Supermarket Patronage: An Analysis of Customer Counts Among Outlets within a Geographic Area

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As new supermarket management tools are introduced, the need for an improved understanding of store patronage is growing. Weekly customer counts for five supermarkets located in a Southeastern metropolitan area covering 261 weeks are analyzed. Descriptive statistics indicate that food shopper patterns vary by outlet. Regression equations are estimated for each location. Results point to store specific relationships. They indicate that evaluation of television and radio ads and double couponing can be quite involved.

Introduction

Substantial advances in our understanding of retail food demand have occurred in recent years. They are primarily due to more realistic theoretical approaches, new statistical techniques, alternative data sets, and the inclusion of nontraditional economic variables such as dietary practices, food safety and quality, and lifestyles. Results of the expanded research have been used by food processors, distributors, merchandisers, and policy analysts.

The theoretical and empirical literature has focused on consumer responses to changes in the economic environment. While the resulting information is useful, store patronage is becoming an increasingly important component of supermarket management as new decision making tools are introduced. Among the developments are micromarketing, category management, shelf space allocation, labor scheduling, and efficient consumer response. As these management techniques are implemented, the risk of stockouts rises. The incidence of stockouts depends, in large part, on the number of food shoppers patronizing a given outlet. Therefore, studies of store patronage are going to be an increasingly important component of applied demand analysis and food retailing.

The present study provides some preliminary analyses of weekly volumes of customers. One of the by-products of the introduction of scanners into the retail checkout process is the ability to track the number of bills processed over a time interval, such as a week, and are called customer counts. Data used here are from five supermarkets. They are located in the same Southeastern metropolitan area and are part of the same chain. The stores are in separate neighborhoods that are average to above average income locations. They are also relatively homogeneous with respect to race and age distribution. One of them is in a rapidly growing area, whereas the others have experienced much more moderate growth. Weeks are seven day periods beginning Sunday morning and ending Saturday night. The time period is May 14, 1988 through May 8, 1993. There was one week for which no customer counts are available (June 20, 1992).

Descriptive Statistics

Table 1 presents some descriptive statistics. Four of the outlets have similar levels of customer counts, ranging between 17,000 and 30,000 per week, and one store has less than half the traffic of the others. Supermarket B has the highest average, and outlet D has the lowest. Store C has the widest range. The coefficients of variation indicate that on a relative basis the variability in customer counts are similar for stores A, B, D, and E, and C is relatively more variable.

Simple correlations among the supermarkets are shown in Table 2. Store A is the most highly correlated with the other stores, and store D is the most unrelated. Although the correlations are all positive, they are somewhat surprising. They suggest independent shopping patterns. Since holidays and other seasonal factors are common to all the supermarkets, other determinants of food shopper behavior must be affecting store patronage. Some of these can be identified through visual inspection of the data.

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Table 1
Weekly Customer Counts: Descriptive Statistics

Supermarket	Mean	Std. Dev.	Minimum	Maximum	Coef. Var.
A	23,356	1,274	19,132	27,502	5.45
B	25,608	1,632	18,895	29,680	6.37
C	22,498	2,272	17,086	30,130	10.10
D	8,792	512	7,340	10,660	5.83
E	22,058	1,299	18,119	27,720	5.89

Table 2

Weekly Customer Counts: Simple Correlations

	Supermarket				
Supermarket	A	B	C	D	E
A	1.00				
B	.50	1.00			
C	.50	.11	1.00		
D	.36	.11	.02	1.00	
E	.65	.36	.20	.54	1.00

Figures 1-5 display the weekly customer counts for the five stores. Peaks occur just prior to Christmas and are followed by sharp declines for the last week of each year. Inspection of the diagrams suggests that four of the stores have comparable levels and have stable patronage or upward trends. Not only does store D have lower customer counts, but there is a long-run decline.

