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THE RELATIONSHIP BETWEEN IMPORT AND RETAIL PRICES: A CASE STUDY OF FRESH GRAPEFRUIT IN JAPAN

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The Relationship Between Import and Retail Prices: A Case Study of Fresh Grapefruit in Japan

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Abstract

This study examined the relationship between import price and retail price of grapefruit in Japan. Estimated retail-import price relationships indicate asymmetry responses distributed over time. Import price changes are not fully transmitted to the retail level, with import price increases being passed on more fully than import price decreases.

Key Words: Grapefruit, price transmission, asymmetric, Japan.

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The U.S. produces roughly two thirds of all grapefruit grown in the world and accounts for more fresh grapefruit exports on the world market than any other country. While the U.S. share of world grapefruit production has remained mostly steady over the past two decades, the U.S. share of world grapefruit exports has risen from 28.2% in the 1969-70 season to 48.6% in the 1988-89 season.

An important factor in the growth of U.S. grapefruit exports is the expansion of the Japanese market. Annual shipments of U.S. grapefruit sent to Japan since 1969 have increased dramatically. Soon after the Japanese government lifted a 3,500 metric ton quota on U.S. grapefruit and oranges (combined) in June 1971, U.S. fresh grapefruit shipments to Japan soared from 2.1% of all U.S. fresh grapefruit exports in 1970 to 49.7% in 1972. Japan has been the largest U.S. grapefruit export market each year since 1972. Additionally, in 14 of those years the Japanese market was larger than all other grapefruit export markets combined.

An important issue concerning U.S. exporters of grapefruit to Japan is how price changes at the U.S. export or Japanese import level are passed through to the Japanese retail level. The assumption that prices are transmitted fully through the vertical market system to the consumer at the retail level is often made implicitly in demand analysis. However, Bredahl et al. have shown that, when evaluating foreign demand elasticities, the assumption of full price transmission is often incorrect. Thus, to determine more effectively how a change in the U.S. grapefruit price may affect U.S. grapefruit demand in Japan,

information on the transmission of grapefruit prices through the Japanese economy should be considered.

The Japanese distribution system for consumer goods can be cumbersome, with government protection at both the wholesale and retail levels resulting in inefficiencies. In Japan there are 13 shops for every 1,000 people, compared with six in the U.S. and West Germany, and 11 in France (*The Economist*). Wholesale sales in Japan are five times greater than retail sales. In comparison, wholesale sales in the U.S. and Europe are one to two times greater than retail sales.

The main function of the wholesale market is to disperse relatively small shipments of fruit to the many low-volume "mom/pop" shops and food sections of department stores throughout Japan. However, due to increased direct buying by supermarkets in recent years, the percentage of grapefruit imports sold through wholesale markets has been in general decline. In the late seventies 84 to 93% of all fresh grapefruit imports passed through wholesale markets. In the five seasons leading up to 1986-87, the last season wholesale movement figures were available, the wholesale movement share declined to a range of 73 to 77%. Expectedly, the estimated share of fruit sold in supermarkets has increased from 20 to 77%, the remaining share dividing evenly between the department and "mom/pop" stores (Japan's Ministry of Agriculture, Forestry, and Fisheries).

Trends in wholesale market movement are a concern within the import-retail price transmission issue. The more grapefruit shipments pass through the wholesale market, the more retail prices will reflect the costs incurred by value-added services typically provided at the wholesale level, such as repacking and storage, as well as the distribution of small

quantities to the retail level. Theoretically, a trend in fresh grapefruit distribution away from the wholesale market should provide downward pressure on retail prices.

The trend away from grapefruit sold through the wholesale market and "mom/pop" shops might also be a factor in changes in grapefruit demand over time. Importers questioned in the ASI trade survey revealed a common concern that, as more grapefruit is sold in supermarkets and less in the "mom/pop" shops and department stores, grapefruit will eventually lose its image as a "luxury" good. According to a majority of the importers questioned, the loss of "luxury" status would reduce sales. The effect of changes in wholesale movement on grapefruit prices and grapefruit demand is an empirical question to be investigated.

This study focuses on the extent of grapefruit price-change transmission through the Japanese vertical market system, including whether or not there are any lagged effects. Understanding transmission of prices can be useful to grapefruit exporters, particularly those who use price promotions in their marketing activities. Price promotions for perishable commodities are common, particularly when supplies are unexpectedly heavy. To generate an increase in demand, price reductions might be considered by the exporter along with other options, such as increasing advertising. In these cases, knowledge of the percentage of the price reduction expected to reach the consumer could be useful to the exporters' analysis.

Model and Estimation Method

Whether or not price transmission differs between periods of price increases and periods of price decreases has been examined in previous studies (Tweeten and Quance;

Wolffram; Nelson; Young; and Ward). Sweezy has suggested that a step in the vertical market chain may be sufficiently oligopolistic so that price stickiness occurs, resulting in asymmetric price responses by firms facing the same cost change. Price transmission is asymmetric if the absolute value of a change in the retail price corresponding to a given change in the import price is not equivalent to the absolute value of a change in the retail price corresponding to the same import price change but in the opposite direction.

