

# **Evaluating Advertising Using Split-Cable Scanner Data: Some Methodological Issues**

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**Abstract**

Relatively new split-cable scanner data collection methods have facilitated controlled market tests of household responses to food commodity promotion. Analysis of such data from a fresh-beef advertising experiment in Grand Junction, Colorado, showed that although experimental advertising failed to increase the level of demand, it did appear to influence feature-price buying patterns. There was an increase in demand for beef over the advertising period, unrelated to the effects of the experimental advertising itself.

## Introduction

Recent changes in data collection methods have facilitated controlled market tests of household responses to food commodity promotion. The use of scanner checkout systems in stores now provides an opportunity for detailed tracking of food purchases by individual test participants. In principle, this capability can be combined with experimental control of the circulation of test advertisements to produce household purchase data sets useful for assessing the effects of advertising. While some use has been made of store-level scanner data in the evaluation of promotions (e.g., Capps 1988), evaluations based on household-level data collected in an environment characterized by experimental control of the test advertising are rare (e.g., Little 1986). Because these data bases have become available only recently and because agricultural economists' use of them has been limited, it is worthwhile to review their nature and potential for the evaluation of commodity promotions.

The following section provides a general review of split-cable scanner data collection systems, one recently developed technique for evaluating the effectiveness of television advertising of food products. The next section describes a particular application involving a fresh beef advertising experiment in Grand Junction, Colorado. The concluding section assesses the applicability of the findings of this isolated experiment to the evaluation of livestock commodity promotion in general.

### Overview of Split-Cable Scanner Data Collection Systems

The use of the split-cable scanner technique to evaluate the effectiveness of television advertising of grocery store items has become popular recently. This technique requires the participation of several hundred subject households and a high percentage of the retail grocery outlets in a test market city. All subject households are connected to a cable TV system with advertising that can be controlled on a household-by-household basis. Households can be divided between a control panel that sees none of the test advertising, and one or more experimental panels that view the advertising at different levels of intensity. In principle, the records of subject household purchases of the targeted good, during and after the test broadcast period, contain information regarding the effectiveness of the experimental advertising.

The technique utilizes a unique method for accurate compilation of these household purchase records. Each cooperating store is equipped with Universal Product Code (UPC) scanners. When the panel household member is ready to check out, an identification card presented to the checkout clerk activates a link to the service's computer, entering household identification and complete purchase information (product, volume, price), all electronically read by the UPC scanner. The information is automatically transmitted and used to update the household's purchase record file. The recorded purchases of the targeted good, evaluated in light of the economic and demographic data collected from each panel household, thus enable an analyst to separate

statistically the effect of the experimental advertising from the effects of numerous other household demand determinants.

There are three main attributes of split-cable scanner data bases that account for their appeal in assessing the effects of advertising campaigns. First, the method for generating these data bases involves a controlled experimental setting. Therefore, at least in principle, it allows the analyst a flexibility in experimental design that is unavailable in studies relying on historical demand data. For example, the monitoring period can be divided between "pretest" and "broadcast" periods in an optimal manner. The media plan for the experimental ads can be designed to enable inferences about subtle effects of ad timing and intensity of presentation. In particular, by subjecting different experimental panels to different, judiciously chosen patterns of advertising exposure, the analyst can investigate threshold effects in ad exposure, day-part timing effects, saturation levels, message decay rates, effects of changes in ad copy, and many other factors affecting advertising impact.

Second, split-cable scanner data bases enable analysis at the household level. This approach produces many more observations on consumer behavior than would be available for studies using demand data aggregated across households (for example, by store or geographic area), at a level consistent with traditional economic models of individual consumer behavior. The household level approach provides the opportunity to control explicitly for the effects of a variety of household characteristics, other than advertising exposure, that

influence demand for the targeted commodity. Thus, information on household income, size, race, residence type, age, employment status, occupation, education, and home appliance ownership are available for the analyst's use in modeling and estimating demand relationships.

Third, the purchase records that result from scanner data collection exercises can be extremely detailed, including information on the specific type of product, the price of each individual purchase, and the precise time of purchase. Given the great amount of available data, extensive aggregation is necessary. Nonetheless, it is beneficial to have the data in disaggregated form to begin with, because it allows the analyst to tailor quantity aggregates to the objectives of the particular project and to construct price indices in theoretically defensible ways.

