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CHANGES IN THE STRUCTURE OF THE FLORIDA PROCESSED ORANGE INDUSTRY AND POTENTIAL IMPACTS ON COMPETITION

BY
Ledia Guci – Graduate Research Assistant – UF
Mark G. Brown – Senior Research Economist - FDOC

FLORIDA DEPARTMENT OF CITRUS
Economic and Market Research Department
P.O. Box 110249
Gainesville, Florida 32611-2049 USA
Phone: 352-392-1874
Fax: 352-392-8634
Email: mgbrown@ufl.edu

www.floridajuice.com

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Ledia Guci and Mark Brown[1]

The Florida processed orange industry has become more concentrated in the last two decades raising questions on competitive behavior, particularly with respect to the purchase by processors of fruit from Florida orange growers. Has the processor bargaining position been transformed through concentration to a point where it may adversely impact the price that Florida growers receive for their fruit? Whether or not noncompetitive behavior occurs is often difficult to determine but the Federal Government recognized such possibilities when it established antitrust laws in the late 1800s. The Clayton Act makes illegal mergers that significantly reduce competition, while the Robinson-Patman Act makes illegal some types of price discrimination and buying power.

In addition to the increase in concentration at the processing level, there has been an increase in concentration at the retail grocery store level, which may adversely impact the prices received by processors for orange juice (OJ) sold to retailers. As a result of grocery store concentration, there may be a greater tendency for retailers to extract lower prices from processors, in turn, possibly resulting in lower prices for growers even without exertion of any buying power by processors on growers.

There are two basic forms of noncompetitive behavior. The first is when a monopoly (one seller) or oligopoly (a group of sellers) charges buyers higher prices than would have occurred under a competitive market structure. The second is when a monopsony (one buyer) or

[1] Prepared by Ledia Guci, Graduate Assistant, UF-IFAS-FRED, and Mark G. Brown, Senior Research Economist, Florida Department of Citrus, Gainesville, FL. July 19, 2007. Staff Report #2007-3.

oligopsony (a group of buyers) uses its bargaining power to obtain lower prices from suppliers than would occur under a competitive structure. As noted by Foer,[2] monopoly and oligopoly have been the main focus of antitrust law enforcement but monopsony and oligopsony are equally important threats to competitive markets. Mega-retailers may dictate terms and conditions of trade as manufactures compete for space in grocery stores. Volume discounts may be extracted from suppliers and slotting allowances for prime shelf space charged.

The purpose of this paper is to examine the changes in market structure of the Florida orange industry at the processor as well as retail and grower levels. Industry structure and anticompetitive behavior has been an issue in various food industries, and a literature review of this topic is first provided. Then citrus data are discussed, revealing that concentration has increased at both the retail and processor levels, while there has been little change in concentration at the grower level. A review of price margins is also provided.

Literature Review of Market Power in Agricultural Markets

Significant structural changes have occurred over time in the agricultural sector especially in the food processing and packing industries. These changes have resulted in highly concentrated processing and packing industries, raising concerns over the exercise of market power or power over price.

Rogers and Sexton (1994) argued that markets for raw agricultural products may be subject to oligopsony behavior due to their distinctive structural characteristics. Such markets

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[2] President of the American Antitrust Institute, an independent, non-profit education research and advocacy organization dedicated to promoting the laws and institutions of antitrust. Web site:http://www.antitrustinstitute.org/Archives/37.ashx.

are characterized by 1) products that are often bulky and/or perishable restricting geographic mobility; 2) farmers that are specialized in supplying particular commodities; 3) product supplies that are inelastic; 4) processors' needs that are highly specialized; and 5) the presence of bargaining cooperatives. High buyer concentration combined with an inelastic supply of the farm commodity suggests buyer market power may be exerted. Looking at the 1987 Census of Manufacturing data for fifty-three food and tobacco industries, Rogers and Sexton observed that most industries have experienced decreasing firm numbers and increasing concentration over time. They also indicated that sellers to the processing industries face fewer and more dominant firms. From their analysis it was concluded that oligopsony behavior deserves strong consideration in food industry policy debates.

Within the agricultural sector, evidence of market power and its use varies across industries. The meat processing and packing industry is highly concentrated, and the potential for anticompetitive behavior in this industry has been of concern since the late 1800's. In the beef packing industry, a high degree of concentration has prompted Federal investigations concerning the conduct of beef buyers. Several studies have been conducted with the purpose of measuring the degree of oligopsony power in this industry.

Schroeter (1988) investigated the degree of market power in the U.S. beef packing industry over the period from 1951 through 1983. His results confirmed the presence of price distortions due to monopoly/monopsony power. The price distortions were statistically significant but small in magnitude. In the latest years of his sample he estimated the output and input market relative price distortions to be about 3% and 1%, respectively, i.e., output prices were 3% higher than would have occurred under competition, while input price were 1% lower than if competitive bargaining would have prevailed. His analysis also suggested that in spite of the trend toward higher concentration there was no indication of less competitive performance during the period of increasing concentration.

Stiegert, Azzam, and Borsen (1993) analyzed the presence of market power in the beef packing industry by looking at the effects of anticipated and unanticipated cattle supplies on the markdown pricing (the deviation of fed cattle price or price paid for live cattle from the associated marginal value of the product). Their results indicated that fed cattle were priced significantly below their marginal value during 31 of the 59 quarters between the second quarter of 1972 and the fourth quarter of 1986. The average markdown was 1.31%. From their results, however, it was not clear that a causal relationship existed between increased concentration in the late 1970's and markdown events. After 1981, the markdown was statistically significant for only one year. Overall, their results were consistent with Schroeter's findings that concentration has not increased market power. They concluded that even though deviations of fed cattle prices from marginal product values are an indication of market power, markdown pricing may be a means for beef packers to avoid economic losses due to inadequate beef supplies to operate slaughter plants efficiently.