Some yearly patterns and differences among the years are apparent. Aside from D, for each store each year, customer counts start at a higher level than the preceding year. Other patterns in the data are store specific. A, C, and E in some years display slight "n" shaped patterns, where the peaks occur in the summer. Store A has a positive overall trend, and within the calendar year 1991 a seasonal summer high is present. Store B is located near some of a land grant university's married and graduate student housing. Consequently, the Christmas holiday and lower summer school enrollments mean the absence of customer count peaks at these times. Store C's customer counts show remodeling effects that occurred during late 1992. Some decline occurred while the renovations were underway, a large increase occurred when the official reopening took place, and patronage then receded somewhat to a level which has been greater than the previous period. Store D also experienced slight within year "n" patterns in 1989 and 1991, and lower store traffic during 1990 when some road repairs were underway. Store E had within year "n" patterns during 1989, 1991, and 1992. Its customer counts show the effects of the opening of a competitor's outlet nearby in June, 1990 and construction of a new, replacement store E in late 1992 and early 1993.

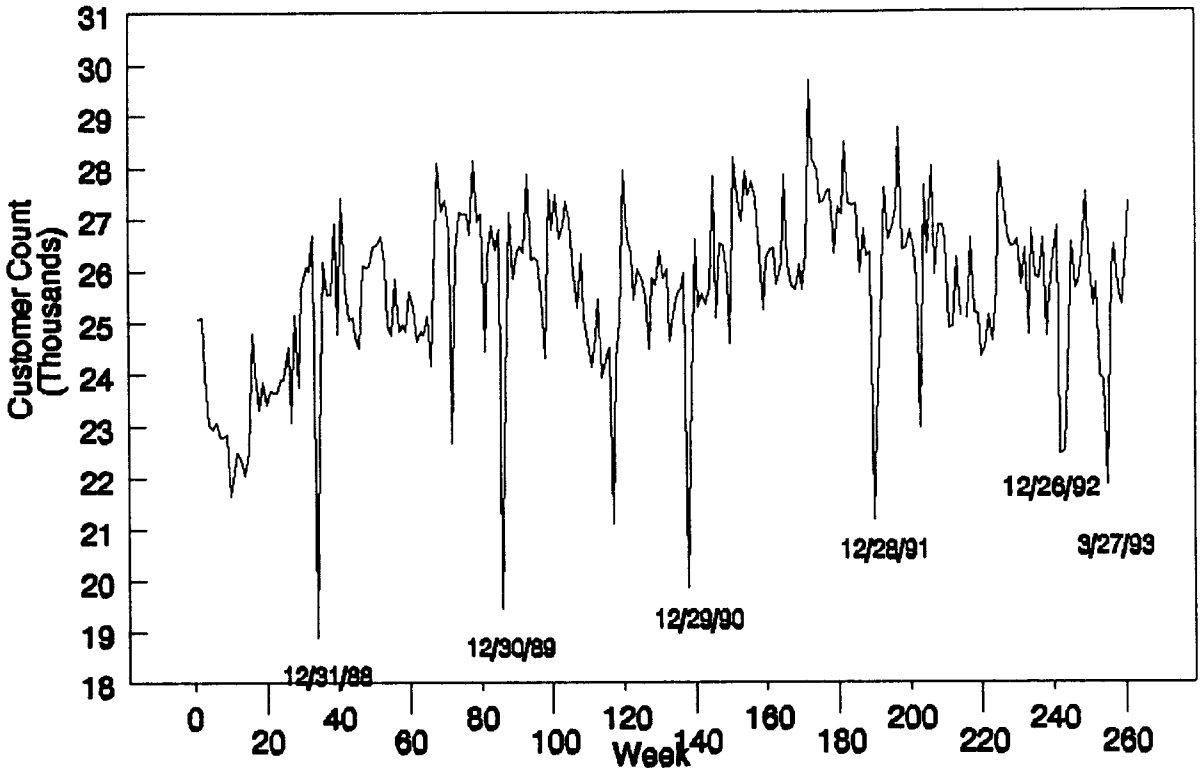

Figure 1. Customer Counts: Store B

