Price Asymmetry in the United States Fresh Tomato Market

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This paper analyzes pricing relationships between the producer, wholesale and retail levels of the U.S. fresh tomato industry. The results indicate that price transmission is unidirectional from producer to retail. There was no asymmetric response for the producer-retail price relationship. Asymmetric price response was exhibited between wholesalers and both producers and retailers. Retail prices respond more to rising wholesale prices than to falling prices. Wholesales prices, however, respond more to declining producer price than to rising producer price.

The issue of market structure and the flexibility of prices came to the fore at the time of the depression of the 1930s when classical economists were struggling to address the failure of the market as evidenced by the high level of unemployment. Earlier studies noted that firms in industries characterized by oligopolies tended to change prices less frequently than theory might predict. This is known as the "administered price hypothesis." Means's work led to analyses of the relationship between structure and pricing, in particular to analyses of structure and the speed and extent of changes in cost and demand on prices.

A related issue, which is the focus of the empirical sections of this paper, is the relationship between market structure and asymmetry in pricing. Asymmetry can be defined as a difference in the reaction of firms to cost increases compared to cost decreases. Asymmetry clearly has long been a feature of economic theory—for example Keynes's theory was in part related to money wages being sticky downwards. Asymmetry can be seen to take two forms, one relating to the speed of adjustment and the other to the extent of adjustment. Industrial economists have undertaken a large number of empirical studies with conflicting results.

The issue of asymmetry in pricing has received considerable attention in the agricultural economics literature (e.g., Ward 1982; Kinnucan and Forker 1987; Schroeder 1988; Willet, Hansmire, and Bernard 1997). Much of this work on asymmetry followed the work of Ward, who examined price transmission for a number of fresh produce items in America. For those products where significant asymmetry was discovered, he found that price rises were not passed on to the same extent as were price falls. He suggested a number of possible reasons for this, including the perishability of produce, which meant that retailers would be unlikely to raise prices and risk stock moving more slowly and deteriorating. Kinnucan and Forker (1987) undertook a detailed study of margins in the U.S. milk sector and concluded that there was asymmetry, but in the opposite direction to that found for fresh produce by Ward. Kinnucan and Forker postulate three reasons why pricing asymmetry in the agricultural sector may occur: the existence of market power, government intervention in the pricing system, and differential impacts of shifts in retail demand as opposed to producer supply.

Recently, changes in the U.S. fresh tomato market have led to higher producer-retail margins. Heien (1980) suggested that margins provide useful information about price linkages in the marketing system for the agricultural sector. Worth (1999) showed that higher marketing costs were correlated with higher producer-retail margins. Marketing costs include transportation, labor and packaging. The role of retailers also has influenced the pricing mechanism, because retailers can independently increase retail prices and therefore the producer-retail margin (Worth 1999). Farmers are concerned with two issues in this area (McLaughlin 1995). First, producer prices are not fully adjusted when retail market prices increase; this results in retailers absorbing more revenues at the expense of producers and consumers. Second, supermarkets may not lower prices when producer prices decrease. When producer price cuts do not pass through to the consumer, demand remains unchanged. The producers concern is that consumers do not receive the benefits of falling producer prices when they pay higher prices at the retail level while producer prices decline. This results in increased margins for retailers at the

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expense of producers and consumers. Therefore, producers are concerned that price transmission and structural change in the U.S. fresh tomato industry have resulted in market imperfections. Price transmission is an important topic because it provides information about the performance of the marketing system and changes in market structure.

This paper investigates asymmetric price relationships among the producer, wholesale, and retail levels in the U.S. fresh tomato market. The general approach of this paper employs Ward's (1982) price-asymmetry model, which is a dynamic model using lagged prices. Granger's causality test is used to analyze the direction of causality. The following section discusses the fresh tomato industry in the U.S. The methodology used in the analysis of the U.S. fresh tomatoes is detailed in the third section. The fourth section presents the empirical results. The final section presents a brief summary in the last section.

