Marketing California–Arizona Lemons without Marketing Order Shipment Controls

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The California–Arizona lemon industry, after a long history of using fresh market shipment controls, operated during 1985–1986 without using the weekly prorate provisions of its federal marketing order. This article compares the level and variability of weekly shipments and prices for the 1985–1986 crop year with the previous nine years when fresh market prorates were used every week. Fresh market shipments increased during most of 1985–1986 and prices were below the level expected. Weekly shipments and prices were more variable during the year without prorate than during most of the preceding nine years.

The California–Arizona citrus industry has a long history of voluntary and government sponsored marketing programs. Lemon packing houses, acting under the leadership of the California Fruit Growers Exchange (now Sunkist Growers, Inc.), voluntarily controlled fresh market shipments of lemons as early as 1925. The effectiveness of the voluntary program was undermined by increasing production and a growing "free rider" problem, leading to industry passage in 1941 of the currently effective federal marketing order for California–Arizona lemons. This marketing order, with amendments, authorizes the Lemon Administrative Committee to recommend weekly allotments of lemons

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for the domestic fresh market and these allotments are then prorated among handlers based on the quantity of lemons picked by their growers during a specified period. The Lemon Administrative Committee has met continuously since 1941 and employed prorates each week for the period from July 1965 through July 1985, except for an eight-week period in late 1975. Thus, it was an unusual event when the California–Arizona lemon industry operated during the entire 1985–1986 marketing year without using fresh market prorate. The availability of data for an entire marketing year without prorate provides an unprecedented opportunity to evaluate some of the economic effects of prorate in the lemon industry.

Fresh market prorate provisions of California–Arizona Lemon, Navel Orange, and Valencia Orange Marketing Orders have been very controversial. Using these provisions, industry administrative committees for each marketing order meet weekly to determine the quantity of fruit that can be sold in the domestic fresh market the following week. Fruit that cannot be sold in the domestic fresh market can be sold for processing or exported. The economic rationale for limited sales to the domestic fresh market, which has the most inelastic demand of the three outlets, is based on the familiar model of price discrimination.

Critics have charged that the citrus prorates increase prices to consumers, result in product waste, increase production and marketing costs, waste resources, and that they do not benefit citrus producers over the long-run because of supply response.[1,2] Prorate supporters note that the purpose of marketing orders is to improve producer income, that marketing orders deal only with products which have already been produced, that prorate does improve returns from a given crop, and that producers benefit from orderly marketing as reflected by more stable intraseasonal prices. They argue that the supply response attributed to marketing orders is more likely due to other factors such as new products and markets and income tax incentives for grove development.

Empirical studies that specifically examine the economic impact of citrus prorates is limited. Recent studies include a short-run analysis of the controversy between the Cost of Living Council and the Navel Orange Administrative Committee concerning the level of fresh market prorate during early 1974,[3] an analysis of the Secretary of Agriculture's suspension of navel orange prorate during the 1984–1985 marketing season by Powers, Zepp, and Hoff,[4] and two long-run simulation analyses of the impact of terminating federal marketing orders for oranges.[5,6] French and Bressler's classic study of production and price cycles in the California lemon industry examined the possible impact of three marketing scenarios on projected lemon acreage, production, and prices.[7] They presented two projections with restricted fresh market sales to maintain specified prices and a projection with no restrictions, i.e., no marketing order. All of their projections suggested a long-term cycle of 25 to 30 years, either with or without market control. The projection without controls demonstrated cycles of greater amplitude than projections with controls. A recent study of the US lemon industry examined the impact on industry adjustments of alternative levels of fresh market prorate but did not analyze the impact of terminating the marketing order prorate.[8]

This article compares the results of marketing the 1986[*] lemon crop without weekly prorate with results for the nine crops between 1977 and 1985 when prorate was utilized continuously. Factors examined include the pattern, level, and variability of fresh market sales and prices, changes in market shares, and weekly price flexibility of demand. Results, while an indicator of what one could expect if the marketing order provisions for prorate were abolished, must be considered in light of the fact that the marketing order continued to be effective during the 1986 crop year. Shippers knew that the Lemon Administrative Committee could recommend a weekly prorate at any time, and thus, their fresh market sales allocations were undoubtedly influenced to some degree. On the other side of the coin, buyers were in a better position to obtain price concessions for volume purchases without prorate than with prorate.