Azzam and Schroeter (1995) and Azzam (1997) addressed the issue of market power as it relates to cost efficiency resulting from consolidation in the beef packing industry. Azzam and Schroeter's results suggested that when consolidation leads to economies of scale and increased market power, unit cost savings of relatively modest magnitudes are sufficient to negate the welfare losses due to anticompetitive pricing. Specifically, they found that the estimated cost savings necessary to neutralize the anticompetitive effects of consolidation in beef packing are about half the actual cost savings from scale economies. From the analysis it was concluded that anticompetitive behavior related to increasing beef packing concentration exists, but associated welfare losses are more than offset by lower costs. Therefore, distributional effects aside, the structural changes in the beef packing industry have been welfare enhancing. Azzam's findings provide support for Azzam and Schroeter's simulations results. He found that the benefits of concentration in beef packing, in terms of slaughter cost efficiency, were twice the cost of market power. In other words, the cost efficiency effect outweighed the market power effect.

Morrison Paul (2001a) studied cost economies and market power in the case of the meat packing industry. The analysis indicated that typical market power measures could be misleading in the case where scale (cost) economies prevailed, because cost efficiencies rather than market deficiencies could be the driving force for imperfect competition patterns. The results indicated the presence of significant but declining market power and cost economies in the U.S. meat packing industry. Markups of output price due to monopoly power were apparent, but evidence of markdowns due to monopsony behavior in the livestock market was weak. So although net market power was substantive, it was primarily evident on the output side. From the analysis it was concluded that the consolidation trend was motivated by cost economies and little excess profitability existed.

Morrison Paul (2001b) generated similar results when studying the market and cost structure for the U.S. beef packing industry for the period from 1992 through 1993. The results suggested significant cost economies in this industry, but little if any market power exploitation in either the cattle input or beef output markets or excess profitability. The lack of excess profitability suggested some form of effective competition at work.

A number of empirical studies provide evidence of a counterintuitive inverse relationship between market power and industry concentration in the meat packing/processing sector.

Schroeter and Azzam (1991) identified a trend toward decreasing market power in the hog packing industry during a period of increasing market concentration from 1972 through 1988. A possible explanation given was that large packing plants could achieve significant cost economies, overwhelming the incentives for oligoponistic behavior.

Koontz, Garcia, and Hudson (1993) also found that meatpacker concentration increased in the fed cattle industry between the 1980-82 period and the 1984-86 period. However, their analysis suggested that a decrease in the probability of cooperation between meatpackers in each regional market occurred, resulting in a decrease in market power in the second period. Market power appeared to have been exercised in fed cattle purchases during the early to mid 1980's in the regional markets examined, however, there were differences across periods and regions. The authors concluded that varying conduct across markets and over time may occur and suggested monitoring of fed cattle markets to assure a competitive environment.

Muth and Wohlgenant (1999) developed a model to measure the degree of oligopsony power, and applied their model to the beef packing industry. However, no evidence of oligopsony power was found over the sample period from 1967 through 1993, contradicting the results of some previous studies of the beef packing industry which indicated that beef packing firms, at least part of the time, have exercised some kind of market power in the purchase of cattle for slaughter.

Oligopsony behavior has also been a concern in other food processing sectors. The potato processing industry has drawn particular attention. This industry is highly concentrated, localized, and susceptible to oligopsony power. Richards, Patterson, and Acharya (2001) investigated the potato processing industry over the period 1984 through 1998 in an attempt to determine whether frozen potato processors behave as an oligopsony, including the specific form of the strategic interaction among processing firms. They also examined possible losses in grower's surplus resulting from processors' market power. During the period studied, the potato processing industry was dominated by five major firms. Although no direct evidence tied these firms to a buying cartel, there was a high potential for anticompetitive behavior. The study found considerable statistical support for anticompetitive, discontinuous pricing strategies among potato buyers. The results suggested that processors colluded, on average, about 65% of the time. It was also found that the loss in producer surplus to the oligopsony amounted to approximately 1.6% of market revenue per month, which would have likely meant the difference between profit and loss for many growers. Processor's oligopsony power was found to be enhanced by higher domestic production, imports and existing stocks, but ameliorated by high capacity utilization rates and exports.

Katchova, Sheldon, and Miranda (2005) developed a linear-quadratic dynamic model to examine market conduct and price distortions in the U.S. potato chips and frozen French fries sectors over the period from 1960 though 1999. The model assumes quadratic adjustments in processor costs associated with changes in the processed quantity of input. The results of their study indicated that the behavior of potato processing firms is much closer to price taking than to collusion. Furthermore, price distortions due to oligopsony power in the purchase of potatoes were smaller than price distortions due to oligopoly in both the potato chips and frozen French fries sectors. The analysis suggested that the potato processing industry was able to extract from potato growers some oligopsony rents, but the rents were lower than the oligopoly rents extracted from consumers of either potato chips or French fries. Although their results supported those found by Richards, Patterson, and Acharya (2001), their analysis suggested that the potential oligopsony rents were lower in the presence of output adjustment costs.

Just and Chern (1980) studied the potential presence of market power in the tomato processing industry subject to an exogenous shock, the introduction of mechanical harvesting technology. A theoretical framework was developed for both the competitive and the oligopsony cases. The analysis was conducted following a simple supply-demand model for both the pre-harvester period from 1951 through 1963 and the post-harvester period from 1967 through 1975. Differences in the pre- and post- harvester cases were analyzed in an attempt to determine the competitive versus the non-competitive behavior associated with the tomato harvester. In the case of the California tomato processing industry, prior research had suggested that a single firm had been the dominant tomato canner for a long period of time and that the dominance of the firm was exercised in the form of price leadership when more firms were present. Therefore, the Just and Chern study tested the null hypothesis of competition versus the alternative hypothesis of dominant-firm-price-leadership oligopsony. The empirical results supported the dominant-firm-price-leadership oligopsony.

Durham and Sexton (1992) further studied the tomato processing industry in California, applying an empirical model they developed to analyze the potential of exercising oligopsony power in food markets. Six regional groups of firms over the period from 1985 through 1989 were studied. The results indicated that market-power potential in the California processing tomato market was limited, contradicting the findings of Just and Chern. From the analysis it was concluded that rivalry between neighboring markets was adequate to make them quite competitive and the industry no longer had a single dominant processor as identified by Just and Chern.