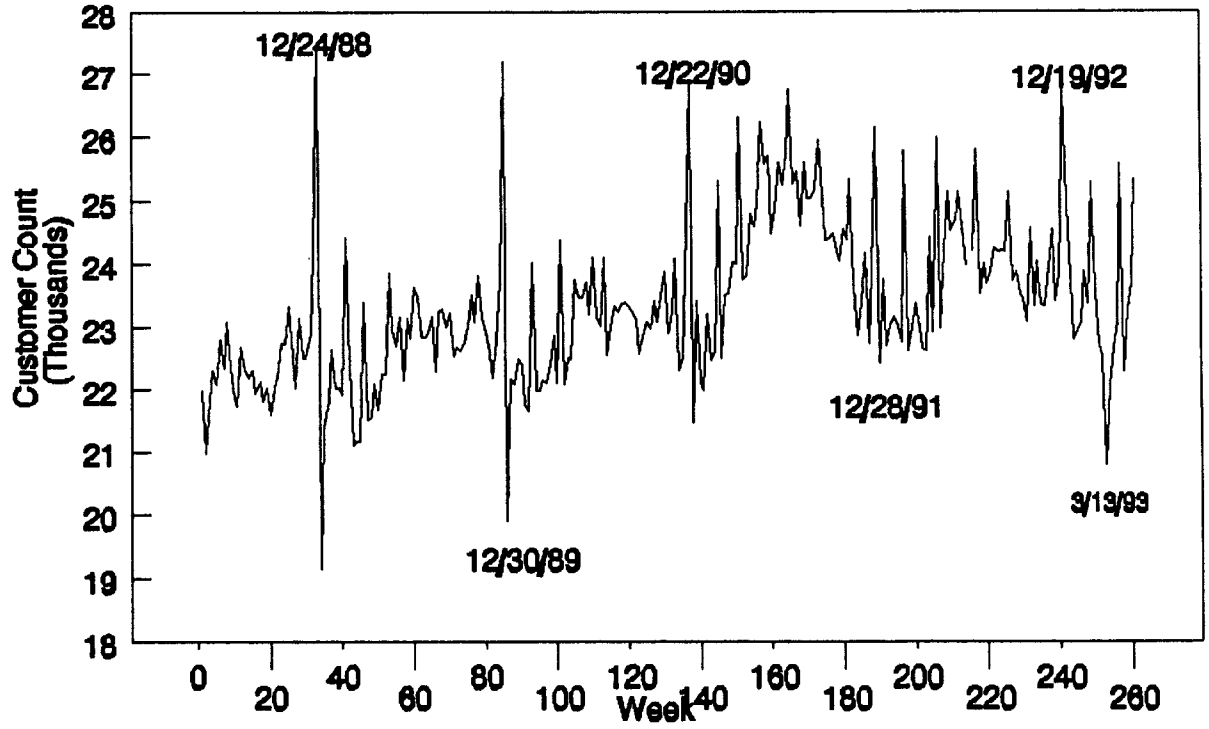

Figure 2. Customer Counts: Store A

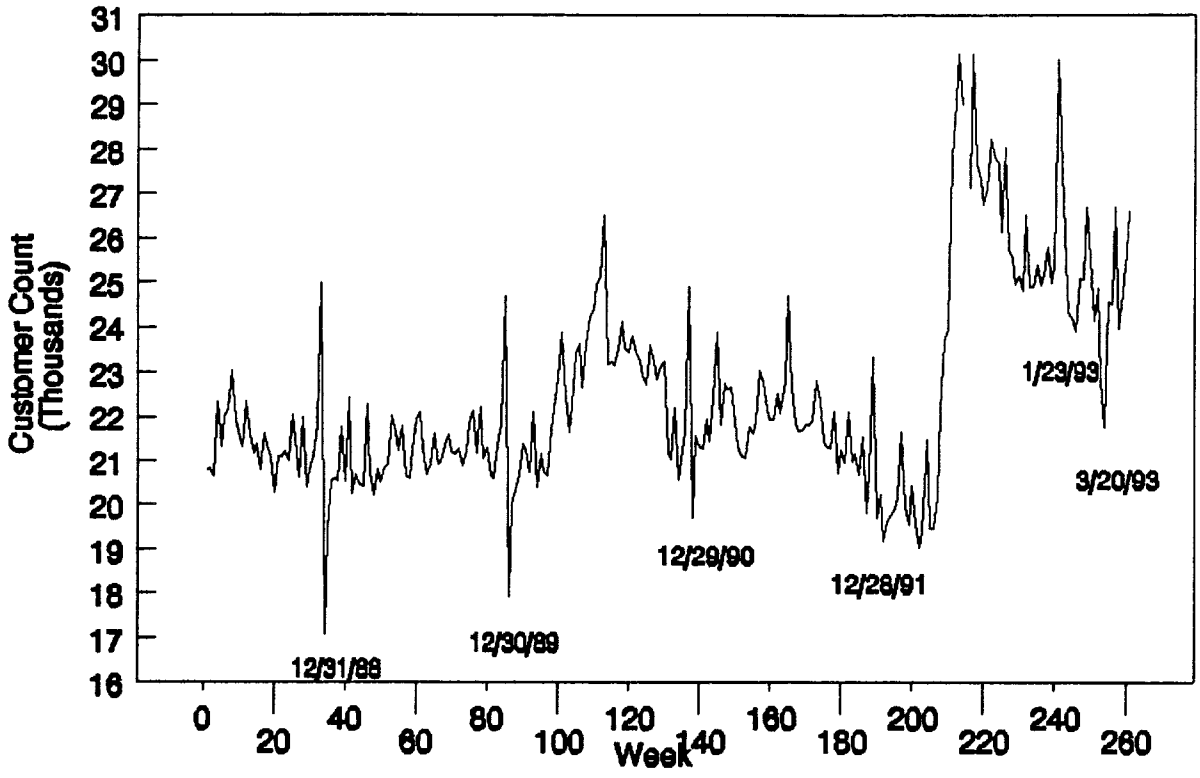

Figure 3. Customer Counts: Store B

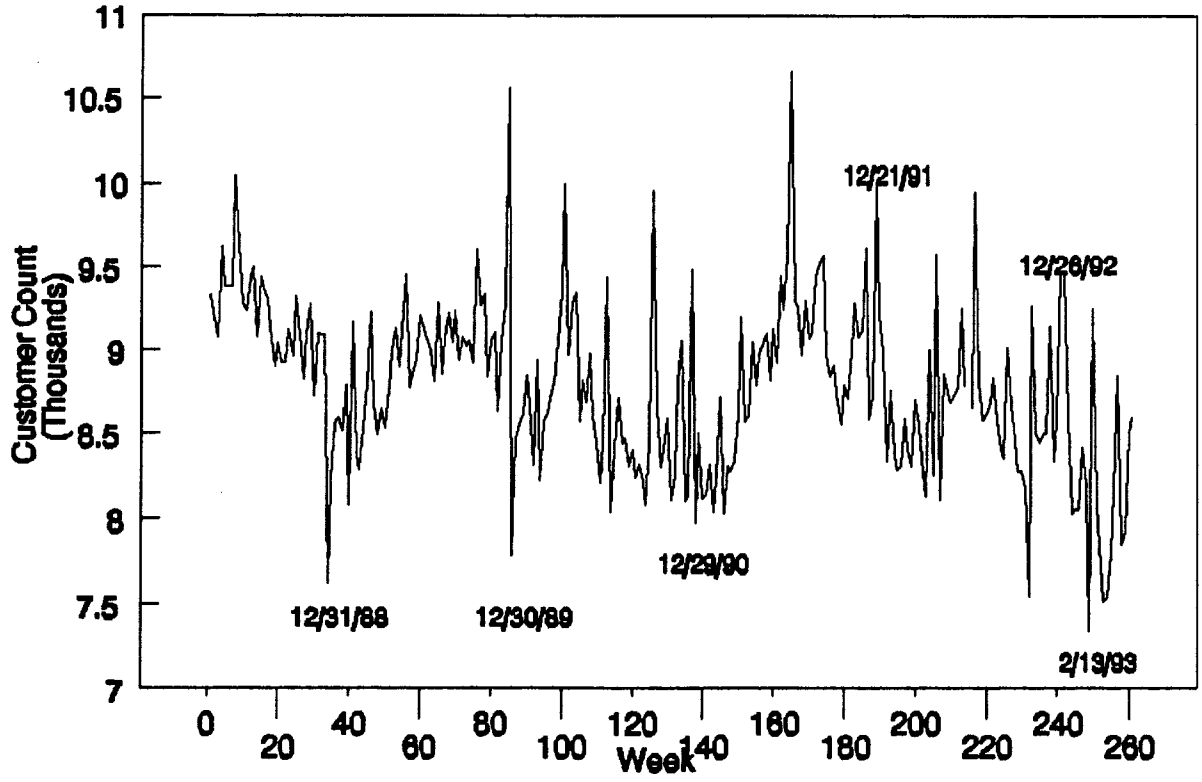

Figure 4. Customer Counts: Store D

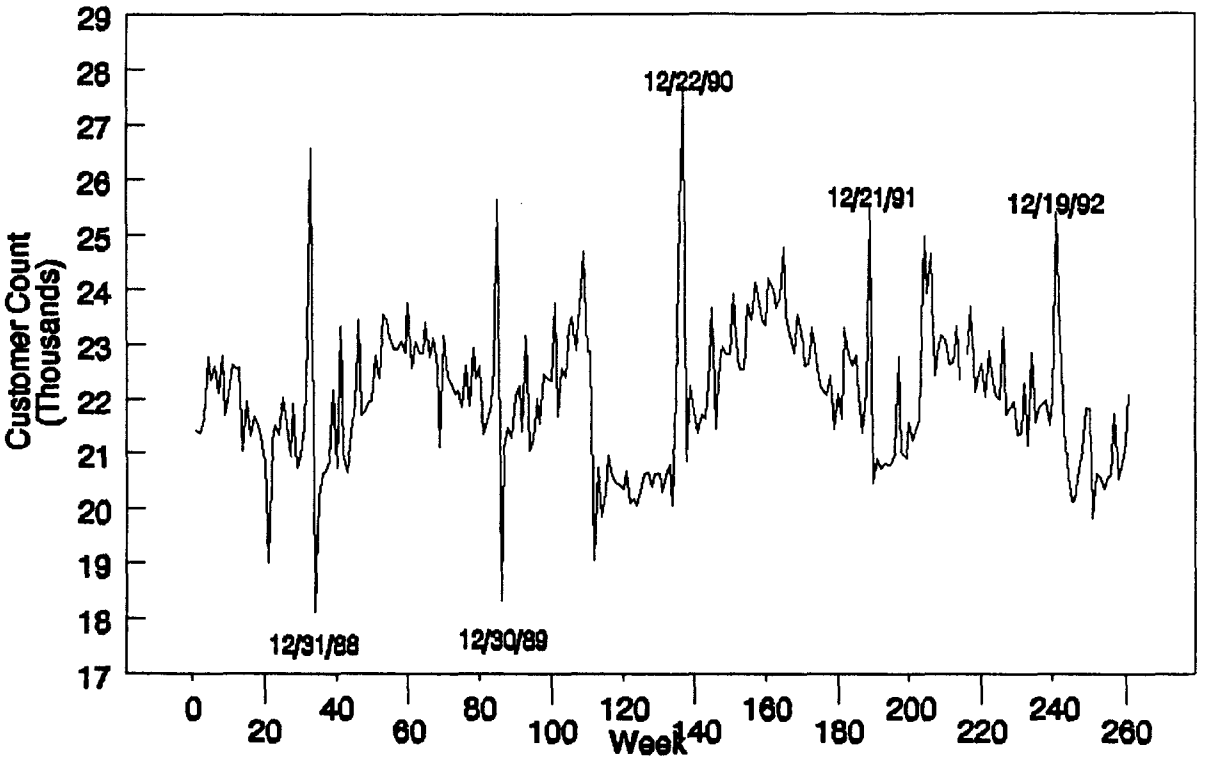

Figure 5. Customer Counts: Store E

Modeling Customer Counts

The preceding discussion shows that patronage tends to be store specific. Different trends for the overall period and within years were identified. Some seasonal patterns were noted, but there was variation across outlets. In addition, the environments changed with some stores being remodeled or replaced, and one supermarket experienced increased competition. Consequently, each outlet is modeled separately, although several variables are common to all five outlets.

An empirical approach is taken here. Several factors were originally considered to be common to all the supermarkets, and others were felt to be store specific. An outlet's weekly customer count is the dependent variable. As an empirical study, an initial regression equation was estimated for each store and then variables were modified or deleted. The problem of introducing pretest bias was minimized through inspection of changes in the overall fit and significance of the variables. Whenever large changes in estimated coefficients, their standard errors, or overall fits occurred, the respective variables were re-introduced into the equations.

