

# Commodity Advertising, Imports and the Free Rider Problem\*

by

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## Abstract

Advertising without supply control in the U.S. orange juice industry illustrates the import dimension of the free rider problem. Estimates of supply response to advertising are offered for "Florida-grown" orange juice, as well as for U.S. orange juice imports into both Florida and other U.S. ports.

## Introduction

Advertising in the U.S. food marketing system exhibits considerable diversity in terms of both form and function. Connor and Ward<sup>1</sup> note that advertising activities have a long history in the food system. Both producers and food marketing firms have funded media advertising efforts. Producers tend to support generic programs while food marketing firms fund individual brand promotions as well as generic promotions. Food manufacturers are among the nation's leading advertisers in terms of both total advertising and promotion as well as media advertising.<sup>2</sup> With the expanded popularity of checkoff programs, producers have also increased their market presence through generic commodity promotions. Currently there are 312 programs authorized under federal or state legislation or marketing orders generating over \$530 million of producer contributions for promo-

tional programs.<sup>3</sup>

A significant increase in producer check-off funds has occurred since 1982, primarily due to large mandatory programs for dairy, hogs and cattle. The Dairy Adjustment Act of 1983 generates about \$200 million of which about \$80 million finances an annual promotion effort by the National Dairy Promotion and Research Board, with the remaining \$120 million retained and used by local and regional dairy promotion organizations. Programs for cattle and hogs were initiated through legislation in 1985 and are subject to final approval by producer referenda. The hog checkoff program is expected to generate approximately \$20-25 million per year while the beef cattle program is expected to accrue funds in excess of \$70 million.<sup>4</sup> These large national mandatory programs in addition to ongoing federal and state programs such as Florida citrus will focus increased attention on generic commodity advertising.

While advertising generally focuses on the movement of the demand curve, commodity groups must also consider the behavior of the supply curve in response to advertising expenditures. As Rhodes<sup>4</sup> observes, when a competitive industry's advertising increases demand, the likely response is an increase in industry output and perhaps in the number of producers so that there may be little or no long-term increase in

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price or producers' profits. Ward and Chang<sup>5</sup> note that one characteristic of generic advertising is the free-rider concept, which is defined as the enjoyment of a certain benefit without actually paying for it. In the present context, free riders are those who benefit from a demand-enhancing commodity promotion program without contributing financial support. Thus, the free-rider problem is critical to commodity groups and their generic promotion efforts.

This paper focuses on the problem of advertising without supply control. Specifically, the objective of the analysis is to estimate the extent of the free-rider problem with respect to orange juice advertising expenditures.

### Advertising Program Perspective

Over a quarter-century ago, Nerlove and Waugh<sup>6</sup> identified and empirically analyzed the problem of advertising without supply control in the U.S. orange industry. They concluded, in part, that if orange production were held constant, the orange growers would find it profitable to spend more on advertising. The advertising emphasis of the U.S. orange industry has shifted from fresh to processed products (orange juice) while the supply control problem has expanded to imports from other countries. Thus, short-run supply responses to advertising expenditures continue to be of interest to the U.S. orange industry.

The Florida citrus industry uses a state-authorized mandatory excise tax or checkoff program to fund promotion, research, education and regulatory programs. The total advertising and merchandising program expenditures of the Florida Department of Citrus (FDOC) exceed \$40 million annually. In addition to the producer checkoff program, a second source of funds is generated by the Florida import equalization excise tax.<sup>7</sup> Thus, the Florida orange industry has attempted to eliminate the free-rider problem with respect to orange juice advertising. With 70 percent of U.S. orange production, over 90 percent of the juice extracted from domestic oranges, and over 80 percent of U.S. orange juice imports entering through Florida ports (subject to Florida advertising tax) as recently as the 1982-82 season, the free-rider problem appeared to be manageable.

