EFFECTS OF THE SUSPENSION AGREEMENT: U.S.-MEXICO FRESH TOMATOES ANTIDUMPING CASE

Jione Jung

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Abstract

This paper analyzes the effects of the suspension agreement of the U.S.-Mexico fresh tomatoes antidumping cases on U.S. consumers. A linear and dynamic version of an inverse almost ideal demand system is developed to estimate consumer behavior. The measure of consumer welfare – compensating and equivalent variations – is derived specifically for the inverse demand system. The variation of cross-price flexibilities obviously reduced since the minimum export price system came into effect, but consumer welfare does not seem to change much in the circumstance. The consumers' budget share on domestic fresh tomatoes is likely to reduce and it suggests that the suspension agreement may not guarantee the profit of domestic producers either.

Introduction

On April 1996, Florida fresh tomato growers filed an antidumping petition to seek relief from increased imports from Mexico. As the number one import source of fresh tomatoes, the quantity imported from Mexico increased by 224% between 1992 and 1995. Over the same period, U.S. production and price of fresh tomatoes fell by 13% and 29%, respectively. In the antidumping investigation, the U.S. International Trade Commission (ITC) made an affirmative injury determination and the U.S. Department of Commerce (DOC) found dumping margins ranging from 4.16% to 188.45%. However, rather imposing a final antidumping duty, the DOC signed with Mexican fresh tomato growers a suspension agreement, in which Mexican growers agreed to revise its export prices to completely eliminate injurious effects of exports of fresh tomatoes to the United States. To ensure no further undercutting or suppression of prices, a reference price was set and to be adjusted after one year if market conditions undergo significant changes.[1] Mexican growers should sell their products at or above the reference price calculated by the DOC. Mexican tomatoes are still in suspension, and lately a new suspension agreement was signed on January 2008.

The reference price system resulted from the suspension agreement can be seen a voluntary price restraint that Mexican growers are obligated to abide by to enter into the U.S. market. Therefore, like voluntary export restraints (VERs), it can have a distorting effect on trade and welfare. According to Baylis and Perloff (2007), the suspension agreement reduced imports from Mexico, however substantial trade diversion occurred: Mexico exported more to Canada and Canada increased exports to the United States. This may weaken the positive

[1] The reference price established in the 1996 suspension agreement was 20.68 cents per pound (the f.o.b., U.S. port of entry at the Mexican border, from the first importer to an unaffiliated purchaser).

effect of the suspension agreement on U.S. growers. Also the structure of Mexican production was affected such that instead of exporting fresh tomatoes, Mexico produced more tomato paste and increased paste exports to the Unites States, which may adversely affect the U.S. tomato processors.

Baylis and Perloff's work was mainly focused on the trade effect of the suspension agreement. This study first attempts to analyze the welfare effect of the suspension agreement on U.S. consumers of fresh tomatoes. Using monthly U.S. domestic shipment and import data from 1990 to date, an inverse almost ideal demand system (IAIDS) is estimated and price and scale flexibilities are calcualted at the every point of the data observation to analyze a change in consumer behavior over the time period. For measuring a change in consumer welfare, the specific compensating and equivalent variations for the IAIDS are derived and calculated using the empirical data.

The paper is organized as follows: first, an overview on U.S. fresh tomato industry and the recent fresh tomato antidumping cases is described. In the next section, an empirical model of the IAIDS for U.S. fresh tomatoes are developed and welfare measures for the IAIDS are derived. Estimation results are reported and a discussion on the calculated price and scale flexibilities and welfare measures are followed. The last section concludes.

Overview of U.S. Fresh Tomato Industry and Antidumping Cases

U.S. fresh tomato industry has been growing significantly over the past several decades. The increase in tomato production is due to improved efficiency at the grower levels. Fresh tomatoes lead in U.S. farm value of vegetable and melon production only next to lettuce with $1.3 billion and accounted for 12% in 2007. Total harvested acreage for fresh tomatoes has decreased from 147,100 acres in 1970 to 122,800 acres in 2006, however yields per acre have been increasing from 12,400 pounds to 30,000 pounds over the same period.

Production of fresh tomatoes steadily increased and peaked with about 4 billion pounds in 2002. Florida and California are the major domestic sources for fresh tomatoes, which account for 37% and 31%, respectively. The annual grower price for fresh tomatoes has been also rising and hit record high in 2006, averaging $0.43 per pound.

