.2. U.S. Price of U.S. Production and Consumption

Prices in table 2.2 were obtained by dividing value by quantity of each category: U.S. production, consumption, and imports. U.S. prices for U.S. production show some volatility. Producer price reached its highest level in 1992 at 35.79 cents per pound, and since then it showed a downward trend until 1995 (Figure 2.2). The prices increased again during 1996 to 1998, and in 1998, the price was 35.24 cents per pound, almost as high as in 1992. The price decreased again in 1999 to 25.89 cents per pound and it went up in 2000 to 31.29 cents per pound.

Table 2.2. Fresh-market Tomatoes: U.S. Price for Production, Consumption, Imports from Mexico and ROW, 1991-2000

Year	U.S. Price for U.S. Production	U.S. Price for U.S. Consumption	U.S. Price for U.S. Imports from Mexico	U.S. Price for U.S. Imports from ROW
	cents/pound			
1991	31.81	32.73	36.41	124.19
1992	35.79	36.07	36.84	91.03
1993	31.75	32.24	34.44	54.43
1994	27.39	29.22	38.05	64.79
1995	25.81	27.35	31.06	72.34
1996	28.16	32.38	38.39	81.18
1997	31.74	34.07	35.50	72.94
1998	35.24	36.89	35.06	76.27
1999	25.89	30.52	36.11	72.14
2000	31.39	33.46	31.66	73.97

Source: USITC Publications 2967, 3130, and 3473.

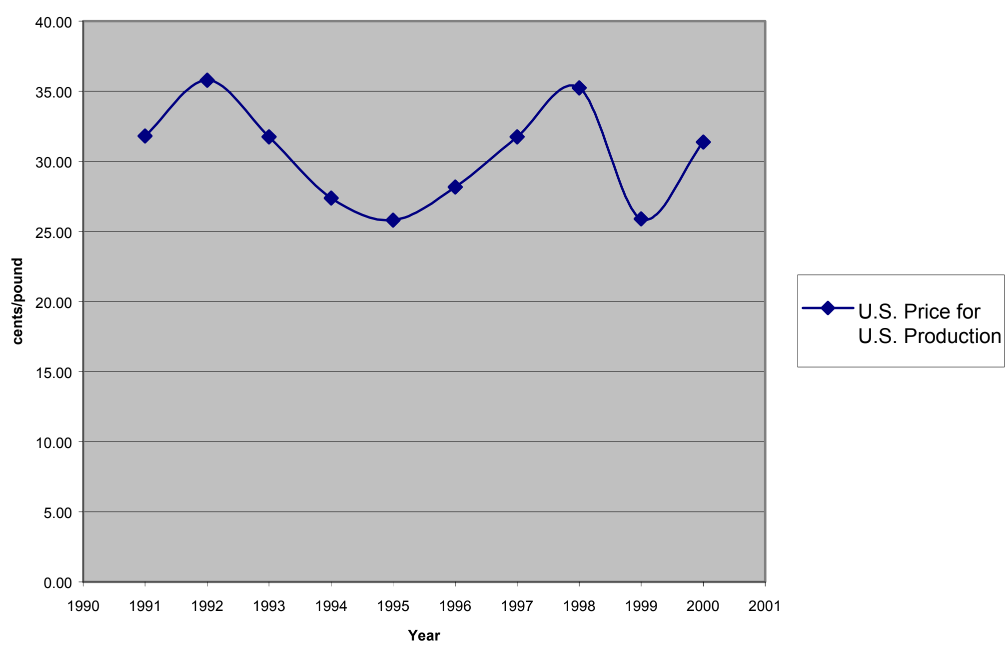

Figure 2.2. U.S. Price of U.S. Fresh Tomato Production

Source: USITC Publications 2967, 3130, and 3473.

Prices paid by U.S. consumers show a similar trend with U.S. producer prices. Price had a downward trend during 1992 to 1995, and reached its lowest level in 1995 at 27.35 cents per pound (Figure 2.3). The prices increased during 1996 to 1998, and reached its highest level in 1998 at 36.89 cents per pound, a 35 percent increase over 1995. The price fell in 1999 to 30.52 cents per pound, and rose again in 2000 to 33.46 cents per pound.

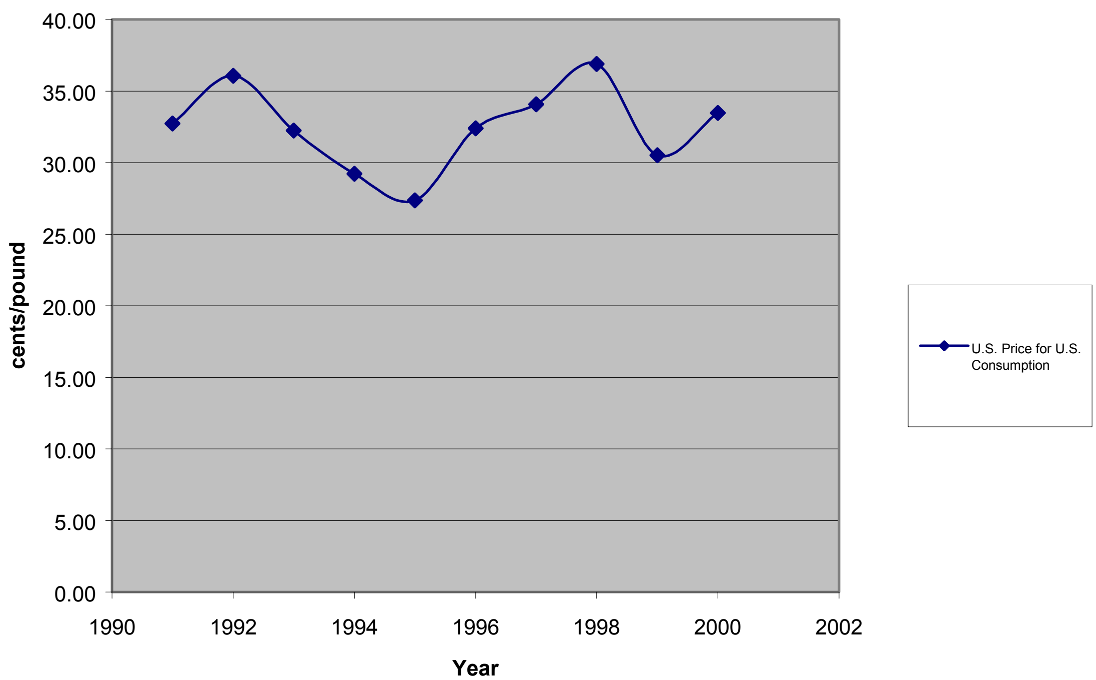

Figure 2.3. U.S. Price of U.S. Fresh Tomato Consumption

Source: USITC Publications 2967, 3130, and 3473.

1.1.3. U.S. Production and Consumption by Value

As shown in Figure 2.4, the value of U.S. fresh tomato production was volatile during 1991-2000. Value of production reached its highest level in 1992, about $ 1.4 billion (table 2.1). In 1995, the year after NAFTA was signed, U.S. production value reached its lowest level of about $ 891 million, 13 percent below 1994. U.S. production value increased in 1996, 1997 and 1998, fell 17 percent in 1999 over 1998, and increased to 1.16 billion in 2000, a 22 percent increase over 1999.

Value of U.S. consumption showed a downward trend from 1992 to 1995. Starting in 1996, it began to increase and reached the highest level in 1998 of about $1.78 billion, a 43 percent increase from 1994. Consumption decreased again in 1999, a 15 percent decrease from 1998. In 2000, U.S. consumption rose 8 percent from 1999.

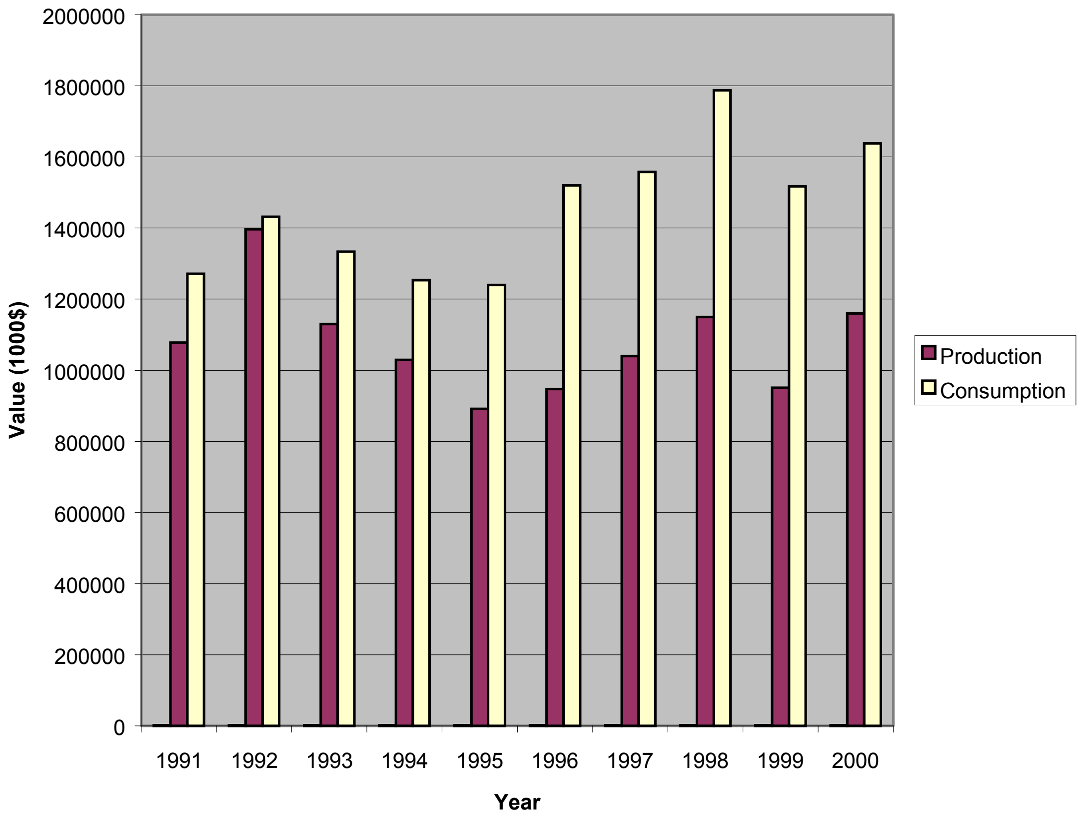

Figure 2.4. U.S. Production and Consumption of Fresh Tomatoes by Value

Source: Compiled from USITC Publications 2967, 3130, and 3473.

1.2. U.S Fresh Tomato Imports from Mexico and the Rest of the World (ROW)

Mexico is the major supplier for winter vegetables to the United States. In 1993, the year before NAFTA began, Mexico supplied 96 percent of all tomato imports, 83 percent of bell peppers, 90 percent of cucumbers, 93 percent of squash, 99 percent of eggplant, and 94 percent of snap beans (Calvin and Lucier, 1997).

1.2.1. U.S. Fresh Tomato Imports by Quantity

U.S. fresh tomato imports from Mexico reached its lowest level in the 90's in 1992 at about 400 million pounds (Figure 2.5). In 1995 and 1996, two years after NAFTA, U.S. imports from Mexico rose in quantity by 58 percent and 82 percent, respectively, relative to 1994 Mexican imports. In 1998, Mexican imports reached the highest level of about 1.6 billions pounds.

During 1991-2000, the rest of the world imports had an upward trend. The biggest sources of non-Mexican tomato imports are from Canada and Netherlands for their greenhouse tomatoes.

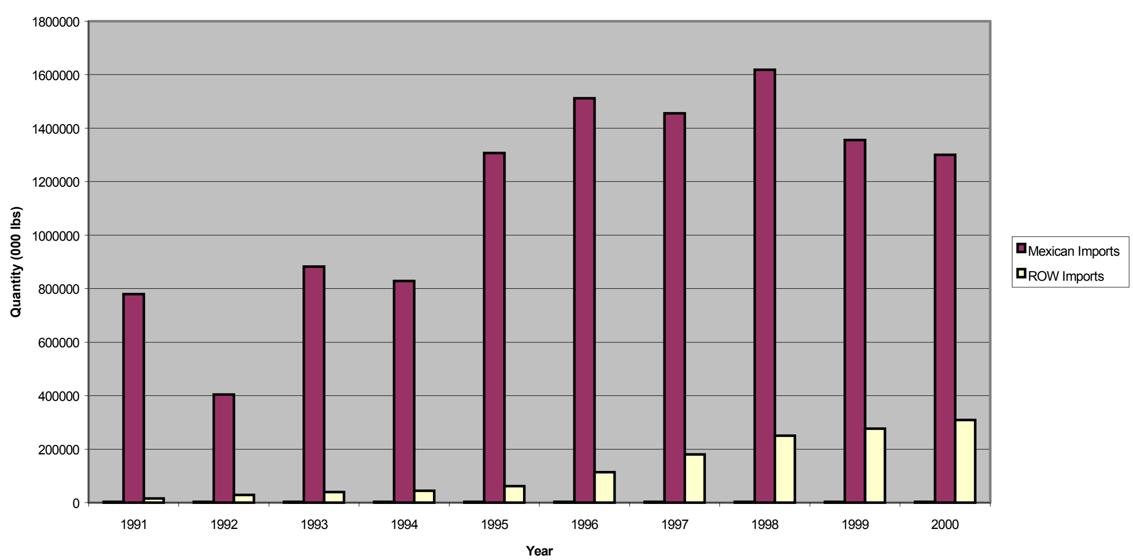

Figure 2.5. U.S. Fresh Tomatoes Imports from Mexico and ROW by Quantity

Source: Compiled from USITC Publications 2967, 3130, and 3473.