A number of events and trends have occurred during the 1980s which have implications for advertising in the U.S. orange juice industry. Four major freezes in Florida during the first half of the decade cut orange production in half and significantly reduced orange

juice supplies. U.S. imports of orange juice into both Florida and non-Florida ports increased dramatically from 127.8 million single-strength equivalent (SSE) gallons in the 1977-78 season to 596.6 million SSE gallons in the 1984-85 season, declining to an estimated 275 million gallons in 1986-87. During this period, the portion of U.S. orange juice imports entering through Florida ports decreased from 83 percent to 46 percent.<sup>8,9</sup>

Two trends associated with the increase in orange juice imports into non-Florida ports are of interest. First, U.S. ready-to-serve or chilled orange juice (COJ) sales have nearly tripled since 1975-76. Second, there has been a dramatic increase in the packaging of COJ by dairies located in the major markets, primarily along the East Coast.<sup>7</sup> Generally, frozen concentrated orange juice (FCOJ) is not packaged outside of Florida due to the level of investment required for freeze tunnels. As Florida orange production returns to pre-freeze levels and imports continue to circumvent Florida ports, the impact of demand-expanding advertising programs on orange juice from Florida and imports gains new significance.

### Data and Methodology

To estimate the extent of the free-rider problem, a model is required that permits estimation of retail demand elasticities, wholesale-import-retail price transmission coefficients, and the derived demands for Florida orange juice and imported orange juice. One independent and two potentially intersecting sets of decision makers are encompassed by the model. The independent set of decision makers are households which determine how much orange juice is purchased in retail stores. The other two sets consist of retailers and processors/importers. Retailers must decide how much to charge consumers for orange juice, how much to buy from non-Florida importers to reprocess, and how much to buy directly from Florida firms.

The endogenous variables are per capita consumer orange juice purchases in all product forms, the composite retail price for all product forms, per capita quantities of orange juices imported through Florida ports and other U.S. ports, per capita Florida FOB orange juice movement, the composite Florida orange juice FOB price, and the beginning Florida orange juice inventory. These variables represent the composite results of the simultaneous interactions among the decision makers in the model.

Exogenous variables are personal disposable income, advertising expenditures, lagged per capita consumer orange juice purchases, the prices of orange juice imports through Florida ports and other U.S. ports, seasonality, a time trend, and Florida crop size estimates.

The data used to estimate the model are from several sources. Retail demand and price information is provided by A.C. Nielsen Company through a contract with the Florida Department of Citrus. FOB movement, exports, price, and inventory information is obtained from the statistical reports published by the Florida Citrus Processors Association. Crop forecasts are collected from reports by the Florida Agricultural Statistics Service. Generic and brand advertising expenditure data were obtained from LNA reports. Import information is obtained from reports by the U.S. Department of Commerce. Bimonthly demand and supply information for the period from December/January 1978 through August/September 1986 were used.

### Estimated Advertising Impacts

#### *Structural Coefficients*

Structural coefficient parameters were estimated using three-stage least squares. It is assumed that advertising has current and lagged impacts on the consumer demand for orange juice. It is also assumed that the current effect is the strongest, and that it persuades consumers to form an orange juice consumption habit which diminishes over time unless it is reinforced by more advertising messages. The partial adjustment model proposed by Houthakker and Taylor<sup>10</sup> was used to measure the habit of orange juice consumption. Results are shown in Table 1.

In the retail demand equation, both brand and FDOC advertising expenditure parameter estimates had the expected sign. The model indicates that if FDOC advertising expenditure is increased (decreased) by one million dollars per bimonthly period, the demand for orange juice would increase (decrease) by 8.24 gallons per 1,000 persons per bimonthly period. The parameter estimate for lagged consumer demand indicates habit-type dominance which means that the short-run price response (-.29) is smaller than the long-run, fully adjusted price response (-.80). The length of the adjustment period is about 6.5 bimonthly periods.