U.S. Fresh Tomato Industry

Tomatoes are an important agricultural commodity in the U.S. because they earn significant cash-crop revenues. Almost two-thirds of the fresh-market tomato production in the United States comes from California and Florida. Domestic production totaled nearly 1.7 million tons in 1997, with more than 1.2 million tons produced in these two states. However, due to location and climate conditions in these two regions, they are not in direct competition with each other. Florida tends to supply most of its production during the winter months, while California supplies most of its production in the summer. Florida's main competition comes from Mexico; Florida and Mexico they supply over 90 percent of the U.S. winter market (VanSickle et al. 1994). The competition between Mexico and Florida has its roots in the U.S. embargo of trade with Cuba, which up to that time was the major import supplier of the U.S. winter fresh-vegetable market. The competition has been fierce, often referred to as the "Great Tomato War," and has been subject to much scrutiny by academics (Schmitz et al. 1981; Thompson and Wilson 1997; Van Sickle et al. 2003). At present there is a truce in the ongoing litigation following the 1996 suspension agreement following an anti-dumping case instigated by U.S. producers in 1996 (VanSickle 1997). California's competition is more domestic in nature, mainly consisting of producers in other states and "backyard" production. Increasing competition has also come from greenhouse-grown tomatoes, but those tomatoes have been judged a different product (U.S. ITC 2002).

Fresh tomato yields have increased slightly since 1980. Florida yields were highest in 1992, when Mexico suffered from severe flooding. This resulted in prices being significantly higher for Florida producers, allowing them to harvest higher yields per acre. However, since 1994, imports of fresh tomatoes have increased significantly. Domestic producer prices have declined, and there has been a reduction in U.S. fresh tomato production. Thompson and Wilson (1997) estimated that less than one thousand producers in the U.S. are responsible for the vast majority of production. These producers are generally well-represented both politically and commercially through a number of groups. For example, producers in Florida are represented by the Florida Tomato Committee (FTC), the Florida Tomato Growers Exchange (FTGE), and the Florida Farm Bureau Federation. This degree of concentration and organization may suggest that producers are in a position of countervailing power to the oligopsonistic retailers. However, attempts by U.S. producers to gain countervailing power are to a certain extent undermined by the availability of a ready supply of imports.

Producers funnel their production through a relatively small number of packing houses. The shipment of produce is accounted for largely by grower-shippers. Thompson and Wilson (1997) estimated that nine grower-shippers in Florida accounted for 80 percent of the State's shipments. Competition in this sector appears fierce, with grower-shippers operating to increase their supply windows by expanding across regions and across countries. Co-ordination between shippers and producers varies considerably, ranging from loose contracts to fully integrated production.

A feature of the production of field-scale tomatoes is their susceptibility to climatic variations. In Florida, for example, untimely frosts can devastate production; this has occurred a number of times in recent years. In addition, the tomato war between Mexico and Florida has also had an impact on the continuity of supplies at certain times. These factors must be considered when the pricing relationships are examined. In summary, the supply chain for tomatoes in the U.S. is characterized by increasing concentration at all levels. However, the degree of competition appears to vary considerably.

Methodology for Empirical Analysis

Price-Asymmetry Model

The fundamental asymmetric model was suggested by Tweeten and Quance (1971) and was modified by Wolffram (1971) and Houck (1977). These models are static models and do not completely explain price changes over time. Ward (1982) elaborated on the existing dynamic asymmetric model by incorporating lagged prices. The attraction of formulating this empirical study of pricing in the form of an asymmetry model is that it will allow a number of issues to be investigated simultaneously. These include the extent of price transmission, the speed of the transmission, and the existence of differences in reaction to rising as opposed to falling markets.

Prices at one level of the marketing chain are related to prices at another by $R_t = f(W)$, where R may be the price at the retail level and W the price at the wholesale level. The general case is where R is related to W through a distributed lag function,

$$(1) \qquad R_t = \alpha_{0t} + \sum_{j=1}^{k} \alpha_j W_{t-j+1} + \varepsilon_t.$$