## A COMPARISON OF WEEKLY SALES AND PRICES

The California–Arizona lemon industry has seasonal patterns of production, harvest and marketing. District 2 (Southern California), which accounts for about 49% of bearing acreage, harvests and sells lemons throughout the year but most of its fruit is picked from January through July. District 3 (California desert and Arizona), which has about 36% of bearing acreage, has a harvest period that begins in late July or early August, usually peaks in November and extends into February or March. District 1 (Central California), with only 15% of bearing acreage, usually begins harvest in October or early November, reaches a peak in January and February, and typically ends in April or May. Significant quantities of lemons are stored by all districts throughout the year, but especially by District 2 during the last four months of the marketing year (April–July).

Lemon supply conditions at the end of the 1985 marketing year were unusual. Lemons stored in District 2 suffered from storage disorders in the form of sour rot and there was a very short crop in District 3. Thus, prices increased during July 1985 in response to short supplies of fresh lemons and they remained relatively high until early February 1986 when both Districts 1 and 2 were harvesting substantial amounts of fruit. The Lemon Administrative Committee recommended open movement (unlimited shipments) for the last week of the 1985 marketing year and continued to recommend open movement for all of the 1986 marketing year. The weekly prorate was not utilized again until the seventh week of the 1987 marketing year.

The estimated 1986 lemon crop totalled only 36,011 carloads,[†] following a 1985 crop of 53,268 carloads. This was the smallest crop since the 1976 crop

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[*]The lemon industry marketing year now runs from August 1 of one year through July 31 of the following (November 30 through October 31 prior to 1970) and is usually designated as, for example, 1985–1986. In this article we use the latter year for the marketing year designation, i.e., 1986.

[†]A carload is 1000 cartons of lemons weighing 38 pounds each. Data series used in this study came from government publications and reports of the Lemon Administrative Committee.[9–12]
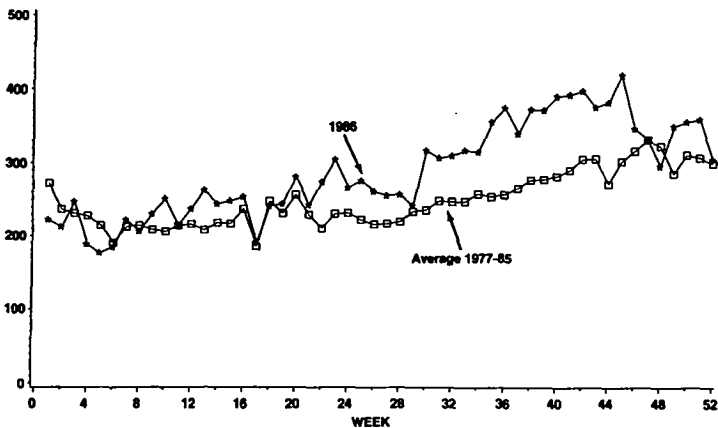
Figure 1. Weekly Domestic Fresh Market Sales of California-Arizona Lemons, Average 1977–1985 and 1986.

of 35,052 carloads and was some 28% smaller than the five year average production for 1981 through 1985. Although production was reduced in all areas, the reduction was most pronounced in District 3 where a 1986 crop of 9064 cars followed production of 19,012 cars in 1985.

Weekly Sales Comparison

Weekly fresh market sales for 1986 are compared with average weekly sales under prorate for the 1977–1985 period in Figure 1. Note that fruit sold under prorate increased steadily from 12,529 carloads in 1977 to 13,999 carloads in 1985. Thus, the most recent prorate allocations would be above the average for the period while the earliest would be below average. Overall, 1986 domestic fresh sales totalled 14,854 carloads, an increase of 855 carloads (6%) over 1985. This was the largest total domestic fresh market sales since 1957, when processed lemon products were becoming readily available. As shown in Figure 1, 1986 domestic fresh market sales were below the nine-year average for 6 of the first 8 weeks of the crop year, then 1986 sales tended to run slightly above average for weeks 9 through 21, and finally, from week 22 through the end of the crop year (except for four weeks), 1986 domestic fresh market sales were substantially higher than average. A comparison of recent cumulative domestic fresh sales reveals that 1985 sales exceeded those in 1986 until week 31, and then 1986 sales exceeded those in 1985 through the end of the year.