There are disadvantages to the use of scanner data, however. One obvious problem with the split-cable scanner method is that the control for test advertising exposure is not perfect. For example, there is no assurance that experimental panel household members have actually watched the test ads. Of course, almost any practical method for the control of ad circulation would be plagued by similar problems. This data collection method also admits the possibility of systematic under-reporting of purchases since participants may fail to use their panel ID cards when shopping, or they may shop in nonparticipating stores. Moreover, only purchases for at-home food consumption are recorded.

These drawbacks are relatively minor, however, compared to the most significant problem with the split-cable scanner method for evaluating



TV advertising effectiveness: the design and implementation of this type of marketing experiment is very costly. Consequently, it generally will be prohibitively expensive to take significant advantage of the opportunities for experimental design. For example, only under rare circumstances would the expected benefits of promotion evaluation justify the costs of tailoring the selection and use of household panels to the needs of any one investigation. The test marketing service, therefore, rather than the client, would assemble the test panels with the intention of eventually using them in a number of experiments involving a variety of products or generic commodities. The panel selection criteria then would be those of the test marketing service; such criteria may or may not coincide with the specific interests of the client.

The relatively high cost of data collection may necessitate other compromises in the method of analysis as well. For example, the requirement that a high percentage of the area's grocery stores be recruited for the study normally limits available test markets to small cities. Cost considerations may overwhelm the benefits of tracking household behavior over an extended period and lead to an experiment of only a few months' duration, confining the analysis to short-term advertising effects. Finally, the incentive to economize on setup costs creates a temptation to stage more than one promotion test simultaneously. Under such circumstances, it could be difficult for the analyst to identify separately the effects of feature price, newspaper ad, and point-of-purchase promotions for the targeted good, or the

indirect, contaminating effects of experimental promotions of substitute or complementing goods.

### A Sample Advertising Experiment

A recent advertising experiment for fresh beef provides an example of the use of split-cable scanner data collection systems. A market research firm, Information Resources, Inc. (IRI), used such a setup to conduct a test of television advertising for fresh beef in Grand Junction, Colorado, between October 1985 and July 1987. The resulting "Behavior Scan" data set was compiled using 2,500 participating households with the cooperation of stores accounting for more than 90 percent of the actual cash grocery volume in the Grand Junction area.

The television advertising campaigns that were the basis of the experiment began in January 1986, following a four-month pretest monitoring period (Figure 1). In phase one of the test, two experimental panels, a "heavy ad" panel and a "base ad" panel, were exposed to different intensities of the "Beef Gives Strength" campaign. A third, control panel received no exposure to the advertisements. The heavy ad and base ad panel exposure levels were chosen to correspond to the intensities of hypothetical national campaigns costing \$30 million and \$12 million per year, respectively. In January 1987, the heavy ad and base ad panels were merged into a single ad panel, and the test advertising copy was changed to the "Real Food for Real People" campaign. During phase two of the test, the period between January and July 1987, the ad panel received exposure at a level consistent with a