Consumption of fresh tomatoes has continously increased due to an increase in consumers' awareness of health and nutrition benefits of tomatoes. As a good source of vitamins A and C and lycopene, fresh tomatoes are known to reduce risk of various cancers and heart disease. The average per capita consumption was 20 pounds in 2006, 45% up from 11 pounds in 1970. The retail price was $1.73 per pound that is the highest amount in recent years.

The United States is a net importer of fresh tomatoes. In 2006, the United States imported 2.2 billion pounds, which accounted for 37% of total fresh tomato consumption. Mexico is the primary source of fresh tomatoes and supplied 86% of total U.S. fresh tomato import volume. The quantity imported from Mexico increased by 108% for the past two decades (1987-2006) and the amount reached at 1.9 billion pounds in 2006 (Figure 1).

Imports from Mexico peak in the winter months, resulting in competition with a certain part of U.S. fresh tomato producing regions – South Florida. Numerous cases of trade disputes were filed between Mexico and the United States since the first antidumping petition was filed by Florida fresh tomato growers in 1978. The North American Free Trade Agreement removed tariffs on fresh tomatoes over the 5- or 10-year transition periods and it accelated imports of fresh tomatoes originated from Mexico.

There are two global safeguard cases on imports of fresh tomatoes. Initiated in 1995 and 1996, the cases were either withdrawaled by the petitioners or completed with a nagative determination. The currently active investigation is the 1996 antidumping case. U.S. fresh tomato growers filed an antidumping petition allerging that the U.S. fresh tomato industry was materially injured or threatened by reason of less than fair value imports of fresh tomatoes from Mexico. Tomato imports from Mexico increased by 224% from 1992 to 1995, while U.S. domestic production and prices fell by about 13% and 29%, respectively.

The ITC's affirmative preliminary injury determination and the DOC found preliminary dumping margins ranging from 4.16% to 188.45%. On October 1996, the DOC and Mexican fresh tomato growers signed an agreement suspending the antidumping investigation. Mexico agreed to voluntarily limit its exports by selling at or above the reference price ($0.21 per pound and reset every year), in return, the United States suspended the investigation and removed antidumping tariffs. In 2002, Mexico wanted to withdrawal from the suspension agreement and the DOC resumed the antidumping investigation. As a result, on December 2002, a new suspension agreement was signed. Again in 2008, the 2002 suspension agreement was terminated by the withdrawal of Mexican growers, a new agreement is in effect.

Empirical Models

To analyze the effect of the suspension agreement on U.S. consumption of fresh tomatoes, first, an inverse almost ideal demand system (IAIDS) is considered. Price and scale flexibilities are calculated using the parameter estimates of the IAIDS to investigate a chage in consumer behavior over the time. Consumer welfare measures are derived and calculated.

Inverse Almost Ideal Demand System

An IAIDS is often used for the analysis of demand for agricultural products of which quantity is predetermined by produciton and price adusts to the available quantity. When a commodity is perishable, an original almost ideal demand system (AIDS) is not appropriate for demand analysis because the commodity is produced in response to biological lag rather than price (Eales and Unnevehr 1994; Brown et al. 1995; Park et al. 2004). Particularly, the IAIDS is useful when agricultural demand is modeled based on monthly or quarterly time series data (Moschini and Vissa 1992). The application of the IAIDS to fresh tomatoes is not new. Grant and Foster (2005) estimated a linear version of the IAIDS mainly focusing on seasonality of the fresh tomato supply from each source.

An IAIDS is derived from the distance function, which is dual to the cost function of the AIDS (Anderson 1980; Deaton 1980). The distance function represents the amount by which quantities need to be divided in order to attain the original level of utility. A distance function *D* is obtained from the direct utility function *U* and it can be implicitly defined as

$$U\{q/D(q,u)\} \equiv u, \tag{1}$$

where *u* is the reference utility level. $D(q, u)$ is decreaseing in *u* and non-decreasing, concave, and homogenous of degree one in *q*. Analogous to the AIDS cost function, a logarithmic distance function can be specified as the following:

$$\ln D(q,u) = a(q) - \mathrm{u}\, b(q), \quad . \tag{2}$$

where $a(q)$ and $b(q)$ are defined as

$$a(q) = \alpha_0 + \sum_j \alpha_j \ln q_j + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln q_i \ln q_j,$$

$$b(q) = \beta_0 \prod_j q_j^{\beta_j}. \tag{3}$$

Since $D(u, q)$ is homogenous in q, the following restrictions hold:

Adding-up: $\sum_i \alpha_i = 1$, $\sum_i \gamma_{ij} = 0$, $\sum_i \beta_i = 0$

Homogeneity: $\sum_j \gamma_{ij} = 0$

Symmetry: $\gamma_{ij} = \gamma_{ji}$. (4)

By Shepherd's Lemma, $\partial D(u,q)/\partial q_i = p_i/x$, i.e., a compensated demand function is derived. p_i/x is the normalized price of the ith good, where x is total expenditure. Multiplying both sides by $q_i/D(u,q)$ yields $\partial \ln D/\partial \ln q_i = p_i q_i/x = w_i$.[2] Shortly substituting Equations (3) into (2) and differentiating it with respect to log of quantity i yields the budget share w_i:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln q_j + \beta_i \ln Q, \tag{5}$$

where $\ln Q$ is a quantity index defined as $\ln Q \equiv a(q)$.

Measuring change of consumer welfare

Welfare changes resulting from a change in price can be measured by comparing two levels of the utility, u_0 and u_1, where u_0 is the original level of utility with initial price p_0 and u_1 is a new utility level in response to a new price p_1. However, utility is ordinal and there is no possible way to quantify such change directly. Using the expenditure function E, the magnitude of welfare changes can be investigated with two different measures, which are

[2] This can be done by knowing that if q is such bundle for holding $u(q) = U$, then $D(u,q) = 1$ from Equation (1).

known as the compensating and equivalent variations, respectively:

$$\text{Compensating variation (CV)} = E(p_1, u_0) - E(p_0, u_0)$$
$$\text{Equivalent variation (EV)} = E(p_1, u_1) - E(p_0, u_1). \tag{6}$$

The compensating variation is defined as the amount of money that would be nessasary for an individual to maintain his initial level of utility with respect to the price change. The equivalent variation is the amount of money that the individual would be prepared to pay at the new budget level to avoid the price change. The welfare analysis of price changes has been studied frequently using traditional demand system approach. Most recently, Creedy (2000) derived the welfare measure for the AIDS in response to price changes.

Analogous to the case of price changes, the measures for welfare changes associated with quantity changes can be specified as the following (Kim 1997):

$$CV^* = D(q_1, u_0) - D(q_0, u_0)$$
$$EV^* = D(q_1, u_1) - D(q_0, u_1) \tag{7}$$

CV^* (EV^*) can be interpreted as the amount of additional expenditure required for a consumer to maintain the utility level u_0 (u_1) while facing the quantity vector q_1 (q_0). The consumer is better off if CV^* (EV^*) is less than 0.

The derivation of the compensating and equivalent variations specifically for the IAIDS follows. Let $D(q_0, u_0)$ and $D(q_1, u_1)$ be m_0 and m_1, respectively. The compensating variations for the IAIDS is defined as

$$\text{CV}^*_{\text{IAIDS}} = D(q_1, u_0) - D(q_0, u_0),$$

$$\text{where } D(q,u) = \exp[a(q) - ub(q)] \text{ from Equation (2).} \quad (8)$$

Rewriting (8),

$$\text{CV}^*_{\text{IAIDS}} = D(q_1, u_0) - m_0$$
$$= \exp[a(q_1) - u_0 b(q_1)] - m_0. \quad (9)$$

Substituting $u_0 = [a(q_0) - \ln m_0]/b(q_0)$ into (9)

$$\text{CV}^*_{\text{IAIDS}} = \exp[a(q_1)] \cdot \exp\left[\frac{b(q_1)}{b(q_0)}[\ln m_0 - a(q_0)]\right] - m_0. \quad (10)$$

Similarly, the equivalent variation of the IAIDS can be derived:

$$\text{EV}^*_{\text{IAIDS}} = D(q_1, u_1) - D(q_0, u_1)$$
$$= m_1 - \exp[a(q_0)] \cdot \exp\left[\frac{b(q_0)}{b(q_1)}[\ln m_1 - a(q_1)]\right]. \quad (11)$$

Estimation Results

Monthly data from 1994 to 2006 are used for estimating U.S. demand for fresh tomatoes. U.S. grower price and shipment data are obtained from *Tomato Statistics* electronically published and periodically updated by the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA). The source of monthly import value and quantity data is *FATUS Commodity Aggregation* maintained online by the Foreign Agricultural Service of the USDA.