Weekly Price Comparison

Weekly domestic fresh f.o.b. real prices (dollars per carton deflated by the Consumer Price Index, 1967 = 1.00) for 1986 are compared with average
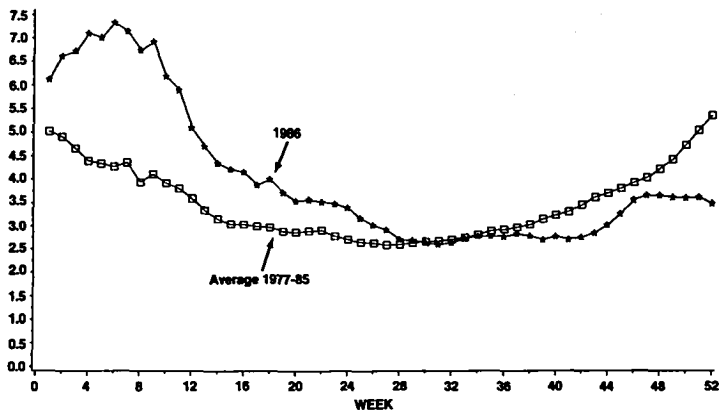
Figure 2. Weekly Real Prices for California-Arizona Fresh Lemons (Dollars per Carton, f.o.b.), Average 1977–1985 and 1986.

weekly real prices for the nine-year period, 1977 through 1985 in Figure 2. A typical seasonal price pattern, as reflected by the nine-year average, is for prices to decrease for the first half of the marketing year (August–January) with a minimum in week 27, and then increase through the end of July. Lemon prices began to increase sharply at the end of the 1985 marketing year and were very high at the beginning of the 1986 marketing year due to the storage problems and short crop prospects mentioned earlier. Nominal prices during the 1986 were above the ten-year average until the last two weeks of the marketing year; 1986 real prices, however, were above nine-year average prices only during the first 29 weeks of the marketing year. Nominal f.o.b. prices for domestic fresh lemons averaged approximately $12.40 per carton for the 1986 marketing year, the highest average recorded. In real terms, however, the 1986 season average real price was exceeded by average real prices for the 1968 through 1974 and the 1977 and 1978 marketing years.

Harvest and Storage Patterns

The 1986 harvest pattern for lemons was expected to differ from average because of the below average crop size and suspension of prorate. Specifically, some observers indicate that the prorate tends to slow the harvest and, thus, we would expect harvest to take less time without prorate. Although the total amount of lemons picked was below average, the 1986 industry harvest pattern differed significantly from average only at the end of the season. There were, however, important differences by District which were not reflected by industry statistics. The District 3 harvest volume was above average for the first nine weeks of the crop year, was slightly below average for the next two

weeks, and was significantly below average for the remainder of 1986 (except for the last two weeks when the 1987 crop harvest began early). Note that the District 3 harvest was completed about eight weeks earlier than usual. The District 2 harvest volume was below average for the first 15 weeks of the 1986 crop year and largely offset the above average volume from District 3. Total industry picks were below the nine-year average for all but 11 weeks during the 1986 crop year and seven of the above average observations occurred during the last nine weeks of the crop year. For the first 43 weeks of the 1986 crop year, industry picks were above average only during weeks 6, 23, 24, and 25.

Lemon storage practices vary by District and time of the year. While lemons are stored in all Districts as part of the marketing process, the majority of the storage occurs in District 2 during the latter half of the marketing year. Total lemon storage during 1986 was slightly below average during the first 22 weeks of the marketing year but was then above average for most of the remaining weeks. District 3 storage was above average for the first 14 weeks of the marketing year and then it dropped below average. Below average storage in District 2 for the first 18 weeks of the marketing year, however, more than offset above average District 3 storage.

Lemon Quality

There are three grades of lemons, with most sales confined to the two highest, grades one and two. During a typical marketing year, weekly sales at the beginning of the season will consist of approximately 45% grade one lemons, 52% grade two lemons, and 3% grade three lemons. The proportion of grade one will gradually increase to almost 60% through the first 20 weeks of the marketing year with grades two and three declining to less than 40% and 2%, respectively. The proportion of grade one then tends to decrease back to a little over 40% by the end of the marketing year as grade two increases to almost 55%, and grade three moves back to about 3% of fresh sales.

The seasonal pattern of grade changes during the 1986 marketing year followed the normal pattern but the proportion of grade one lemons was below average, especially during the latter half of the marketing year, while the proportion of grade two and three fruit was above average.