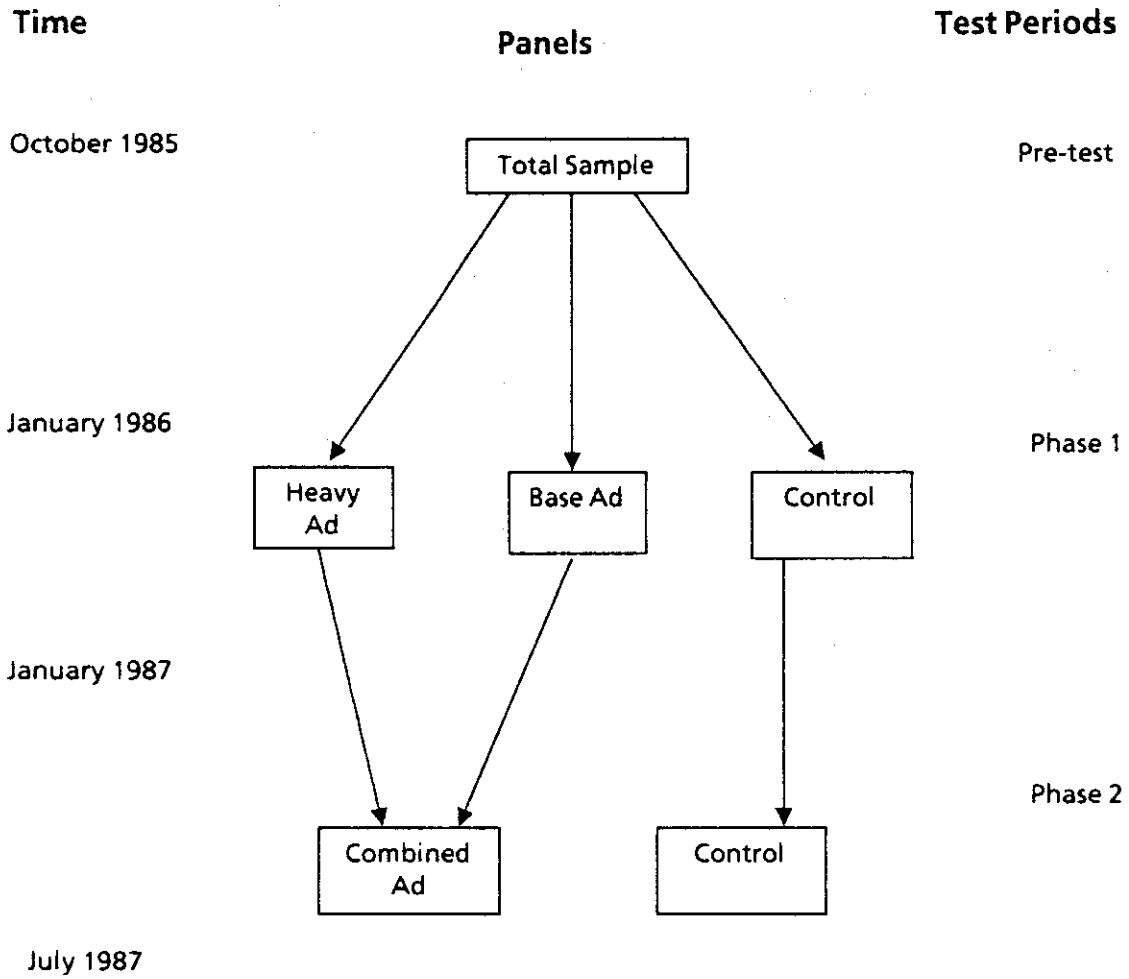


Figure 1. Experimental design for beef advertising Grand Junction, Colorado

nationwide expenditure of \$20 million per year. Again, the control panel households viewed none of the test ads. Table 1 shows the panel's average consumption of fresh beef during each of the test periods.

### **Model Specification**

A single-equation, linear demand model was used to explain the panel households' fresh beef purchases. The dependent variable measured the seasonally adjusted quantity of fresh beef purchased by each household in each of the 23 four-week demand periods that comprised the sample. Among the independent variables were those reflecting household composition, income, demographic characteristics, age of household head, employment status of household head, occupation of household head, education, average quality of beef cuts purchased by each household, proportion of beef purchased at feature prices, beef price, and prices of substitutes (pork and poultry).

These variables are described in detail in Schroeter (1988). Additional independent variables were introduced to capture advertising impacts and any not otherwise explained effects of the phase of the experiment. Each of these variables is defined as equal to one for observations in which the household and demand period meet the listed criteria, and as zero otherwise:

- AD\_EFT11 = base ad panel, phase one;
- AD\_EFT12 = base ad panel, phase two;
- AD\_EFT21 = heavy ad panel, phase one;
- AD\_EFT22 = heavy ad panel, phase two;
- PHASE1 = control, base ad, or heavy ad panel, phase one;
- PHASE2 = control, base ad, or heavy ad panel, phase two.

For example, AD\_EFT11 is a dummy variable equal to one for observations corresponding to base ad panel households, but only in those periods during phase one of the ad test. The coefficient of this variable will measure the difference between the beef purchases of a representative base ad panel household and an otherwise comparable control panel household during phase one of the test. It can therefore be interpreted as that portion of the effect of the base panel's exposure to experimental advertising that was realized in phase one. Likewise, the coefficient of AD\_EFT22 is the portion of beef demand by heavy ad panel households during phase two that can be attributed to those households' cumulative exposure to advertising in phases one and two.

