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ADVERTISING AND PRODUCT CONFUSION: A CASE STUDY OF GRAPEFRUIT JUICE

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Abstract

Demand relationships for two closely related products--grapefruit juice and grapefruit-juice cocktail--were estimated from grocery-store scanner data to analyze the contention that consumer confusion exists between the two products. Results suggest confusion may exist, with grapefruit-juice advertising not only increasing the demand for grapefruit juice but also for grapefruit-juice cocktail.

Key Words: Advertising, demand, grapefruit juice, cocktail, scanner data.

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Advertising and Production Confusion: A Case Study of Grapefruit Juice

Advertising has become an important marketing activity for many farm commodities in the United States. Commodity organizations for product groups such as beef, milk and citrus, among others, have developed advertising programs to promote their product lines. The type of advertising used by commodity groups is usually generic in nature, aimed at expanding the overall demand for products in the commodity line by focusing on general product attributes. In contrast, brand advertising has been used by individual firms and, to a lesser extent, some commodity groups to promote farm products. Brand advertising is aimed at expanding the demand for specific branded product, often at the expense of other competing brands.

The effectiveness of advertising can be analyzed by surveying consumers about product attitudes and recall of advertising messages. Such surveys, though, usually do not obtain information that quantitatively indicates the impact of advertising on sales. However, given data on sales, advertising and other economic variables, quantitative measures of the impact of advertising on sales can be estimated. Sales, or quantity demanded, depends on a number of factors, including price of the product in question, prices of other related goods, income, and consumer preferences (Lee et al.). Advertising can be viewed as affecting preferences. Just as both the price of the good analyzed and the prices of related goods should be included in the demand specification, both the level of advertising for the good analyzed and the levels of advertising for related goods should be included. Specifying demand completely can be important for understanding the impact of advertising.

In this paper, the impact of grapefruit-juice (GJ) advertising on U.S. retail demand for two alternative grapefruit-juice based products is analyzed. GJ advertising is carried out by the Florida Department of Citrus (FDOC) as well as by private firms. The FDOC is primarily involved in generic advertising, while the private firms in the industry are

primarily involved in brand advertising. Over the last ten years, GJ gallon sales have been declining.[1] In 1977-78 (December, 1977, through November, 1978), retail GJ sales were 105.7 million gallons (Nielsen Marketing Research). By 1987-88, retail GJ sales had fallen by 31.8% to 72.0 million gallons. Partially offsetting the decline in GJ sales has been the growth in recent years of sales of grapefruit-juice cocktail (GJC). GJC is not a 100%-juice product; the percentage of grapefruit juice in GJC is not declared on the product label but is generally less than 50%. The absence of percentage juice content on GJC product labels, along with use of the word "juice" in the product name and packaging similarities between GJC and GJ, raises the possibility that some consumers may confuse GJC for 100% pure GJ product.

The growth in GJC sales has not completely offset the sales decline of 100% GJ juice. In 1987-88, GJC gallon sales were 26.4% of GJ sales in retail stores with total sales in excess of 4 million dollars (Nielsen Marketing Research). Assuming GJC sales are the same percentage of GJ sales in both retail stores with total sales in excess of 4 million dollars and all retail stores, total 1987-88 retail sales of GJ and GJC are estimated to be 91.0 million gallons, 13.9% below the 1977-78 level. However, the amount of pure 100% juice sold in GJ and GJC products in grocery stores in 1987-88 is estimated to be only 81.5 million gallons, assuming GJC contains 50% pure juice. For grapefruit growers who sell their fruit to make juice, the trends in GJ and GJC sales could be worrisome. A switch from GJ to GJC in the market could result in a decline in the demand for grapefruit by juice producers. In addition, the trends in GJ and GJC markets may be a concern from the consumer viewpoint, given confusion over juice content in GJC may exist.

The paper is organized as follows. In the next section, the possibility of consumer confusion in the markets for GJ and GJC is discussed. A demand model used to estimate the impacts of GJ and GJC advertising is then presented; the model provides a means to examine the consistency between consumer behavior and the contention of confusion. Along with the

presentation of the model, data and variables used in the analysis are discussed. Next, results are presented and discussed. The last section provides some concluding comments.

