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# Impact of Nominal and Real Price Changes on the Sweet Potato Pack in Louisiana

by

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## Abstract

Changes in consumer demand have led to a prolonged decline in per capita consumption of sweet potatoes, both fresh and processed form. With a product line of various container sizes and styles, processors may respond to changes by altering product line composition to enhance sales. Changes in quantity of individual products were contrasted to changes in nominal and real prices. Quantities were not consistently related to real prices in an inverse manner, though recent increases in total production of canned sweet potatoes have occurred while real price has decreased.

## Introduction

Social and economic changes having had an impact on consumer behavior are manifested in attributes of products demanded. Effects of such changes can be seen in product lines offered by food processors. An excellent example is the vegetable product group, where growth was the norm during the past three decades, with increased consumption rates particularly in the 1980s. Processed vegetable growth has been in frozen product, which increased from 1.1 to 1.8 million tons between 1970 and 1985 (Hamm), as output of canned pack stagnated.

An exception to the growth experience among vegetables is the sweet potato, a product whose per capita consumption has declined slowly but steadily in both fresh and processed forms since the 1940s. Nationally, sweet potato processing is dominated by Louisiana's canners (Hinson). The vegetable processing industry in that state is highly specialized in locally grown sweet potatoes, with a limited volume of other products, mostly okra (Figure 1). A 1987 description of the state's fruit and vegetable processing industry indicated that all sweet potatoes that were processed were canned (Broussard and Hinson). As a group, total output of Louisiana processors, at about 3.2 million standard cases, is about where it was 30 years ago, though output among years has varied. Attrition among small processors has resulted in fewer firms (from 13 to 5), implying expansion among the remaining processors.

According to available data, Louisiana sweet potato processors have not been quick to switch to alternative product forms or alternative products. With declining demand on a per capita basis, it could be hypothesized that real prices should decline, inducing an evaluation of whether to continue to process sweet potatoes, alter the product mix or take other actions to maintain net income. There are, of course, many reasons that

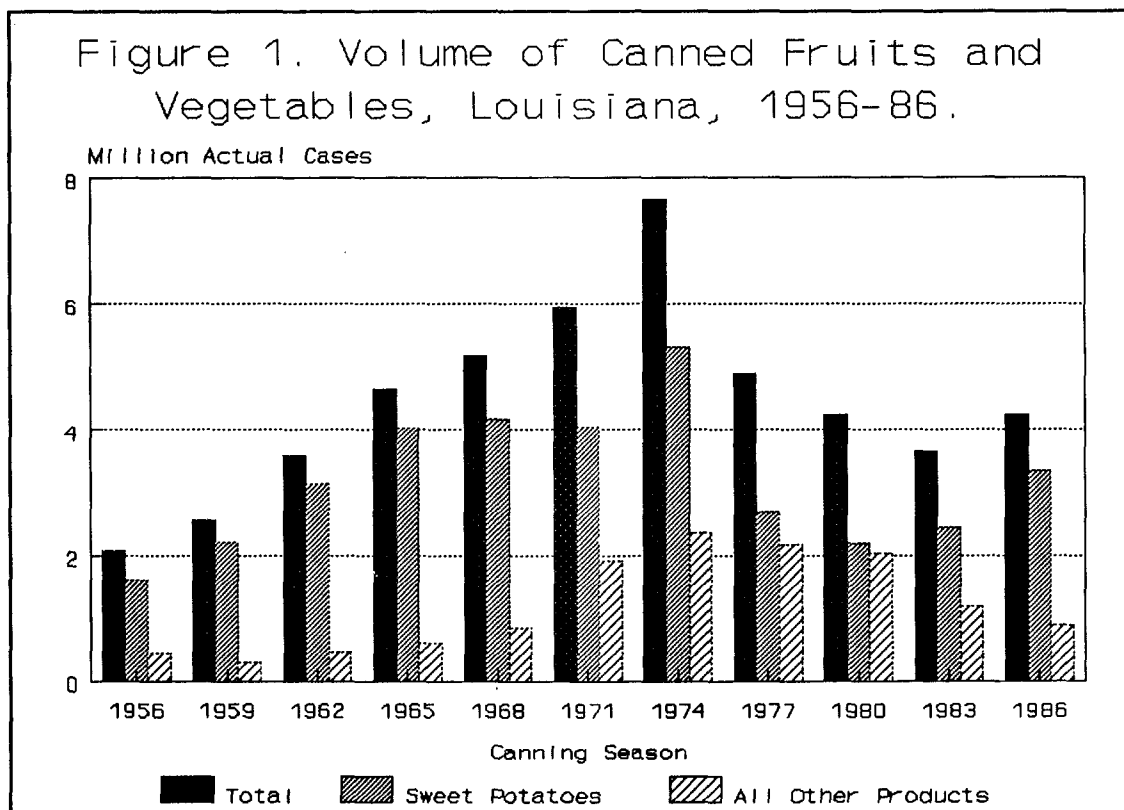
a given processor would maintain its course, including specialized production knowledge and equipment (fixed assets that might have a very low reservation price in other uses), and a market niche.