Common independent variables in the initial regressions reflected merchandising programs that could increase customer counts, seasonal events, and an unusual weather situation. The merchandising measures were television and radio advertising and a double couponing policy, which was introduced during the second half of the period. Weekly gross rating points were included under the assumption that electronic media promotions increased outlet visibility and consequently customer counts (e.g., Rotschild). Alternative specifications were estimated to allow for the possibility that television and radio, or their combination, affected store traffic. Seasonal events were included as dummy variables for Christmas, the last week of the year, Easter, Memorial Day, July 4th, Labor Day, and Thanksgiving. Once these seasonal factors were evaluated, dummy variables for each of the months were included and evaluated. Another dummy variable denoted the week of a snow storm.

Store specific variables reflect changes in the economic environment in which an outlet was located

and to accommodate the slight "n" pattern that was observed for some stores for some years. In these instances the monthly dummy variable scheme was introduced subsequently to minimize possible confounding problems with multicollinearity. The "n" pattern was incorporated by using a week variable that begins at one, rises to 26 and then declines to one (D_i and D_{ii} variables below). Consequently, D_i and D_{ii} attain maximum values (i.e., 26) at the end of June, assuming the respective estimated coefficients are positive.

Results

Table 3 presents the estimated equations. Significant overall fits were obtained for each equation. There was a wide range of explanatory power, as reflected in the R^2s and Fs. Autocorrelation does not appear to be present based on the Durbin-Watson or the Durbin's h statistic where the lagged dependent variable is present.

The dummy variable for year is significant in three instances. With respect to store A, it is located in an area that has been growing steadily for a long period of time. Store B is located in a much more developed population area, so its growth has been much smaller and is consistent with a smaller yearly increase. D's negative and significant YEAR coefficient is consistent with the overall decline in patronage associated with this facility.

Christmas and the following last week of the year are typically the yearly peak and trough. The exception for Christmas is store B which is affected by the academic year. With respect to mean customer counts, the Christmas increase is approximately ten to fifteen percent. Estimated LAST coefficients for stores C and E suggest a symmetric decline in store traffic, where as A's and D's decreases are roughly half the Christmas increase. Easter has increased customer counts except for C, and the extent of the increase varies by outlet.

An unusual snow storm occurred in February, 1993 with respect to the amount of precipitation and the length of time that roads remained covered. However, two of the outlets did not experience significant declines in patronage. Reasons for this include proximity of residences to the stores, the speed with which the streets were cleared, and variations in the amount of snowfall received in a particular location.

Double couponing is significant only in the C regression equation. In addition, the coefficient is negative. It was introduced via a message on the front page of the newspaper supplement and the use of banners hanging over the entrances to the supermarkets. Once introduced, they have been present virtually every week. The insignificance suggests that consumers adjusted gradually to the promotion and/or couponing by competitors has created a neutral environment.

Television and radio advertising also have mixed results. Outlet A is associated with separate effects, and that of radio is approximately three times larger. Store E has a positive and significant radio coefficient. Combined radio and television is positive and significant in the C equation. These results suggest that neither electronic medium has a unified impact across all outlets. The results are also consistent with reported shifts in food promotions away from the electronic media toward in-store merchandising technologies (e.g., Donnelley Marketing, Food Institute Report).

Customer counts--lagged one week--are significant in four of the outlet equations. The preceding week's customer counts are positive and significant with the exception of store A. The "n" shaped patterns for the years noted in the discussion of the figures are significant in the outlet equations.

The month coefficients pertain to significant shifts in monthly customer counts versus January. Periods of higher customer counts occur in the late spring through fall, although the pattern is somewhat store specific.

The changing competitive environment also is significant. Renovated store C does experience an increase in customers initially of almost 4,000 customers per week. But following the opening there is a downward trend in patronage suggesting that some of the initial increase is lost over the ensuing weeks. The result confirms that the renovation raised customer counts at store C to a new level of patronage. The introduction of competitor's outlet near store E does have a negative effect on customer counts.