QUANTITATIVE ANALYSIS

Comparison of 1986 marketing year sales and prices with the 1977–1985 averages provides a general description of what happened to lemon marketing without prorate. Figures 1 and 2 indicate that real fresh market prices tended to be above average when sales were below average and vice versa. While there was a general inverse relationship between sales and real prices, similar levels of sales at different times of the year resulted in different prices, indicating a seasonal shift in demand. Weekly sales appear to follow a similar pattern from year to year and to vary directly with the quantity of lemons in

storage. Within a given week, lemon prices tend to vary directly with grade and grade varies throughout the marketing year in a regular pattern.

Weekly Demand for Fresh Lemons

The quantity of lemons sold on the domestic fresh market during a given week is predetermined by the prorate and is essentially predetermined even when the prorate is not used. Based on this observation and the price–quantity patterns described above, the following inverse weekly demand function for fresh market lemons was specified:

$$P_t = f(Q_t, Y_t, P_{t-1}, G_t, S, D86)$$

where t designates week of the marketing year, P is the weekly real price of lemons (dollars per carton), Q is the population adjusted weekly fresh sales of lemons, Y is a measure of weekly real consumer income, G is a measure of weekly grade or quality, S is a seasonal demand shifter, and $D86$ is a dummy variable to measure the possible change in structure (no prorate) during the 1986 marketing year. No substitutes were included in the model. Lemon juice and frozen lemonade concentrate appear to substitute for fresh lemons, but satisfactory data series for these variables were not available. The grade variable specification is also based on data availability. While the proportion of fresh sales in each grade are reported, f.o.b. prices by grade and size are not. The use of a partial adjustment model is based on the observation that f.o.b. prices tend to be sticky and adjust to new equilibrium values over time rather than instantaneously. While this is a comparatively straightforward specification of the demand for lemons, there is a problem associated with determining the nature of the seasonal demand shifter.

Seasonal shifts in demand may involve shifts in the intercept and/or the slope of the demand relationship. Sosnick[13] summarized three approaches to estimate the impact of intraseasonal shifts in demand. These approaches are to: (1) distinguish subperiods (e.g., weeks or summer–winter) and treat data for each subperiod as a separate set of observations, (2) treat all observations as a single data set and distinguish subperiods through the use of dummy variables, and (3) treat all observations as a single set but quantify each observation in an additional dimension such as week of the year. Our efforts to determine the nature of intraseasonal shifts in the demand for lemons involved these three approaches.

Previous studies of the demand for lemons by Hoos and Seltzer,[14] Hoos and Kuznets,[15] and Nicolatus[16] distinguished two subperiods, the summer months of May through October and the winter months of November through April. The use of temperature as a shift variable in the first two studies met with mixed success; Nicolatus did not use a temperature variable.

We began our analysis of seasonal shifts in the demand for lemons by estimating a set of 13 separate price equations, beginning with week three and every four weeks after that for the marketing year. In these equations, real

price per carton for lemons sold fresh was specified as a function of fresh weekly shipments and real income (both population adjusted). All but one of the price coefficients had a negative sign but only one was significantly different than zero at the five percent level of significance. Most of the estimated price coefficients varied little and for those that did vary, there was no discernable pattern to the variation. Thus, we concluded that possible seasonal demand shifts had not affected the slope of the demand curve. There did, however, appear to be a pattern to changes in the intercept of the estimated demand relationships. Our next step in the analysis was to specify a single price equation, using bimonthly dummy variables to account for the seasonal shifts in demand. This equation, estimated with 520 weekly observations, indicated that the demand for fresh lemons did shift in a regular manner and that demand was higher in the summer than in the winter. The similarity of the pattern of demand shifts and temperature changes led us to investigate a temperature variable. When the temperature variable was included in the demand equation, however, its estimated positive coefficient was small and not significantly different than zero. We deleted the temperature variable from our final demand equation and used the bimonthly dummy variables to account for seasonal shifts in demand.