Changes in a firm's product line composition normally should continue in an iterative manner until relative prices are stable and additional changes would not improve net income. In a similar manner, a firm might choose to pursue alternative market channels, including a reorientation from retail to foodservice or pursuit of an export market. Product quality might be raised or lowered. Another strategy that could be adopted as a short-term defense against a declining market is an increase in advertising (through electronic media, print, couponing) and/or the sales effort (number and quality of sales force).

In terms of income and employment effects on farms and in communities where plants are located, it is important to know whether these firms have been making appropriate adjustments to the changing environment.

### Problem Statement and Objectives

This paper will focus on a small subset of those potential adjustments, specifically, an evaluation of price relationships within the line of sweet potato products. Changes in relative real prices serve to illustrate changes in demand for individual products. More specifically, if sales cannot be maintained at existing prices, then prices on particular container sizes and product styles should be changed and resources reallocated in anticipation of improved results in the next production run. Price changes would reduce margins on particular products and influence whether the firm retains the product line or even remains in business.



An analysis of the relationship between nominal and real price changes as related to output by style/container size combinations may provide the basis for inferences about behavior. Despite advances in decision-making assistance through operations research methodology, behavior of managers over time probably is still an iterative process as various opportunities are explored to determine their impact on profit. In processing seasonally produced vegetables, there is limited flexibility to change product mix, particularly toward the end of the season. In planning product mix for a season, the manager must look at last season's outcome (an information lag of one period) and his forecasts for the next season, then make his choice about product mix. However, product mix changes based on past prices and forecasts are likely to yield partial adjustments, since forecasts are not certain outcomes and the actual season average price received will be known only after the fact. It is also reasonable to assume that managers associate higher risk with larger changes. These considerations imply that managers probably are cautious about changes despite the economic incentive to change.

The objectives of this paper are to describe the response of sweet potato processors in Louisiana to changes in demand. In particular, (1) output level and distribution of container sizes will be documented, (2) nominal and real prices received by processors by year will be evaluated, and (3) the combined impact of changes in output and prices received will be reviewed.

### **Data and Procedures**

On a triannual basis since 1963, processors of fruit and vegetable products with establishments located in Louisiana have been surveyed to document price and quantity by product lines, by style of product (if appropriate), and by size of container. This series provides a snapshot of individual firm activity in a given year, and of activity across firms over the years covered by the survey. The series does not include information relevant to many of the factors discussed in the introductory section. For example, information is not available on cost; total revenue (except when all establishments of the company are located within the state); market territories; firm response in other

product categories, particularly those operations outside the state; sales effort; or raw product availability from farmers, which varies from year to year.

Price was reported as wholesale value, before any discounts or allowances provided by firms as sales incentive, and quantity was reported in cases. For both price and quantity, all reports were converted to the standard 24/303 basis (case of 24 cans of size 303). The producer price index for canned vegetables was used (*Vegetable Situation and Outlook Yearbook*) to convert all prices to a 1982 base. This measure is broader than sweet potatoes alone (since it includes alternative products) but should provide a reasonable representation of price change.