Transmission of a price change may also be distributed over time (Heien; Silver and Wallace, Ward). Heien theorized that the cost of making retail price adjustments and concern over pricing stability compel retailers to smooth the effects of wholesale (import) price changes on retail prices. In order to account for this, retail prices need to be specified as a distributed lag in import prices.

The method proposed by Wolffram and used by Nelson, Young, and Ward, among others, is used in this study to examine price transmission asymmetry. The asymmetric retail-import price relationship can be expressed in first differences as

$$(1)\quad \Delta R_t = \sum_{j=0}^{n} \beta_j \Delta I_{t-j} + \Delta X_T \cdot \gamma + \Delta e_t$$

$$\beta_j = \beta_{1j} + \beta_{2j} w_{t-j}$$

$$w_{t-j} = 0 \quad \text{if } \Delta I_{t-j} \geq 0$$

$$1 \quad \text{if } \Delta I_{t-j} < 0,$$

where R_t and I_t are the retail price and import price, respectively, in period t; x_t is a vector of other explanatory variables; e_t is a disturbance term; the β's and γ's are parameters to be estimated; and $\Delta Z_t = Z_t - Z_{t-1}$ for variable Z in general. If $\beta_{1j} \neq \beta_{2j}$ an asymmetric

transmission relationship exists. Using the relationship $R_t = R_1 + \sum_{i=2}^{t} \Delta R_i$, equation (1) can be written in terms of levels as

$$(2)\quad R_t = \alpha + \sum_{j=0}^{n} \beta_{1j} I_{t-j} + \sum_{j=0}^{n} \beta_{2j} I^*_{t-j} + x_t \gamma + e_t,$$

$$I^*_{t-j} = I_1 + \sum_{i=2}^{t} w_{i-j} \Delta I_{i-j},$$

where α is an intercept related to R_1 and I^*_{t-j} is the cumulative sum of price decreases, appropriately lagged, added to the first period value of I.

The dimension of the estimation problem can be reduced by assuming the price transmission parameters follow some pattern such as

$$(3)\quad \beta_{1j} = a_0 + a_1 \phi(j)$$

$$\beta_{2j} = b_0 + b_1 \phi(j)$$

where $\phi(j)$ is some function of j and the a's and b's are parameters. A number of alternative specifications of $\phi(j)$ were examined in this study; based on fit, $\phi(j) = \sqrt[3]{j}$ was chosen. Also, different lag lengths were examined, and, based on significance of the lag parameter estimates, a length of $n = 3$ was chosen with the restrictions $\beta_{13} = 0$ and $\beta_{23} = 0$. Given the latter restrictions, $\beta_{1j} = a_1(\phi(j) - \phi(3))$ and $\beta_{2j} = b_1(\phi(j) - \phi(3))$, and equation (2) can be written as

$$(4)\quad R_t = \alpha + a_1 Z_t + b_1 Q_t + X_t \gamma + e_t$$

$$Z_t = \sum_{j=0}^{2} \left(\phi(j) - \phi(3)\right) I_{t-j}$$

$$Q_t = \sum_{j=0}^{2} \left(\phi(j) - \phi(3)\right) I^*_{t-j}.$$

Sources of Data and Results

The import-price and retail-price information for fresh grapefruit in Japan was obtained from the Japan Tariff Association and the Japanese Ministry of Agriculture, Forestry, and Fisheries, respectively. Monthly import value and quantity data for fresh grapefruit were collected for the period from January 1978 through June 1989. Import values are comprised of the cost of product, insurance, and freight (CIF). Import prices were derived by dividing import values by quantities. Retail price data at the Tokyo and Osaka retail markets were collected for the same time period. In raw form, the retail price data are reported as average grapefruit prices for the first, second, and third part of each month for each market. A simple average is calculated for each market from the three observations per month in order to obtain a monthly retail price series. A dummy variable is included in the price model to capture the effects of the tariff rate increase on shipments from November through May. Finally, a trend variable is added as a proxy for decreased movement through the wholesale market over time.

The basic sample statistics for the variables used in the analysis are presented in Table 1. Table 1 shows that both retail prices averaged roughly two and three-fourths times the import price. Tokyo prices averaged slightly higher than Osaka prices, though the

highest price over the observation period occurred at Osaka. The Osaka price also showed a higher standard deviation over the observation period than that for Tokyo.

Results are shown in Table 2. As shown in Table 2, the parameter estimates for import price, variable Z, are statistically significant in both the Tokyo and Osaka price equations. The statistical significance of the parameter estimates for variable Q, the accumulation of downward movements in import price, suggests an asymmetrical relationship between import and retail prices at both markets. The significance test on the parameter estimate for Q for each market can be interpreted as a test for the null hypothesis that the price transmission of import price decreases is no different than the price transmission of import price increases. Given the statistical significance of the parameter for Q, the null hypothesis should be rejected.