The IAIDS for domestic fresh tomatoes and imports from Mexico, Canada, and the rest of the world was estimated using seemingly unrelated regressions, which are usually employed when the disturbance in the regression equation under consideration could be correlated with the disturbance in some other regression equations in the system (Zellner 1962). By adding-up restriction, the sum of the dependent variables equals one and $\sum_i \alpha_i = 1$. In this case, the disturbances of each equation sums one and this makes the system singular. For solving this problem, one of the equations in the system was dropped in estimation (Greene 2000). Dynamics were considered: the IAIDS for fresh tomatoes was estimated allowing for first-order autocorrelation. To be invariant to the equation deleted, the autocorrelation coefficients are constrainted to be the same across the equations of the system (Berndt and Savin 1975). To control seasonality of the supply of fresh tomatoes from each source, two dummy variables were included in each equation: one is for the period of the winter from January through April when the share of Mexican fresh tomatoes in the U.S. market is significant and the other dummy for the summer from May to August when the Canadian tomatoes are abundant. In addition, a dummy indicating the suspension agreement is effective is included to investigate the effect of setting for the minium export price of fresh tomatoes from Mexico on demand for domestic and Canadian tomatoes as well as Mexican ones. For the practical use of the inverse demand system, the quantity index in Equation (5) is replaced by the following Stone's quantity index:

$$\ln Q_t^* = \sum_j w_{jt} \ln q_{jt}. \qquad (12)$$

To be invariant to the choice of units of measurement, quantities are scaled by dividing through the mean (Moschini 1995). The final model to estimate can be written as

$$w_{it} = \alpha_i + \sum_j \gamma_{ij} \ln q_{jt} + \beta_i \ln Q_t^* + d_1 \mathrm{dmy1}_t + d_2 \mathrm{dmy2}_t + d_3 \mathrm{dmys}_t + \varepsilon_{it},$$

$$\text{where} \quad \varepsilon_{it} = \rho \varepsilon_{it-1} + v_{it}, \qquad v_{it} \sim \mathrm{i.i.d.} \qquad \text{and}$$

$$i, j = \mathrm{US, MX, CD, and\ RW.} \tag{13}$$

The inverse demand system in (13) was estimated with homogeneity and symmetry imposed using TSP 4.4. The parameter estimates and their standard errors are summerized in Table 1. Most of the estimated coefficients show statistical significance at the 95% confidence level.

Dummy variables

The parameter estimates for two seasonal dummy variables show expected negative signs and statistical significance in the US equation, implying that during the months when imports from Mexico and Canada increase, the budget share of domestic products decrease by 6 and 4 percentage points, respectively. On the other hand, between January and April, U.S. consumers increase demand for Mexican tomatoes and by the same token during summer demand for Canadian tomatoes rises.

More attention is given to the estimated coefficient for the dummy indicating the period of the suspension agreement in effects. In the US equation, the sign of the parameter estimate is negative and significant. The purpose of the suspension agreement is to reduce too cheap imports, but in this case U.S. consumers reduce their budget shares on domestic products by 8 percentage point and rather increase their expenditure more on imports.

Price and scale flexibilities

Flexibilities measure the sensitivity of inverse demand (i.e., price) with respect to a change in quantity demanded. Price and scale flexibilties for a linear approximate IAIDS are shown as

Own and cross price flexibilities:

$$f_{ij} = \frac{\partial \ln p_i}{\partial \ln q_j} = -\delta_{ij} + \frac{\gamma_{ij} - \beta_i w_j}{w_i}, \quad \text{where } \delta_{ij} = \begin{cases} 1, & \text{if } i = j \\ 0, & \text{otherwise} \end{cases}$$

Scale flexibilities:

$$f_i = \frac{\partial \ln p_i}{\partial \ln Q} = -1 + \frac{\beta_i}{w_i}. \tag{14}$$

Demand is price flexible if a one percent increase in consumption of a good *i* leads to a more than one percent decrease in the marginal value of the good *i*. Two goods, *i* and *j* are *q*-substitutes if their cross-price flexibility is negative and *q*-complements if it is positive (Hicks 1956). Scale flexibilities measure the percentage change in the price of good *i* in response to a 1% increase in quantities of all goods (Anderson 1980).