JUICE VERSUS COCKTAIL

Presently, the Food and Drug Administration and Congress are considering the issue of product labeling and food safety. The product labeling issue involves the concern that some consumers may be confused and misled by some product labeling. The market for 100% pure grapefruit juice and diluted grapefruit juice beverages provides a good example where product confusion may exist. The issue over confusion begins with product name and labeling. Both GJ and GJC contain the word "juice" in their names. Research by Drossler Research Corporation in 1972 for the FDOC found that the word "juice" in diluted-beverage-product names had a tendency to result in confusion over juice content; with "juice" in the product name, consumers tended to think the product was 100% pure juice. The problem of identifying pure grapefruit-juice products is compounded by the fact that product labels for diluted grapefruit-juice products are not required to declare the percentage of juice in the beverage. A study by the Chelsea Consulting Group in 1987 for the FDOC found that ". . . almost four in ten (respondents) felt that it (GJC) was described 'extremely/very well' by: 'is 100% pure juice'; 'is all natural'; 'contains nothing but grapefruit juice'; and 'has no artificial additives.'" Since GJC contains 50% or less real juice, some consumers were apparently confused. Confusion was also evident from the finding that a number of consumers also thought GJC was described "not very well/poorly" by "has sugar added" and "has water added." Again, since sweeteners and water are added to the grapefruit juice in GJC, some consumers seem to be confused.

Additional evidence of possible confusion between GJ and GJC can be found by examining the food diaries filled out by consumers participating in the Nielsen Marketing Research monthly survey of consumer purchases. Over the period from May through July,

1989, a little over 30% of the consumers surveyed described GJC as GJ (the uniform product code (UPC) for GJC was entered in the diary, but the product was described as juice).

The issue over confusion has important market efficiency implications. Some consumers apparently purchase GJ for specific health benefits. GJ is rich in vitamin C and potassium, and low in sodium. The health and nutrition aspects of grapefruit juice, along with taste and refreshment qualities of the product, have been focal points for both GJ and GJC advertising. Consumers who purchase GJC for its health benefit may very well be obtaining less nutrition than they realize. In addition, GJC costs more than GJ (the average prices of GJ and GJC over the period studied during 1987 to 1989 were \$3.95 and \$4.68 per single-strength gallon, respectively), so that consumers of GJC who purchase the product because they think it is pure juice are paying more for less.

MODEL AND DATA

A dynamic flow adjustment specification was used to analyze the demand for GJ and GJC (see Houthakker and Taylor for basic discussion of model; Tilley for an application in the area of citrus; and Capps for a recent application in studying meat demand). The demand equations for the model are

(1) $QGJ_t = f(QGJ_{t-1}, S_t, H_t, t, PGJ_t, PGJC_t, AGJ_t, AGJC_t)$,

and

(2) $QGJC_t = g(QGJC_{t-1}, S_t, H_t, t, PGJ_t, PGJC_t, AGJ_t, AGJC_t)$,

where QGJ and QGJC are per capita gallon sales of GJ and GJC, respectively, in retail grocery stores with total sales of \$4 million or more; t is a trend variable with t = 1 for week ending on March 7, 1987, t = 2 for week ending on March 14, 1987, etc.; S is a dummy variable for seasonality taking a value of one during winter: January, February and March;

H is a dummy variable taking a value of one for the holiday period from Thanksgiving through Christmas; PGJ and PGJC are real dollar-per-gallon prices of GJ and GJC, respectively; and AGJ and AGJC are advertising levels for GJ and GJC, respectively.[2]

The lagged variables QGJ_{t-1} and $QGJC_{t-1}$ are included in specifications (1) and (2) to capture habit/inventory effects (Sexauer; Phlips; Houthakker and Taylor). If the lagged variable has a positive (negative) effect on sales, consumer habits (inventory buildup) dominate. The trend variable t is included in the specifications to account for shifts in consumer preferences. The trend variable may also capture the effect of income to some extent, as income was generally increasing over the period studied. The variation in income (and the consequent, likely income effect), however, was quite small--real per capita income changed by only six-tenths of one percent over the period studied. The seasonality variable S is included based on previous research which indicates winter-summer sales patterns for citrus juice products (Myers and Liverpool; Brown and Lee). The holiday variable H is included, based on demand research on grocery-store sales indicating holidays are important in analyzing weekly scanner data (Capps). Own and cross effects for prices and advertising are measured through PGJ, PGJC, AGJ, and AGJC. In preliminary analysis, lag values for AGJ and AGJC were considered but did not fit the data well. Perhaps this result is related to the type of advertising analyzed--printed material in newspapers as discussed below. In a similar analysis, Capps did not include lagged advertising in his demand equations for meats. The type of data used (grocery-store scanner data) and the definition of advertising in the latter study were similar to the data and definition used in the present study.