Wann and Sexton (1992) studied imperfect competition in multiproduct food industries, focusing on California pear processing over the period from 1950 through 1986. The California pear processing industry was selected because of the large number of growers selling to relatively few pear processors. Imperfect competition on both the buying and the selling side of the market was considered. Based on the array of product forms made from raw pears, a model was developed to distinguish input market power from output market power, assuming that there is a competitive "benchmark" processed product form. Oligopsony power was then estimated by comparing the margin (difference between the processed and raw-pear prices) for each processed product form with the margin for the benchmark product form. Their results indicated that the pear processing industry has exerted power in both its raw input market and the markets for canned pears and fruit cocktail. The grade pack pear market was found to be less concentrated and therefore more competitive.

Crespi, Gao, and Peterson (2005) looked at oligopsony behavior in the rice milling industry for the period from 1978 through 2001. They derived a set of equations to estimate buyer market power. Their model contained fewer equations with less explicit functional forms compared to other models typically used in such studies. They applied the model to the U.S. rice milling industry, which due to restructuring and consolidation was considered to be a rather stable structural oligopsony with respect to the purchasing of rice by millers from domestic producers; millers, however, appeared to operate in a rather competitive output market. When testing for market power, they found that the prices paid for rough rice by the milling industry were lower than what would have occurred under competitive conditions. Their market conduct parameter was estimated to be 0.27, similar in magnitude with many reported market conduct parameters in other agricultural industries, suggesting rather modest oligopsony power, analogous to a symmetric, four-firm oligopsony market under Cournot behavior. They concluded that the U.S. rice industry has characteristics of structural oligopsony in purchasing rough rice, but is competitive in the output market for milled rice. The degree of oligopsony behavior found in rice milling was consistent with oligopsony behavior found in other agricultural markets.

Sexton, Zhang and Chalfant (2005) examined retail-farm price margins for perishable fresh produce, and found that retail buyers have exercised oligopsony power in procuring iceberg lettuce from growers. They also examined fresh tomatoes and found mixed results with respect to oligopsony power.

In summary, a number of studies suggest non-competitive behavior in various sectors of the food industry. Market conduct was found to be related to product characteristics and concentration levels. However, although research suggests that some form of market power is being exercised in the food processing industry, at least part of the time, the estimated extent varies depending on the commodity market, as well as estimation methods and procedures used to determine the market behavior.

Orange Processor Concentration

In the Florida orange industry, concentration at the processor level is based on Florida Department of Citrus (FDOC) records on box-paid taxes by processors (by State law, all Florida processors must pay a tax to the FDOC on the amount of oranges processed; the tax is used to promote Florida OJ and conduct citrus research). The data are confidential and individual processors will not be noted. The measures of concentration are for the overall group of processors.

Over the last two decades, the number of Florida orange processors has declined by 57.7% from 52 in 1987-88 to 22 in 2006-07 (Table 1). The four firm concentration ratio (percentage of the total tax-paid boxes that the four largest processors account for) has increased from a low of 42.6% in 1995-96 to highs of 68 to 69% from 2004-05 through 2006-07. The eight firm concentration ratio has increased from 63.0% in 1995-96 to 96.8% in 2006-07.

Three additional measures of processor concentration were calculated from the tax-paid data---1) Theil's Index (TI) based on his measure of entropy, 2) the Herfindahl Index (HI) and 3) the Gini Coefficient (GC). Letting w_i be the share of total processed boxes accounted for by firm i, TI = $\sum_{i=1 \text{ to } n} w_i \log(w_i/(1/n))$. A firm's share would be (1/n) when each firm processes the same amount of fruit. Thus, the term $w_i/(1/n)$ is the i^{th} firm's processing share relative to the equal share, the term $\log(w_i/(1/n))$ is a measure of the percentage difference between the actual and equal processing shares, and TI is a measure of the weighted average percentage difference in the actual and equal shares. TI = 0 when all firms have an equal processing share, while T = log (n) when one firm accounts for all the processing (n = 127 in the present analysis or the total number of different processors over the period from 1987-88 through 2006-07). In Table 1, we see that TI has increased from 1.97 in 1995-96 to 2.76 in 2006-07, indicating an increase in processing concentration.

The Herfindahl index is defined as HI = $\sum_{i=1 \text{ to } n} w_i^2$, taking a value of 1/n when each firm has an equal share and one when a single firm accounts for all of the industry's processing. HI has increased from 0.08 to .10 from 1987-88 through 1998-99 to 0.15 to .16 from 2004-05 through 2006-07, again indicating an increase in concentration.

The Gini Coefficient is defined by the Lorenz curve which in the present case shows the cumulative percentage of industry processing for firms ranked from smallest to the largest (Figure 1). In Figure 1, let the area between the horizontal axis (x axis) and the Lorenz curve be A. The Gini Coefficient is then defined as GC = 1-2A. We approximate the area A for the discrete data used in this study.[3] The GC ranges from zero (each processor has an equal share of the tax-paid boxes) to one (one processor accounts for all the tax-paid boxes). In Table 1, we see that the GC has increased from 0.78 in 1995-96 to 0.90 in 2004-05 through 2006-07. Thus, the GC and other measures of concentrations indicate a notable increase in processed orange concentration over the last decade.

Grower Concentration

Based on Census of Agriculture data (United States Department of Agriculture), the structure of the Florida orange industry at the farm or grove level has been relatively stable over the last two decades. The data reflect individual groves and not grove ownership. An individual or group may own more than one grove, and one grove could be jointly owned by a group. Nevertheless, the data provide an indirect indication of the grower structure in Florida. Over the period from 1997 through 2002, about 7,000 to 8,000 orange groves have been in operation in Florida (Table 2). Large groves have accounted for most of the acreage. For example, in 2002, 208 groves, representing 2.9% of all groves, each had 500 or more acres, and together accounted for 64.0% of Florida's orange acres. The Lorenz curve at the grove level for 2002 shows a relatively high level of concentration (Figure 2). Table 3 shows that grove concentration, measured by the GI and TI, has been relatively stable over time.