Table 2 presents the price and scale flexibilities calculated at the sample means. All the own-price flexibilities are negative as expected and less than one in absolute value. The own-price flexibilities of imports from Mexico and Canada are larger in absolute value than that of domestic tomatoes, implying that the price of imports are likely to respond more sensitively to the increase in quantity. Figure 2 shows the point estimates of the own-price flexibilities for domestic and imported fresh tomatoes calcualted over the sample period. The most noticeable is the seasonality of the flexibilities: the own-price flexibilities become larger in absolute value generally when the supply peaks, October for the U.S., February for Mexican, and June for Canadian fresh tomatoes. Particularly, the variation with season is more apparent in the graphs of the own-price flexibilities of imports from Mexico and

Canada and this may act as an evidence of dumping: the increase in supply associated with high price cut.

The estimates of cross-price flexibilities at the mean shares indicate that on average, domestic fresh tomateos and imports from Mexico are q-substitutes while fresh tomateos from Canada are q-complements to U.S. and Mexican fresh tomatoes. The cross-price flexibility of the price of U.S. produced fresh tomatoes with respect to the quantity of Mexican tomatoes are less than that of the price of Mexican tomatoes with respect to the quantity of U.S. tomatoes in absolute value ($f_{\text{US,MX}} = |-0.121| < f_{\text{MX,US}} = |-0.624|$), indicating that the price of domestic fresh tomatoes is not responsive to an increase or decrease in quantity imported from Mexico. This is true for the price of U.S. fresh tomatoes with repect to the quantity change in Canadian fresh tomatoes ($f_{\text{US,CD}} = 0.027 < f_{\text{CD,US}} = 0.165$). The point esimates of the cross-price flexibilities over the sample period are calculated and the seasonal variation of them are summarized in Table 3.[3] Overall, the cross-price flexibilities of the price of U.S. fresh tomatoes in response to a change in import quantities do not vary much by season. Figure 3 graphs the seasonal variation of the cross-price flexibilities of US price to MX quantity and MX price to US quantity. The seasonality of the cross-price flexibilities between domestic fresh tomatoes and imports from Mexico was reduced after 1995 when the suspension agreement became effective.

Scale flexbilities are ranged from -0.5 to -1.3 (Table 2). The scale flexibility of U.S. fresh tomatoes is -1.248, which indicates that a 1% proportionate increase in all fresh tomatoes would reduce the price of domestic fresh tomatoes by about 1.248%. The marginal value of fresh tomato imports from Mexico declines less than proportionately when

[3] The minimum and maximum values of the flexibilities are used for calculating the seasonal variation for a certain year.

consumption of all fresh tomatoes increases by 1%.

Welfare changes

To obtain the welfare measures for the linear approximate IAIDS, the quantity index $a(q)$ is replaced by Stone's quantity index, $\ln Q^*$ in Equation (8). Then, the compensating and equivalent variations for the linear approximate IAIDS,

$$\mathrm{CV}^*_{\mathrm{LA/IAIDS}} = Q^*_1 \left[\frac{m_0}{Q^*_0}\right]^{b(q_1)/b(q_0)} - m_0$$

$$\mathrm{EV}^*_{\mathrm{LA/IAIDS}} = m_1 - Q^*_0 \left[\frac{m_1}{Q^*_1}\right]^{b(q_0)/b(q_1)} \qquad (15)$$

The welfare measures above are used to analyze the welfare effects of changes in quantities demanded for fresh tomatoes. Table 4 shows the signs of the compensating and equivalent variations calculated over the sample period. As mentioned before, the positive CV or EV mean that consumer welfare after the change is lower than in the original situation. The welfare measures appear to be affected by season: during the months of March through June consumers are likely to experience lower welfare than the previous month. There seems to be a year-to-year variation in the welfare effects but not much: the number of the positive measures increased and slightly reduced after 1995, but started to rise again from 2000, suggesting that the suspension agreement is not likely to be a factor for consumer welfare.

Summary and Conclusion

For a Mexican fresh tomatoes grower to sell his products in the U.S. market, he faces a restriction that he needs to sell tomatoes over the minimum price set by the suspension agreement of the antidumping investigation. Since the first suspension agreement was effective in 1996, the antidumping investigations on fresh tomatoes imported from Mexico never terminated and rather a set of the new suspension agreements came into effect. An expected outcome from antidumping measures including the suspension agreement is to remedy domestic industry injured from an increase of less-than-fair-valued imports. In other words, such remedy is primarily focused on producers in a domestic market. The consumer-side who might be benefited from cheap imports is rarely taken into account.