If advertising has had a positive impact on the level of demand, the coefficients of the AD\_EFT variables should be statistically significant and positive. If an accumulation of advertising exposure over time enhances demand, the coefficients of AD\_EFT12 and AD\_EFT22 should be greater, respectively, than the coefficients of AD\_EFT11 and AD\_EFT21. If the intensity of advertising exposure at a point in time generates a lasting positive stimulus to demand, the coefficient of AD\_EFT21 should be greater than the coefficient of AD\_EFT11, and the coefficient of AD\_EFT22 should be greater than the coefficient of AD\_EFT12. On the other hand, negative or statistically insignificant estimates of these parameters will constitute evidence that the experimental TV advertising has not had the intended effect on the level of household demand for fresh beef.

PHASE1 is a dummy variable equal to one for all observations corresponding to demand periods in the first phase of the test. Its

coefficient reflects any change in purchases between the pretest and phase one period that is common to households of all panels and unexplained by other independent variables (prices, for example). Similarly, the coefficient of PHASE2 represents any not otherwise explained, panelwide differences in consumption between the pretest and phase two periods.

### **Estimation and Results**

The sample of households was limited to those who used their panel identification cards with reasonable regularity. Further curtailment was necessary because some households provided incomplete demographic information or, as in the case of one household, reported monthly beef purchases that were extreme outliers in the sample distribution. The remaining 1,788 households constituted a sample that was reasonably representative of national norms in its fresh beef purchase behavior and its demographic composition. Pooling of the time series of data for each household produced a total of 41,124 observations (23 four-week demand periods times 1,788 households).

The error components model was used for the stochastic specification of the fresh beef demand equation; that is, coefficients of the explanatory variables were treated as constants, while household-specific intercept terms were regarded as random drawings from a distribution characterizing the population at large. The method of feasible generalized least squares was applied using standard procedures for estimating the variances of the error components (Judge et al.

1982). The model performed satisfactorily, with  $R^2$  significant at the 0.01 percent level and estimated coefficient signs generally as expected. A Chow test verified that the hypothesis of "no behavioral differences across panels" (other than any attributable to the AD\_EFT variables) could not be rejected at conventional significance levels.

One important validation of the model is provided by the results concerning own- and cross-price demand elasticities. Evaluated at the sample means, the estimates of elasticities of demand for fresh beef with respect to the prices of beef, pork, and poultry are -0.51, 0.48, and 0.33, respectively. These figures, all significant at the 1.5 percent level or better, are roughly consistent with estimates obtained by others (e.g., Chavas 1983).

The main objective of the estimation was the evaluation of the demand effects of the experimental television advertising. Here, there is no evidence of a positive impact on the level of demand: the point estimates of the coefficients of the AD\_EFT variables are all negative; one of them, the coefficient of AD\_EFT22, is negative with a marginal significance level of 6 percent (Table 2).

Factors related to the time periods during the experiment are indicated by the estimated effects of the PHASE variables. Although the coefficient of PHASE1 was statistically insignificant, the coefficient of PHASE2 was statistically significant and positive. During the phase two ad test period (January through July 1987), for reasons not attributable to any other explanatory factor represented in the model, household consumption was 0.28 pounds per month higher on average than

in either the pretest or phase one, post-test periods. While the model offers no guidance in interpreting this difference, one possibility is that the continual growth in nonexperimental advertising (for example, the beef advertising distributed to all households through national radio and print media) began to have a significant positive impact on demand in this period.

### **Alternative Forms for the Advertising Effect Variables**

In each phase of the test, the experimental advertising was distributed in a manner consistent with customary industry practices: broadcasts were concentrated within advertising "flights" of from four to six weeks, separated by hiatus periods of two weeks or more. However, the form of the AD\_EFT variables in the demand model implies that any effects of advertising on the level of household demand, while possibly different between the phase one and phase two periods, are constant within each phase. Thus, the model was not sufficiently general to admit the plausible hypothesis that consumer responses to advertising might differ between broadcast and hiatus periods.