1.2.2. U.S. Price of Imports from Mexico and ROW

Trends in U.S. prices of U.S. fresh tomato imports from Mexico are shown in figure 2.6. The price reached its lowest level in 1995 at about 31.06 cents per pound. Note that U.S. prices for U.S. production and consumption also reached their lowest point in the same year, 1995. U.S. price of imports from Mexico reached its highest level in 1996 at 38.39 cents per pound, and since then this price had a generally downward trend.

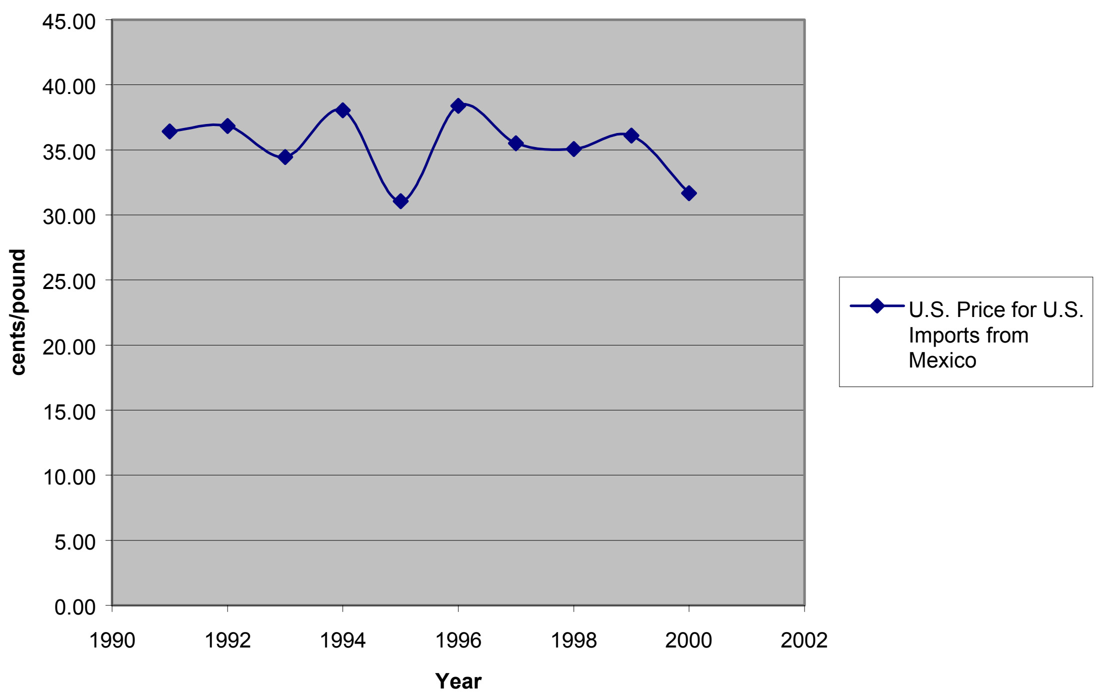

Figure 2.6. U.S. Price of U.S. Fresh Tomato Imports from Mexico

Source: USITC Publications 2967, 3130, and 3473.

In 1991, the U.S. price for the rest of the world imports was $1.24 per pound, considerably high compared to prices for imports from Mexico. A sharp decrease occurred in 1993 when the price was 54.43 cents per pound, a 60 percent decrease from

1991. Since then the ROW prices had an upward trend from 1994 to 1996, and this trend was relatively stable from 1997 to 2000.

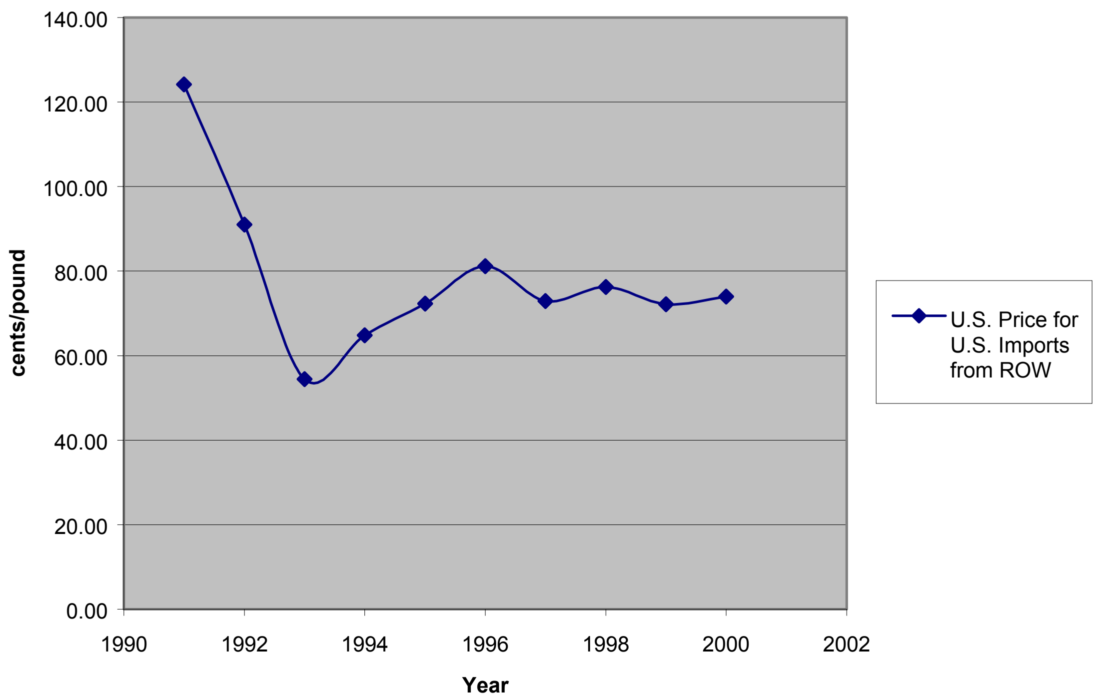

Figure 2.7. U.S. Price of U.S. Fresh Tomato Imports from ROW

Source: USITC Publications 2967, 3130, and 3473.

1.2.3. U.S. Fresh Tomato Imports by Value

The value of U.S. fresh tomato imports from Mexico showed a somewhat different pattern than the quantity of imports. In 1992, import value reached its lowest level of the 90's at about $ 150 million. In 1995, there was an increase of 29 percent in import value over 1994, and it reached the highest level in 1996 at about $ 580 million, an 84 percent increase from 1994. Mexican import value fell 11 percent in 1997 from 1996, and rose again 10 percent in 1998 from 1997. After 1998, the value of imports had a downward trend. The rest of the world value of imports showed more fluctuation than the corresponding quantity of imports during the 1991-2000 period.

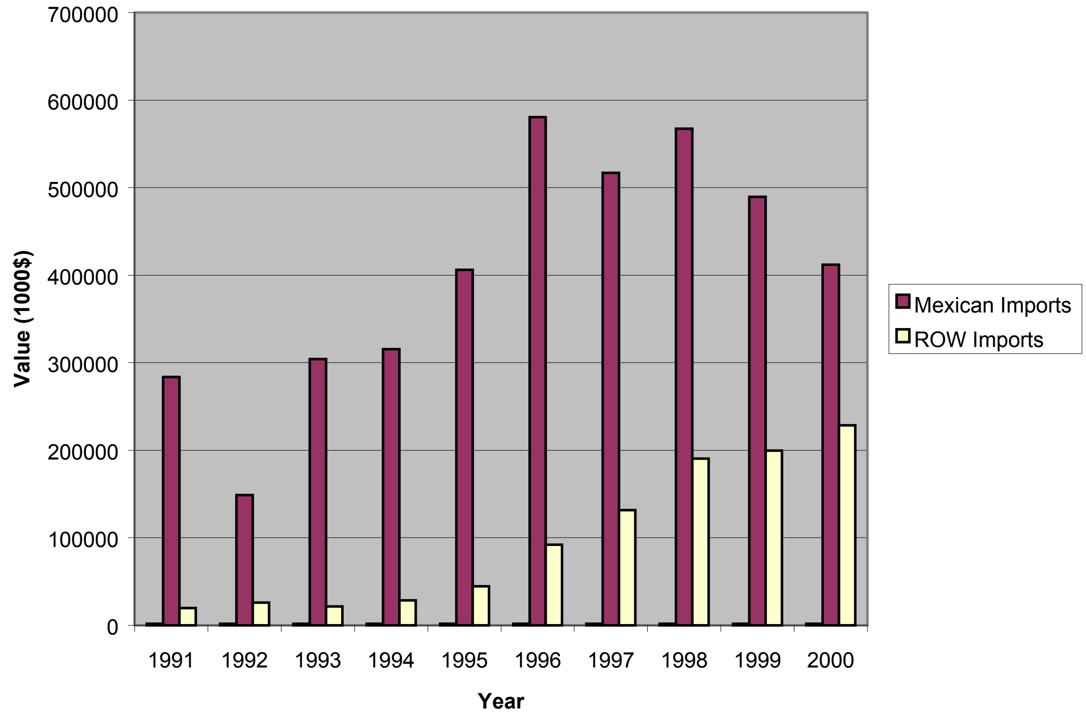

Figure 2.8. U.S. Imports of Fresh Tomatoes from Mexico and ROW by Value

Source: Compiled from USITC Publications 2967, 3130, and 3473.

1.3 Mexican Share of U.S. Fresh Tomato Consumption

Based on Figure 2.9 and Table 2.1, the Mexican share of U.S. fresh tomato consumption showed a similar trend in quantity and value. However, Mexican share in quantity reached its highest level in 1998 at about 33 percent, whereas in value, the highest share was in 1996 at about 38 percent. In 1996, there was an increase of 67 percent and 52 percent in quantity and value, respectively, from 1994. Shares in quantity showed a downward trend during 1998-2000, whereas in value showed a downward trend from 1996 to 2000 except for a small increase in 1999.

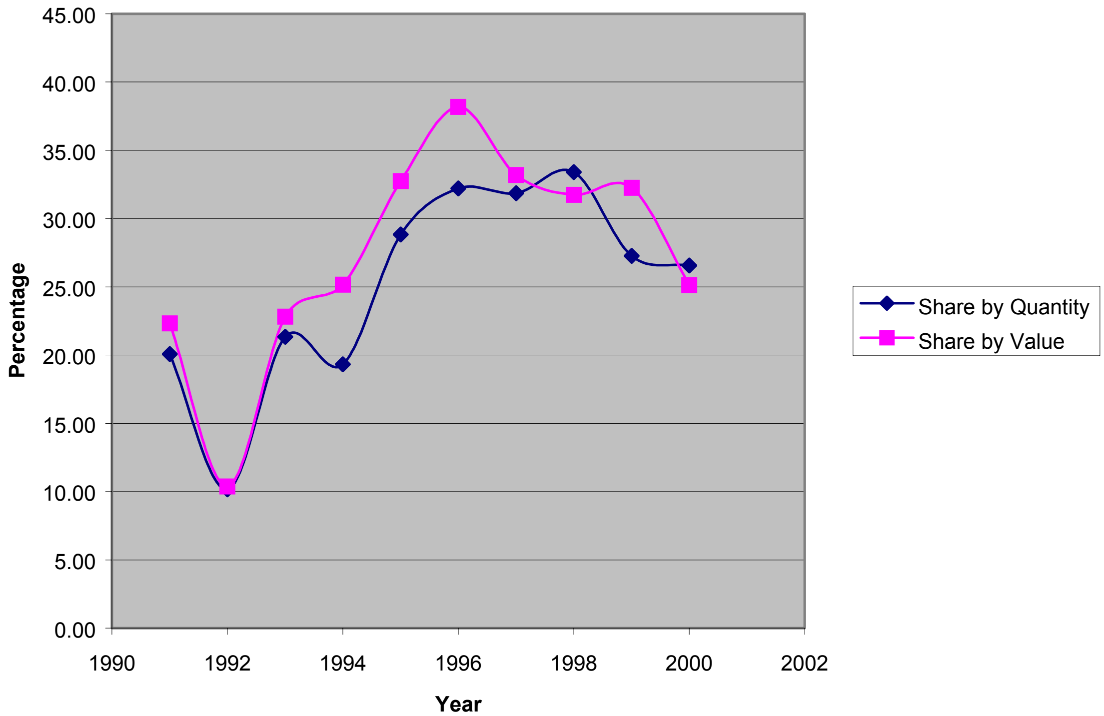

Figure 2.9. Mexican Share of U.S. Consumption of Fresh Tomatoes

Source: Compiled from USITC Publication 2967, 3130, and 3473

1.4 Fresh-market Winter Tomatoes

In this study, we focus on fresh winter tomatoes; thus, we will discuss the market trends of fresh winter tomatoes in this section. According to VanSickle ***et al***. 1994, Florida and Mexico are in direct competition during October through June, and the most intense competition is during December through April when both areas are in full production. Most of the winter imports came from the Customs District of entry of Nogales, Laredo, and San Diego (USITC Pub. 3473).