Estimates of the price transmission relationship between the import and FOB levels and

the retail level indicate that the retail price is positively related to Florida FOB prices and non-Florida import prices. Imports through non-Florida ports are estimated to be positively related to Florida FOB price and consumer demand. For every 100 gallon increase in consumer orange juice purchases per 1,000 persons, non-Florida imports would increase by 72 gallons. Imports of orange juice entering through Florida ports were not responsive to either import price or to Florida FOB price. However, Florida imports were sensitive to Florida crop size and seasonality. These results indicate that Florida imports of orange juice were used to supplement reduced supplies due to freeze damage.

Estimates of Florida wholesale movement indicate that the demand for Florida orange juice is negatively related to Florida FOB price and positively related to retail demand. Results indicate that if consumer demand for orange juice is increased by 100 gallons per 1,000 persons per bimonthly period, the demand for Florida orange juice would increase by 60 gallons. This increase is smaller than the 72 gallon increase for non-Florida imports. Note that the sum of the increases in non-Florida imports and Florida FOB movement is greater than the 100-gallon increase in consumer demand. This is because the institutional sales of orange juice were not reported by A. C. Nielsen Company (it is believed that A. C. Nielsen estimates represent about 75 percent of total U.S. orange juice sales).

The implication of this result is that if media advertising or promotional activities are used to increase consumer demand for orange juice, the increased retail demand would generate a stronger demand for non-Florida imports than for orange juice from Florida. However, whether Florida benefits from its investment in industry and brand advertising requires further analysis.

#### *Dynamic Analysis*

The coefficient estimates of the reduced form equations were derived from the structural estimates and are provided in row one of Table 2. A particular reduced form coefficient indicates the effect of a change in a predetermined variable on an endogenous variable. This effect takes account of the interdependencies among the current endogenous variables. Economists call such coefficients "multipliers." In contrast, a structural coefficient indicates only the direct effect of a change in a predetermined variable.

**Table 1**  
**Structural Parameter Estimates,**  
**December/January 1978 through April/May 1986**

	Equation						
	(1) RQ	(2) RP	(3) UIMQ	(4) FIMQ	(5) FMV	(6) FOBP	(7) OH
<b>Endogenous Variable</b>							
Retail demand (RQ)	-1.000		0.7184 (0.2303)		0.6003 (0.2529)		
Retail price (RP)	-149.9503 (34.2024) <sup>a</sup>	-1.000					
Non-Florida imports (UIMQ)			-1.000				
Florida imports (FIMQ)				-1.000			.0030 (.0019)
Florida movement (FMV)					-1.000		
Florida FOB price (FOBP)		0.5570 (0.1487)	372.4854 (151.5570)		-275.1266 (148.4131)	-1.000	
<b>Predetermined Variable</b>							
Constant	355.2557 (90.2644)	0.5216 (0.0702)	-600.0560 (212.8277)	575.1055 (34.6556)	568.3208 (231.3100)	0.8542 (0.0911)	-.7968 (1.0878)
Lagged RQ (RQ <sub>t-1</sub> )	0.6353 (0.0722)						
Per capita income (INC)	7.3877 (9.6256)						
Brand Advertising (ADB)	3.0202 (2.7089)						
FDOC Advertising (ADG)	8.2448 (5.5668)						
Non-Fla. import price (UMIP)		0.6409 (0.1531)					
Florida import price (FIMP)						0.6419 (0.1089)	
Florida crop size (FCZ)				-2.2648 (0.1933)		-0.0016 (0.0003)	.0084 (.0044)
Lagged inventory (OH <sub>t-1</sub> )						-0.0143 (0.0076)	
Time trend (TIME)						-0.0022 (0.0007)	
Dec/Jan (S1)	-0.2029 (5.8337)			-35.1099 (20.7963)	52.9022 (27.5410)		.9313 (.1962)
Feb/Mar (S2)	-16.1766 (6.1325)			-92.4986 (20.3159)	-16.3832 (26.5948)		1.2126 (.2481)
Apr/May(S3) (S3)	-28.7446 (5.9316)			-116.8502 (20.3352)	-56.6712 (26.6046)		2.0890 (.2833)
Jun/Jul(S4) (S4)	-40.0164 (5.6804)			-121.0019 (20.3626)	6.6410 (28.1000)		1.9141 (.2935)
Aug/Sep (S5)	-11.0960 (6.2443)			108.3427 (20.3481)	15.7229 (27.1378)		.9231 (.2737)