A slightly modified demand model was used to investigate whether advertising effects differed between the broadcast and hiatus periods. First, the AD\_EFT variables were redefined:

For  $j$  and  $k = 1$  and  $2$ ,  $AD\_EFT_{jk}_{it}$  = a dummy variable equal to one for households in the corresponding panel ( $j = 1$ , base ad;  $j = 2$ , heavy ad) during broadcast periods in phase  $k$ , and equal to zero otherwise.



The coefficient of the redefined AD\_EFT11 variable, for example, represents the effect of advertising on base ad panel households during those phase one periods in which the base ad panel actually was exposed to advertising.

Second, variables AD\_HIAT1 and AD\_HIAT2 were introduced to capture behavioral differences during advertising hiatus periods. These new variables were defined as follows:

$AD\_HIAT1_{it}$  = a dummy variable equal to one for base ad panel households in hiatus periods and equal to zero otherwise.

$AD\_HIAT2_{it}$  = a dummy variable equal to one for heavy ad panel households in hiatus periods and equal to zero otherwise.

As these variables are defined, the coefficients of AD\_HIAT1 and AD\_HIAT2 will reveal, respectively, the base and heavy ad panel members' responses to hiatus periods.

The demand model was estimated with the redefined AD\_EFT variables and the new AD\_HIAT variables. The results (Table 3) suggest that the base ad panel's negative response to advertising during phase one was the net result of a small, but positive and marginally significant (significance level = 35 percent), response during the broadcast periods of phase one, which was more than offset by a negative and statistically significant response during the hiatus periods of phase one. However, for the base ad panel during phase two and for the heavy ad panel during phases one and two, the responses appear to be negative during

broadcast periods as well as hiatuses. In fact, the heavy ad panel's response during the broadcast periods of phase two was significantly negative at the 6 percent level. Thus, while closer examination uncovered modest evidence of a small, positive test advertising effect, this effect was limited to base ad panel households and to broadcast periods during phase one. Moreover, even this small positive effect appears to have been more than offset by subsequent negative effects during hiatus periods.

#### **Advertising Effects on Expenditures Made at Feature Prices**

An alternative means of promoting fresh beef and other meats is feature pricing, placing a particular meat item at a "featured" price in the store display and often in newspaper ads. Using the scanner data it was possible to investigate the determinants of household use of feature-price opportunities by estimating a linear model in which the dependent variable was  $PROP\_FT_{it}$ , the proportion of household  $i$ 's beef budget in period  $t$  that was spent at feature prices. The independent variables were the same as those for the previous analyses. The  $AD\_EFT$  and  $AD\_HIAT$  variables were as defined earlier. As an aid in interpreting the magnitudes of the estimated coefficients, note that the mean values of  $PROP\_FT$  for the pretest, phase one, and phase two periods are 0.323, 0.285, and 0.195, respectively. The model was estimated as before, and the results are reported in Table 4.

Advertising effects on the proportion of meat purchased at feature prices are revealed by the coefficients of the  $AD\_EFT$  and  $AD\_HIAT$  variables. The strongest responses to advertising were tendencies by members of both ad panels to increase their proportionate use of

feature prices during the broadcast periods of phase one. There also was some tendency, at least among heavy ad panel members, to cut back on feature-price buying during hiatus periods. In sum, advertising appears to have induced more feature-price buying, presumably an unintended effect. This finding must be interpreted with caution, however, since the analysis of the determinants of feature-price buying is preliminary. Data limitations made it impossible to control for changes through time in the number of feature prices offered by retailers or for the magnitudes of the differences between "feature" and "regular" prices. If advertising does stimulate feature-price buying, it may be because advertising, in some way, creates a consumer perception of beef as a good value. At a minimum, the results suggest an important connection between advertising and feature-price buying worthy of further study (see Capps 1988).

#### Implications and Summary

In summary, split-cable scanner data offer new opportunities for examining the effects of advertising on consumer demand in an experimental setting. In practice, the experimental design is difficult to fully implement and, in some cases, may limit the interpretation of findings. In the example discussed (a fresh beef television advertising experiment in Grand Junction, Colorado), the experimental advertising failed to increase the level of demand but did appear to influence feature-price buying patterns.