If asymmetry occurs then α_j differs depending on whether W_t is less than or greater than W_{t-1}. Using Young's (1980) framework, the W variable can be split into two, one section capturing price rises and the other price falls. Equation (1) can be rewritten as

$$(2) \qquad R_t = \beta_{0t} + \sum_{j=1}^{k} (\alpha'_j W'_{t-j+1} + d''_j W''_{t-j+1}) + \varepsilon_t$$

where

$$W'_t = \sum_{t=0}^{t} (W_{t-i} - W_{t-i-1}) Z'_{t-i},$$

$$W''_t = \sum_{t=0}^{t} (W_{t-i} - W_{t-i-1}) Z''_{t-i},$$

$$Z'_{t-i} = \left\{ \frac{1 \forall\ W_{t-i} \geq W_{t-i-1}}{0 \text{ otherwise}} \right\}, \text{ and}$$

$$Z''_{t-i} = \left\{ \frac{1 \forall\ W_{t-i} \leq W_{t-i-1}}{0 \text{ otherwise}} \right\}.$$

Equation (2) can be simplified into equation (3) by using Gollnick's derivation.

$$(3) \quad R_t = \beta_{0t} + \sum_{j=1}^{k} \left[\alpha'_j W'_{t-j+1} - W_0 + (\alpha''_j - \alpha'_j) W''_{t-j+1} \right] + \varepsilon_t.$$

Here the estimate of $\alpha''_j - \alpha'_j$ gives a direct test of the asymmetry condition.

Polynomial lags can be incorporated into this general model. Under the assumption that the peak response to a price change is immediate, the use of a first-degree polynomial is valid. Letting φ_j be some weighting of the lags, then equation (4) can be incorporated into equation (3). This results in only four unknown parameters, rather than 2k unknown parameters in equation (3).

$$(4) \qquad \begin{aligned} \alpha'_j &= \lambda'_0 + \lambda'_1 \varphi_j \\ \alpha''_j - \alpha'_j &= \lambda''_0 + \lambda''_1 \varphi_j \,. \end{aligned}$$

In Ward's model the data used are seasonal in nature and the model is developed to take account of this. However, continuous data are used in this study, which allows us to bypass some of the problems in estimation. Putting equation (4) into equation (3) produces a general model for estimating the price linkage:

$$(5) \quad R_{1t} = \lambda_{0(t)} + \lambda'_0 H_{1(t)} + \lambda'_1 H_{2(t)} + \lambda''_0 H_{3(t)} + \lambda'_1 H_{4(t)} + \varepsilon_t,$$

where

$$H_{1(t)} = \sum_{j=0}^{3} \left[W_{(t-j)} - W_0 \right],$$

$$H_{2(t)} = \sum_{j=0}^{3} \left[W_{(t-j)} - W_0 \right] \varphi_j,$$

$$H_{3(t)} = \sum_{j=0}^{3} \left[W''_{(t-j)} \right], \text{ and}$$

$$H_{4(t)} = \sum_{j=0}^{3} \left[W''_{(t-j)} \right] \varphi_j,$$

where R is the producer price, W is the wholesale price, W'' is the falling wholesale price, and ε_t is a random error term. The asymmetric hypothesis tests whether price changes at one level are symmetric in response to increases and decreases in prices at other levels of the market system. If the null hypothesis that retail price response is symmetric to both increases and decreases in wholesale prices is rejected, then we conclude there is asymmetric behavior between wholesale and retail price levels.

Two further issues need to be resolved before estimation can take place: the direction of causality and the nature of the lag system to be used. Generally, two approaches are adopted in the literature with respect to establishing causality. Either Granger causality tests are used or direction of causality is simply assumed. Clearly, the use of empirical tests should be preferable, but the validity of these tests is subject to considerable debate (see Kinnucan and Forker 1987). This relates not only to the fact that the results are susceptible to the number of included lags, but also to whether filters should be used.

The choice of lag structure for this study was undertaken on the basis that it needed to be flexible to allow for possible changes over time. Previous studies have used a number of lag structures, including Almon and Shiller lags. The polynomial specification adopted by Ward when analyzing tomatoes implicitly assumes that peak effects occur at the outset, followed by a smooth decline. Ward chose a value for φ_j which represented a geometric-decay function. Different types of lag structures were considered for this study; however, the function used by Ward appeared to fit the data well and was chosen. The lag structure chosen was $\varphi_j = \sqrt[3]{j}$.