Nominal and real prices were regressed on time to generate trend values (which were tested for difference from zero), a procedure followed for size/style combinations with quantity and price data available for every reporting period. The combined impact of changes in prices and quantities, termed the weighted average price, was evaluated for evidence that particular size/style combinations were stronger or weaker members of the product line.

### **Sweet Potato Pack by Container Size and Style**

A standard and traditional set of can sizes is available to processors. While there are common industry names for these containers (303, No. 10, for example), here each is identified by its capacity in ounces (17, 110). Product styles were cut, mashed, and whole. Whole was the higher priced, premium product. The pack was predominantly in syrup of varying brix levels, though small volumes of specialty products (fruit-flavored syrup) were included.

Significant change in composition of the sweet potato pack has occurred since the 1963-64 season. In a somewhat simplistic characterization, container sizes of less than 25 ounces might be called retail while those of more than 25 ounces could be called institutional. Summarizing this change in emphasis, in 1963 smaller containers accounted for more than 47 percent of the pack, while in 1987 they made up only 29 percent of the

pack (Table 1). Within the retail sizes, the smallest sizes became less important in share of production. In particular, the two smallest sizes, 8- and 15-ounce, declined from almost 10 percent to less than one percent. Only the 20-ounce can was an exception to this generalization. The 17-ounce can, a popular retail size, has averaged almost 17 percent, while the importance of the 24-ounce can has waned since 1975.

In the 'institutional' sizes, variation between years of the 30-, 40-, 52- and 110-ounce containers was noted. The 30-ounce can traditionally has been most important, varying from a high of 39.3 percent to less than 20 percent with an average value of about 29 percent. The 110-ounce can was much more important later in the period, while the 40-ounce container held a relatively constant share of 15 percent after 1969. The 52-ounce can became progressively less important, while the mashed style became more important on a percentage basis.

### Prices By Style and Container Size

#### *Cut and Mashed Potatoes*

Trends were evaluated for five of these 12 categories. In the other cases, quantities were zero in one or more of the years reported. While procedures to forecast these zero values are available, that would be appropriate only if these were missing values. In this case, there is no reason to assume the values are missing, since composition of the pack may vary due to processor perception of demand and to the quality of raw potatoes (which can be affected by weather and fresh market potato prices).

Nominal prices of the various containers of sweet potatoes increased in multiples of between three and four over the time period (Table 2). In every case where trend coefficients were estimated, they were significant. Within both size categories at the end of the period, smaller cans tended to have higher real prices while larger cans had lower real prices. However, all the trend coefficients for real prices were positive but not significantly different from 0. This outcome apparently resulted from the latter two periods, when prices declined. In both retail and institu-

tional sizes, real prices generally rose until the late 1970s/early 1980s. Several sizes were discontinued or produced infrequently during the period, including the 8-, 15-, and 52-ounce size. Despite the overall stability of prices as indicated by the trend, 1987 real prices appeared to have weakened, particularly compared with 1981.

#### *Relationship to quantities*

A market apparently exists for a limited quantity of the two smallest can sizes at premium prices, illustrated by high real prices and the declines in quantity of the 8- and 15-ounce sizes. Otherwise, real price increases were not consistently related to quantity change. For example, the 17-ounce size maintained a relatively steady share while the share of the 24-ounce size dropped by half; trend values for each size were slightly positive, though the value for the 24-ounce was almost twice as large as for the 17-ounce. Institutional sizes also had inconsistent real price to quantity relationships. The real price trend for the 30-ounce can was up marginally, and its share was only slightly lower at the end of the period despite considerable fluctuation. The 40-ounce size became much more important, and its real price outpaced other institutional sizes until 1987.

#### *Whole Potatoes*

As a generalization, fewer can sizes are relevant to the whole sweet potato market. There was no production reported in the last three reporting seasons for the 20-ounce size, the 40-ounce can appeared only in 1963, and the 15-ounce can was not reported in any year. Nominal prices increased significantly for all sizes (Table 3). For the retail containers, real price trends were similar to the cut and mashed styles. The 8-ounce size increased significantly. Real prices for the 17- and 24-ounce sizes were lower in 1987 than in 1963 though trend coefficients were not significantly different from 0. In the institutional sizes, the trend value for the 30-ounce size was positive and significant. Generally, there appeared to be less price variation over the years for the whole style compared with the cut and mashed style.