How generalizable are these conclusions about advertising's effects on beef demand? Examination of the distributions of economic and

demographic characteristics within the test panels indicates that the sample was reasonably representative of national norms. The samplewide average consumption figure conformed closely to comparable statistics from the USDA's 1985/86 Continuing Survey of Food Intake by Individuals (USDA 1987). Moreover, results not reported here confirm the conclusions for certain demographic subgroups of the sample households (see Schroeter 1988). These observations suggest that the findings are generalizable to other populations in other areas of the country. Whether or not they are generalizable with respect to alternative advertising copy is another matter. Obviously, other messages may have been more effective or more convincingly counterproductive.

Finally, these findings must be interpreted in light of the magnitude of the task confronting would-be commodity promoters. Television advertising is likely to be most effective when it is for branded household products, particularly when the ad campaigns accompany such significant market events as the introduction of a new brand or an areawide feature-price offer. In such cases there is potential for relatively large, prompt effects, since sales can increase at the expense of the market shares of rivals' close substitute brands. These impacts should be easily discernable using split-cable scanner research means, even if cost considerations limit the experiment to a modest, affordable scope.

Using promotions in an attempt to increase total demand for a generic commodity, such as fresh beef, is a more ambitious undertaking, however. Success in such an endeavor requires that consumers'

long-standing attitudes about familiar food products be changed. The consumption impact of such attitude changes would be realized through substitution among different products rather than among different brands of the same product. Therefore, any effects are likely to be much more subtle and to take longer to appear compared to those associated with branded product advertising. The compromises in split-cable scanner experimental design necessitated by high cost make the analyst's efforts to discern these subtle effects very difficult.

Table 1. Panel average consumption of fresh beef (seasonally adjusted pounds per four-week period per household) and percentage changes between periods

	Control	Base ad	Heavy Ad
Pretest	5.619	5.582	5.575
	+6.763%	+5.500%	+4.861%
Phase 1, ad test	5.999	5.889	5.846
	-2.000%	-0.611%	-5.748%
Phase 2, ad test	5.879	5.853	5.510

Source: IRI Behavior Scan Data, Grand Junction, CO (October 1985-July 1987).

Table 2. Results of estimation of the demand model (AD\_EFT and PHASE parameters only). Dependent variable = seasonally adjusted household purchases in pounds per four-week period. Mean = 5.79

Variable	Parameter Estimate	Standard Error	Marginal Significance Level (%)
AD_EFT11	-0.10	0.19	59.03
AD_EFT12	-0.07	0.20	72.57
AD_EFT21	-0.13	0.17	43.22
AD_EFT22	-0.36	0.18	5.32
PHASE1	0.02	0.14	90.30
PHASE2	0.28	0.16	6.92

F-value = 97.79      Significance level for F-value = 0.01%       $R^2 = 0.14$

Source: IRI Behavior Scan Data, Grand Junction, CO (October 1985-July 1987).

Table 3. Results of estimation of the demand model with redefined advertising effect variables (AD\_EFT and AD\_HIAT parameter only). Dependent variable = seasonally adjusted household purchases in pounds per four-week period. Mean = 5.79

Variable	Parameter Estimate	Standard Error	Marginal Significance Level (%)
AD_EFT11	0.19	0.20	35.01
AD_EFT12	-0.10	0.20	61.90
AD_EFT21	-0.09	0.17	60.70
AD_EFT22	-0.35	0.19	5.76
AD_HIAT1	-0.25	0.19	18.09
AD_HIAT2	-0.30	0.18	10.74

Source: IRI Behavior Scan Data, Grand Junction, CO (October 1985-July 1987).

Table 4. Results of estimation of the "proportion on feature" model (AD\_EFT, AD\_HIAT, and PHASE parameters only). Dependent variable = proportion of household beef expenditure made at feature price. Mean = 0.323 (pre-test), 0.285 (phase 1), 0.195 (phase 2)

Variable	Parameter Estimate	Standard Error	Marginal Significance Level (%)
PHASE1	-0.083	0.010	0.01
PHASE2	-0.141	0.011	0.01
AD_EFT11	0.078	0.015	0.01
AD_EFT12	0.005	0.015	73.86
AD_EFT21	0.051	0.013	0.01
AD_EFT22	-0.005	0.014	70.74
AD_HIAT1	-0.004	0.014	77.16
AD_HIAT2	-0.044	0.014	0.17

Source: IRI Behavior Scan Data, Grand Junction, CO (October 1985-July 1987).

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