The final estimated weekly demand for domestic fresh market lemons was:

$$P_t = -2.9198 - 0.1115\ Q_t + 0.8508\ Y_t + 0.9358\ P_{t-1} + 0.0034\ GD1$$
$$(-7.60) \quad (-1.17) \quad (10.87) \quad (62.00) \quad (1.58)$$
$$- 0.3346\ D86 - 0.1956\ D1 - 0.4001\ D2 - 0.3758\ D3 - 0.3195\ D4 - 0.2050\ D5$$
$$(-5.84) \quad (-3.46) \quad (-6.46) \quad (-5.84) \quad (-5.09) \quad (-3.99)$$

where the figures in parentheses are the *t*-ratios and $R^2 = 0.95$. The variables included in the final equation are defined as:

P_t = Average weekly f.o.b. price of lemons for domestic fresh use, dollars per carton for all grades and sizes, deflated by the consumer price index (1967 = 1.00).

Q_t = Weekly domestic fresh lemon sales adjusted for population, cars per million persons.

Y_t = Total personal income ($ billion) divided by population (million persons).

$GD1$ = Percentage of grade one fruit in fresh market sales.

$D86$ = Dummy variable for the 1986 crop year (1 for 1985–1986, 0 otherwise).

Di = Bimonthly dummy variables, $i=1$ is August–September, $i=2$ is October–November, $i=3$ is December–January, $i=4$ is February–March, and $i=5$ is April–May.

The weekly price equation was estimated by ordinary least squares. The Yule–Walker method was used to correct for autocorrelation after the Durbin *h*-statistic led to rejection of the hypothesis of zero autocorrelation at the 5% level. Each of the estimated coefficients has the expected sign and all except the coefficients for quantity and grade one fruit are statistically significant at the one percent level. Note that the coefficients for quantity and grade one

fruit were also significant before the equation was corrected for autocorrelation.*

Focusing on 1986 marketing year real prices, we conclude that the absence of prorate did have an adverse impact on prices after accounting for differences in sales, income, average grade, and seasonal price patterns. Real f.o.b. prices for lemons sold in the domestic fresh market were approximately $0.33 per carton lower in 1986 without prorate than one would have expected given the same level and pattern of fresh market sales with prorate. More detailed analysis using bimonthly shifters in place of the single dummy variable for 1986 indicated that real prices were at the level expected during the first two months of the marketing year (when there was a great deal of uncertainty regarding supplies of fresh market lemons), but were significantly lower than expected during the remaining ten months of the marketing year. We can only speculate on possible reasons for the lower price in the absence of prorate. One explanation relates to relative market power of buyers and sellers and buyer behavior. It is possible that a few large buyers could drive down prices by being much more aggressive with unrestricted supplies than they would be with weekly fresh market allocations. The threat by a large buyer to acquire all needs elsewhere if the seller does not reduce his price is of real concern to sellers. Some sellers could be devastated by the loss of a large customer and respond to a threat of loss of business by sharply reducing prices. Thus, the lower than expected price in the absence of prorate could be attributed to the ability of buyers to take advantage of their market power in an unregulated market. Another possible explanation relates to the variables included in our model and the model assumptions. The impact of any omitted factor that caused a decrease in the f.o.b. demand for lemons during the 1986 crop year would be included in the 1986 dummy variable. For example, increased marketing margins as a result of increased costs of transportation or labor could reduce f.o.b. demand for lemons. We have no evidence of large changes in omitted variables confined to the 1986 crop year, but do plan to further investigate margin behavior and price transmission, if data problems can be solved.

Weekly Fresh Market Shipments

The Lemon Administrative Committee (LAC) submits a proposed shipping schedule to the Secretary of Agriculture prior to the beginning of each marketing year. This proposed schedule, which reflects the seasonality observed in prior years, is used as a guideline by the Committee but is modified weekly in response to supply and demand conditions. When prorate is being used, the Committee meets each week to establish the level of domestic fresh market

*A reviewer expressed concern over the low t-value on quantity (a concern we share and suggested that the result was probably related to the strong autoregressive coefficient. He was not convinced of the need for an autoregressive model and suggested that the lagged price variable be dropped. While we continue to believe that the price adjustment process must be included in the model, we did investigate his suggestion. When lagged price was deleted from the equation, we found that the t-value on quantity decreased from the t-value for our specification (again after correcting for autocorrelation).

shipments for the following week. Major factors considered by the Committee when establishing the fresh market allocation include sales the prior week, price movements and the strength of prices, storage stocks, the level of orders booked for the next week, and historical seasonal demand. Based on LAC discussions and these factors, we specified the following fresh market sales equation:

$$WS_t = f(WS_{t-1}, WS_{t-52}, ST_{t-1}, \Delta P)$$

where t designates the week of the marketing year, WS is weekly sales, ST is the quantity of lemons in storage, and ΔP is a measure of recent price changes for fresh lemons. While this equation is a very simplified representation of a complex Committee decision process, it does include the major quantifiable variables entering weekly prorate decisions.