**Table 1**

**Composition of Sweet Potato Pack by Container Size, Standard Cases, Louisiana, 1963-87**

Size (ounces)	1963	1966	1969	1972	1975	1978	1981	1984	1987
	----- percent -----								
8	8.9	3.5	3.0	4.2	2.4	3.5	1.6	0.7	0.3
15	0.3	0.0	0.1	0.9	0.0	0.0	0.0	0.0	0.0
17	23.9	9.8	16.4	18.0	11.6	15.5	16.3	21.6	17.7
20	1.5	0.2	0.8	1.3	0.2	4.4	0	1.8	4.8
24	13.0	15.3	11.8	13.6	13.4	8.6	7.7	7.4	6.2
30	30.0	35.5	39.3	23.1	32.9	24.3	28.5	19.6	28.5
40	4.2	3.0	12.7	17.4	19.0	15.9	11.5	14.0	17.2
52	6.1	6.6	3.3	2.2	1.6	2.3	2.7	1.5	2.4
110	12.2	23.6	12.6	15.8	15.9	23.1	30.1	29.7	18.9
mashed	0.0	2.4	0.0	3.3	3.0	2.4	1.6	3.7	3.9

The relationship between real price (Table 3) and quantity (Table 1) for whole style potatoes was similar to that for cut style, though the distinctions were more pronounced. The higher price for 8-ounce cans did not stimulate supply, and surely depressed demand. Whether the decline in production of this particular size was supply or demand induced is unclear, though one might suppose that the margin on this product even at the higher price is not enough to displace other production.

Although a modest decline in price occurred for the 17-ounce size, its share remained about the same. The lower real price for the 24-ounce size was associated with a 50 percent decline in share of the pack. In a similar manner, some institutional sizes responded to real price changes while others did not. The dominant 30-ounce size maintained its share of the pack while increasing in price. The 52-ounce size lost major share despite price changes that were similar to other sizes. The 110-ounce size declined in price, yet its share increased until the 1987 season.

**Weighted Contribution to Real Price**

The combined impact of quantity and price changes on sweet potato processors can be seen through analysis of price changes weighted by actual shares packed in specific containers by individual firms. This number was calculated by dividing quantity packed in the various containers by total firm output, then multiplying the resulting proportion by real price. Averages by year and size were calculated. These average weighted contributions over time indicate whether the container size and style became more or less important (Table 4), since increases in real price might be offset by declines in quantity sold, or vice versa. As an assessment of the contribution of each container size and style combination to gross revenue, a combined impact that is positive would indicate that a firm should consider production of that size and style.

For the cut style, the 17- and 40-ounce sizes had positive and significant coefficients, while the 30-ounce size was significantly negative. For the whole style, the 24- and 52-ounce sizes had significant negative coefficients. This was expected

**Table 2**

Nominal and Real Canned Sweet Potato Prices, by Container Size,  
for Cut and Mashed Style, 1982 = 100, Louisiana, 1963-87