Causality

A simple problem in the asymmetric-price model is determining whether movements in one variable are caused by movements in another. A causality test is one approach that answers this problem. There are several approaches in which the direction of causality can be analyzed; however, the Granger causality test is used in this paper. The basic idea of Granger (1969) causality theory is to test the null hypothesis that changes in one variable are not able to predict the other. For example, if the null hypothesis "producer price does not cause wholesale price" is examined, the Granger causality test is performed by regressing wholesale price on lagged values of itself and lagged values of producer prices and also regressing wholesale price on lagged values of itself as follows:

$$(6) \qquad W = \sum_{i=1}^{m} \alpha_i W_{t-i} + \sum_{i=1}^{m} \beta_i P_{t-i} + \varepsilon_t ,$$

$$(7) \qquad W = \sum_{i=1}^{m} \alpha_i W_{t-i} + \varepsilon_t .$$

From these results, an F-test is used to test the null hypothesis that lagged producer prices are significant in determining wholesale price. If the null hypothesis is rejected (not rejected), it implies that producer prices do not cause (cause) wholesale price. On the other hand, it is necessary to test whether wholesale price leads producer price by using the same procedure.

Previous studies have examined the direction of causality in the agricultural food industry. For example, Gujarati (1995) suggested, "the direction of causality may depend critically on the number of lagged terms included." Pindyck and Rubinfeld (1998, 244) argued that the causality test should be performed with different lag values to make sure that the empirical results are not sensitive to the lag length.

Empirical Results

Data

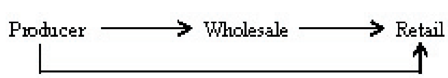
Market prices are set daily, and producers respond to these prices in determining their harvest, packing, and shipping schedules. However, given data availability for the periods necessary to allow examination of structural changes in the industry, the use of monthly data was the only practical possibility. Monthly data for producer, wholesale, and retail prices for the U.S. fresh tomato industry are used in this study. Producer and retail prices are available from the United States Department of Agriculture (USDA) and contain price data from January 1960 through April 1998, a total of 448 monthly observations. Collection of wholesale prices was more problematic. Monthly price data from Chicago and New York terminal markets were obtained from the Agricultural Marketing Service (AMS) in Washington. A simple average of the two sets of prices was taken to represent wholesale prices. It proved difficult to collect a meaningful series for this data before 1970. Therefore, this analysis is restricted to the period from January 1970 to February 1998.

Causality Results

The estimation of equations (6) and (7) used different lags for each of the variables because Pindyck argued those tests of causality may be sensitive to the lag length. Moreover, Kinnucan and Forker (1987) suggest that Granger's causality test might be inconclusive. Davidson and MacKinnon recommend that Granger causality tests should use more rather than fewer lags. We used the results of different lags to judge the confidence in the causality results. Gujarati (1995) indicates that the direction of causality could be confident if the causality test is not sensitive to the lag length.

The Granger causality F-tests are summarized in Table 1. The results indicate that changes in the producer price of U.S. fresh tomatoes clearly led changes in wholesale and retail prices. Granger causality tests for retail-to-wholesale prices and for retail-to-producer prices do not yield strong evidence of causality because the results are sensitive to the length of the lags used. In other words, the direction of causality from retail price to wholesale price and from retail price to producer price depends on the number of lagged terms used in the model.

Price transmissions for U.S. fresh tomatoes are clearly unidirectional from wholesale to retail. Furthermore, the results for price linkage from the wholesale price to the producer price are inconclusive because results are more sensitive to the number of lags included. In summary, the Granger causality tests suggest that directions of causality for U.S. fresh tomatoes are:



where the arrows represent the causal effect.

Price-Asymmetry Results

The asymmetry model must consider both the lag length and weight structure. Based on previous studies and empirical evidence (Ward and Myers 1979, 5; Ward 1982; and Willett, Hansmire, and Bernard 1997, 657), this study uses the weighting of a first-degree polynomial equal to $\sqrt[3]{j}$ (for j=0,1,2,3,4 months) where j is the lag length. Following Kinnucan and Forker (1987) the lag length was determined by adding statistically significant lagged variables. Pick, Karrenbrock, and Carmen (1990) and Worth (1999) concluded that the maximum lag length should be 4 months for fresh vegetables. Greene (1995, 718) reasoned that determining the lag length and weight structure simultaneously was problematic. The weight structure should be arbitrarily picked first and used to select the length of the lag, based on the Schwartz criterion.