<sup>a</sup>Standard error of the estimates.

**Table 2**

**Estimated Delay Multipliers and Cumulative Multipliers  
For Generic Advertising Expenditure**

Bimonthly Period	Florida FOB Movement		Non-Florida Imports	
	Delay	Cumulative	Delay	Cumulative
	----- Gallons per 1,000 Persons/Million Dollars Increase -----			
1 <sup>a</sup>	4.9491	4.9491	5.9232	5.9232
2	3.1441	8.0931	3.7629	9.6861
3	1.9974	10.0905	2.3905	12.0766
4	1.2689	11.3594	1.5187	13.5953
5	.8061	12.1655	.9648	14.5600
6	.5121	12.6776	.6129	15.1729
10	.0834	13.4243	.0998	16.0667
15	.0086	13.5546	.0103	16.2225
20	.0009	13.5680	.0011	16.2387
30	.0000	13.5696	.0000	16.2405
∞	.0000	13.5696	.0000	16.2405

<sup>a</sup>Reduced-form Parameter Estimates

The results indicate that lagged consumer demand has a positive impact on current consumer demand (as discussed previously, this is a habit effect). This increased demand is supplied by both non-Florida imports and orange juice from Florida. Coefficient estimates show that non-Florida imports would supply 54 percent of the increased consumer demand and the rest would come from Florida. Similar results can be found for the impact of FDOC advertising on consumer demand and on non-Florida imports and shipments from Florida. (See the first row in Table 2.)

Some of the most interesting applications of estimated structural models are concerned with their dynamic aspects. In the consumer demand and Florida FOB price equations, the predetermined variables included lagged consumer demand and lagged inventory variables, respectively; thus the model is dynamic in nature. The model results can be used to estimate the time path of the endogenous variables. For example, the structural coefficient estimate in Table 1 indicates that if the FDOC media advertising expenditure is increased by one million dollars, the consumer demand would increase by 8.24 gallons per 1,000 persons. Furthermore, the consumer demand in period *t* will increase non-Florida imports and orange juice shipments from Florida during the same period and the consumer demand in period *t*+1. There-

fore, any change in FDOC advertising expenditures in period *t* will have an impact on current and future consumer demand, non-Florida imports, and the quantity of orange juice shipped from Florida. In order to study the impact of FDOC media advertising on the quantity of non-Florida orange juice imports and the quantity of orange juice shipped from Florida, the delay multipliers and cumulative multipliers<sup>11</sup> for the FDOC advertising expenditure variable are computed and presented in Table 2.

The delay multipliers in Table 2 give the time path of changes in non-Florida imports and Florida FOB movement, given that FDOC media advertising expenditure is raised by one million dollars in a bimonthly period and then restored to its original level. Estimates indicate that if FDOC advertising expenditure is increased by one million dollars in period 1, non-Florida imports and Florida FOB movement would increase, respectively, by 5.92 and 4.95 gallons per 1,000 persons in period 1; by 3.76 and 3.14 in period 2; and so on.

The cumulative multipliers in Table 2 give the current and future values of the change in non-Florida imports and Florida FOB shipments given that FDOC media advertising expenditure is raised by one million dollars in a bimonthly period and then sustained at its new level, other things held constant. The cumulative multipliers

suggest that non-Florida imports and Florida movement would increase, respectively, by 5.92 and 4.95 gallons per 1,000 persons in period 1; by 9.69 and 8.09 in period 2; etc., and finally reach a new equilibrium which is 16.24 and 13.57 gallons per 1,000 persons, higher than the original levels.