During the 1991/92-winter season, U.S. fresh winter tomato imports reached their lowest level of the 90's, accounting for about 280 million pounds. There was a 26 percent increase in the period of 1995-1996 over the period of 1994-1995. These imports reached their highest level in 1997-1998 and had a downward trend during 1998-2000.

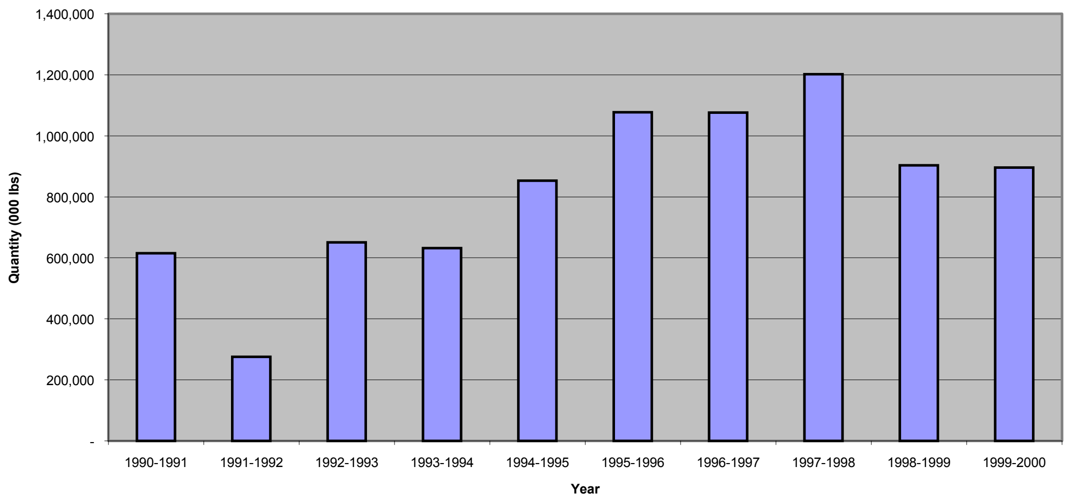

Figure 2.10. U.S. Imports of Fresh-market Winter Tomatoes from Mexico, December through May, 1990-2000

Source: USITC data web, http://dataweb.usitc.gov/scripts/user_set.asp

1.5. U.S. Prices for Fresh Tomatoes

The f.o.b. shipping-point price is the average, unweighted unit price received by the shipper or grower-shipper primarily for sales in carload or truckload quantities, but also including mixed loads (ERS, USDA, VGS-2002, July 2002). The highest U.S. season average f.o.b. shipping point price was in 1992, at 35.80 cents per pound, and the lowest U.S. f.o.b price was in 1995 (Table 2.3). The U.S. annual retail price reached its highest level in 1998 at $1.48 per pound. The U.S. annual retail price index shows a generally upward trend during 1992-2001.

Table 2.3. U.S. Prices for Fresh Tomatoes, 1991-2001

Year	U.S. season average f.o.b. shipping point price	U.S. annual retail price	U.S. annual retail price index 1/
	cents per pound		1982-84=100
1991	31.70	100.7	153.1
1992	35.80	109.4	171.8
1993	31.50	108.4	168.0
1994	27.40	108.6	173.5
1995	25.50	115.6	188.3
1996	28.10	121.0	198.2
1997	31.70	129.3	213.6
1998	35.20	147.6	239.2
1999	25.90	137.0	224.1
2000	30.80	138.2	234.7
2001	30.20	132.0	250.0

1/ Index of retail prices paid in major U.S. cities
Source: ERS, USDA, Vegetables and Melons Situation and Outlook Yearbook, July 2002

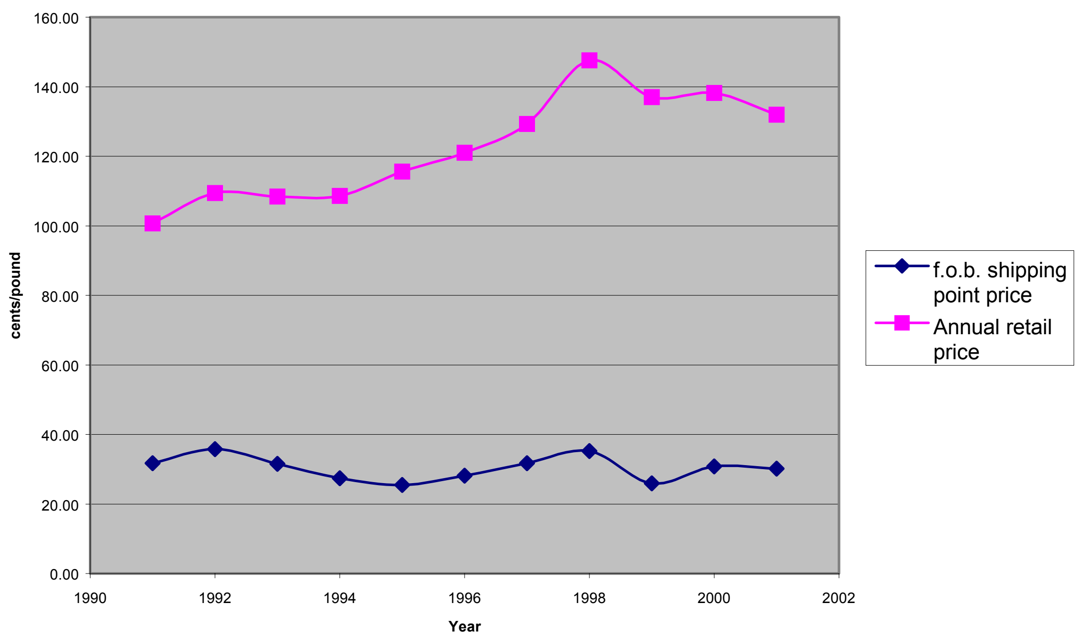

Figure 2.11. U.S. Season Average F.o.b. Shipping Point Price, and Annual Retail Price of Fresh–market Tomatoes

Source: ERS, USDA, Vegetables and Melons Situation Outlook Yearbook, July 2002

1.6 Mexican Fresh Tomato Production, Exchange Rate, and GDP

Table 2.4 shows that Mexican fresh tomato production generally increased during 1992-2001. Mexican tomato production was down somewhat in 1996, compared to 1994 and 1995. In 1997, however, Mexican production increased from the 1996 level of 3.6 billion pounds to 4.3 billion pounds, and production has had a relatively upward trend since that time.

The Mexican peso was devalued in late 1994. As shown in table 2.4, pesos per dollar jumped from 3.39 in 1994 to 6.50 in 1995. The value of peso has continued to fall gradually since that time, with the average exchange rate of 9.32 pesos per dollar occurring in 2001.

During 1992-1994, Mexican Gross Domestic Product had an upward trend rising from an index value of about 98.68 in 1992 to 105.08 in 1994. In 1995, however, the GDP index fell suddenly to 98.55, showing a bad economic situation in Mexico after the devaluation. During 1997-2001, the GDP has shown a relatively strong upward trend, however, indicating a substantial recovery of the economic situation in Mexico.

Table 2.4. Mexican Fresh Tomato Production, Exchange Rate, and GDP, 1992-2001

Year	Production (l000lbs)	Peso/dollar	GDP
1992	3,020,329	3.09	98.68
1993	2,689,636	3.11	100.60
1994	3,732,422	3.39	105.08
1995	3,858,085	6.50	98.55
1996	3,584,712	7.59	103.61
1997	4,315,506	7.95	110.63
1998	4,570,962	9.24	116.06
1999	4,282,166	9.56	120.40
2000	4,492,863	9.47	128.31
2001	4,384,989	9.32	127.91

Source: Attaché Reports, and Banco de Mexico

2. U.S.– Mexico Fresh Winter Tomato Dispute

2.1 Florida growers petition for protection from Mexican imports

Florida growers mainly blamed NAFTA for their loss of market share and for the surge in imports of Mexican tomatoes, and filed petitions to seek protection from the U.S. government. The first petition was filed on March 11, 1996. The Florida Fruit and Vegetable Association, the Florida Bell Pepper Growers Exchange, the Florida Commissioner of Agriculture, the Ad Hoc Group of Florida Tomato Growers and packers, and individual Florida bell pepper growers filed a petition requesting global safeguard relief against increased imports of fresh tomatoes and bell peppers pursuant to Section 202(a) of the Trade Act of 1974. The domestic industry requested relief for a four-year period, using both a volume quota and increased duties based on the value of the imported product (Petition March 11, 1996, p.50). Consequently, the U.S. International Trade Commission instituted Investigation No. TA-201-66 of fresh tomatoes and bell peppers on March 11, 1996.

On March 29, 1996, the Florida Commissioner of Agriculture, the Florida Tomato Growers Exchange, the Florida Tomato Exchange, the Florida Fruit and Vegetable Association (and its Tomato Committee), the Florida Farm Bureau Association, the Gadsden County Tomato Growers Association, the South Carolina Tomato Association, the Accomack County Farm Bureau (VA), and the AD Hoc Group of Florida, California, Georgia, Pennsylvania, South Carolina, Tennessee and Virginia Tomato Growers also filed a petition "to request initiation of an antidumping duty investigation of fresh tomatoes imported from Mexico which are being, or likely to be, sold in the United States at less than fair value" (Petition March 29, 1996, p.2). The petitioners alleged that increased imports are directly attributable "to dumping by Mexican growers and their importers" (Petition March 29, 1996, p.6). The International Trade Commission instituted antidumping investigation No. 731-TA-747, effective April 1, 1996.

The U.S. International Trade Commission investigates petitions from producers claiming to be hurt by the imported products. In this case, the U.S. ITC investigated two petitions, under Section 202(a) of Trade Act 1974, and under Section 733(a) of the Tariff Act 1930. Since there was not enough evidence that the domestic industries were harmed by an import surge, the first petition under Section 202(a) was rejected in July 1996. For the second petition, the International Trade Administration (ITA) of the Department of Commerce determines whether dumping has occurred.

2.2. Investigation No. TA-201-66

According to USITC, publication 2985, an investigation under Section 202 of the Trade Act of 1974, the commission must find that three criteria are satisfied: (1) imports of the subject article are in increased quantities; (2) the domestic industry is seriously injured or threatened with serious injury; and (3) such increased imports are a substantial cause of the serious injury. Consequently, based on the information that the commission had for this investigation, they determined that fresh tomatoes and bell peppers imports did not injure the U.S. domestic industry. The hearing in connection with the injury phase of the investigation was held in Washington DC on June 3, 1996, and all persons who requested the opportunity were permitted to appear in person or by counsel

(Investigation No. TA-201-66). Since the commission made a negative determination, the hearing on the remedy phase scheduled for August 1, 1996, was not held.

The terms " serious injury" and " threat" of serious injury are defined in Section 202(c)(6) of the Trade Act (USITC, Investigation No. TA 201-66). According to this Act, " serious injury" is defined as "a significant overall impairment in the position of a domestic industry". Threat of serious injury is defined as " serious injury that is clearly imminent".

The statute also set forth economic factors that the Commission is to consider in determining whether serious injury or threat exists (USITC, Investigation No. TA 201-66). Section 202(c)(1) provides all the economics factors for the commissions to consider (USITC, Investigation No. TA 201-66):

(A) with respect to serious injury

(i) the significant idling of productive facilities in the domestic industry which includes the closing of plants or the underutilization of production capacity,

(ii) the inability of a significant number of firms to carry out domestic production operations at a reasonable level of profits, and

(iii) significant unemployment or underemployment within the domestic industry;

(B) with respect to threat of serious injury

(i) a decline in sales or market share, a higher and growing inventory (whether maintained by domestic producers, importers, wholesalers, or retailers), and a downward trend in production, profits, wages, productivity, or employment (or increasing underemployment) in the domestic industry),

(ii) the extent to which firms in the domestic industry are unable to generate adequate capital to finance the modernization of their domestic plants and equipment, or are unable to maintain existing levels of expenditures for research and development,

(iii) the extent to which the United States market is the focal point for the diversion of exports of the article concerned by reason of restraints on exports of such article to, or on imports of such article into, third country markets.

In order to get data to be analyzed, the Commission sent questionnaires to growers and packers of tomatoes and bell pepper. The questionnaires requested financial, shipment, employment, pricing, and other data. Also, the Commission used data from USDA.

Based on the requested data, the Commission concluded that there was no significant idling of production facilities; acreage planted and harvested, production and shipments, in the domestic industry (USITC, Investigation No. TA 201-66). U.S. acreage planted and harvested was relatively constant during 1991-1995. According to USDA, the acreage planted in 1995, 135,910 acres, was slightly increased compared to 1991 at the level of 135,440 acres. The percentage of acreage harvested during the same time remained relatively unchanged. In 1992, 96.4 percent of acreage planted was harvested, and in 1995 was 96.9 percent. Production has shown an increase in some years and decrease in the others. However, there is no significant big change in any year.

Shipments showed a significant increase during 1991-1995, from 1.2 billion to 1.6 billion pounds.

Employment, hours worked, total compensation, and hourly wages either trended upward or were virtually unchanged during the period 1991-1995, both for growers and packers (USITC, Investigation No. TA 201-66). In fact, in 1995 employment levels reached their highest level of the 1991-1995 period.