The double log functional form of (1) and (2) with the quantity, price and advertising variables transformed to logarithms and the remaining variables left in original form fit the data well and was used in the present study. In this case, the coefficient estimates for the price, advertising and lagged variables are elasticities, indicating percentage changes in gallon sales for one percent changes in the explanatory variables. The double log specification has

been used in previous citrus juice demand studies by Ward and Tilley, Tilley, Ward and Davis, Brown, and Brown and Lee; Capps also used the double log form in his study of meats.

Weekly scanner data for retail grocery stores with annual sales for all products of $4 million or greater, provided by Nielsen Marketing Research, were used to estimate (1) and (2). Gallon sales of GJ in $4-million-and-greater grocery stores represent about 74% of total GJ gallon sales in all grocery stores. The time period studied was from March 1, 1987, to February 25, 1989, providing 104 weekly observations.

The raw data from Nielsen included sales for GJ and GJC in gallons and dollars; prices were obtained by dividing dollar sales by gallon sales. The Nielsen data also included information on advertising. The advertising variables were percentages of all commodity volume (ACV) dollar sales in the $4-million-and-greater stores subject to advertising of type a and/or b. Advertising of this type is comprised of printed material of 2 or more lines in newspapers. The advertising measures used provide an indication of how extensive or widespread GJ and GJC advertising was. Measures of the intensity of advertising were not available.

Data on the consumer price index (base period was 1982-1984) and the U.S. population from the U.S. Department of Commerce, Bureau of Economic Analysis and the Bureau of Census, respectively, were used to deflate prices and create per capita quantities.

Descriptive statistics for the basic variables analyzed are given in Table 1. Means and standard deviations in Table 1 are measured in levels as opposed to logs, for convenience.

RESULTS

Equations (1) and (2) were estimated by Zellner's method of seemingly unrelated regressions to take advantage of the contemporaneous correlation across equations. The

weighted R^2 for the system of equations was .86. The Durbin h statistics for equations (1) and (2) were .77 and 1.29, respectively, suggesting autocorrelation was not a problem.

The coefficient estimates for the two demand equations are reported in Table 2. All coefficient estimates are significant at the .05 level except the cross-price estimate in each equation, the cross-advertising estimate in the GJ equation and the intercept in the GJC equation. The effects of the lagged quantity variables are both positive, indicating consumer habits are important for GJ and GJC demand. The coefficient estimates for the lagged variables also indicate how much greater the long-run effects are than the short-run effects. The estimates in Table 2 indicate short-run effects; the long-run effects are found by multiplying the short-run effects times the reciprocal of one minus the coefficient estimate for the lagged variable. For GJ, the long-run effects are 1.29 times larger than the short-run effects; for GJC, the long-run effects are 2.79 times larger than the short-run effects.

The coefficient estimate for the dummy variable S is positive in each equation, indicating demand increases during the winter. The coefficient estimate for the dummy variable H is negative in each equation, indicating demand decreases during the Thanksgiving/Christmas holiday period. The trend variable estimate is negative in each equation; the time period studied, however, was relatively short and the direction of the trends in future is unclear. The own-price elasticity estimates are -.7 and -1.7 for GJ and GJC, respectively. (As this study is one of the first studies to analyze weekly scanner data for these two product forms, comparisons between the results of the present study and other studies are generally not very meaningful. Nevertheless, using monthly data from NPD Research, Brown estimated the own-price elasticity for GJ to be -.6, while Brown and Lee estimated own-price elasticities for GJ ranging from -.6 to -1.3, depending on product form, using bimonthly Nielsen data.)

GJ advertising has a positive and significant effect in both equations, indicating GJ advertising has a generic-type impact on the demand for both GJ and GJC. The positive

effect of GJ advertising on GJC demand is consistent with the claim that some consumers may incorrectly think that GJC is a 100% pure product. In this case, GJC may be capitalizing on the generic attributes of GJ by inclusion of the word "juice" in the product name and omission of percentage of real juice on the label. For GJ to capture more of the benefits of its own advertising, perhaps a clearer distinction between GJ and GJC needs to be made. Requiring a juice content declaration on product labels might help consumers in comparing products. With such a labeling requirement, GJ advertising focusing on the pureness of the product would, perhaps, be more effective with less spillover to GJC.

Although the estimated effect of GJ advertising on GJC demand is consistent with the claim that consumer confusion exists, the result does not provide conclusive evidence of confusion and could have an alternative interpretation. For example, GJC consumers could understand the differences between the alternative products and simply prefer GJC based on its mix of taste and nutritional attributes. In this case, GJ advertising may positively affect GJC demand simply because the advertising is a reminder of the attributes, common to both GJ and GJC, that GJC consumers value.