The purpose of this study was to investigate the effect of the suspension agreement on consumers. Considering that fresh tomatoes are a perishable agricultural product and therefore the equilibrium price is deteremined by quantity, inverse demand approach was used. The empirical model for the analysis was a linear and dynamic version of the IAIDS. For empirical use of the traditional welfare measures, the specific compensating and equivalent variations were derived for the IAIDS.

The estimation results show that when the suspension agreement is in effect, U.S. consumers reduce the budget share on domestic fresh tomatoes and rather increase on imported tomatoes, implying a possible reduction of the profit of domestic producers. The own-price flexibilities were calculated using the parameter estimates of the IAIDS over the sample period. Generally, the own-price flexibilities showed a large negative value when the supply is abundant. The seasonal variation of the own-price flexibilities of imports from Mexico and Canada was intensive meaning that when imports surges, the prices respond more sensitively than usual and in such circumstances an affirmative judgement on dumping would be easily made. From the point estimates of cross-price flexibilities between U.S. and Mexican fresh tomatoes, the seasonality of the price flexibilities is apparently reduced after the suspension agreement took effect. This can be regarded as an only positive effect of the suspension agreement on the consumer-side. Lastly, the change in consumer welfare after the suspension agreement was investigated. The number of the positive welfare measures which mean that consumers become worse off than the previous period was used to see if there is a definite change due to the suspension agreement. The number was up and down throughout the sample period however the difference is not that evident suggesting that the suspension agreement may not give a major impact on consumer welfare.

This study first analyzed the effect of the suspension agreement of the antidumping investigation, mainly focusing on consumer behavior. As expected, consumers are not likely to be benefited from the suspension agreement. Even for producers, the positive effect of the agreement seems not guaranteed. A suspension agreement is not an usual outcome in U.S. antidumping cases. This may be the reason why studies investigating its economic effects are rarely attempted. However, it is obvious that the minimum price system is one of kinds that distort trade. In the case of fresh tomatoes, the trade-distorting measure has been in place over 10 years. Analyses on welfare effects on producers and the overall economy are necessary and that would be an area for future research.

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Table 1. Parameter estimates of linear approximate IAIDS for fresh tomateos[a]

	Constant	lnq_{us}	lnq_{mx}	lnq_{cd}	lnq_{rw}	lnQ*	dmy1	dmy2	dmys
US	0.584**	0.114**	-0.115**	0.005**	-0.004**	-0.140**	-0.057**	-0.036*	-0.078*
	(0.035)	(0.010)	(0.009)	(0.002)	(0.001)	(0.032)	(0.019)	(0.016)	(0.035)
MX	0.329**		0.132**	-0.008**	-0.009**	0.162**	0.055**	0.005	-0.017
	(0.032)		(0.009)	(0.002)	(0.001)	(0.030)	(0.019)	(0.016)	(0.033)
CD	0.022			0.003**	0.000	-0.012	-0.004	0.028**	0.080**
	(0.014)			(0.001)	(0.000)	(0.014)	(0.008)	(0.007)	(0.015)
RW	0.064**				0.012**	-0.010**	0.006*	0.003	0.016**
	(0.006)				(0.001)	(0.004)	(0.002)	(0.002)	(0.004)

[a] Autocorrelation is corrected. The estimated rho was 0.718 (0.030).
* and ** indicate that a coefficient is statistically significant at the 5% and 1% significance levels.

Table 2. Price and scale flexibilities at the sample mean

	Price flexibilities				Scale
	US	MX	CD	RW	Flexibilities
US	-0.659	-0.121	0.027	0.001	-1.248
MX	-0.624	-0.764	-0.059	-0.042	-0.511
CD	0.165	-0.058	-0.948	0.005	-1.164
RW	0.065	-0.179	0.022	-0.593	-1.316

Table 3. Seasonal variation of the cross-price flexibilities over the sample period