The commission received the financial data from the growers. The data showed that the industry was least profitable in the 2 years (1994 and 1995) when domestic sales were at their highest in quantity (USITC, Investigation No. TA 201-66). In addition, changes in the number of growers reporting losses did not correlate with overall grower financial performance.

For these reasons, the commission concluded that the evidence did not provide a basis to find that U.S growers and packers of fresh tomatoes were seriously injured or threatened with serious injury (USITC, Investigation No. TA 201-66).

2.3. Investigation No. 731-TA-747

The commission determined that there was a reasonable indication that Mexican fresh tomato imports were sold in the United States at less than fair value (LTFV). The legal standard in preliminary antidumping investigations requires the Commission to determine, based upon the information available at the time of the preliminary determination, whether there is a reasonable indication that a domestic industry is materially injured, or threatened with material injury, by reason of the allegedly LTFV imports (USITC, Investigation No. 731-TA-747).

The investigation found that the quantity of subject imports increased 57.7 percent in 1995 over 1994, and the value of subject imports rose 32.2 percent in 1995 over 1994. The market share of subject imports by quantity also rose, from 19.8 percent in 1994 to 30.0 percent in 1995. Finally, based on the price record in this investigation, the commission concluded that the surged imports have had effects of depressing or suppressing prices for the domestic like product to a significant degree.

According to USITC, Investigation No. 731-TA-747, the subject imports did have an adverse impact on the domestic industry through both volume and revenue effects. Between 1993-1995, the domestic U.S. market share fell from 77.7 percent to 68.6 percent. At the same time, the market share of subject imports increased 8.7 percentage points. From the above explanation, the commission determined that there was a reasonable indication that the domestic industry of fresh tomatoes was materially injured by reason of allegedly LTFV imports from Mexico.

2.4 Suspension Agreement on Fresh Tomatoes from Mexico

On October 10, 1996, the US Department of Commerce and the signatory producers/exporters of fresh tomatoes from Mexico initialed a proposed agreement to suspend the antidumping duty investigation on Mexican tomato imports. On October 28, 1996, the U.S. Department of commerce and signatory Mexican producers/exporters signed the final suspension agreement, which established a minimum import reference price of $5.17 per 25-pound box or $0.2068 per pound. In order to prevent price suppression of domestic fresh tomatoes by imports, the signatory Mexican producers/exporters cannot sell the product less than the established reference price. The minimum reference price represents the lowest average monthly price for fresh-tomatoes imported from Mexico during the base-period, 1992-1994 (Department of Commerce, 1996).

On August 6, 1998, the Department of Commerce accepted the amendment of the Agreement, which established a second reference price and the time period during which each price is applicable. The Department and the signatory producer/exporters agreed to adjust the reference price that is applicable to imports to the U.S. for July 1 to October 22 of any given year, to $0.172 per pound or $4.30 per 25-pound box. On October 23, 1998, the Department and the signatory Mexican exporters agreed to adjust the reference price for the period of October 23 to June 30, to $0.2108 per pound or $5.27 per 25-pound box.

The agreement was expected to be terminated no later than November 1, 2001. According to the Uruguay Round Agreement Act, the Department of Commerce must revoke an antidumping or countervailing duty order, or terminate a suspension agreement after five years unless the Department of Commerce and ITC determine that revoking or terminating the agreement would likely to lead continuation of dumping and of material injury (http://ia.ita.doc.gov/sunset/).

On October 1, 2001, the Department of Commerce extended the time limit for final results in the full sunset review of the suspended antidumping duty investigation on fresh tomatoes from Mexico (www.usitc.gov). The commission conducted a full review to determine whether termination of the suspended investigation would be likely to cause the continuation or recurrence of material injury within a reasonably foreseeable time (USITC, 2002). They found that the case to be extraordinarily complicated due to issues related to the on-going re-negotiation of the suspension agreement from Mexico (www.usitc.gov). Therefore, the Department of Commerce set a deadline for the final ruling on tomatoes from Mexico, of no later than August 27, 2002 in accordance with section 751(c)(5)(B) of the Act.

On May 31, 2002, Mexican tomatoes growers, accounting for a large percentage of all fresh tomatoes imported into the United States from Mexico, provided written notice to the Department of Commerce of their withdrawal from the agreement suspending the antidumping investigation on fresh tomatoes from Mexico (www.usitc.gov). These withdrawals were to become effective 60 days after this notification to the Department. Because the suspension agreement would no longer cover substantially all imports of fresh tomatoes from Mexico, the Department intended to terminate the suspension agreement effective July 30, 2002 (www.usitc.gov).

With the termination of the suspension agreement, the Department intended to resume the underlying antidumping investigation as if it had published the affirmative preliminary determination under Section 733(b) of the Act on July 30, 2002 (www.usitc.gov). The Department was to make its final determination in the resumed investigation by December 12, 2002.

The Department notified the International Trade Commission of its intent to terminate the suspension agreement and resume the LTFV investigation. The ITC was scheduled to make its final determination concerning injury within 45 days after publication of the Department's final determination, approximately January 27, 2003. If both the Department's and ITC's final determinations were affirmative, the department would issue an antidumping duty order (www.usitc.gov).

With this termination of the suspension agreement, the Department of Commerce would instruct the U.S. Customs Service to suspend the liquidation of entries of fresh tomatoes from Mexico that are entered, or withdrawn from warehouse, for consumption on or after the effective date of the termination. Customs would require antidumping duty cash deposits or bonds for entries of the subject merchandise based on the preliminary dumping margins, which ranged from 4.16 to 188.45 percent (www.usitc.gov).

2.5 The New Suspension Agreement on Fresh Tomatoes from Mexico

In November 2002, the Department of Commerce and Mexican tomato growers/exporters initialed a proposed agreement suspending the resumed antidumping investigation on Mexican imports of fresh tomatoes. The new suspension agreement was signed by the Department and certain growers/exporters of fresh tomatoes from Mexico on December 4, 2002. The reference prices in this agreement are $0.172 per pound for the July 1 through October 22 period, and $0.2108 per pound for the October 23 through June 30 periods.

CHAPTER III

LITERATURE REVIEW

1. Tomato markets

According to the Economic Research Service, USDA, the United States is one of the world's leading producers of tomatoes, ranking second only to China. Annual per capita use of fresh and processed tomatoes rose in the 1990's, averaging 18 percent higher than during the 1980's, and reaching 91 pounds (fresh-weight basis) in 1999. The most important foreign suppliers of U.S. fresh market tomatoes are Mexico and Canada.

The U.S. fresh-market and the processing tomato industries are separate markets (ERS, USDA). Factors that distinguish these two industries are:

- Tomato varieties are bred specifically to serve the requirements of either the fresh or the processing markets. Processing requires varieties that contain a higher percentage of soluble solids (averaging 5 to 9 percent) to efficiently make tomato paste and sauces.
- Most tomatoes grown for processing are produced under contract between growers and processing firms. Fresh tomatoes are largely produced and sold to the open market.
- Processing tomatoes are machine-harvested while all fresh –market tomatoes are hand-picked.
- Fresh-market tomato prices are higher and more variable than processing due to larger production costs and greater market uncertainty.

Florida is the largest producer of fresh-market tomatoes for the season from October to June, and has the greatest production during November through January and during April and May (Agricultural Outlook, July 1994). The main production areas change with the season. Dade County is the main production area for winter months, whereas Collier and Manatee Counties are the main production areas when the weather gets warmer.

Mexico began its export orientation during the 1960s, after the U.S. ban on imports from Cuba and termination of the U.S. bracero (Mexican guest-worker) program (Plunkett, 1996). Mexico’s tomato export sector is concentrated in the states of Sinaloa and Baja California. These states typically accounted for 75 to 90 percent of Mexican tomato exports (Plunkett, 1996). Sinaloa harvests in the winter and spring, with more than half its tomato production go to the U.S., whereas Baja harvests in the summer and fall.

Using a dynamic model of spatial price adjustment, Jordan and VanSickle (1995) studied alternative market integration hypotheses between Florida and Mexico in the U.S. winter market for fresh tomatoes. Measurement of market integration provides basic information on the dynamics of price movement, and also provides useful information about the market behavior in these two supply areas. The results showed that while Florida and Mexico integrated in the same market, a price change in one area was not instantaneously reflected in the other. They also found that Florida was dominant in the price formation process, with Mexico responding to changes in the Florida price.

2. Tomato Consumption and Production

Tomatoes are the most widely consumed vegetable in the U.S. after potatoes (Agricultural Outlook, July 1994). From juice in the 1920's to pizza sauce in the 1960's, chili sauce in the 1970's, and salsa in the 1990's, new tomato products have become food classics nearly every decade (Agricultural Outlook, July 1994).

Gains of fresh tomatoes consumption during the 1980's likely resulted from the increasing popularity of salad bars and fast foods, rising health consciousness, and a surge in immigrants with vegetable-intensive diets (ERS, USDA). Furthermore, the popularity of cluster tomatoes, which are still attached to the vine, and other greenhouse, hydroponics tomatoes may have increased tomato consumption in the 1990's. University research shows that tomatoes may protect against some cancers (ERS, USDA).

Using data from USDA's CSFII survey, Lucier, *et al.*, show the locations and quantities of tomato consumption and link this consumption to economic, social, and demographic characteristics. The important findings include:

- Fresh tomatoes were favored slightly more in the Northeast and the West and slightly less in the Midwest and South. Consumption of processed tomato products was strongest in the West and Midwest and weakest in the South
- Hispanic consumers were the strongest consumers of fresh-market tomatoes.
- Per capita consumption of fresh and processing tomatoes increases as incomes rise.
- Men and women over the age of 39 represent 39 percent of the population, yet they consume 50 percent of all fresh tomatoes.

2.1 Technology

Factors that distinguish Mexican tomatoes from Florida tomatoes are: Mexico's comparative advantages in production (climate, labor and land), improved quality with the adoption of extended shelf-life varieties, and a lengthened harvest (Plunkett, 1996).

Plunkett states that most of Mexico's export producers use:

- Drip irrigation. Drip users consume one-third as much water and get higher yields than growers using movable irrigation rigs. Hoses with regularly spaced drip holes are laid permanently at the center of tomato beds, delivering water right at the root base of the plant. Water is not wasted between the rows as with the movable rigs.
- Fertigation. It uses the same drip irrigation hoses to efficiently deliver liquid fertilizer to the roots of the tomato plants. This will reduce water pollution from leaching and run-off of agricultural chemicals. Tomatoes for export are grown according to U.S. tolerance standards for chemicals residues.
- Plastic mulch. It reduces weeds, promotes growth, and blocks microorganisms moving from the soil to the plant. Plastic raises the soil temperature, reduces water evaporation, and increases total photosynthetic activity of the plant. After the raised and rounded soil beds are formed, long clear plastic sheets are laid over the entire bed, pierced only where the young transplants are sown. New plastic is used each year.
- Planed stakes are replacing traditional bark-covered sticks and branches in Sinaloa and Baja, because planed stakes are stronger and do not bend as much. As the plants grow, they are tied to lines strung between the stakes. Growing plants upright, rather than along the ground, increases disease and insect-pest control efficiency.

- Extended shelf-life seed varieties (ESL) are based on Israeli (and to a lesser extent, Dutch) research that allows the tomato to be left on the vine several days longer, until 90 percent of the fruit is pink and red. After reaching the supermarket or wholesaler within 5 to 7 days, ESL tomatoes last about 2 to 3 weeks on the shelf, a week longer than a mature green tomato (picked before it turns pink).

Florida has used the same technology package for the last 20 years, except ESL varieties grow well in Mexico but not in Florida (Plunkett, 1996). Current varieties of ESL tomatoes do not grow well in Florida because heavy rains cause the tomatoes to crack on the vine (Calvin and Lucier, 1997).

The appearance of the vine-ripened ESL tomatoes is bright, red, and firm, which are considered important factors for fresh-market consumer demand.

3. Marketing

The winter-vegetable export industry of Western Mexico, centered in Sinaloa, is an important component of the highly integrated North American produce market (Calvin, and Barrios, 1998). Mexican winter vegetables--tomatoes, bell peppers, cucumbers, summer-type squash, snap beans, and eggplant--account for a large portion of U.S. supply during October-June season. Traditionally, the majority of tomatoes from Mexico have entered the U.S. during December through April (Calvin and Lucier, 1997).

Main destinations of Mexican vegetables in U.S. markets are wholesale markets 53 percent, restaurants 28 percent, re-exported 16 percent, supermarkets 3 percent, and directly to consumers 1 percent (Shweden, and Lopez, 2002). Although only 3% of imports from Mexico go directly to supermarkets, it is important to note that most of the produce purchased by U.S. consumers is via supermarket sales (Shweden, and Lopez, 2002).

Shipments of fresh tomatoes from Florida and Mexico vary seasonally depending on the climatic condition in each region. The winter and spring seasons pit Florida production from four main regions--Homestead, Ft. Pierce-Pompano, Immokalee, and Palmetto-Ruskin--against Mexican-grown tomatoes from two major regions--Culiacan and Los Mochis (Thompson and Wilson, 1997). Mexican -grown tomatoes from Culiacan area compete most directly from mid-January through mid-March with he Homestead, Ft. Pierce-Pompano, and Immokalee areas (Thompson and Wilson, 1997).