The parameter estimates of the pricing-asymmetry models in equation (5) are presented for each specific function in Table 2. In general, the signs of the estimated parameters were as expected. All the significant tests on H_1 and H_2 (rising effect) at 95-percent confidence suggest a price linkage in the U.S. fresh tomato market. The significant tests on H_3 and H_4 (asymmetry effect) for both the producer-wholesale and wholesale-retail price relationships suggest that there is significant evidence of asymmetry. In contrast, the insignificant tests on H_3 and H_4 for the producer-retail price relationship indicate that there is no evidence to support asymmetry between the producer and retail sectors. Furthermore, each of the intercepts is positive and significant at the five-percent level, indicating the range of the marketing margins between the two market levels.

Table 1. F-test for Granger Causality Tests for U.S. Fresh Tomato Market, May 1975–February 1998.

Market relationship	Lag 2 F-statistic	Lag 10 F-statistic
Producer → Wholesale	50.94*	10.66*
Wholesale → Producer	8.04*	1.3
Wholesale → Retail	90.38*	14.52*
Retail → Wholesale	1.81	0.97
Producer → Retail	178.18*	34.49*
Retail → Producer	5.82*	1.67

* indicates significantly different from zero at 5 percent level.

The cumulative effects are presented in Table 3. The empirical evidence indicates that the retail price response to both increases and decreases in producer prices is symmetric, implying that there is no significant evidence of market distortion between producer and retail markets. The producer-wholesale price relationship has positive asymmetry. This implies that wholesale prices of U.S. fresh tomatoes respond more to declining producer price than to rising price, which is asymmetric. One possible reason wholesalers respond more to price decreases is that they are trying to maintain their customer base and market share in the wholesale sector. If wholesale prices responded more to rising producer prices

Table 2. Estimated Coefficients for Pricing Asymmetry in the U.S. Fresh Tomato Market between May 1975 and February 1998.

Parameter	Producer-Retail	Producer-Wholesale	Wholesale-Retail
C	50.346	22.251	43.556
	(15.637)*	(9.615)*	(12.502)*
H1	1.140	0.976	0.971
	(17.713)*	(22.840)*	(18.470)*
H2	-0.771	-0.667	-0.821
	(-9.139)*	(-11.916)*	(-12.058)*
H3	-0.095	0.212	-0.275
	(-0.725)	(2.444)*	(-2.719)*
H4	0.092	-0.221	0.285
	(0.655)	(-2.363)*	(2.600)*
R^2	0.864	0.830	0.871
Adjusted R^2	0.855	0.819	0.863
F-test	101.814	78.162	108.253
Number of observations	274	274	274

* significant at the five-percent confidence level.
Note: t-values in parentheses.

Table 3. Asymmetric Price Response for U.S. Fresh Tomato Market.

Relationship	Mean price ($/pound)	Mean lag		Cumulative	
		Rising	Falling	Rising	Falling
Producer-Retail	Producer = 21.63	0.430	0.468	1.684	1.615
Producer-Wholesale	Wholesale = 31.48	0.439[1]	0.282	1.550	1.604[2]
Wholesale-Retail	Retail = 69.00	0.125	0.228	1.100	0.829

[1] Mean lag of rising effect is significantly different from falling effect.
[2] Cummulative of falling effect is significantly different from falling effect.

than to falling prices, wholesalers would jeopardize their customer base, because buyers could buy from other wholesalers or use direct-procurement contracts. The negative asymmetry at the wholesale-retail price level indicates that retail prices respond more to rising wholesale prices than to falling wholesale prices. In other words, the retail prices for U.S. fresh tomatoes increase more in response to increases in the wholesale price than to similar price decreases in wholesale prices. This result is counter to Ward's (1982) result that retail prices tended to reflect more of a wholesale price decrease than a wholesale price increase. Ward reasoned that rising prices might reduce retail sales and increase the incidence of spoilage. However, it has been argued by Renwick and VanSickle (1998) that better post-harvest handling practices, direct procurement, and extended-shelf-life (ESL) varieties have reduced perishability problems. Furthermore, they argue that retailers may be exercising market power to support this pricing relationship. These arguments support the conclusion that responses of retail prices to wholesale price increases are quicker than the response of retail prices to wholesale price decreases.