GJC advertising has a positive and significant effect on the demand for GJC, and a negative but insignificant effect on the demand for GJ. The direction of the effects are consistent with expectations for competitive, differentiated products. Moreover, since most advertising in the GJC segment is dominated by a single brand, the brand-type effects of GJC advertising are thus not surprising.

Finally, the insignificance of the cross-price elasticities are interesting with respect to the confusion issue. On first glance, the results may not appear to describe correctly the demands for two products that are seemingly close substitutes. One might interpret the results, however, as evidence of confusion in the market. For example, due perhaps to labeling confusion, some consumers may simply view an increase in the price of either product as indicating a general price change in the overall GJ-GJC category and not

substitute between products. Alternatively, as with the cross-advertising results, the cross-price results do not conclusively indicate confusion. Consumers may be aware GJC is not a pure juice, yet simply view GJC as a premium product (receiving a premium price as mentioned earlier) and not readily substitutable with GJ.

CONCLUSIONS

Theory tells that both own- and cross-advertising effects could be important in specifying demand. Empirical studies, however, often ignore cross-advertising effects, probably, in many cases, because of data limitations. The results of the present study show the importance of cross-advertising effects in one particular market, the market for GJ and GJC. The analysis is consistent with the contention that some consumers may be confused between GJ and GJC, and that requiring declaration of juice content on product labels along with generic advertising focusing on the purity of GJ product might increase the demand for GJ product. Such changes in product labeling could, perhaps, make GJ advertising more effective by capturing more of the benefits and reducing the spillover to GJC.

By itself, this study does not provide conclusive evidence of confusion between GJ and GJC. However, the results of this study together with the results of other studies on this topic suggest confusion in the grapefruit-juice market may very well be a problem for some consumers.

FOOTNOTES

[1]GJ in this paper refers to 100% pure juice.

[2]Equations (1) and (2) do not, of course, include all possible explanatory variables as the data analyzed are limited. Omitted variables that may be important include prices, and advertising and promotion for other juices and drinks, as well as other types of advertising and promotion for GJ and GJC themselves. The combined effects of omitted variables

provide a rationalization for the error terms for the two equations, and, as many of the omitted variables are common to both GJ and GJC, between-equation error terms are likely to be contemporaneously correlated. The estimation approach used in this study and discussed in the following section takes advantage of the correlation between error terms.

Table 1. Descriptive statistics of basic variables.[a]

Variable	Mean	Standard Deviation
QGJ*[b]	.555	.040
QGJC*[b]	.143	.019
PGJ*[c]	3.952	.098
PGJC*[c]	4.681	.095
AGJ*[d]	16.010	5.865
AGJC*[d]	7.212	4.083

*Asterisk indicates levels, as opposed to logs.

[a]Based on 104 weekly observations.

[b]Ounces per capita per week.

[c]Real prices--1982-84 dollars per gallon.

[d]Percentages.

Table 2. Seemingly unrelated regression estimates for the demand for grapefruit juice and grapefruit juice cocktail, based on weekly scanner data for March 1, 1987, through April 25, 1989.

Independent[a] Variable	Dependent Variable[a,b] QGJ	QGJC
CONSTANT	-3.163*[c]	-.449
	(-6.404)[d]	(-.0579)
LAG	.223*	.642*
	(3.961)	(15.784)
S	.032*	.056*
	(3.696)	(3.696)
H	-.086*	-.070*
	(-6.991)	(-3.602)
t	-.001*	-.001*
	(-8.263)	(-3.474)
PGJ	-.706*	.138
	(-3.564)	(.419)
PGJC	-.206	-1.685*
	(-.986)	(-4.748)
AGJ	.062*	.062*
	(5.004)	(2.955)
AGJC	-.008	.029*
	(-1.075)	(2.209)

Footnotes for Table 2

[a]QGJ and QGJC are logarithms of per capita gallon sales; lag is the lagged dependent variable; S and H are dummy variables for season: S = 1 for January through March, and H = 1 for the Thanksgiving-Christmas period; t is a trend variable with t = 1 for the week ending March 7, 1987, etc.; PGJ and PGJC are logarithms of the prices; and AGJ and AGJC are logarithms of the percentages of advertising. See equations (1) and (2) in text for more exact definitions.

[b]The weighted R^2 for the system was .86. For the initial ordinary least squares regressions, the R^2s were .83 and .86 for the GJ and GJC equations, respectively.

[c]Coefficient estimate. Asterisk denotes significance at the $\alpha = .05$ level.

[d]t-statistic in parentheses.

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