4. NAFTA

The North American Free Trade Agreement (NAFTA), which took effect on January 1, 1994, removes most trade barriers among the United States, Canada, and Mexico over specified time periods. Under NAFTA, agricultural trade among the three countries has increased. During 1992-2000, the value of U.S. agricultural exports worldwide climbed 19 percent (FAS online, http://www.fas.usda.gov/ info/factsheets/nafta.html). Over the same period, U.S. farm and food exports to Mexico increased over six fold from $916 million to $6.5 billion.

Under NAFTA, all non-tariff barriers to agricultural trade between the United States and Mexico were eliminated (FAS online, http://www.fas.usda.gov/ info/factsheets/nafta.html). Some tariffs were eliminated immediately; others were phased out over 5 to 15 years. NAFTA also contains special agricultural safeguard provisions to provide relief against import surges (FAS online, http://www.fas.usda.gov/

info/factsheets/nafta.html). The United States applies this safeguard provision on imports of Mexican onions, tomatoes, eggplants, chili peppers, squash, and watermelons. Mexico applies this safeguard on imports of U.S. live swine and most pork products, apples, and potato products.

Despite all the advantages that NAFTA offers, fresh tomato disputes between the U.S. and Mexico are still occurring. The historical trade dispute between the tomato industries in Florida and Northwest Mexico is rooted in U.S. trade disruption with Cuba nearly three and a half decades ago (Thompson, and Wilson, 1997).

NAFTA is often cited as the main factor that caused the recent growth in imports of fresh vegetables, primarily fresh tomatoes by the U.S. Using an econometric simulation model for Mexican markets for five vegetables--tomatoes, cucumbers, squash, bell peppers, and onions--Malaga *et al.*, 2000 suggest that the 1994-1995 peso devaluation rather than NAFTA would result in a sharp increase in U.S. imports of Mexican vegetables in the first years following the implementation of NAFTA. These simulation results also suggest that differences in the growth rates of U.S. and Mexican production yields and, to a lesser extent, of U.S. and Mexican real incomes and/or real wages rates could plausibly contribute more to the future growth of U.S. tomato, squash, and onion imports from Mexico than the trade liberalizing effects of NAFTA. It should be noted, that these are simulation results based on a regression using 1974-1993 data, so these are forecasts of impacts of NAFTA, the peso devaluation, etc., and are not based on what actually occurred after NAFTA.

Some of the studies that examined the trade effects of NAFTA used the time series estimation approach. Due to data limitations, time dummy variables were used to capture the effects of NAFTA (Agama and McDaniel, 2002). Other studies used a gravity model approach. Using a gravity approach at the macro level, Gould (1998) finds that both U.S. imports from Mexico and U.S. exports to Mexico were about 16 percent higher on average each year, over 1994-1996 due to NAFTA. With the same approach, Krueger (1999) finds that NAFTA did not have large effects on trade relative to other factors.

Agama and McDaniel (2002) estimated the effects of NAFTA on U.S. import demand for Mexican goods and Mexico's demand for U.S. exports, using tariff data to capture the actual policy changes over time. The results find that U.S. import demand for Mexican goods is responsive to tariff preferences, and the responsiveness is greater during the NAFTA years. Also, they find that Mexico's demand for U.S. exports was responsive to the NAFTA preference.

Hilberry and McDaniel (2002) used a simple decomposition of trade growth offered by Hummels and Klenow (2002) that provides insights into whether the United States is trading more of the same goods with NAFTA partners since 1993, or trading new products. They found that the results provide evidence of both.

Sarkar and Park (2001) find that the trade between the United States and Mexico was significantly larger after NAFTA. They were using a simple regression analysis and statistical t-test.

5. Exchange Rate, dumping, and prices

Raafat and Salehizadeh (2002) examined the effect of currency fluctuation over time on U.S. import prices by using U.S. data from 1975-2000 and the pass-through period concept. They find that a small percentage of decreases (increases) in the U.S. dollar exchange rate are reflected in higher (lower) prices in six quarters. They also find that during 1995-2000, when there was a persistent U.S. dollar appreciation, U.S. import prices would remain too high, signaling the existence of a condition opposite that of dumping. However, U.S. antidumping cases increased during this period. Rafaar and Salehizadeh (2002) stated that antidumping complaints fail to take into account the proper impact of currency fluctuations and seem to be, instead, protectionist tools used for shielding indigenous producers from import competition.

Schmitz *et al.* (1981) examine the 1978 agricultural dumping charge brought by Florida winter vegetable producers against Mexican growers. They discuss fair value in the context of three antidumping criteria: prices at home and abroad, selling below cost of production, and a third-market test. The results show that the application of the antidumping laws to highly perishable commodities, such as fresh vegetables, presents a formidable problem of economic analysis. The third-country test, as applied in this study, can lead to ambiguous results. The authors suggest that the law should be changed so that future cases can be decided on a normal business practice concept, accounting for production and costing decisions unique to highly perishable products.

Pick (1990) analyzed the effect of exchange rate risk on U.S. agricultural trade flows by using a model that incorporates exchange rate risk in ten countries. The result shows that the exchange rate risk was not significant in the seven developed countries, but adversely significant to the three developing countries (Brazil, Mexico, and South Korea). These results find the importance of exchange rate risk in developing countries' trading behavior.

A recurring question in agriculture is to what degree are changes in grower prices reflected in retail prices (Worth, 1999). Worth examined the price behavior of six vegetables: carrots, celery, lettuce, onions, potatoes and tomatoes. The result indicated that, for celery, lettuce, onions, and potatoes, there is no evidence of price asymmetry, whereas for carrots and tomatoes, there is evidence that retail prices show a greater response to f.o.b. price increases. Worth concluded that these findings would lead to concern that retailers gained market power with carrots and tomatoes to increase the f.o.b.-retail margin at grower's expense.

Using hedonic price models, Bierlen and Grunewald (1995) estimated whether there are incentives to supply higher quality tomatoes. The result indicated that tomatoes prices are higher for vine-ripe tomatoes in summer, when household consumers dominate the market, and prices are higher for mature green in the fall and spring when the hotel and restaurant buyers dominated.

CHAPTER IV

ECONOMETRICS AND THE ESTIMATED MODELS

1. Theoretical Framework

1.1 General Theory of Supply and Demand

Markets are driven by the selling and buying of goods and services among producers and consumers. These two sides of market transactions are called supply and demand. Demand is the ability and willingness to buy specific quantities of a good at alternative prices in a given time period, ceteris paribus (Schiller, 1999). Consumers' willingness and ability to buy a product depend on many variables, including tastes (desire for this and other goods), income (of the consumer), and other goods (their availability and price). A simple demand function can be specified as:

$$Qd = f(P, Palt, I, T)$$

where Qd is quantity of a good demanded, P is own price of the good, Palt is price of alternate goods, I is income, and T is tastes and preferences.

The inverse demand function expresses own price as a function of quantity demanded and the other variables cited above. That is, for each level of demand for good 1, the inverse demand function measures what the price of good 1 would have to be in order for the consumer to choose that level of consumption (Varian, 1999).

Supply is the ability and willingness to sell (produce) specific quantities of a good at alternative prices in a given time period, *ceteris paribus* (Schiller, 1999). Factors that influence market supply are price of own good, input prices, and technology. Therefore, a simple supply function can be specified as:

Qs = f(P, W, Tech)

where Qs is quantity supplied, P is the own-price of the good, W is set of input prices, and Tech is technology.

1.2 General Theory of Excess Supply and Excess Demand

Excess supply, or surplus, exists for prices such that the quantity supplied exceeds the quantity demanded. At "high" prices the quantity firms wish to sell is greater than the quantity consumers wish to buy. If the price in the market were higher than the equilibrium price, the quantity supplied would be greater than the quantity demanded.

In figure 4.1, suppose that Ph is a price that offers in the market, which is higher than the equilibrium price, PE. At the Ph point, the quantity supplied, Qs, is greater than the quantity demanded, Qd, which creates a surplus or excess supply, equal to Qs-Qd.

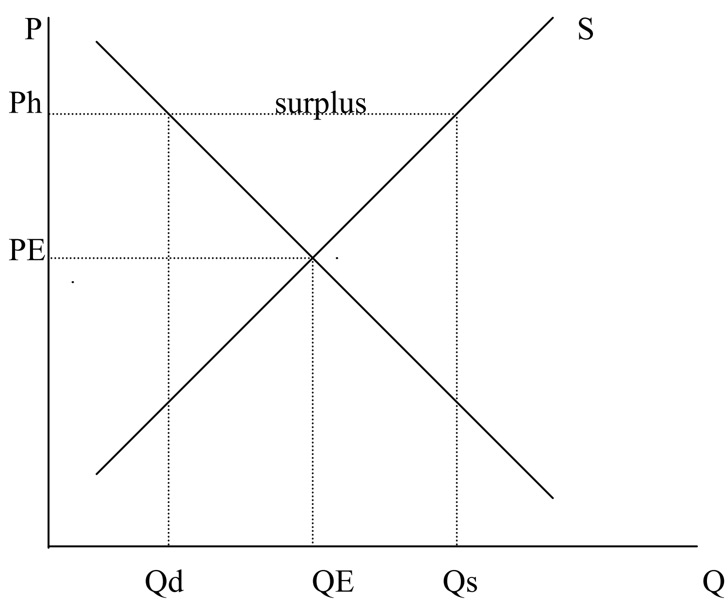

Figure 4.1. Excess Supply of Hypothetical Commodity

Excess demand or shortage is the opposite of excess supply, where the quantity demanded exceeds the quantity supplied. Consider that the market price, Pl, below the equilibrium price, PE (Figure 4.2). In this situation, the quantity demanded would be greater than the quantity supplied (Qd>Qs). At the lower price, quantity demanded is high but the producers are less willing to provide goods to the market, and this creates a shortage.

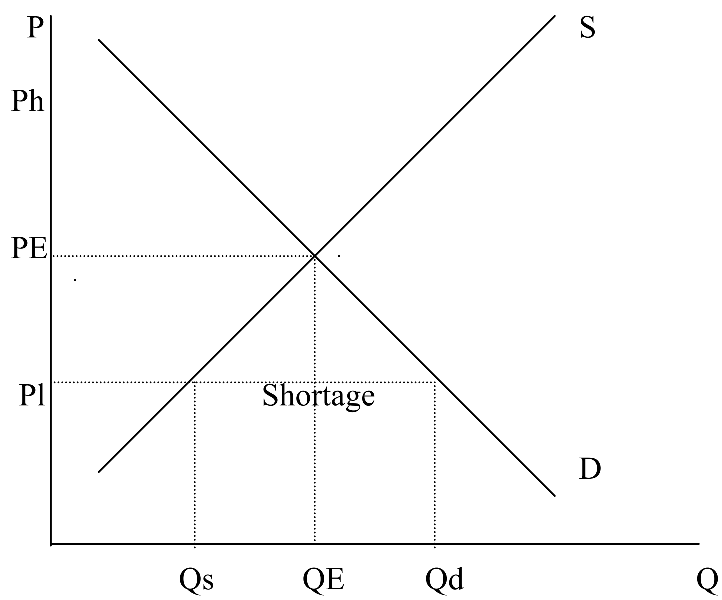

Figure 4.2 Excess Demand of a Hypothetical Commodity

1.3 International Trade

International trade is very important for agricultural products. Countries import many items that are difficult or impossible for them to produce, given their climate and soil (Reed, 2001). Furthermore, Reed states that countries import agricultural products that are produced at a lower cost by foreign countries.

One way to look at world market equilibrium is by using excess demand and excess supply curves (Reed, 2001). In figure 4.3, world equilibrium occurs at the price where the sum of excess supply for exporters equals the sum of excess demand curves for importers. The gains from trade for exporting countries is the area of BCD, whereas for the importing countries it is the area of ABC.

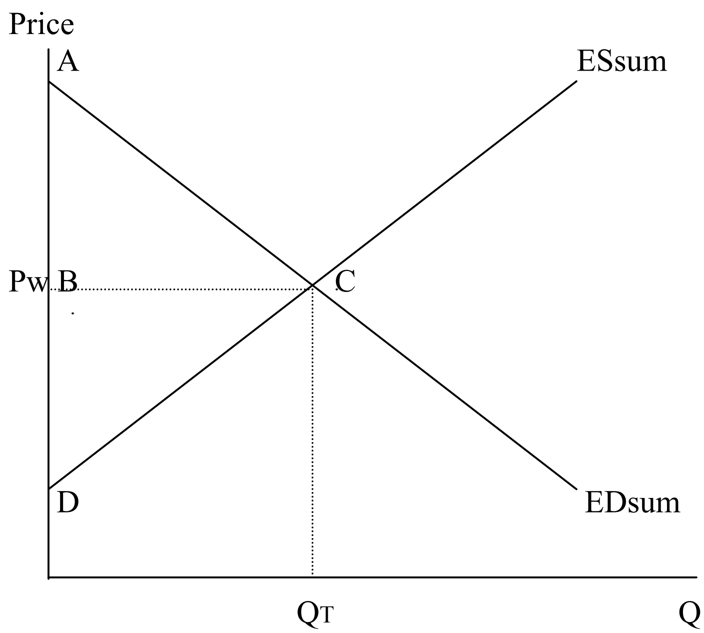

Figure 4.3 World Equilibrium Using Excess Supply and Demand Curves

Figure 4.4 shows the situation where there is a two-country world (an exporting and an importing country) and one good. The left figure depicts the domestic supply and demand in the exporting country, and the right figure presents the domestic supply and demand in importing country. The middle figure is the excess supply and excess demand in the world market. The excess supply function in the middle figure is derived from the left figure, whereas the excess demand function is derived from right figure. P_W is the world market equilibrium price and Q_T is the equilibrium level of trade. With no trade barriers and transportation costs, price P_W will prevail in both countries and the excess supply in exporting country ($Q_{PA} - Q_{CA}$) will exactly equal excess demand in importing country ($Q_{CB} - Q_{PB}$). The world welfare gain from trade is maximized at area ACD in the middle figure, with area ABC going to importers, and area BCD to exporters.