The estimated equation for weekly fresh market sales of lemons for the 1977 through 1985 marketing years when prorate was utilized is:

$$WS_t = 40.06 + 0.5306\ WS_{t-1} + 0.2366\ WS_{t-52} + 0.0065\ ST_{t-1} + 291.10\ \Delta P$$
$$(5.21)\quad (15.39)\qquad\quad (7.39)\qquad\qquad\quad (6.19)\qquad\qquad (1.38)$$

where the figures in parentheses are t-statistics and $R^2 = 0.70$. The variables included in the final equation are defined as:

WS = Weekly sales, carloads of 1000 cartons (week t).
ST = Lemons held in storage, carloads of 1000 cartons.
ΔP = Change in average price per carton for lemons sold fresh, price for week $t-2$ minus price for week $t-3$.

The signs on the estimated coefficients are positive, as expected, and each except the change in price is statistically significant at the 1% level (the coefficient on the price variable is significant at the 16% level).

We then estimated the sales equation for the 11-year period through 1986, using dummy variables to account for the impact of no prorate during the 1986 marketing year. We examined two different dummy variables for the no prorate situation: (1) a single dummy variable to determine the average change in weekly fresh sales during 1986, and (2) a set of six bimonthly dummy variables. The single dummy variable was significant at the 1% level and indicated that 1986 sales were 13 carloads per week higher than in previous years after accounting for lagged sales, lemons in storage, and price changes. The bimonthly variable provided more detail on the 1986 pattern of sales. Sales during the first two months of the 1986 marketing year were less than expected (−15 carloads per week); sales for the next ten months of the 1986 crop year were above sales for the previous nine years after adjusting for lagged sales, price movements, and storage. The increase in 1986 weekly sales by bimonthly periods were: Oct.–Nov., 11 carloads; Dec.–Jan. and Feb.–Mar., 17 carloads; April–May, 35 carloads; and June–July, 16 carloads. Thus, the response of lemon handlers to suspension of prorate was to increase shipments, as expected.

The supply conditions that led the Lemon Administrative Committee to

recommend open movement at the beginning of the 1986 marketing year (storage quality problems and a very short crop in District 3), were associated with below average fresh sales during the first two months of the marketing year. Even without prorate, sales did not exceed seasonal averages by large amounts until harvest was well underway in Districts 1 and 2 and storage inventories approached normal levels. Although 1986 fresh lemon sales were significantly larger than previous years sales, they were not as large as some industry observers expected. One would expect that each handler's sales to the fresh market maximized net revenue from all outlets. Since net on-tree returns for processed lemons remained negative, it appears that marginal grades and sizes would have also sold for negative on-tree returns in the fresh market. Discussions with industry participants indicate that most, when faced with negative on-tree returns in the fresh market, chose to divert the fruit to processing. Quality considerations probably constrained fresh market sales during a portion of the year. The quality being shipped during the March through June 1986 period included a higher proportion of grade 2 fruit (and less grade 1) than was usual for that time of the year. The limited availability of grade 1 lemons may have restricted some fresh market shipments. In addition, the Lemon Administrative Committee could have recommended imposition of weekly prorate at any time. This and declining prices during the March through June period when shipments were much higher than average probably restrained fresh market sales by some handlers.

OTHER OBSERVATIONS

Much of the criticism of the Lemon Marketing Order from within the industry has come from independent producers and handlers. Sunkist Growers, Inc., the major cooperative marketing organization, is the unit most often criticized. Thus, it is of interest to examine Sunkist market shares both with and without the weekly domestic fresh market prorate. A second area of interest involves the impact of the marketing order program on stability (or variability) of volume marketed and prices. Price and volume stability is often used as a performance indicator for the marketing order objective of "orderly marketing." A comparison of calculated variances for weekly sales and f.o.b. prices for the nine-year period with prorate and the year without prorate provides evidence on this point. We will briefly examine these two questions.

