Temporary price reduction and price expectation in U.S. orange juice sales

Hyeyoung Kim, Oregon Employment Department, Hyeyoung.Kim@oregon.org

Lisa A. House, University of Florida, lahouse@ufl.edu

Selected Poster prepared for presentation at the Agricultural & Applied Economics Association's 2017 AAEA Annual Meeting, Chicago, IL, July 30-August 1, 2017.

Temporary price reduction and price expectation in U.S. orange juice sales

Hyeyoung Kim[a] and Lisa A. House[b]

[a]*Oregon Employment Department,* [b] *University of Florida*

Introduction and Background

Temporary Price Reduction

Promotions with price-cuts are popularly used to encourage sales and to compete with different brands in retail markets. The temporary price reduction (TPR) leads to increased sales at a lower price than regular and has an adverse effect on subsequent sales (Kalwani and Yim, 1992). The effect of TPR will vary depending on the levels of price discounts and frequency of promotions. Della, Bitta, and Monrow (1980) described that a 15% discount is needed to attract consumers to a sale.

Frequent Promotions and TPR

Frequent promotion with TPR influences consumer reference prices (Lattin and Bucklin, 1989; Kalwani et al., 1990; Krishnamurthi et al., 1992; Mayhew and Winer, 1992) and purchase time (Krishnamurthi et al., 1992). If consumers frequently encounter low prices and make a decision at a price, the TRP will be a reference. Finally, consumers may consider that the regular price is unacceptably greater than their expectation. Therefore, consumers may wait until the next promotion. This behavior may be common with inessential products.

NFC Orange Juice

NFC OJ Market and TPR

In 2015-2016, gallon sales of NFC orange juice accounted for 63% of total sales of refrigerated 100% orange juice. The top four brands accounted for approximately 75% of total sales volume in the category. Leading brands and store brands frequently use TPR to compete with other brands and other beverage categories. Promotions discount orange juice prices on average 15% compared to regular prices. Sales with promotion account for 45% of total 100% refrigerated orange juice sales.

Data

Nielsen weekly U.S. retail NFC OJ sales data was used for the period week ending January 5, 2013, through the week ending October 31, 2015, a total of 148 weeks. The markets included U.S. grocery stores with at least $2 million in annual sales, drug stores with at least $1 million annual sales, mass merchandisers, super centers, dollar stores, and military/the defense commissary agency. This market data account for approximately 55% of presumed orange juice consumption in the United States (Zansler, 2015).

Estimated Results

Variables	Coefficient	S.E.
Intercept	-1.809**	0.900
Time Trend	0.000**	0.000
LN Pt	-0.976**	0.440
LN Pt-1	-0.621**	0.199
LN Pt-2	-0.266	0.347
Seasonality1 (Sin)	0.045**	0.008
Seasonality2 (Cos)	0.091**	0.009
PSI	0.055**	0.019
(PSI>.5)*LN Pt	-0.013*	0.007
LN DPI	0.063**	0.026
ρ	0.4241**	0.07671
R-squared	0.88421	
Durbin-Watson	1.9163	
Log Likelihood	277.05	
Observations	146	

**, * indicates that estimated parameters are significantly different from zero at 5% and 10% levels.

Purpose of Study

The purpose of the study is to measure an index of price satisfaction resulting from TPR and to investigate the effect of price satisfaction on market sales using store-level scanner data.

$$PSI_t = \frac{MAX_t - P_t}{MAX_t - MIN_t}$$
$$MAX_t = Max(P_{t-i,} \cdots P_t)$$
$$MIN_t = Min(P_{t-i,} \cdots P_t)$$

The price satisfaction index (PSI) will near 1 when the current price is close to the minimum price, and it will near 0 when the current price is close to the maximum price. Therefore, the index of price satisfaction indicates the closeness of price expectation at time t, compared to previous price information.
In this study, we set *i* as 7. Therefore, we assume that consumers will determine a level of satisfaction at week t, using the past 7 weeks price information.

This study is unique in terms of investigating the effect of TPR by measuring price satisfaction using aggregated data.

Methodology

We consider variables influencing OJ demand: price, income, time trend, seasonality and PSI. Unit prices of orange juice ($/gallon) are calculated using total dollar sales and total volume sales.
Unit prices and personal disposable income are deflated using the consumer price index (CPI) to remove price changes due to economic growth. Volume sales are divided by U.S. population to calculate per capita purchases in given periods.
To reflect flexible responses, the variables of per capita purchases, deflated unit price and deflated income were transformed by taking natural logs.
We used an AR(1) model to estimate the model to correct for serial correlation. The model was expanded with Almon's distributed lags (PDL) to reflect the dynamic effect of price. The optimal lag length (2 lags) and degree (linear form) were selected based on the AIC and BIC criteria. The final model includes an interaction term of price and a dummy variable of PSI. From a sensitivity test, we created a dummy variable: 1 if the index is greater than 0.5 and 0 otherwise.

Findings

- Per capita purchases of NFC orange juice decrease by 1.6% when NFC OJ price increases by 1.0%.
- As price satisfaction increases, the sales of NFC OJ increase. The elasticity of price satisfaction on NFC OJ demand was 2.7% in the middle of the index of price satisfaction (0.5). This indicates that when the market price is between the maximum and minimum prices for a given period, increased price satisfaction by 1% will increase demand for NFC OJ by 2.7%.
- The interaction effect of price and price satisfaction was significant and negative, -0.013. This indicates that demand for NFC OJ is much more price sensitive above the middle of price satisfaction.
  - This finding supports the concept of kinked demand for NFC OJ. Consumer response to price increases may not be equivalent to their response to price decreases.
- Competition with price reduction promotions may increase sales in the short run, but TPR may lead to price sensitivity at lower prices that may eventually weaken consumer willingness to purchase at regular prices.