Concentration of Florida's orange acreage among large groves raises the issue that large growers might act together to extract favorable prices from processors. As noted above, this issue can not be directly addressed since the data on groves may not reflect grove ownership. It

[3] See, for example, http://mercury.soas.ac.uk/users/sm97/teaching_intro_qm_notes_gini_coefficient.htm.

can be noted, however, that the larger the number of grove owners the less likely growers will behave non-competitively; and, although concentration of acreage among large groves exists in Florida, there is still a relatively large number of large groves. For example in 2002, the total number of large groves defined by 1,000 or more acres per grove (accounting for 1.5% of the grove population and 55.0% of the State's acreage) was 116 (Table 2).

Retail Concentration

Over the last decade, concentration at the retail food level has increased raising concern over noncompetitive pricing behavior as mentioned in the introduction. Table 4 shows several concentration ratios in 2002 versus 1992. For example, the eight firm concentration ratio for grocery stores increased from 25.3% in 1992 to 43.4% in 2002.

Have large food retailers obtained lower prices from processors and indirectly from growers than would have occurred if the retail industry were less concentrated? Non-competitive pricing is difficult to determine. Below, some historical price data at the industry level are reviewed to address this issue. Price data for individual firms were not available to examine non-competitive behavior.

Price Margins

Prices are dependent on fundamental supply and demand factors, costs underlying price margins, the amount of price dealing or price-promotions occurring in retail stores, and bargaining between growers and processors, and processors and retailers. Prices at the grower, processor and retail levels over the period from 1988-89 through 2005-06 are shown in Table 5. The grower delivered-in price, processor FOB price for bulk frozen concentrated orange juice (FCOJ), and retail prices for FCOJ, not-from-concentrated orange juice (NFC), reconstituted orange juice (RECON) and the total orange juice category are provided. The margins between the FOB price for bulk FCOJ and the grower price, and between the FOB price and the retail prices are also provided (Table 6, Figures 3 and 4). The data indicate that the real (CPI deflated) FOB-grower price margin, although variable, has tended to decline over time, while the real retail-FOB price margins have varied with no clear tendency. The decline in the FOB-grower margin is not consistent with the expectation that the increase in concentration at the processing level over time would favor processors in bargaining grower prices. If processors had set prices to their advantage, an increase in the margins would have been expected, all else constant.

All else, however, was not constant over the period of increasing processing concentration and the downward trend in the FOB-grower price margin. Crop sizes and associated boxes utilized for processing tended to increase over time, spreading fixed costs out across larger output levels and resulting in lower average fixed costs. At the same time, the costs of some of the inputs used in processing such as energy increased over time. Changes in the processor-by-product allowance (for the value of citrus oils and citrus pulp made from processed oranges) may also help explain changes in the margin (the FOB price only reflects the value of OJ and not the values of by products). Additionally, in seasons when the orange crop was not large enough to operate processing plants at or near full capacity, processors may have bid up fruit prices, attempting to secure fruit to increase operating efficiency and achieve reduced per unit costs.

It is difficult to determine the separate effects of processor concentration and other factors that impact the processor-grower price margin, based on the available annual data at hand (1989-90 through 2005-06). In preliminary analysis, the FOB-grower margin was related to the number of processed boxes, the producer price index for fuel and energy, the NFC share out of total production, and the level of processor concentration (TI, HI GC were alternatively considered as explanatory variables). However, the coefficients for the different measures of processor concentration and most of the other explanatory variables were not statistically significant at the $\alpha. = .10$ level. A major problem with this analysis was multicollinearity. For example, the simple correlations between the processor concentration measures and the price of fuels and energy were .80 or higher, depending on the concentration measure used.

Retail FCOJ-FOB and RECON-FOB price margins are shown in Figure 6 (the margins for NFC and total OJ follow similar patterns, although the cost of NFC differs from that for FCOJ with respect to storage and transportation). The variability in these price margins may be related to changes in costs and retail dealing over time. Based on these data, however, there is no clear pattern that the retail-FOB price margins are increasing over time and retailers are exerting oligopsony power over processors, as might be expected given the increase in retail concentration over this period. Caution, however, should be taken in reaching conclusions given the level of data aggregation. Retail and FOB prices are averages across grocery stores and processors, respectively, and individual firm level data may reveal other patterns. This cautionary point also applies to the FOB-grower price margins discussed above, which are based on average FOB and grower delivered-in prices. That is, price data for individual processors and growers may indicate price-margin patterns that differ from what has been found here based on average prices.

Conclusions

Based on a number of published studies, non-competitive pricing appears to have occurred at times in some food industries, although findings have varied across industries and modeling approaches used in the analyses. The results suggest that the increase in concentration in the Florida orange processing industry, as well as the increase in concentration at the retail grocery store level, has increased the likelihood of non-competitive pricing behavior involving these industrial sectors. The more concentrated the processors are, the more likely they will behave as an oligopsony in determining fruit prices that growers receive. Based on an analysis of data on the FOB-grower price margin, processor concentration and other variables that may affect the margin, it is problematic, however, to conclude that the increase in processor concentration over time did in fact adversely impact grower prices. While processor concentration has increased, the FOB-grower price margin has tended to decline, the opposite of what would be expected based on the concentration change by itself. The analysis, however, is plagued by multicollinearity among the variables used to explain the price margin. The possibility of an adverse impact on processor prices as a result of retail concentration is also difficult to determine from the data. Variability in the retail-FOB price margins has occurred but there are no clear trends.

Although the price data examined in this study do not directly support non-competitive pricing behavior in the Florida orange industry, caution should be taken in concluding that such behavior has not occurred. FOB and fruit prices used in the present analysis are averages across processors and growers, respectively, and disaggregated data for individuals may reveal other price patterns.

Table 1. Alternative Measures of the Distribution of Farms, By Sizes.