Table I. Sunkist Growers, Inc. Share of US Lemon Sales by Outlet and Total, Marketing Years Ending November of Each Year, 1982–1986.[a]

| Year | Sales Outlet | | | Total |
	Domestic	Export	Processed	
1982	67.7	62.8	54.8	59.5
1983	59.7	60.5	60.3	60.6
1984	55.5	59.9	52.7	55.2
1985	58.0	56.5	51.8	54.4
1986	56.1	64.5	52.1	56.2

[a]Source: Sunkist Growers, Inc. Annual Reports and Lemon Administrative Committee Reports.

Sunkist Market Shares

Sunkist reports their volume of sales by utilization (domestic fresh, export and processed) on a marketing year which runs from November 1 through October 31 of the following year. Calculation of market shares thus required recalculation of industry sales for a marketing year beginning on November 1 rather than August 1. Sunkists percentage share of lemon sales by outlet and in total are shown in Table I. Note that the sale of Blue Goose Growers to Castle & Cook involved five packinghouses affiliated with Sunkist and was responsible for the reduction in Sunkist's market share during the 1984 marketing season. The only significant change from the 1985 season to the 1986 season was a sharp increase in Sunkist's share of the export market. Sunkist's utilization of lemons in the low return processing outlet was below its share of total lemon production for each of the three years, 1984, 1985, and 1986. Sunkist increased its domestic fresh market sales by one million cartons from 1985 to 1986 even though its share of total domestic fresh sales decreased from 58 to 56.1% (Table I). Total industry domestic fresh sales during Sunkist's marketing year ranged from 12,856 carloads in 1982 to 13,731 carloads in 1983 to 13,698 carloads in 1984 to 13,447 carloads in 1985 and then fresh sales jumped to 15,686 carloads in 1986. This 16.6% increase in domestic fresh market sales from the 1985 to the 1986 Sunkist fiscal year (November through October) contrasts with a 6.1% increase in domestic fresh market sales between the 1985 to the 1986 Marketing Order crop year (August through July). Note that suspension of prorate continued during August and most of September, 1986 and lemon sales during that period were substantially higher than during the same period in 1985.

There did not appear to be a significant shift in market shares for domestic fresh lemon sales between cooperative and noncooperative firms in the absence of weekly prorate during the 1986 marketing year. It appears that Sunkist was able to increase its domestic fresh market sales roughly in proportion to the rest of the industry in the absence of weekly prorate. The small observed changes in shares could easily be attributed to seasonality of production and the regional location of packing houses. Sunkist did, however, significantly increase its export sales and export market share during the 1986 marketing year while total lemon exports were decreasing.

Price/Volume Stability

Use of the weekly prorate to regulate the flow of lemons to fresh domestic markets is justified on the basis of stabilizing intraseasonal shipments and prices. Standard statistical tests can be used to determine whether or not there were significant differences in the variability of shipments and prices between the period when prorate was used continuously and the 1986 marketing year when prorate was not used. Two sets of tests were performed. First, the variances for weekly shipments, nominal prices, and real prices during the 1986 marketing year were compared with variances for the same variables during the entire 1977–1985 period using an F-test, as presented by Powers, Zepp, and Hoff.[4] Then, variances for the same variables for 1986 were com-

pared pair-wise with variances for each of the nine years during the 1977–1985 period. All tests of significance were at the five percent level.

Results of the F-tests indicate that the variances of sales, nominal prices, and real prices were each significantly greater during the 1986 marketing year without prorate than they were during the preceding nine-year period when prorate was used. Pairwise tests of the variances of sales lead to acceptance of the alternative hypothesis that the variance of sales was greater in 1986 than in the years 1977 through 1979 and 1982 through 1985. The null hypothesis that variances of sales were equal was accepted for 1986 and the two years 1980 and 1981. Pairwise tests of the variances of nominal prices lead to acceptance of the alternative hypothesis that the variance of nominal prices was significantly greater in 1986 than it was during each of the years from 1977 through 1985. Results of the statistical tests comparing the variance of real prices in 1986 with prior years led to acceptance of the alternative hypothesis for seven of nine years. That is, the alternative hypothesis that the variance in real prices was significantly greater in 1986 than in the years 1977, 1978, and 1981 through 1985 was accepted. The null hypothesis that variances in real prices were equal was accepted for 1986 and the two years 1979 and 1980. On the basis of the foregoing statistical tests, we conclude that there is substantial evidence that both sales and prices were more stable during years when the prorate was used than during the 1986 crop year when prorate was not used.