The parameter estimates for both the trend and seasonality variables are significant in the Tokyo price equation and nearly significant in the Osaka price equation. The negative sign on the trend parameter estimate suggests that, over time, the Tokyo retail price has declined. The negative sign on the seasonality parameter estimate suggests that retail price is lower during the period from November through May than the rest of the year. This result may appear somewhat contradictory to a priori expectations, since the grapefruit tariff rate was highest in these months. However, the heaviest shipments also occurred within this time period, which may have generated downward pressure on the Tokyo retail price, enough to more than offset the upward pressure on retail price caused by the higher tariff rate assessed on imported fresh grapefruit.

Estimated lagged effects ($\beta_j, j = 0, 1, 2$) of import price increases and decreases are provided in Table 3. The estimates for import price increases are determined by the

specifications of β_{1j}; while the estimates for import price decreases are simply the sum of β_{1j} and β_{2j} as shown by equations (1) and (3). The lag calculations show that the retail price response to falling prices is less than the response to rising prices at all values of j in both markets. The result also shows that the retail price response to an import price change is mainly immediate, with the effects of lagged import price changes being relatively minor. This finding is consistent with Heien's estimated wholesale-retail price relationships for perishable products.

The cumulative lag calculations are simply the sum of the estimates over j for each direction of import price change for each market. The values represent the total import-retail price transmission. These calculations show that, in both markets, retail price is positively related to import price. The cumulative transmissions also show that import price increases are eventually passed through more fully than are import price decreases. This asymmetry condition is more pronounced at the Osaka market. The result shows that, if the import price increases by one Yen, retail price will eventually increase by .356 Yen and .374 Yen at Tokyo and Osaka, respectively. If the import price decreases by one Yen, the retail price will eventually decrease by .263 Yen and .219 Yen at Tokyo and Osaka, respectively.

The estimated relationship between grapefruit prices at the import and retail levels in Japan shows, firstly, that price changes at the import level are, on average, not transmitted fully to the retail levels at both the Tokyo and Osaka markets. This result might be useful to grapefruit marketers who possess information on the retail demand elasticity for grapefruit in Japan. Typically, price elasticities of demand are interpreted by assuming full transmission of prices through the marketing channels. Combining the information on price transmission should result in better demand response estimates.

The results also show that the import-retail price transmission is dependent on the direction of the import price change. At both the Tokyo and Osaka retail markets, import price increases are passed on more fully than are import price decreases. This result could be important to U.S. grapefruit exporters who consider price promotions in their marketing activities. For instance, a comparison of price transmission behavior between export markets may help grapefruit exporters target their price promotions where they will be most effective; presumably, where price decreases are passed on more fully to the consumer.

More generally, evidence of price asymmetry in Japan may provide clues to the market structure of retail outlets in Japan. Asymmetrical or sticky price behavior tends to suggest an imperfectly competitive market structure (Tomek and Robinson). Information on market structure in foreign markets has become increasingly important to shippers wishing to expand their exporting activities.

Concluding Remarks

This study examined the relationship between the import price and retail price of grapefruit in Japan. Estimated retail-import price relationships indicate asymmetry responses distributed over time. Price changes at the import level are not fully transmitted to the retail level, with import price increases being passed on more fully than import price decreases.

A price-transmission issue, not examined in this study due to data limitations, is the pass-through of changes in the exchange rate to the retail level. While the U.S. grapefruit export price may remain constant in terms of dollars, a change in the exchange rate affects the cost to Japanese importers of U.S. grapefruit. With full import-to-retail transmission,

the total amount of a cost increase or decrease due to changes in exchange rates is passed on to the consumer generating a change in quantity demanded, ceteris paribus. Exchange-rate pass-through could prove to be an important issue for grapefruit exporters.

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Table 1. Sample statistics for import and retail prices of fresh grapefruit in Japan, January 1978 through June 1989.

Price Variable	Minimum	Maximum	Mean	Standard Deviation
		---- Yen per Kilogram ----		
Import	86.42	436.9	136.2	36.8
Tokyo Retail	234.7	474.3	361.3	46.3
Osaka Retail	220.0	508.3	347.3	60.0

Table 2. Parameter estimates for price transmission models, January 1978 through June 1989.

Variable	Tokyo Price	Osaka Price
Z	-0.173* (3.183)[a]	-0.181* (2.862)
Q	0.045* (2.223)	0.076* (2.683)
T	-0.005* (1.833)	-0.008 (1.922)
S	-16.118* (2.393)	-10.104 (1.295)
Intercept	295.800* (12.958)	256.180* (8.650)
ρ	0.626* (9.211)	0.703* (11.471)
R^2	0.440	0.465

*Statistically different from zero at $\alpha = 0.05$ level.
[a]t-ratios are shown in parentheses below parameter estimates.

Table 3. Estimated lag values for price transmission models, January 1978 through June 1989.

Time Path	Tokyo Retail Price	Osaka Retail Price
	Import Price Increases	
t	0.249	0.261
t-1	0.076	0.080
t-2	0.031	0.033
Cumulated	0.356	0.374
	Import Price Decreases	
t	0.184	0.152
t-1	0.056	0.047
t-2	0.023	0.020
Cumulated	0.263	0.219