	Number of Processors	4 Firm Concentration Ratio[1]	8 Firm Concentration Ratio[2]	Theil Index[3]	Herfindahl Index[4]	Gini Coeff[5]
1987-88	52	46.8%	68.8%	2.03	0.08	0.80
1988-89	44	46.7%	69.6%	2.05	0.08	0.81
1989-90	46	49.5%	70.7%	2.09	0.10	0.81
1990-91	42	51.5%	72.8%	2.14	0.09	0.82
1991-92	41	49.1%	72.2%	2.15	0.09	0.82
1992-93	44	46.6%	69.0%	2.06	0.08	0.81
1993-94	47	47.4%	69.6%	2.07	0.09	0.81
1994-95	43	42.9%	65.3%	1.98	0.08	0.79
1995-96	44	42.6%	63.0%	1.97	0.08	0.78
1996-97	49	44.6%	66.5%	2.02	0.08	0.80
1997-98	46	49.8%	71.2%	2.15	0.09	0.82
1998-99	45	54.0%	74.9%	2.22	0.10	0.84
1999-00	43	53.7%	76.9%	2.27	0.11	0.84
2000-01	43	61.3%	86.2%	2.49	0.13	0.88
2001-02	40	62.3%	87.9%	2.56	0.13	0.88
2002-03	35	61.4%	88.2%	2.54	0.13	0.88
2003-04	37	58.7%	86.8%	2.49	0.12	0.87
2004-05	31	68.1%	94.0%	2.72	0.16	0.90
2005-06	29	69.9%	94.8%	2.74	0.15	0.90
2006-07	22	68.2%	96.8%	2.76	0.15	0.90

Source: Florida Department of Citrus (FDOC).

[1] The percentage of FDOC tax-paid processed boxes accounted for by the four largest processors.

[2] The percentage of FDOC tax-paid processed boxes accounted for by the eight largest processors.

[3] The Theil index increases as concentration increases, ranging from zero (each processor has an equal share of the tax-paid boxes) to log of n (one out of n processors accounts for all the tax-paid boxes).

[4] The Herfindahl coefficient equals 1/n when each of n processors has an equal share of the tax-paid boxes, and one when one processor accounts for all the tax-paid boxes.

[5] The Gini coefficient ranges from zero (each processor has an equal share of the tax-paid boxes) to one (one processor accounts for all the tax-paid boxes).

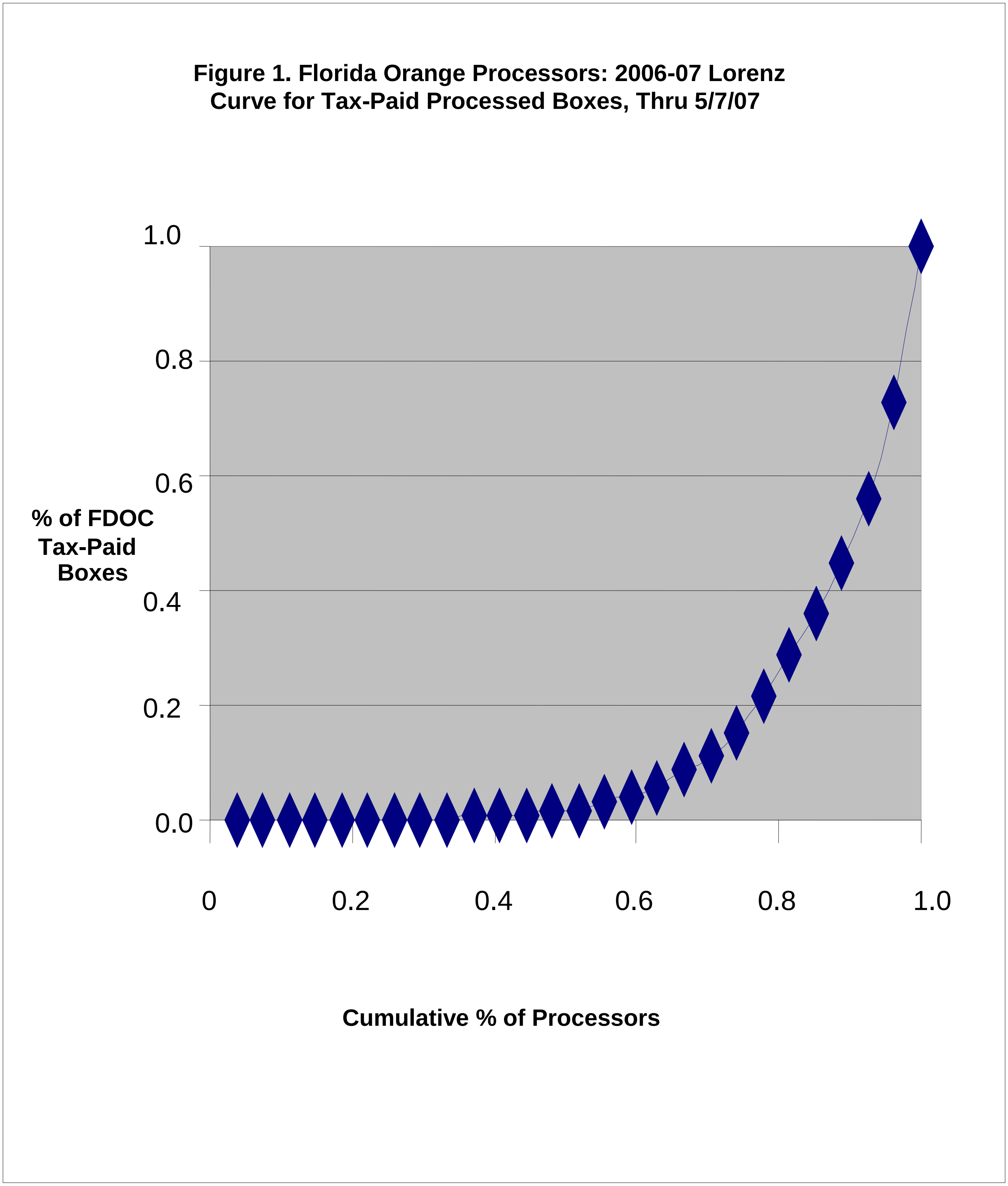
Figure 1. Florida Orange Processors: 2006-07 Lorenz Curve for Tax-Paid Processed Boxes, Thru 5/7/07
% of FDOC Tax-Paid Boxes
1.0
0.8
0.6
0.4
0.2
0.0
0
0.2
0.4
0.6
0.8
1.0
Cumulative % of Processors

Table 2. Florida Orange Farms/Groves & Acres.