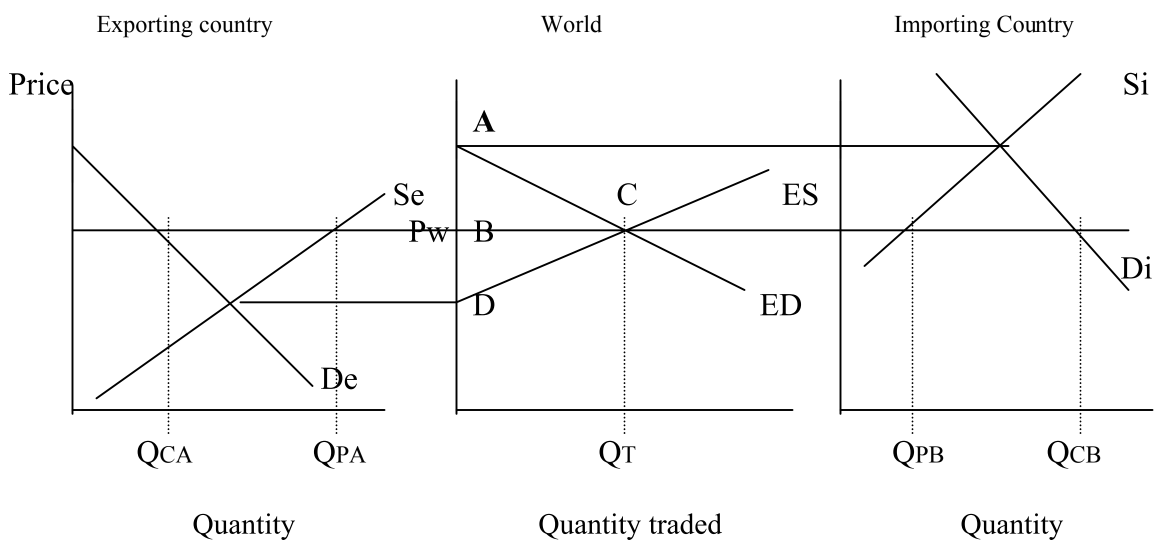

Figure 4.4 Trade Equilibrium in the Exporting Country, Importing Country, and World

2. Economic Model

The primary focus of this study is to analyze factors that contributed to Florida producers' loss of market share to Mexico. For the analysis, U.S. demand functions for Florida and Mexico tomatoes are required, as well as Florida supply and Mexico excess supply functions.

Having discussed the general theory of supply and demand function, we may now discuss the estimated model. Some modifications are made to the theoretical model to create the estimated model.

U.S. Inverse Demand for Florida Tomatoes

In an inverse demand function, own price was said to be a function of own quantity, prices of alternate goods, consumer income, and consumer tastes and preferences. Our estimating equation for U.S. inverse demand for Florida tomatoes includes the quantity of Florida tomatoes, the quantity of the closest substitute, Mexican tomatoes, prices of related goods, and year and month as conditioning variables. We specified the following inverse demand equation for Florida tomatoes:

$$PFL_{y,i} = \alpha_0 + \alpha_1\, QFL_{y,i} + \alpha_2\, QFL_{y,i}\, QMX_{y,i} + \alpha_3\, CPIF_{y,i} + \alpha_4\, PLET_{y,i} + \alpha_5\, YR_y + \sum_{i=1}^{5} \alpha_{(i+5)}\, DMO_i + \varepsilon_{1t}$$

where PFL is the average monthly tomato price for Florida tomatoes, QFL is monthly quantity of tomatoes shipped from Florida, QMX is monthly quantity of tomatoes shipped from Mexico to the U.S., CPIF is the monthly U.S. consumer price index for food, PLET is the U.S. average monthly retail price of lettuce, YR is the annual time trend, DMO's are monthly 0-1 dummy variables for January through May, subscript i indicates the month and subscript y indicates the year. Noting that dummy is not included for December since it is used as the base month.

The Consumer Price Index for food (CPIF) is a measure of prices paid by urban consumers for a market basket of food. CPIF and PLET represent the prices of other food items which may impact tomato demand. The time trend in the demand equations is included to test the contention by Mexican growers that their increased market share is due to shift in consumer preferences away from mature green Florida tomatoes and toward vine-ripened Mexican tomatoes. Florida quantity is included in the demand equation independently and in an interaction term with Mexican import quantity. The interaction term is included to measure the impact of Mexican tomato imports on the response of Florida price to Florida quantity.

U.S. Inverse Demand for Mexican Tomatoes

The U.S. inverse demand for Mexican tomatoes was constructed in a similar manner to inverse demand for Florida tomatoes as:

$$PMX_{y,i} = \beta_0 + \beta_1 QMX_{y,i} + \beta_2 QFL_{y,i} QMX_{y,i} + \beta_3 CPIF_{y,i} + \beta_4 PLET_{y,i} + \beta_5 YR_y + \sum_{i=1}^{5} \beta_{(i+5)} DMO_i + \varepsilon_{2t}$$

$PMX_{i,y}$ is the U.S. price of Mexican tomatoes in month i and year y, and all other variables used in this equation are the same as in the Florida demand equation. However, in this equation, the quantity of tomatoes shipped from Mexico (QMX) is included independently rather than the quantity of Florida tomatoes.

Florida Supply

The Florida supply equation was specified as:

$$QFL_{y,i} = \gamma_0 + \gamma_1 PFL_{y-1} + \gamma_2 DFW_{y,i} + \gamma_3 DNAF_{y,i} + \gamma_4 DSUS_{y,I} + \sum_{i=1}^{5} \gamma_{(i+4)} DMO_i + \varepsilon_{3t}$$

where, PFL_{y-1} is the quantity weighted average monthly Florida tomato price for the previous production year, DFW is a dummy variable for adverse weather in Florida, DNAF is a 0-1 dummy variable with a 0 value for the pre-NAFTA (before January 1994) months, DSUS is a 0-1 dummy variable for the suspension agreement implementation with a 0 value for the pre-agreement months (before November, 1996), and DMO's are the monthly dummies.

The average monthly Florida tomato price for the previous production year is used because planting occurs before current season prices are known, and growers have limited options to increase and decrease supplies in response to current prices once the crop has been planted. A dummy variable for adverse weather reflects lower production in response to adverse growing or harvesting conditions. A dummy value of 1 was included for three of the 72 monthly observations: January and February 1990, and April 1996, in consideration of dramatically low production in these months. The NAFTA dummy is intended to capture a supply response to the conclusion of this trade agreement. The suspension agreement dummy is used to identify the response from

Florida growers after the implementation of the agreement. The monthly dummies allow for seasonal differences in Florida tomato supply.

Mexican Excess Supply

The Mexican excess supply equation was specified as:

$$QMX_{y,i} = \eta_0 + \eta_1\, PMX_{y-1} + \eta_2\, PMX_{y,i} + \eta_3\, EXR_{y,i} + \eta_4\, PDOM_{y,i} + \eta_5\, MXGDP_{y,i} + \eta_6\, DMW_{y,i} + \eta_7\, DNAF_{y,I} + \eta 8\, DSUS_{y,I} + \sum_{i=1}^{5} \eta_{(i+8)}\, DMO_i + \varepsilon_{4t}$$

where PMX_{y-1} is the quantity weighted average monthly U.S. price for Mexican tomatoes for the previous production year, $PMX_{y,i}$ is the current month U.S. price for Mexican tomatoes, PDOM is the Mexico City wholesale tomato price, EXR is the exchange rate in pesos/dollar, MXGDP is a monthly index of Mexican GDP, DNAF is the NAFTA dummy, DSUS is the suspension agreement dummy, and DMW is a weather dummy variable for Mexico.

The complexity of the Mexican excess supply equation reflects the ability of Mexican growers to divert output between the domestic and export markets in response to changes in supply and demand conditions both in the U.S. and Mexico. $PMX_{y,i}$ and $PDOM_{y,i}$ are included to capture incentives to channel existing supplies to either market as prices in each market change. The exchange rate in pesos/dollar is included because of the impact of the exchange rate on the price of Mexican tomatoes for U.S. consumers. A monthly index of Mexican GDP is included to capture the impact of the state of the Mexican economy on domestic consumption in Mexico. For Mexican weather dummy, a 1 value was included for April 1990, and February, March and April 1992, because Mexican fresh tomato production was extremely low in these months. NAFTA, suspension agreement, and monthly dummy variables play the same role as in the Florida supply equation.

3. Econometrics

3.1 Simultaneous Equation Models

Different than the single-equation models, simultaneous models have mutual relations between some dependent and explanatory variables. Y is not only determined by the X's, but some of the X's are, in turn, determined by Y. Thus, there is a two-way, or simultaneous, relationship between Y and (some of) the X's (Gujarati, 1988). In simultaneous equation models, there is more than one equation, one for each of the mutually, or jointly, dependent or endogenous variables (Gujarati, 1988). Furthermore, in such models, one may not estimate the parameters of a single equation without taking into account information provided by other equations in the system. Consider a demand and supply model:

Demand function	$Q_d = \alpha_0 + \alpha_1 P_1 + \varepsilon_1$	$\alpha_1 < 0$
Supply Function	$Q_s = \beta_0 + \beta_1 P_1 + \varepsilon_2$	$\beta_1 > 0$
Equilibrium condition	$Qd = Qs$	

where Qd is quantity demanded, Qs is quantity supplied, α's and β's are the parameters. For example, if ε_1 changes because of changes in other variables (income, wealth, and tastes) affecting Qd, the demand curve will shift upward, if ε_1 is positive, or downward if ε_1 is negative (figure 4.5).

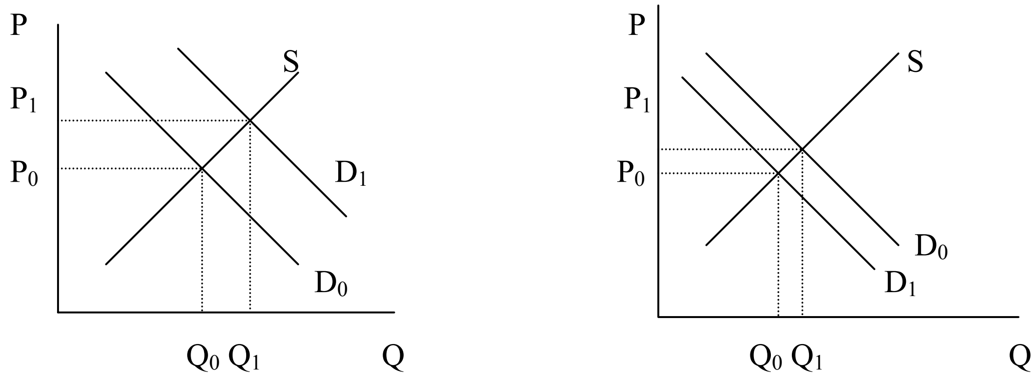

Figure 4.5 Interdependence of Price and Quantity in Simultaneous Equation

A change in ε_2 will shift the supply curve as well, and will again affect P and Q. Because of the simultaneous dependency between Q and P, ε_1 and P, and ε_2 and P, a regression of Q on P would violate an important assumption of the classical linear regression model, which is that the stochastic disturbance terms are independent, identically distributed with zero mean normal random variables (Gujarati, 1988).

3.2 The Identification Problem

The problem of determining the structural equations, given knowledge of the reduced form, is called the identification problem (Pindyck and Rubinfeld, 1998). It is important to consider the identification problem before estimating the model. According to Pindyck and Rubinfeld, 1998, an equation is unidentified if there is no possible way of estimating all the structural parameters from the reduced form. An equation is identified if it is possible to estimate the parameters from the reduced form. An equation is exactly identified if a unique parameter value exists and is over-identified if more than one value is obtainable for some parameters. If we let:

- g* is the number of endogenous variables in the equation

- k^* is the number of exogenous variables in the equation
- K is the total number of exogenous variables in the equation system

then, $g^* - 1 < K - k^*$, the equation is over-identified

$g^* - 1 = K - k^*$, the equation is just-identified

$g^* - 1 > K - k^*$, the equation is under-identified

Therefore, to achieve identification for each stochastic equation in the system, the number of right-hand-side variables in an equation must be equal to or less than $K - k^*$, the number of exogenous variables excluded from the equation (Griffiths, Hill and Judge, 1993).

3.3 Two-Stage Least Squares (2SLS)

The method of single equation least squares should not be applied to estimate simultaneous equations because it will produce biased and inconsistent parameter estimates, which is called simultaneous equation bias. One method to remove simultaneous equation bias is by using two-stage least squares (2SLS). Two-stage least squares provides a very useful estimation procedure for obtaining the values of structural parameters in over-identified equations (Pindyck and Rubinfeld, 1998). The first stage of 2SLS involves the creation of an instrument, and the second stage involves a variant of instrumental-variables estimation. Formally, the two-stage least squares process works in the following manner (Pindyck and Rubinfeld, 1998):

1. In the first stage, the reduced form equation is estimated by using ordinary least squares. From this stage, the fitted values of the dependent variable are determined. The fitted values will by construction be independent of the error terms. Thus, the first stage

process allows us to construct a variable which is linearly related to the predetermined model variables.