Size	1963	1966	1969	1972	1975	1978	1981	1984	1987	Trend
Nominal prices (\$ per standard case)										
8	2.92	2.87	3.20	0.00	0.00	6.18	0.00	0.00	12.65	-
15	2.78	0.00	3.22	3.22	0.00	0.00	0.00	0.00	13.88	-
17	3.40	3.43	3.90	4.35	6.06	7.90	9.76	9.40	10.22	1.007*
20	4.11	4.52	4.88	5.99	0.00	11.90	0.00	13.75	13.96	-
24	2.97	3.22	3.51	4.10	5.87	6.90	9.30	9.62	8.64	0.937*
30	2.49	2.59	2.97	3.39	5.54	6.03	7.77	8.24	7.64	0.829*
40	2.94	2.99	3.51	3.86	5.72	6.24	8.28	10.09	8.72	0.939*
52	2.95	2.77	3.71	4.14	4.75	0.00	0.00	0.00	0.00	-
110	2.49	2.67	3.05	3.59	5.38	5.20	7.88	8.75	7.73	0.841*
15m	0.00	2.78	0.00	3.89	5.49	8.61	9.66	8.89	13.88	-
17m	0.00	3.17	0.00	2.75	4.00	4.74	0.00	10.00	7.00	-
110m	0.00	2.44	0.00	3.46	4.92	4.60	5.35	7.96	5.81	-
Real prices										
8	8.79	7.53	7.71	0.00	0.00	8.37	0.00	0.00	12.22	-
15	8.36	0.00	7.76	7.04	0.00	0.00	0.00	0.00	13.41	-
17	10.24	8.99	9.39	9.51	9.00	10.70	10.41	8.97	9.87	0.028
20	12.36	11.85	11.77	13.11	0.00	16.12	0.00	13.12	13.49	-
24	8.96	8.44	8.47	8.98	8.71	9.35	9.91	9.18	8.35	0.050
30	7.49	6.79	7.17	7.41	8.22	8.16	8.28	7.86	7.38	0.096
40	8.84	7.84	8.45	8.46	8.48	8.45	8.82	9.62	8.42	0.073
52	8.87	7.26	8.94	9.07	7.05	0.00	0.00	0.00	0.00	-
110	7.49	7.01	7.34	7.86	7.98	7.05	8.40	8.35	7.47	0.087
15m	0.00	7.28	0.00	8.50	8.15	11.67	10.30	8.48	13.41	-
17m	0.00	8.31	0.00	6.02	5.93	6.42	0.00	9.54	6.76	-
110m	0.00	6.40	0.00	7.58	7.30	6.23	5.70	7.60	5.62	-

\* significantly different from 0 at alpha = 0.05

m = mashed style

**Table 3**

**Nominal and Real Canned Sweet Potato Prices, by Container Size,  
for Whole Style, 1982 = 100, Louisiana, 1963-87**

Size	1963	1966	1969	1972	1975	1978	1981	1984	1987	Trend
Nominal prices (\$ per standard case)										
8	2.80	2.96	3.43	4.07	6.15	8.02	8.90	12.11	14.60	1.492*
17	4.48	4.48	4.92	5.78	9.13	9.23	13.13	11.00	13.07	1.229*
20	4.19	4.52	5.01	0.00	13.63	11.70	0.00	0.00	0.00	-
24	3.74	3.85	4.41	4.70	7.76	7.82	11.38	9.29	7.73	0.822*
30	3.11	3.31	3.69	4.19	6.80	7.67	9.89	10.81	10.45	1.129*
52	3.87	3.98	4.35	5.02	7.51	9.45	10.42	9.91	12.14	1.124*
110	3.26	3.50	3.90	4.37	7.04	7.32	8.53	9.00	7.85	0.785*
Real prices										
8	8.44	7.76	8.28	8.92	9.13	10.86	9.49	11.55	14.10	0.639*
17	13.49	11.75	11.85	12.64	13.55	12.51	13.99	10.50	12.63	-0.051
20	12.61	11.85	12.07	0.00	20.22	15.85	0.00	0.00	0.00	-
24	11.25	10.11	10.62	10.29	11.52	10.60	12.14	8.87	7.46	-0.259
30	9.38	8.69	8.89	9.18	10.09	10.39	10.54	10.31	10.10	0.204*
52	11.66	10.45	10.47	10.99	11.14	12.80	11.10	9.46	11.73	0.006
110	9.83	9.19	9.41	9.55	10.45	9.92	9.10	9.35	7.59	-0.146

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\* significant at alpha = 0.05



Table 4

Quantity Weighted Contribution to Real Price Received by Louisiana Sweet Potato Processors,  
by Style and Container Size, 1963-87