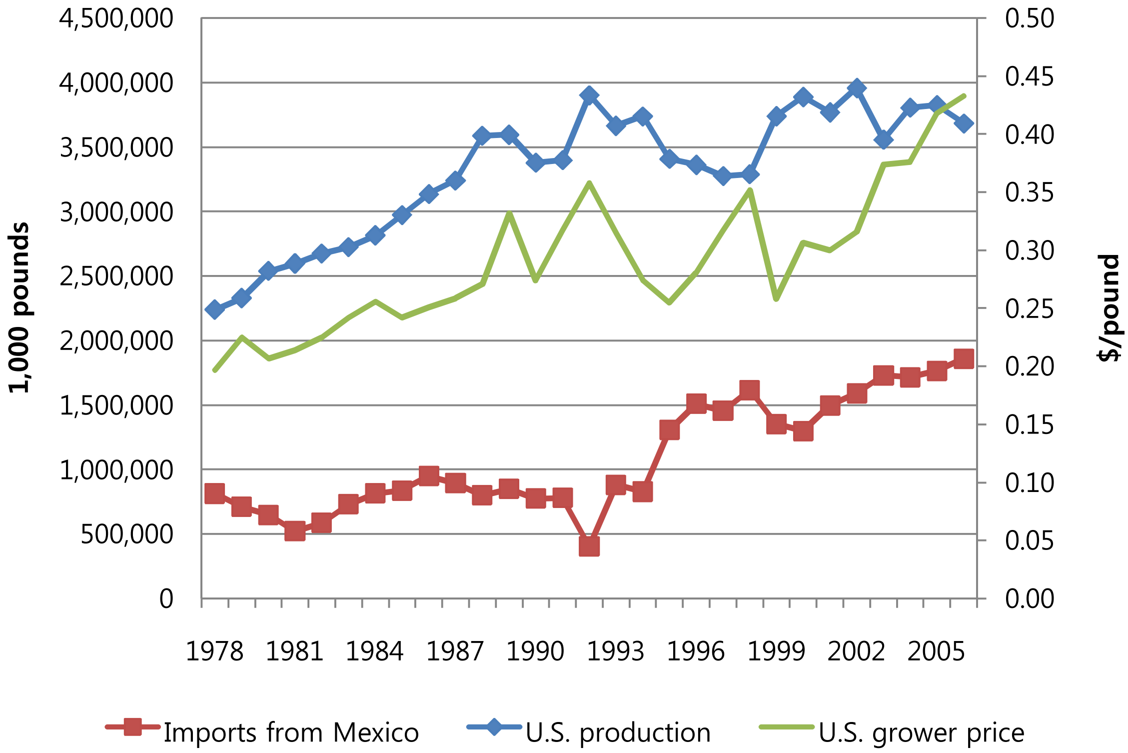
Year	US price – MX quantity	MX price – US quantity	US price – CD quantity	CD price – US quantity	MX price – CD quantity	CD price – MX quantity
1990	4.866	27.451	12.563	284.060	5.930	276.257
1991	0.287	11.159	25.092	309.367	17.759	236.691
1992	0.085	3.482	3.849	122.676	28.108	97.766
1993	0.675	8.048	13.614	913.308	10.367	430.327
1994	5.379	12.216	8.747	498.958	15.657	39.529
1995	8.473	6.776	17.721	144.806	13.297	141.792
1996	2.184	4.937	11.205	68.642	13.165	28.486
1997	1.116	5.018	8.715	134.959	14.601	53.882
1998	1.296	4.506	7.142	107.995	14.742	32.597
1999	1.502	3.644	8.790	31.007	5.565	31.155
2000	0.766	3.433	8.485	138.111	6.292	178.908
2001	1.191	3.258	5.508	37.929	17.051	13.518
2002	1.472	3.700	7.041	123.949	14.479	25.318
2003	1.453	3.332	6.351	34.928	12.780	16.633
2004	1.574	4.794	10.533	207.721	12.938	139.246
2005	1.615	3.545	5.383	68.838	15.668	9.599
2006	1.672	6.690	9.093	47.306	8.976	117.371
Average	2.094	6.823	9.990	192.621	13.375	109.946

Table 4. Compensating and equivalent variations for the change in quantity demanded for fresh tomatoes[a]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990		+	+		+	+						
1991	+		+	+	+	+					+	
1992	+		+		+	+				+		
1993	+		+	+	+	+				+		
1994		+	+	+	+	+				+		
1995			+	+	+	+	+			+		
1996			+	+	+	+				+		
1997			+	+	+	+						
1998			+	+	+					+		
1999			+	+	+	+						
2000			+	+	+	+				+		
2001			+	+	+	+				+		
2002			+	+	+	+	+				+	
2003			+	+	+		+			+	+	
2004			+	+	+					+	+	
2005			+	+	+	+	+			+		
2006			+	+	+		+		+			