Effects or Prorate Suspension: Oranges versus Lemons

Comparison of the results of the Powers, Zepp, and Hoff[4] study of prorate suspension for navel oranges with the results of this study reveals some important differences. The observed differences may be due to circumstances surrounding prorate suspension as well as the research approach. Weekly prorates for navel oranges were suspended by the Secretary of Agriculture midway through the 1984–1985 marketing season because prices were exceeding the parity level. The suspension was very controversial, with substantial opposition coming from industry members. In the case of lemons, weekly prorate was suspended by the Lemon Administrative Committee in response to short supplies and the suspension continued for the entire marketing year with industry support.

Powers, Zepp, and Hoff compared the level and stability of prices and shipments during the period of the 1984–1985 navel orange prorate suspension with the same period during the five seasons 1979–1980 through 1983–1984 when prorate was used. They also did a direct comparison of 1981–1982 and 1984–1985 seasons because supplies were similar during the two periods. They concluded that average weekly shipments during prorate suspension were slightly higher than for comparable prorated periods; that stability of weekly shipments to fresh domestic, export and processing markets during prorate suspension did not differ from prorated periods; that prices for both fresh and processed use were higher during suspension than during prorated periods due mainly to relatively small US fresh orange supplies during winter 1984–1985; and that there was no consistent pattern of more or less price stability between the suspension and prorate periods. They also concluded that no category of

handlers appeared to have increased their fresh market share of navel orange shipments.

Our study of lemon marketing without prorate also found that weekly fresh market shipments increased and that there were no dramatic changes in fresh shipment market shares between cooperative and independent handlers. Weekly analysis of f.o.b. prices and fresh shipments, however, indicated that both were more variable without prorate than during prior years with prorate. Nominal average prices for fresh lemons without prorate were higher than average during the first portion of the marketing year and lower than average during the latter portion. Weekly price analysis indicated that 1985–1986 real f.o.b. fresh lemon prices were lower than expected after accounting for increased sales, seasonal variation in demand, consumer income, and average grade. Note that the research approach utilized by Powers, Zepp, and Hoff did not permit them to evaluate whether orange prices were higher or lower than expected after adjusting for quantity shipped and various demand shifters; their real price comparisons related only to mean prices during the period of prorate suspension versus earlier periods. The question of whether or not the entire f.o.b. derived demand curve for navel oranges shifted in response to suspension of prorate, as charged by some in the industry, was not answered.

CONCLUDING COMMENTS

The 1986 marketing year was clearly an "unusual event" for the US lemon industry. Restricted supplies of lemons for the fresh market and very high nominal prices at the beginning of the marketing year led the industry, which has a long history of exercising tight control over the rate of flow of fresh lemons to domestic markets, to suspend the fresh market prorate. Even without controls, fresh domestic shipments of lemons were below or only slightly above recent averages during the first half of the marketing year. Fresh market shipments were significantly greater than average during the second half of the year, resulting in above average shipments for the entire year. Average 1986 marketing year nominal f.o.b. prices for domestic fresh lemon sales were the highest recorded.

Quantitative analysis of the weekly demand for lemons at the f.o.b. level revealed a seasonal shift in demand, with demand being highest during the summer months of April through September. Focusing on 1986 marketing year real prices, the absence of prorate appears to have decreased f.o.b. prices more than expected, even after accounting for differences in sales, income, average grade, and seasonal price patterns. Real f.o.b. prices for lemons sold on the domestic fresh market were approximately $0.33 per carton lower in 1986 without prorate than one would have expected given the same level and pattern of fresh market sales with prorate. Real prices were at the level expected during the first two months of 1986 marketing year, but were significantly lower than expected during the remaining ten months. The reduced price during 1986 could be explained by factors such as pricing behavior and the exercise of market power by large buyers or by a change in market conditions not accounted for by the model.

Comparison of weekly domestic fresh lemon sales during 1986 with the

previous nine years indicates that fresh market sales increased when prorate was not used, although not as much as some observers expected. Sales were less than expected during the first two months of the 1986 marketing year because of a short crop in District 3 and the sour rot problem for lemons in storage. Sales for the last ten months of the 1986 crop year were above sales for the previous nine years after adjusting for lagged sales, price movements and storage. The increase in 1986 weekly sales over prior years peaked at an average of 35 carloads per week during the April–May period. The estimated sales increase for the entire 1986 marketing year averaged 13 carloads per week. Sunkist, the major lemon marketing cooperative, increased its fresh market sales in line with the remainder of the industry.

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