Size	1963	1966	1969	1972	1975	1978	1981	1984	1987	Trend
<i>cut</i>										
8	0.21	0.48	0.21	0.00	0.00	0.17	0.00	0.00	0.16	-
15	0.87	0.00	0.44	0.32	0.00	0.00	0.00	0.00	0.06	-
17	0.81	0.77	0.79	0.83	0.58	1.08	1.30	1.17	1.31	0.075*
20	0.31	0.21	0.31	0.36	0.00	1.25	0.00	0.60	1.12	-
24	0.41	0.79	0.71	0.70	0.40	0.60	0.94	0.54	0.52	0.008
30	2.98	2.82	2.55	1.89	2.37	2.06	1.82	1.64	1.99	-0.147*
40	0.66	0.46	1.05	1.37	0.94	1.11	0.89	1.82	1.27	0.099*
52	0.10	0.03	0.19	0.52	0.05	0.00	0.00	0.00	0.00	-
110	2.01	1.34	1.87	1.67	2.54	1.47	1.49	1.45	1.47	-0.052
<i>whole</i>										
8	0.53	0.40	0.27	0.31	0.22	0.54	0.22	0.30	0.13	-
17	0.62	0.39	0.86	0.79	0.65	0.77	1.17	0.70	0.54	0.02
20	0.06	0.10	0.50	0.00	0.17	0.04	0.00	0.00	0.00	-
24	0.86	0.88	0.72	1.01	0.93	0.84	0.73	0.36	0.41	-0.058*
30	0.42	0.39	0.50	0.39	0.87	0.27	0.39	0.46	0.25	-0.014
40	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
52	0.81	0.58	0.45	0.46	0.39	0.33	0.44	0.19	0.33	-0.054*
110	1.18	0.49	0.67	0.62	0.46	0.73	0.93	0.92	1.35	0.043
Total	8.62	7.81	8.36	8.64	8.83	9.13	9.76	8.87	8.29	0.086

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\* significant at the alpha = 0.05 level.

since, as noted earlier, quantity share of the pack dedicated to these sizes had declined. Other size/styles were not significant.

### Summary

Sweet potato processors in Louisiana have faced a declining market and have been shifting product line shares. The smaller "retail" container sizes declined in importance over time, from almost half the total pack to less than one-third. The larger sizes, assumed to be destined for institutional use, increased to more than two-thirds of the total pack. Despite substantial increases in nominal prices, real price changes varied widely across sizes and styles. Two sizes of whole style potatoes had significantly higher real price trend coefficients, while three other sizes were not statistically different from zero. In the cut/mashed category, there was only one positive significant real price trend coefficient.

When converted to a weighted average contribution to revenue basis, a different picture emerged. For whole style, trend coefficients were negative and significant in two sizes. The cut/mashed style had only one negative and significant coefficient, while two sizes were positive and significant.

### Implications

The predominant theme of this paper has been the relationship between price and quantity of individual size/style of product. However, a more general response should be recognized. For both cut and whole styles, real prices climbed to a peak in the 1981 season. Referring to Figure 1, total production by the state's processors, having peaked in 1975, moved down sharply until the 1981 season. The decline in real prices during the 1980s is associated with a modest recovery in production. This correlation does not indicate whether (1) prices were forced down by market processes as additional product became available, or (2) processors reduced price in an attempt to stimulate sales. In either case, the relatively weak demand as reflected in per capita consumption probably is responsible. In addition, if the latter proposition is the case, this information should be weighed heavily in the industry's strategic plan-

ning. It has been assumed that the whole potato is the premium product for sweet potato processors. In some sense this notion is supported by the increases in real prices for selected sizes, and reinforced by the insignificant trend coefficients for cut potatoes. A different picture emerges from the weighted average contributions, where three of the whole style coefficients were negative and two were significant, indicating weaker performance. The cut style appears to be a stronger competitor in the retail market, given the positive performance of the 17-ounce size when compared to the weak overall performance of the 24-ounce size in whole style. This result may indicate growing price sensitivity by retail purchasers of sweet potatoes.

The weakness of sweet potato products against the backdrop of strongly increasing sales of vegetable products in general should signal the industry that action is needed. This descriptive study of firm level prices and quantities leaves questions about causes and remedies unanswered. An analytical study addressing causes of this decline, development of an aggressive pricing policy, and a market strategy focusing on product attributes are needed to provide new momentum for this product.

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