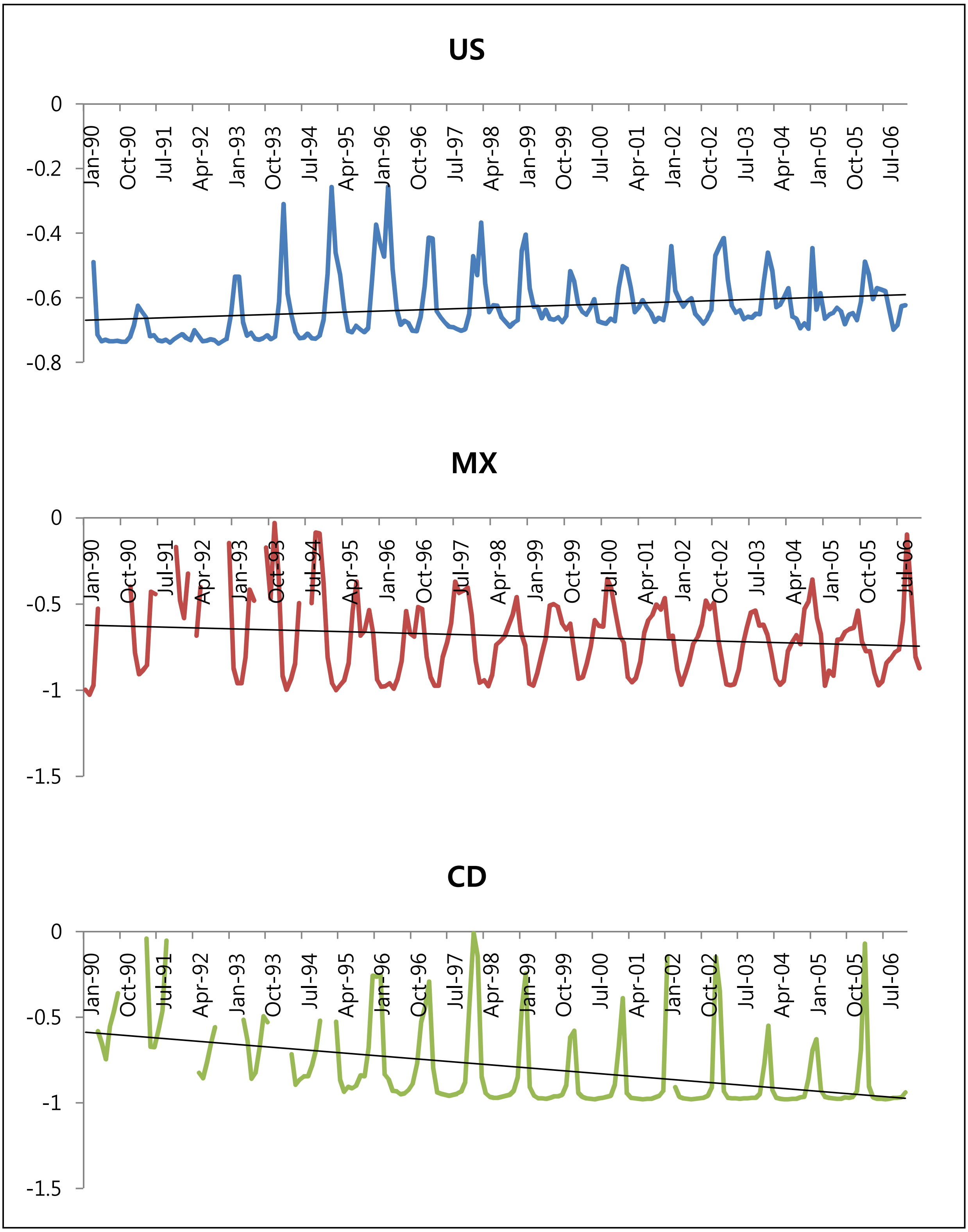
[a] + denotes that the signs of both CV and EV are positive.

Figure 1. Imports from Mexico, U.S. domestic production and price of fresh tomatoes volume: 1978-2006



Source: Prepared by ERS from data of U.S. Dept. of Commerce, U.S. Census Bureau

Figure 2. Own-price flexibilities at every point of the observations[a]



[a] Abnormal values of flexibilities at some data points are not shown. The Straight lines imply trend.

Figure 3. Seasonal variation of the cross-price flexibilities over the sample period: US price to MX quantity and MX price to US quantity