Grove Size	Distribution of Farms, By Size				Distribution of Acreage, By Grove Size			
	1987	1992	1997	2002	1987	1992	1997	2002
Acres	Number of Farms(Growers)				Acres			
0.1 to 0.9	204	307	357	350	85	130	151	167
1.0 to 4.9	1,409	1,418	1,615	1,181	3,736	3,565	4,166	2,989
5.0 to 14.9	2,243	1,993	2,181	2,028	19,054	17,209	18,727	17,060
15.0 to 24.9	1,113	978	1,086	904	20,739	18,477	20,459	17,172
25.0 to 49.9	1,024	1,065	1,154	1,009	35,134	36,419	39,772	34,823
50.0 to 99.9	582	708	750	706	39,079	47,639	50,495	48,018
100.0 or more				894				599,445
100.0 to 249.9	440	438	443	496	66,364	67,386	66,842	74,386
250.0 to 499.9	128	149	177	190	44,527	51,201	60,545	64,317
500.0 or more	191	242	264	208	342,554	449,964	502,466	460,742
500.0 to 749.9	46	59	77	49	na	35,954	46,335	28,777
750.0 to 999.9	31	40	45	43	na	34,217	38,305	36,332
1,000.0 or more	114	143	142	116	na	379,793	417,826	395,633
1000.0 to 1,499.9	na	na	na	38	na	na	na	47,105
1,500.0 or more	na	na	na	78	na	na	na	348,528
Total Farms	7,334	7,298	8,027	7,072	571,272	691,990	763,623	719,674
	Percent of Total							
0.1 to 0.9	2.8%	4.2%	4.4%	4.9%	0.0%	0.0%	0.0%	0.0%
1.0 to 4.9	19.2%	19.4%	20.1%	16.7%	0.7%	0.5%	0.5%	0.4%
5.0 to 14.9	30.6%	27.3%	27.2%	28.7%	3.3%	2.5%	2.5%	2.4%
15.0 to 24.9	15.2%	13.4%	13.5%	12.8%	3.6%	2.7%	2.7%	2.4%
25.0 to 49.9	14.0%	14.6%	14.4%	14.3%	6.2%	5.3%	5.2%	4.8%
50.0 to 99.9	7.9%	9.7%	9.3%	10.0%	6.8%	6.9%	6.6%	6.7%
100.0 or more								
100.0 to 249.9	6.0%	6.0%	5.5%	7.0%	11.6%	9.7%	8.8%	10.3%
250.0 to 499.9	1.7%	2.0%	2.2%	2.7%	7.8%	7.4%	7.9%	8.9%
500.0 or more	2.6%	3.3%	3.3%	2.9%	60.0%	65.0%	65.8%	64.0%
500.0 to 749.9	0.6%	0.8%	1.0%	0.7%	na	5.2%	6.1%	4.0%
750.0 to 999.9	0.4%	0.5%	0.6%	0.6%	na	4.9%	5.0%	5.0%
1,000.0 or more	1.6%	2.0%	1.8%	1.6%	na	54.9%	54.7%	55.0%
1000.0 to 1,499.9	na	na	na	0.5%	na	na	na	6.5%
1,500.0 or more	na	na	na	1.1%	na	na	na	48.4%
Total Farms	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Census of Agriculture, USDA, National Agricultural Statistics Service.