Implications

These preliminary analyses of weekly customer counts provide some interesting insights that are consistent with current trends in food retailing. These include the following points. First, there is a need to focus on individual stores. That is, store patronage varies by outlet, not only in terms of levels of patronage, but more importantly in terms of variations. Second, the competitive environment has an effect on store traffic. New competitor's outlets decrease patronage, whereas remodeling does have a positive impact. These comments are consistent with one's intuition, and as an initial study of customer counts, they are reassuring.

Table 3
Weekly Customer Counts: Regression Results (Standard Errors in Parentheses)

	Supermarket				
Supermarket	A	B	C	D	E
Constant	20,978* (1,485)	12,984* (1,085)	11,465* (1,143)	6,823* (735)	16,384* (1,289)
YEAR	367.35* (30.79)	191.65* (47.19)		-175.06* (44.02)*	
CHRISTMAS	3,618.21* (348.63)		3,414.16* (394.08)	1,008.25* (169.69)	3,661.12* (408.58)
LAST	-1,697.75* (349.31)	-6,238.90* (539.51)	-3,219.39* (441.25)	-485.47* (180.09)	-3,013.62* (491.16)
EASTER	2,169.63* (306.16)	891.92[a] (500.01)	651.09 (394.82)	817.35* (169.95)	1,311.84* (408.58)
WEATHER	-2,511.15* (671.62)	-2,184.83* (1,074.88)	-1,997.79* (888.48)	-583.20 (378.14)	
COUPON			-355.39* (130.29)		
TV	.24[a] (.14)			.02 (.28)	.08 (.17)
Radio	.77* (.37)			.19 (.90)	1.39* (.44)
TV & RADIO			.37* (.17)		
CC_{-1} .21*			.47*	.45*	.18*
		(.04)	(.05)	(.06)	(.06)
CC_{-2}					.07
				(.06)	
FEB 448.06[a]					
					(241.39)
MAR					476.62* (237.01)
APR		539.19 (204.70)			821.48* (261.19)

Table 3 Continued
Weekly Customer Counts: Regression Results (Standard Errors in Parentheses)

	Supermarket				
Supermarket	A	B	C	D	E
MAY	1,033.94*	779.14*		210.97*	1,324.04*
	(163.33)	(352.04)		(90.89)	(277.43)
JUNE	864.77*			185.66*	1,250.29*
	(166.64)			(90.89)	(281.56)
JULY	960.97*	-425.79*		245.61*	1,096.38*
	(166.20)	(246.13)		(90.08)	(266.70)
AUG	944.27*				859.70*
	(164.38)				(260.89)
SEP	697.59*				587.40*
	(163.67)				(252.50)
OCT	822.77*				500.42*
	(166.97)				(248.26)
NOV	905.38*			146.77*	755.03*
	(166.88)			(88.71)	(256.09)
DEC	877.84*	689.84*			1,049.48*
	(199.66)	(267.77)			(272.66)
D_i*[b]	81.34*	514.39*	56.14*	321.19*	17.32[a]
	(6.91)	(204.70)	(9.22)	(96.50)	(8.77)
D_{ii}[b]				20.23*	42.63*
				(4.74)	(9.41)
D*NEW			-35.39*		
			(10.32)		
NEW			3,973.02*		
			(504.07)		
COMPET					-1,369.39*
					(209.77)
R^2	.75	.59	.86	.51	.70
F	44.50*	36.18*	152.59*	15.35*	25.72*
DW/h	2.02	1.53	.64	.35	1.76

*Significant at .05 level.
[a]Significant at .10 level.
[b]Trend variable for "n" shaped patterns in respective outlets.

Electronic media effects differ by outlet. This suggests that one should not estimate the success or failure of these ads in terms of an overall market area or single store. Rather, one should evaluate a variety of outlets individually. Store A, which has significant estimated television and radio effects, is in a rapidly growing area. An implication is that the electronic media may be an excellent way of reaching potential food shoppers as they relocate in the vicinity of an outlet or to remind them of a newly renovated facility.

Most importantly, the results point to a problem of evaluating merchandising programs. Not only are weekly customer counts quite variable, but the variability is due to much more than simple seasonal and holiday factors. This makes it very difficult to estimate whether a program is working because in order to do so, one needs to know what patronage (or sales) would have been without the program. These results show that is it not straightforward. Several years of data are needed in order to begin to unravel the factors associated with a supermarket's customer counts.

References

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