2. In the second-stage regression, the equation of the structural model is estimated by replacing the dependent variable with the first-stage fitted variable. The use of ordinary least squares in this second stage will yield a consistent estimator of the parameter.

Two-stages least squares and instrumental-variables estimators yield consistent parameter estimates when equation systems are simultaneous (Pindyck and Rubinfeld, 1998). However, this method does not account for the cross-equation correlation among errors. A Seemingly Unrelated Regression (SUR) model consists of a series of equations that are linked because the error terms across equations are correlated but there is no simultaneity. According to Pindyck and Rubinfeld (1998), SUR method involves generalized least-squares estimation and achieves an improvement in efficiency by taking into account that cross-equation error correlations may not be zero. The extension of SUR estimation to two-stage least squares is the technique of three-stage least squares.

3.5 Three-Stage Least Squares (3SLS)

Three-Stage Least Squares (3SLS) involves the application of generalized least-squared estimation to a system of equations, each of which has first been estimated using 2SLS (Pindyck and Rubinfeld, 1998). The 3SLS can be summarized as follows (Pindyck and Rubinfeld, 1998):

- In the first stage of the process, the reduced form of the model system is estimated.

- The fitted values of the endogenous variables are then used to get 2SLS estimates of all the equation in the system. After that, the residuals of each equation are used to estimate the cross-equation variances and covariances.
- The third and final stage of the estimation process, generalized least-squares parameter estimates are obtained.

Three-stage least squares procedure is more efficient than 2SLS because it takes into account cross-equation correlation.

In this study, non-linear three-stage least squares are used to estimate the model. We used non-linear 3SLS because the inverse demand equations are non-linear in endogenous variables. The non-linear variable is the interaction between Florida and Mexican tomato supply (QFL*QMX).

4. Hypotheses

In this study, we want to find out the factors that impacted Florida producers to lose market share to Mexico in the 1990's. We analyze the following factors; NAFTA, the suspension agreement, peso devaluation, Mexican recession, and changing consumer's preferences. In the U.S. inverse demand for Florida and Mexican tomatoes equations, we will address the questions shown below. The parameter tests listed with each question represent the null hypotheses of no impact.

- Was there a shift in consumer preferences from mature green Florida tomatoes to vine-ripened Mexican tomatoes?

  $\alpha_5 = 0, \beta_5 = 0$

- Do total quantity of tomatoes supplied impact Florida and Mexico prices?

  $\alpha_2 = 0$, $\beta_2 = 0$

- Do the prices of other food items, CPIF and lettuce prices, impact tomato demand?

  $\alpha_3 = 0$, $\alpha_4 = 0$, $\beta_3 = 0$, $\beta_4 = 0$

In the Florida supply equation, we will test the following hypotheses:

- Does the average Florida tomato lag price affect the Florida quantity of tomatoes supplied?

  $\gamma_1 = 0$

- Was NAFTA a factor that influenced the Florida producers to reduce production after accounting for other influences?

  $\gamma_3 = 0$

- Has the suspension agreement affected Florida supply?

  $\gamma_4 = 0$

In Mexican excess supply, we will analyze:

- Did the Mexican lag price impact the Mexican tomato shipments to the U.S.?

  $\eta_1 = 0$

- Do the current period U.S. and Mexican prices for Mexican tomatoes affect shipments of Mexican tomatoes to the U.S.?

  $\eta_2 = 0$, $\eta_4 = 0$

- Did the exchange rate affect the supply of Mexican tomatoes shipped to the U.S.?

  $\eta_3 = 0$

- Does the Mexican macroeconomics situation impact the Mexican tomatoes quantity?

  $\eta_5=0$

- Was NAFTA a significant factor that affects increased shipments of Mexican tomatoes to Florida?

  $\eta_7=0$

- Has the suspension agreement affected Mexican supply?

  $\eta_8=0$

CHAPTER V

RESULTS, SUMMARY AND CONCLUSIONS

1. Data

The models in this study used monthly data from December to May in years 1989 through 2001. U.S. import data from Mexico were obtained from the USITC database, http://dataweb.usitc.gov/scripts/user_set.asp. Mexican GDP data were obtained from INEGI, http://www.inegi.gob.mx/difusion/ingles/fbie.html, and the exchange rate was also obtained from INEGI, http://dgcnesyp.inegi.gob.mx/cgi-win/bdi.exe. The Mexican average wholesale prices were obtained from 1995 to 2001 Mexican attaché reports, Foreign Agricultural Service, USDA.

Florida tomato quantity was compiled from 1989-2001 Fresh Fruit and Vegetable Shipments, Agricultural Marketing Service, USDA, http://www.ams.usda.gov/fv/mncs/fvannual.htm. Florida prices were obtained from Economic Research Service, USDA, http://www.ers.usda.gov/publications/VGS/Jul02/VGS2002.pdf. Consumer Index Prices for food and the price of lettuce were obtained from Economic Research Service, USDA, http://www.ers.usda.gov/publications/VGS/Jul02/VGS2002.pdf.

2. Results

For overall results, the supply equation results include more significant coefficients of expected signs than the demand equations results (Table 5.1-5.3). To test the null hypotheses that all regression coefficients equal zero, we used a Wald test, which is a joint F-tests for large samples. As shown in table 5.4, the Wald test rejects the hypothesis that all coefficients equal zero for all four estimated equations, although this hypothesis is rejected at only the ten percent level for the Mexican inverse demand equation.

For a goodness-of-fit measure, we used pseudo R^2, which is the squared coefficient of correlation between the observed and predicted values of the dependent variables. The pseudo R^2 for the four equations: US inverse demand for Florida tomatoes and Mexican tomatoes, Florida supply, and Mexican excess supply are 0.42, 0.07, 0.71, and 0.88 respectively. The low goodness-of-fit measure for the Mexican inverse demand equation is consistent with the relatively weak results of the Wald test for this equation.

Table 5.1. Estimation Results for U.S. Inverse Demand for Florida and Mexican Tomatoes

Dependent Variables:	PFL	PMX
Independent Variables	Coefficient (Standard Deviation)	Coefficient (Standard Deviation)
Intercept	-6.7918** (2.5502)	-4.2461 (2.6287)
QFL	-0.0363 (0.0560)	-
QMX	-	0.1706** (0.0669)
QFL*QMX	-0.1941** (0.0585)	-0.1791** (0.0574)
CPIF	0.0590** (0.0203)	0.0377* (0.0209)
PLET	-0.2316* (0.1324)	-0.1740 (0.1301)
Year	-0.1779** (0.0712)	-0.1166 (0.0736)
DJAN	0.1467 (0.0910)	0.0135 (0.0957)
DFEB	0.0159 (0.0940)	-0.1646 (0.1022)
DMAR	0.1630 (0.1002)	-0.1124 (0.1111)
DAPR	0.0914 (0.0876)	0.0587 (0.0961)
DMAY	-0.00519 (0.0760)	0.0244 (0.0804)
Fit 1/	0.65	0.26

1/ Correlation between observed and predicted values of dependent variables
*significant at 10% level, ** significant at 5% level

Table 5.2. Estimation Results for Florida Supply of Fresh Tomatoes

Independent Variables	Coefficient (Standard Deviation)
	Dependent Variable QFL
Intercept	2.3767** (0.3403)
LPFL	-0.6721 (0.8579)
DFW	-0.8934** (0.2072)
DNAF	-0.6505** (0.1268)
DSUS	0.6748** (0.1124)
DJAN	-0.4026** (0.1638)
DFEB	-0.8216** (0.1638)
DMAR	-0.6328** (0.1628)
DAPR	0.2121 (0.1638)
DMAY	0.4651** (0.1628)
Fit 1/	0.84

1/ Correlation between observed and predicted values of dependent variables
* significant at 10% level, ** significant at 5% level

Table 5.3. Estimation Results for Mexican Excess Supply of Fresh Tomatoes

Dependent Variable, QMX	
Independent Variables	Coefficient (Standard Deviation)
Intercept	-0.1469 (0.5325)
LPMX	-0.1596** (0.0687)
PMX	0.8442* (0.5012)
EXR	0.1451** (0.0311)
PDOM	-0.0967* (0.0545)
MXGDP	-0.0013 (0.0049)
DMW	-0.6765** (0.1151)
DNAF	0.1407 (0.1093)
DSUS	0.2033 (0.1403)
DJAN	0.7166** (0.1246)
DFEB	0.9590** (0.1357)
DMAR	0.1553** (0.1187)
DAPR	0.5536** (0.1344)
DMAY	-0.0622 (0.1213)
Fit 1/	0.94

1/ Correlation between observed and predicted values of dependent variables
* significant at 10% level, ** significant at 5% level

5.4. F-test for Inverse Demands, Supply, and Excess Supply Equations

Equation type	Statistic	Pr > Chisq
Inverse demand for Florida tomatoes	33.30	0.0002
Inverse demand for Mexican tomatoes	16.64	0.0828
Florida supply	114.63	< 0.0001
Mexican excess supply	883.77	< 0.001

2.1 U.S. Inverse Demand for Florida Tomatoes

The coefficient of the interaction term for Florida and Mexican quantities was negative and significant at the 5 percent level (Table 5.1). The coefficient of Florida quantity was insignificant. However, there is a relationship between Florida quantity variable and the interaction term for Florida and Mexican quantities variable. To see the relationship between these two variables, we calculated the partial derivative of Florida tomato prices with respect to Florida and Mexican quantities:

$$\partial PFL/\partial QFL = \alpha_1 + \alpha_2 \, QMX \text{ and } \partial PFL/\partial QMX = \alpha_2 \, QFL$$

Average Florida and Mexican monthly quantities during the data period were 173 million pounds and 138 million pounds, respectively. Evaluating $\partial PFL/\partial QFL$ and $\partial PFL/\partial QMX$ at the means of QFL and QMX, and noting that these quantities were expressed in units of 100 million pounds for the regressions, these findings indicate that a 10 million pound increase in either Florida or Mexican shipments would decrease the price of Florida tomatoes by approximately \$ 0.03 per pound, *ceterus paribus*.

The coefficient of the general level of food price is positive and significant. Tomato prices tend to rise and fall directly with other food prices, *ceterus paribus*, indicating that tomatoes and other food are substitution goods in consumption. The coefficient of the price of lettuce is negative and significant. This indicates that tomatoes and lettuce are complementary goods in consumption. The coefficient for time trend is negative and significant, suggesting that there maybe a shift in U.S. consumer's preferences and tastes away from Florida mature green tomatoes. Note that this finding is consistent with the Mexican producers' claim about the taste and preferences for Florida tomatoes (USITC, Investigation No. TA 201-66). The insignificance of the coefficients of the monthly dummy variables suggests the lack of a seasonal price pattern in Florida tomato prices.

2.2 U.S. Inverse Demand for Mexican Tomatoes

Results for U.S. inverse demand estimation for Mexican tomatoes yielded a significant positive coefficient for Mexican quantity variable and a significant and negative coefficient for the quantity interaction term (Table 5.1). The partial derivatives of U.S. prices of Mexican tomatoes with respect to Mexican quantities, and Florida quantities, respectively, are:

$$\partial PMX / \partial QMX = \beta_1 + \beta_2 \, QFL \text{ and } \partial PMX / \partial QFL = \beta_2 QMX$$

Evaluating these responses at mean monthly quantities, and adjusting for the units used in estimation, the impact of a 10 million pound increase in Mexican tomato shipments to the U.S. would be a $0.014 per pound decrease in the price of Mexican tomatoes in the U.S. A 10 million pound increase in monthly Florida shipments would reduce the price of Mexican tomatoes in the U.S. by $0.025 per pound, *ceterus paribus*.

The coefficient of general level of food price is positive and significant, indicating that the U.S. prices of Mexican tomatoes increase (decrease) with an increase (decrease) in food prices generally. The insignificant results for lettuce prices and time trend suggest that these two variables have no effect on the U.S. prices of Mexican tomatoes. Furthermore, there is lack of a seasonal price pattern in the U.S. prices of Mexican tomatoes since the results of monthly dummy variables were insignificant.

2.3 Florida Supply

The average price of tomatoes in the previous year had an insignificant coefficient in the Florida supply equation, suggesting that the tomato supply of Florida tomatoes is not responsive to previous year prices (table 5.2). The NAFTA dummy coefficient is negative and significant at 5 percent level, showing that Florida monthly supply was approximately 65 million pounds lower after NAFTA than before NAFTA, *ceterus paribus*. There is also an impact of the suspension agreement on the Florida supply, an increase of approximately 67 million pounds for Florida supply after the implementation of the agreement, *ceterus paribus*. This implies that the implementation of the suspension agreement has been working and has increased the confidence of the Florida growers to increase their tomato supply. The NAFTA dummy and suspension agreement dummy variables together explain the drop observed in Florida production immediately after NAFTA, with recovery after the suspension agreement took effect.