Figure 2. Distribution of Florida Orange Acreage: 2002 Lorenz Curve

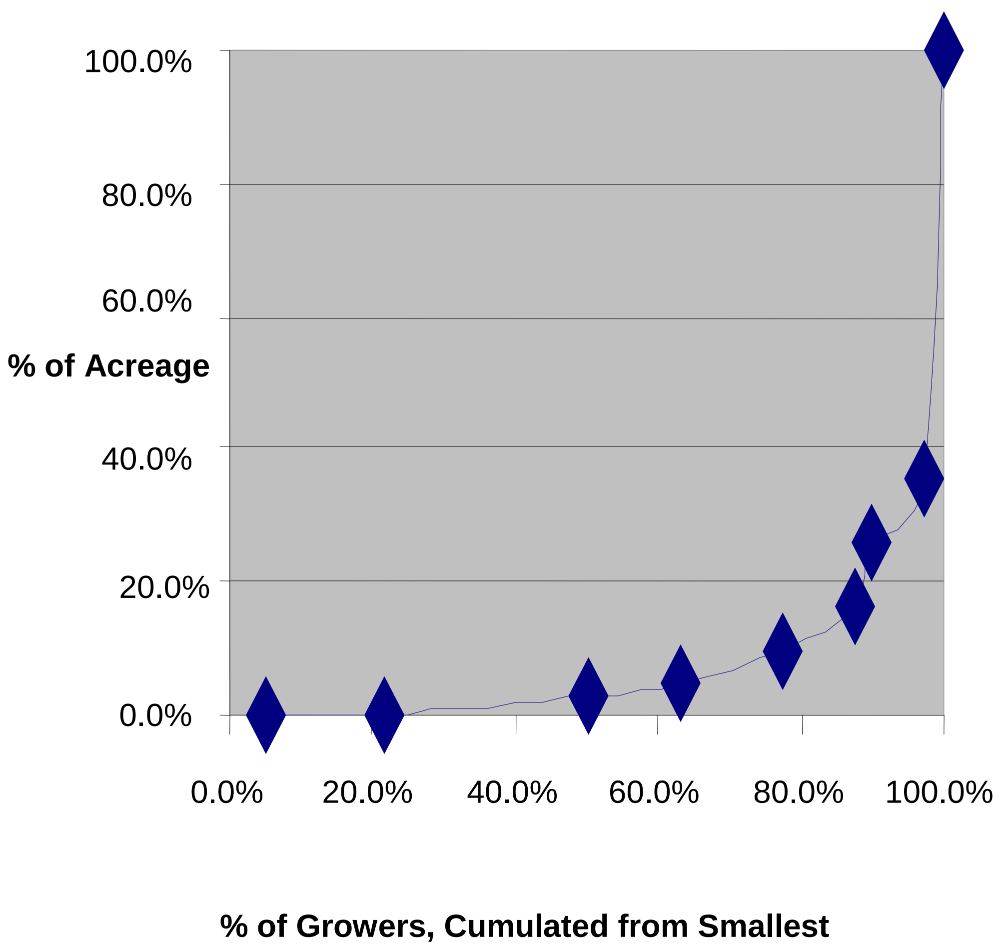

Table 3. Alternative Measures of the Distribution of Farms, By Size.

	Gini Coefficient[1]	Theil Index[2] (No. Farms)	Theil Index[2] (No. Acres)
1987	0.823	0.498	0.819
1992	0.836	0.422	0.941
1997	0.840	0.423	0.956
2002	0.837	0.405	0.932

[1] The Gini coefficient ranges from zero (each grove category has an equal share of the acreage) to one (one grove category accounts for all the acreage).
[2] The Theil index increases as grove concentration increases, ranging from zero (each grove category has an equal share of the total farms or acreage) to log of n (one out of n grove categories accounts for all the farms or acreage).

Table 4. U.S. Retail Grocery Store Concentration

	Concentration Ratio[1]	
	1992 [2]	2002 [3]
	% of Industry Sales	
4 Largest Firms	16.1	31.0
8 Largest Firms	25.3	43.4
20 Largest Firms	37.6	54.5
50 Largest Firms	49.9	65.3

Source: U.S. Census Bureau, Economic Census: Concentration Ratios, http://www.census.gov/epcd/www/concentration.html.

[1] Sales/receipts/revenue for establishments in a specified firm size range as a percent of total sales/receipts/revenue of all establishments.
[2] SEC code 541.
[3] NAICS code 4451.

Table 5. Processed Orange and OJ Prices.

	USDA/NASS		Florida Citrus Mutual		ACNielsen Retail Prices				U.S. Dept. Com.	
	Florida Processed Orange Grower Price		Bulk FCOJ FOB		FCOJ	NFC	RECON	Total OJ	CPI	
	$/PS	$/SSE Ga.	$/PS	$/SSE Ga.	$/SSE Ga.				82-84=100	05-06=100
1988-89	1.45	1.49	1.67	1.72	3.25	4.98	3.72	3.72	124.0	0.61
1989-90	1.54	1.58	1.97	2.03	3.64	5.50	4.17	4.20	130.7	0.64
1990-91	1.25	1.29	1.31	1.35	3.09	5.20	3.80	3.78	136.2	0.67
1991-92	1.18	1.21	1.53	1.57	3.10	5.23	3.83	3.83	140.3	0.69
1992-93	0.82	0.84	1.07	1.10	2.71	4.75	3.21	3.39	144.5	0.71
1993-94	0.92	0.94	1.28	1.32	2.73	4.60	3.19	3.40	148.2	0.73
1994-95	0.89	0.91	1.21	1.25	2.72	4.65	3.16	3.43	152.4	0.75
1995-96	1.02	1.04	1.43	1.47	2.91	4.76	3.37	3.64	156.9	0.77
1996-97	0.83	0.85	1.07	1.10	3.01	4.91	3.52	3.80	160.5	0.79
1997-98	0.84	0.86	1.19	1.22	2.89	4.76	3.46	3.76	163.0	0.80
1998-99	0.95	0.98	1.29	1.33	3.15	5.20	3.83	4.21	166.6	0.82
1999-00	0.86	0.88	1.06	1.09	3.26	5.45	3.90	4.37	172.2	0.85
2000-01	0.78	0.80	0.90	0.93	3.24	5.40	3.92	4.42	177.1	0.87
2001-02	0.83	0.86	1.05	1.08	3.28	5.28	3.89	4.44	179.9	0.88
2002-03	0.82	0.85	1.08	1.11	3.42	5.20	3.88	4.47	184.0	0.90
2003-04	0.77	0.79	0.84	0.86	3.40	5.11	3.76	4.42	188.9	0.93
2004-05	0.84	0.87	0.99	1.02	3.39	5.32	3.73	4.51	195.3	0.96
2005-06	1.17	1.21	1.52	1.56	3.54	5.47	3.98	4.74	203.5	1.00

Table 6. Price Margins.

	FOB-Grower Margin	Retail-FOB Margin (real)			
		FCOJ	NFC	RECON	Total OJ
		$/SSE Ga./CPI			
1988-89	0.37	2.51	5.36	3.28	3.29
1989-90	0.69	2.51	5.40	3.34	3.38
1990-91	0.09	2.61	5.75	3.67	3.63
1991-92	0.52	2.21	5.30	3.27	3.28
1992-93	0.37	2.26	5.14	2.97	3.23
1993-94	0.51	1.94	4.51	2.57	2.86
1994-95	0.44	1.96	4.55	2.56	2.92
1995-96	0.55	1.86	4.27	2.46	2.82
1996-97	0.32	2.43	4.83	3.07	3.43
1997-98	0.45	2.08	4.41	2.79	3.17
1998-99	0.42	2.23	4.73	3.06	3.52
1999-00	0.25	2.56	5.15	3.32	3.88
2000-01	0.14	2.66	5.14	3.44	4.01
2001-02	0.25	2.49	4.75	3.18	3.80
2002-03	0.29	2.55	4.52	3.06	3.71
2003-04	0.08	2.73	4.57	3.12	3.83
2004-05	0.16	2.47	4.48	2.83	3.64
2005-06	0.36	1.98	3.91	2.42	3.18