McLaughlin (1995) suggested a number of possible reasons why retailers may not adjust their prices downward in times of oversupply. These relate to the perception that consumers will not buy more if the price is lowered, either because the fall is so small it might not be registered as a fall, or even if it is large enough to be noticed it may not induce increased sales. In addition, inelastic demand for tomatoes suggests that a price cut will lead to a fall in revenue for the retailer when price falls, even if the good is elastic in demand, perishability still places a limit on purchases by consumers. Finally, the product is only one of many products sold in the store, and pricing needs to be related to an overall strategy for the store, including such factors as shelf space allocation.

The mean lag shown in Table 3 indicates how long, on average, it takes for the effect of a price change to be observed. It is an indication of the average speed of price transmission. Mean lags in this study are small, ranging from 0.125 to 0.468. Ward (1982) concluded that a small mean lag indicates quick decays. In this study, the mean lags related to the rising producer price variables are larger than are the corresponding mean lags of the falling producer-price variables, implying that wholesale prices adjust more quickly to falling prices than to rising prices at the producer level. However, the mean lag of wholesale-retail price changes occurred in the opposite direction.

Conclusion and Summary

This study found unidirectional causality from the producer level to the retail level. Producer price led both wholesale and retail prices. This indicates that price transmissions in the U.S. fresh tomato market flow from producer to wholesale to retail levels. However, Ward (1982) found the lead linkage from wholesale level to both retail and shipping-point levels. The results of the analysis suggest that causality has changed because of structural changes in the U.S. fresh tomato market over time. Furthermore, the results of the asymmetric-price-response model indicate that wholesale prices respond more to falling producer prices than to rising producer prices. These results suggest wholesalers compete to keep their customer base and market share in the wholesale sector. Therefore, wholesale prices adjust more quickly to falling prices than to rising prices at the producer level. Retail prices of U.S. fresh tomatoes respond more to rising wholesale prices than to falling wholesale prices. This result differs from Ward, who found retail prices reflect more wholesale-price decreases than wholesale-price increases. Ward reasoned that rising prices might decrease retail sales and increase the incidence of spoilage. However, Renwick and VanSickle (1998) suggested that better post-harvest handling practices, direct procurement, and extended-shelf-life (ESL) varieties reduce the perishability problem. These changes may be contributing to retail prices increasing more quickly in response to wholesale price increases than to wholesale price decreases. Finally, retail price responses to increases and decreases in producer prices were symmetric. This indicates that there is no significant evidence of market distortion between these two markets.

Finally, knowing price linkages among market levels will aid in the evaluation of the potential impacts of agricultural policy on producers and consumers. For example, supporting programs to help reduce the cost of production may not benefit consumers if retail prices do not decrease because of decreasing producer prices. The results obtained from price-transmission and price-asymmetry tests give an indication of efficiency in the market. In this study, the existence of asymmetric behavior between producer-wholesale and wholesale-retail price relationships carries important policy implications. They imply that there is significant evidence indicating market distortions in these relationships. In addition, the causality test suggests prices are set at the producer level and passed on to wholesale and retail levels. These results suggest that producers can use market strategies such as direct procurement to avoid problems with price transmission in the vertical market system, thereby offsetting some of the problems associated with market power.

These results are significant for understanding the pricing behavior between market segments in the produce industry. The results of this analysis are dependent on the assumption of stationary transaction costs. It should be noted that some of the results may be due to shocks occurring in that sector which are not identified in this analysis. Use of scanner data and collection of marketing-sector cost data could be used to augment these analyses and provide further insight into price transmission in the fresh produce sector.

References

Greene, W. H. 1995. *Econometric Analysis*, 4th ed. Prentice Hall Book Co., New Jersey.