Cumulative multipliers can be used to estimate the economic impact of FDOC media advertising on Florida FOB revenue. The impact of FDOC advertising can be obtained by multiplying the sample average of Florida FOB price (\$.7244) by the cumulative multiplier for the FDOC advertising variable (13.5696) and by population. Similar results can be obtained for the free benefits received by non-Florida imports (its cumulative multiplier equals 16.2405 and the average non-Florida price for the sample period equals \$.3030 per gallon). Results indicate that marginal returns of FDOC media advertising expenditure, i.e., the return for an increase of one million dollars from the current level, are \$2.28 million and \$1.14 million, for Florida wholesalers and non-Florida importers, respectively. Note that the cumulative multipliers for non-Florida imports are larger than those for Florida FOB movement; however, the price for non-Florida imports is about half of the Florida FOB price, therefore the estimated dollar revenue return from FDOC media advertising for non-Florida importers is lower than that for Florida wholesalers.

### Conclusions

The uniqueness of the Florida orange juice production and marketing system, in terms of supply control, has been altered by expanded production in other countries and resulting imports. This transformation has been aided by changes in product form demand, technology, transportation costs and infrastructure.

Demand expansion through advertising of Florida orange juice has resulted in increased orange juice imports through non-Florida ports as well as increased Florida FOB movement. In response to a sustained increase in FDOC media advertising expenditure of one million dollars per bi-monthly period, non-Florida orange juice imports and Florida FOB movement would be expected to increase 16.24 and 13.57 gallons per 1,000 persons per bi-monthly period, respectively. Non-Florida imports are more responsive than Florida FOB movement to Florida orange juice advertising. Thus, on a volume basis, free riders appear to benefit more from the Florida orange juice advertising program than do Florida

orange growers.

In terms of revenue, estimates indicate that Florida orange growers receive a positive return on their advertising investment as measured at the FOB level. The return to Florida orange growers (FOB level) for an additional one million dollar FDOC media advertising expenditure is estimated to be \$2.28 million compared to a \$1.14 million benefit to non-Florida importers. The estimated revenue for non-Florida importers is lower than that for Florida wholesalers because the price for non-Florida imports is about half of the Florida FOB price.

### Implications

While the Florida orange juice industry receives positive benefits from Florida Department of Citrus advertising expenditures, the free rider problem is substantial. Industry concern centers around: (1) equity question concerning advertising program benefits accruing to non-Florida orange juice importers in the absence of program contributions; and (2) the reduced advertising programs benefit received by the orange juice industry as the result of non-Florida imports which are not subject to the Florida orange juice advertising tax. Clearly, the free rider problem as manifested through non-Florida orange juice imports is beyond the control of the Florida commodity advertising program. As such, the citrus industry may wish to consider the possibility of a national advertising tax which would assess all domestic production as well as all orange juice imports.

The demand expansion associated with the Florida orange juice advertising program in conjunction with non-Florida orange juice imports has had an impact on the industry structure and distribution channel of the U.S. orange juice market. There are implications of the orange juice example for other commodities in the U.S. food system. As agricultural producers at both state and national levels initiate or expand commodity promotion activities, attention may need to be given to imports. Unless provisions for imposing advertising taxes on imports are implemented, successful demand expansion programs may encounter free rider problems in the form of imports. The free rider import issue is best addressed before vested interests are firmly established.

Producers of several commodities which enjoy a degree of protection from imports, such as beef, pork and dairy, are currently expanding their generic advertising programs. However,

supply control through import restrictions may be subject to erosion as the trend toward free trade gains momentum. Thus, the relationship between commodity advertising/demand expansion, and free rider imports may become a very real issue for many commodity groups in the near future.

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