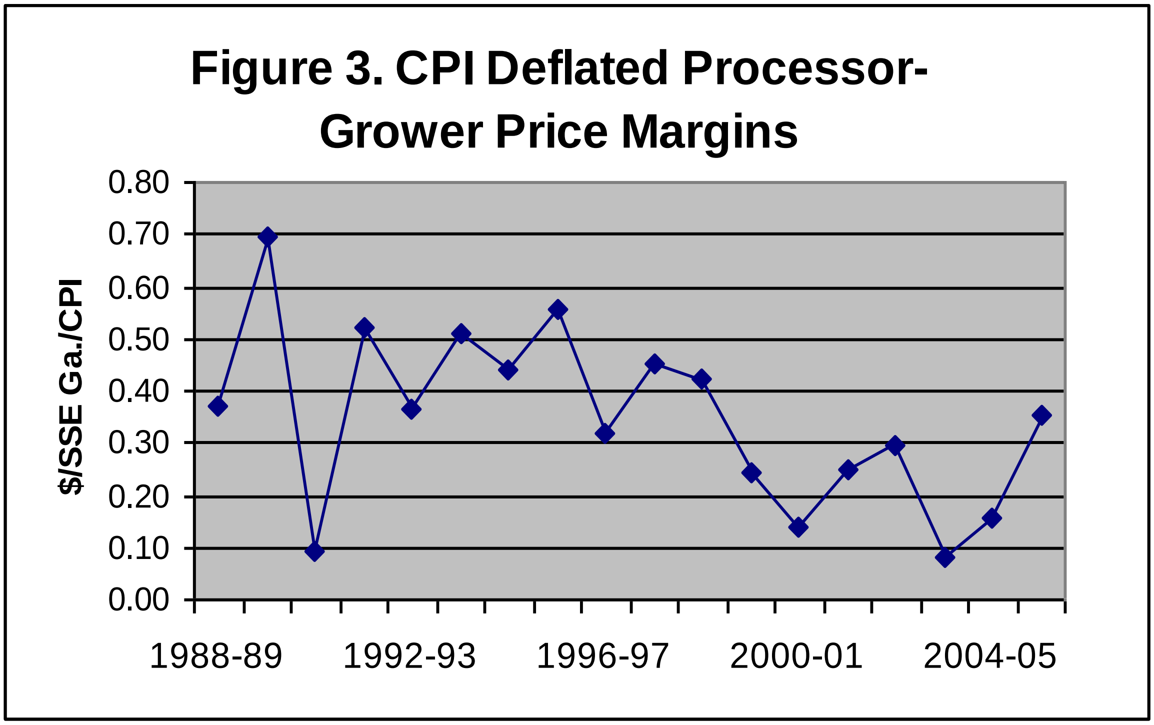
Figure 3. CPI Deflated Processor-Grower Price Margins
$/SSE Ga./CPI
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1988-89
1992-93
1996-97
2000-01
2004-05

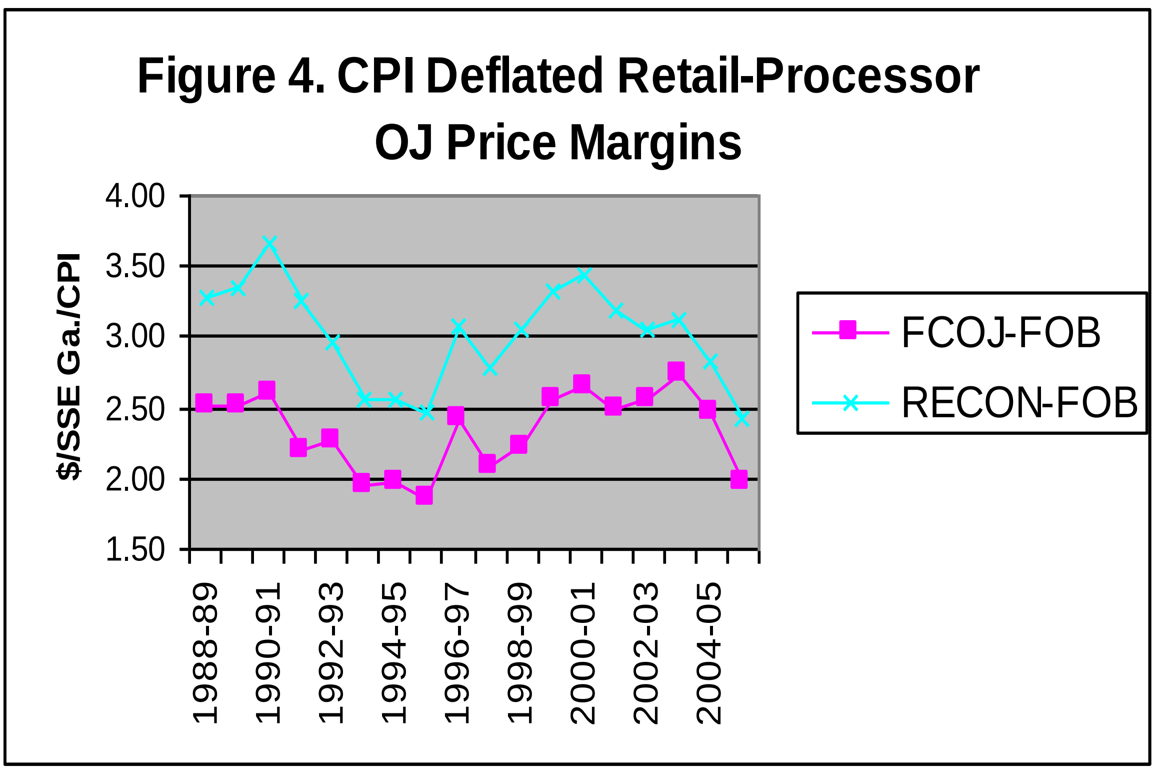
Figure 4. CPI Deflated Retail-Processor OJ Price Margins
$/SSE Ga./CPI
4.00
3.50
3.00
2.50
2.00
1.50
1988-89
1990-91
1992-93
1994-95
1996-97
1998-99
2000-01
2002-03
2004-05
FCOJ-FOB
RECON-FOB

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