Gujarati, D. N. 1995. *Basic Econometrics*, 3rd ed. McGraw-Hill, New York.

Granger, C. W. J. 1969. "Investigating Causal Relations by Econometric Models and Cross-spectral Methods." *Econometrica* 37:424–438.

Heien, D. M. 1980. "Markup Pricing in a Dynamic Model of the Food Industry." *American Journal of Agricultural Economics* 62:10–18.

Houck, J. P. 1977. "An Approach to Specifying and Estimating Non-Reversible Functions." *American Journal of Agricultural Economics* 59: 570–572.

Kinnucan, H. W. and O. D. Forker. 1987. "Asymmetry in Farm-Retail Price Transmission for Major Dairy Products." *American Journal of Agricultural Economics* 69:285–292.

McLaughlin, E. W. 1995. "Buying and Selling Practices in the Fresh Fruit and Vegetable Industry in the USA: A New Research Agenda." *International Review of Retail, Distribution and Consumer Research* 5:37–62.

Pick, D. W., J. Karrenbrock, and H. F. Carman. "Price Asymmetry and Marketing Margin Behavior: An Example for California Arizona Citrus." *Agribusiness* 6(1990):75-84.

Pindyck, R. S., and D. L. Rubinfeld. 1997. *Econometric Models and Economic Forecasts*, 4th ed. McGraw-Hill, Boston.

Renwick, A. and J. J. VanSickle. 1998. "Issues Surrounding the Assessment of the Impact of Increased Retail Concentration on Marketing Margins." Staff Paper, Food and Resource Economics Department, University of Florida.

Schroeder, T. 1988. "Price Linkages between Wholesale and Retail Cuts of Meat." *Agribusiness* 4:359–369.

Thompson, G. D. and P. N. Wilson. 1997. "The Organizational Structure of the North American Fresh Tomato Market: Implications for Seasonal Trade Disputes." *Agribussiness* 13:533–547.

Tweeten, L. and L. Quance. 1971. "Techniques For Segmenting Independent Variables in Regression Analysis: Reply." *American Journal of Agricultural Economics* 53:359–360.

U. S. Department of Agriculture, Agricultural Marketing Service, Fruits and Vegetable Division, Marketing News Branch. Monthly Summary, various issues.

U. S. International Trade Commission (U.S. ITC). 2002. "Greenhouse Tomatoes from Canada." ITC Pub. 3424, Inv. No. 731-TA-925 (final). April.

VanSickle, J. J. 1997. "A Compromise in the Fresh Tomato Trade Dispute." *Florida Journal of International Law* 11:399–408.

VanSickle, J. J., E. Belibasis, D. Cantliffe, G. Thompson, and N. Oebker. 1994. "Competition in the U.S. Winter Fresh Vegetable Industry." USDA ERS Agricultural Economics Report 691. July.

VanSickle, J. J., E. A. Evans, and R. D. Emerson. 2003. "U.S.-Canadian Tomato Wars: An Economist Tries to Make Sense Out of Recent Antidumping Suits." *Journal of Agricultural and Applied Economics* 35:283–296.

Ward, R. W. 1982. "Asymmetry in Retail, Wholesale, and Shipping Point Pricing of Fresh Vegetables." *American Journal of Agricultural Economics* 64:205–212.

Ward, R. W. and L. H. Myers. 1979. "Advertising Effectiveness and Coefficient Variation Over Time." *Agricultural Economics Research* 31: 1–11.

Willett, L. S., M. R. Hansmire, and J. C. Bernard.

1997. "Asymmetric Price Response Behavior of Red Delicious Apples." *Agribusiness* 13: 649–658.

Worth, T. 1999. "The F.o.b.-Retail Price Relationship For Selected Fresh Vegetables." *Vegetables and Specialties, Situation and Outlook Report.* ERS: U.S. Department of Agriculture. November:26–31.

Wolffram, R. 1971. "Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches—Some Critical Notes." *American Journal of Agricultural Economics* 53:356–359.

Young, T. 1980. "Modeling Asymmetric Consumer Response, With an Example." *American Journal of Agricultural Economics* 31:175–186.