The adverse weather coefficient is negative and significant at the 5 percent level. This suggests a decrease of Florida quantity when adverse weather occurred. The coefficient of monthly dummies for January, February, and March were negative and significant, while the coefficient was positive and significant for May. This suggests seasonality in the Florida production of fresh tomatoes.

2.4 Mexican Excess Supply

In the Mexican supply equation, the coefficient of the previous year's average tomato price was unexpectedly negative and significant; indicating that the Mexican tomato supply has a negative response to previous year prices of tomatoes in the U.S. market (table 5.3). The current U.S. price is positive and significant, suggesting that the Mexican shipments to the U.S. increase (decrease) along with an increase (decrease) in the U.S. prices of Mexican tomatoes in the U.S. The Mexican domestic tomato price is negative and significant, implying that lower domestic prices will increase Mexican tomato shipments to the U.S., *ceterus paribus*. These results are consistent with the diversion of Mexican tomatoes between the domestic and export markets as the markets change in each country.

The exchange rate coefficient is positive and significant at the 5 percent level, suggesting that the increase in pesos per U.S. dollar caused an increase in Mexican tomato exports to U.S. The peso experienced a strong devaluation relative to the dollar during 1994 and 1995, making Mexican tomatoes considerably cheaper in the U.S. For example, exchange rates expressed as peso/dollar in January 1994, 1995, and 1996, respectively were 3.11, 5.58, and 7.47. If Mexican tomatoes were priced at 1.5 pesos per pound, the U.S. price of Mexican tomatoes would have been $0.48 per pound using the January 1994 exchange rate, but only $0.20 per pound using the January 1996 exchange rate.

The insignificance of the coefficient of Mexican GDP indicates the macroeconomic situation in Mexico had little effect on the shipments of Mexican tomatoes to the U.S. beyond what was captured by the Mexican domestic price of tomatoes and the exchange rate. The NAFTA dummy was insignificant, indicating no direct effect of NAFTA on Mexican shipments to the U.S. The insignificance of the suspension agreement coefficient indicates that the agreement had no impact on the supply of Mexican tomatoes to the U.S., *ceterus paribus*. The monthly dummy coefficients for January, February, March, and April are positive and significant, but the dummy coefficient for May was insignificant. This indicates a seasonality pattern in Mexican fresh tomato production.

2.5 Elasticity Estimates

Elasticity is a common unit-free measure of the responsiveness of one variable to another variable. The general formula of elasticity is:

$$E = (\partial y / \partial x)(X^0/Y^0)$$

where Y is the dependent variable and X is an independent variable and the elasticity is evaluated for specified levels of X and Y, X^0 and Y^0 . Elasticities were calculated from the demand equations and the Mexican excess supply equation. The estimated elasticities for the equations are presented in tables 5.5 and 5.6.

For inverse demand equations, elasticities are referred to as price flexibility coefficients. We calculated price flexibilities for prices of Florida and Mexican tomatoes with respect to Florida and Mexican monthly tomato shipments.

The calculated price flexibility coefficients in the demand equation for Florida tomatoes is – 1.4223 for Florida price to Florida quantity, and – 1.2434 for Florida price to Mexican quantity. A one percent increases in Florida monthly shipments decrease prices of Florida tomatoes by 1.42 percent, compared to a 1.24 percent price decrease for a 1 percent increase in Mexican tomato shipments.

Table 5.5. Estimated Price Flexibilities for U.S. Demand for Florida Tomato and Mexican Tomato

	Price Flexibilities
	U.S. demand for Florida Tomatoes: PFL
QFL	- 1.4223
QMX	- 1.2434
	U.S. demand for Mexican Tomatoes: PMX
QFL	- 1.1254
QMX	- 0.5055

Table 5.6. Estimated Elasticity for Mexican Excess Supply

	Elasticity
	Mexican Excess Supply: QMX
PMX	0.2316
PDOM	- 0.3092

As for the demand equation for Mexican tomatoes, the percentage changes in the U.S. price of Mexican tomatoes with respect to one percent changes in Mexican quantity and Florida quantity are - 0.5055 and - 1.1254 respectively. This implies that the U.S. price of Mexican tomatoes is less responsive to changes in Mexican quantity, than it is to changes in Florida quantity.

In the Mexican excess supply equation, the percentage change in Mexican quantity supplied with respect to the U.S. price of Mexican tomatoes is 0.2316. That is, a one percent increase in the U.S price of Mexican tomatoes will result in a 0.23 percent increase in Mexican tomato shipments to the U.S. The percentage change in Mexico quantity supplied with respect to Mexican domestic price is - 0.3092, indicating a one percent increase in Mexican domestic price will decrease Mexican tomato shipments to the U.S by 0.31 percent, *ceterus paribus*. This indicates that the Mexican quantity shipments are not very responsive to price change in either U.S. price of Mexican tomatoes or Mexican domestic price.

3. Review of Hypothesis Tests

In this section, we will review the hypothesis tests for each equation, and relate our findings to the explanations offered for Florida's loss of market share to Mexico.

3.1. Inverse Demand Equations

The hypothesis tests for the inverse demand equations were:

- Was there a shift in consumer preferences from mature green Florida tomatoes to vine-ripened Mexican tomatoes?

  $\alpha_5 = 0, \beta_5 = 0$
- Does total quantity of tomatoes supplied impact Florida and Mexico prices?

  $\alpha_2 = 0, \beta_2 = 0$
- Do the prices of other food items, CPIF, and lettuce prices, impact tomato demand?

  $\alpha_3 = 0, \alpha_4 = 0, \beta_3 = 0, \beta_4 = 0$

We find that the coefficient of the time trend in the Florida inverse demand was negative and significant, indicating that there was a decrease in Florida tomato demand. This finding suggests that there is a shift in U.S. consumer's preferences and tastes away from Florida mature green tomatoes. However, the result from the inverse demand for Mexican tomatoes was insignificant for the time trend coefficient.

The total quantity supplied impacts the U.S. price of Florida and Mexican tomatoes. The results from evaluating the partial derivative in the U.S. inverse demand for Florida tomatoes show that a 10 million pound increase of either Mexican or Florida tomatoes supplied will decrease U.S. price for Florida tomatoes by $0.03 per pound. For the inverse demand for Mexican tomatoes, an increase by 10 million pounds of Mexican tomatoes decreases the U.S. price of Mexican tomatoes by $0.014 per pound. An increase by 10 million pounds of Florida tomatoes will decrease the U.S. price of Florida tomatoes by $0.025 per pound. A decrease (increase) of Florida quantities with the increase (decrease) of Mexican quantities would not affect the price of either tomato much due to the offsetting affects of these changes on prices.

Prices of other goods are significant in both inverse demand equations, indicating that Mexican and Florida tomatoes and other foods are substitution goods in consumption. However, lettuce price was significant only in U.S. inverse demand for Florida tomatoes. This finding suggests that tomato and lettuce are complement good in consumption.

3.1. Florida Supply Equation

The Florida supply hypothesis were:

- Does the average Florida tomato lag price affect the Florida quantity of tomatoes supplied? $\gamma_1 = 0$
- Was NAFTA a factor that caused the Florida producers to reduce production after accounting for other influences? $\gamma_3 = 0$
- Has the suspension agreement affected Florida supply? $\gamma_4 = 0$

Based on the results, the average Florida tomato lag price does not affect the Florida quantity of tomatoes supplied. This finding suggests that tomato acreage is not responsive to the previous year price. As for NAFTA, the result shows that there was a monthly decrease of approximately 65 million pounds of Florida tomatoes supplied after NAFTA implementation after accounting for other factors. Since Florida tomato production is apparently not responsive to the previous year price, the decrease of Florida supply after NAFTA may have been caused mainly by the anticipation of NAFTA effects by Florida producers. For example, in anticipation of lower prices from increased Mexican imports under NAFTA, the Florida producers reduced their production after NAFTA took effect. However, the suspension agreement apparently brought back the confidence of the Florida tomato producers to increase their tomato supply as suggested by the positive and significant impact of the suspension agreement. The estimated positive impact of the suspension agreement in Florida supply almost exactly offset the negative impact of NAFTA in the Florida supply equation.

3.2. Mexican Excess Supply

The hypothesis for Mexican Excess supply were:

- Did the Mexican lag price impacted Mexican tomato shipments to the U.S.? $\eta_1 = 0$
- Do the current period U.S. and Mexican prices for Mexican tomatoes affect shipments of Mexican tomatoes to the U.S.? $\eta_2 = 0$, $\eta_4 = 0$.
- Did the exchange rate affect the supply of Mexican tomatoes shipped to the U.S.? $\eta_3 = 0$

- Does the Mexican macroeconomics situation impact the Mexican tomatoes quantity? $\eta_5=0$
- Was NAFTA a significant factor that caused increased shipments of Mexican tomatoes to Florida? $\eta_7=0$
- Has the suspension agreement affected Mexican supply? $\eta_8=0$

The Mexican lag price affects the Mexican supply of tomatoes to the U.S. negatively. This negative sign coefficient is an unexpected result. However, in making decisions in production, Mexican producers have to consider both markets--U.S. and Mexican domestic markets--and contemporaneous prices in these markets affect current period allocations to these markets.

The current U.S. and Mexican prices for Mexican tomatoes impacts the Mexican tomato shipments to the U.S. The results are consistent with a Mexican tomato market that diverts tomatoes between the export market and domestic market in response to changes in the relative price of tomatoes in these two markets.

Based on the estimation results explained in section 2.4, we conclude that the peso devaluation had a stronger affect than NAFTA on Mexican tomato shipments to the U.S. Due to peso devaluation in 1994, the U.S. market became more attractive to Mexican tomato producers, and Mexican tomatoes became more attractive to U.S. consumers. Mexican producers gained more profit by selling their tomato products in the U.S. market after devaluation. The Florida complaint of the surge in Mexican tomato imports in 1995 and 1996 is consistent with the timing of the peso devaluation.

While the peso devaluation affected the supply of Mexican tomatoes shipped to the U.S., NAFTA, Mexican macroeconomics situations, and the suspension agreement did not affect the quantity of Mexican tomatoes supplied to the U.S. market. Based on the explanation above, we conclude that the insignificant finding of NAFTA effects on Mexican tomato exports is not consistent with the Florida producers' complaint about NAFTA. The reduction in trade barriers due to NAFTA did not increase the import of Mexican tomatoes, *ceterus paribus*, but NAFTA did impact fresh tomato Florida production.

4. Summary and Conclusion

The fresh winter vegetable market is a very important market to the United States and Mexico. Among all the fresh winter vegetables, tomatoes are the leading commodities. Due to climate conditions, Florida is the main domestic supplier for winter fresh vegetables for the U.S., and Mexico is the main exporter to the U.S. for the fresh winter vegetables.

The competition between Florida and Mexican producers for the U.S. fresh tomato market intensified around the time of NAFTA. In 1995, one year after NAFTA implementation, Florida growers filed a petition to the Department of Commerce requesting protection from a surge of imports of Mexican fresh tomatoes. There was a 58 percent increase in U.S. import of fresh tomatoes from Mexico in 1995 compared to 1994. The Florida growers mainly blamed NAFTA for their loss of market share because of the reduction of trade barriers.

Florida growers also claimed the dumping by the Mexican fresh tomato producers. On October 11, 1996, the Department of Commerce and the signatory exporters/producers of fresh tomatoes from Mexico entered an agreement to suspend the antidumping investigation on Mexico tomato imports. On November 1, 1996, the suspension agreement established a minimum import price of $5.17 per 25-pound box or $0.2068 per pound. On December 2, 2002, the Department of Commerce, and Mexican fresh tomato producers/exporters signed a new suspension agreement with two different reference prices: $0.172 per pound for the July 1 through October 22 period, and $0.2108 per pound for October 23 through June 30 period.

The objective of this study was to analyze the factors associated with changes in the U.S.– Mexico tomato market around the time of NAFTA. Those factors we considered included the impact of NAFTA, the peso devaluation, the deterioration of the Mexican economy, shifts in consumer preferences, and the suspension agreement.

A theoretical framework based on supply, demand, and excess supply equations was adopted. Four equations--the U.S. inverse demands for Florida and Mexican tomatoes, Florida supply, and Mexican excess supply--were econometrically estimated for the analysis.

The results suggest that NAFTA significantly impacted the Florida supply of fresh tomatoes. After NAFTA implementation there was a decrease in Florida quantity compared to before NAFTA. However, this is not true for Mexico. The implementation of NAFTA did not appear to affect the Mexican quantity of fresh tomatoes. The exchange rate appeared to play a more important role for Mexico. There was a big increase in Mexican tomato shipments to the U.S. when peso devaluation occurred in

1994 and 1995. The export market became more economically attractive to Mexican producers because they could gain more profit by selling their product in the U.S. market, which is paid by the dollar. The exchange rate also may have impacted the appearance of dumping. The lower value of the peso with respect to dollar causes a decrease in the U.S. price for Mexican tomatoes, and Florida producers may have attributed this lower price to dumping rather than to a fall in the value of the peso.

For Florida producers, the suspension agreement had a positive impact. Based on our results, the decrease in production by Florida producers that occurred when NAFTA was signed was offset by an increase of production when the suspension agreement went into effect. The minimum price of fresh tomatoes protected Florida producers from the dumping by the Mexican producers because Mexican producers cannot sell their fresh tomatoes below the minimum prices. This suspension agreement appeared to give Florida producers the confidence to increase production to pre-NAFTA levels.

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