Articles

Generic Advertising Wearout

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Advertising wearout, defined as the declining effectiveness of a commercial or campaign associated with increased exposure, is examined from a generic advertising perspective. Generic advertising campaigns of the type typically undertaken by agricultural commodity groups differ from branded advertising in that the former seek to increase aggregate demand for a product category (e.g., beef, milk, wool) rather than the market share of a particular brand within a category. A major hypothesis addressed in this research is whether generic campaigns are subject to the same generation-satiation-decay cycles found for the more typical brand advertising campaigns. The hypothesis is examined by estimating a time-varying parameter model using data from the first fourteen years of an advertising campaign for fluid milk. Results suggest that the cycles predicted by wearout theory do exist in the case of specific generic thematic appeals. However, other phenomenon, such as a "learning curve" on the part of campaign managers, may be more important in explaining overall changes in effectiveness of generic advertising campaigns over time.

1. Introduction

Advertising wearout, defined as the declining effectiveness of a commercial or campaign associated with increased exposure, is a well recognised phenomenon in the marketing literature (Weilbacher 1970; Craig, Sternthal and Leavitt 1976; Calder and Sternthal 1980; Rethans, Swasy and Marks 1986; Parsons 1975; Simon 1982). Yet despite significant increases in the size of generic advertising campaigns for food and fiber products both in the United States and Australia and the attendant increase in economic research (e.g., see Forker and Ward 1993 and the annotated bibliography by Hurst and Forker 1991), no scholarly work exists in the agricultural economics literature on the wearout hypothesis. Ward and Myers (1979) estimated a random coefficients regression model for citrus advertising and found a significant variation in advertising response over time. Seasonal changes in advertising response were noted by Kinnucan and Forker (1986) and by Hochman, Regev and Ward (1974). More recently, Ward and Dixon (1989) examined whether the large increases in milk advertising brought about by changes in federal legislation significantly impacted response coefficients. But none of these studies addresses the wearout hypothesis.

The wearout hypothesis has important implications for advertising policy and resource allocation. If generic campaigns are subject to the generation-satiation-decay cycles predicted by wearout theory, research that takes these patterns into account will likely produce more accurate prescriptions about optimal spending levels over time. Advertising budgeting decisions must take into account optimal times for copy replacement and optimal investment in new advertising copy, both of which are influenced by wearout (Pekelman and Sethi 1978). Benefit/cost measurements

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of generic advertising campaigns, of key importance to producers who fund the campaigns and policy makers who provide enabling legislation, are likely to be improved if models reflect wearout. The recent sharp increases in beef and pork promotion in Australia highlight the need for an improved understanding of the mechanisms governing market responses to generic advertising (Ball and Dewbre 1989).

The purpose of this paper is to determine whether the wearout hypothesis is applicable to generic advertising campaigns. The fluid milk campaign in New York City serves as the basis for the tests because reliable data are available covering the campaign from its inception in 1971 until the commencement of the national fluid milk campaign in 1984. Fluid milk, moreover, is perhaps the most heavily promoted agricultural commodity worldwide (Forker and Kinnucan 1991). The wearout hypothesis is tested using a time-varying parameter model in which the market responses to advertising are permitted to change in a pre-specified pattern over the life of the campaign. A review of wearout theories precedes model specification and hypothesis testing.

2. Wearout Theories

Theories to explain wearout differ depending on the researcher's disciplinary background, i.e., whether marketing, psychology or consumer behavior. To more nearly reflect the differing perspectives, the theories are labeled life cycle, learning-based, information processing and elaboration.

2.1 Life Cycle

Life-cycle theories take the perspective that each advertisement, or ad, generates its own three-stage response pattern. Stage one, called the "quicksilver state" by Weilbacher (1970), occurs when an ad is fresh and new. The opportunity to entertain and inform is at a maximum. The ad has not been repeated enough to have gone beyond the point of information and entertainment.

Because attention levels are increasing, Grass and Wallace (1969) refer to the quicksilver stage as the generation phase. Attention implies cumulative learning which, in turn, implies improvements in attitude. However, as noted by Weilbacher (1970), because the information in ads is deliberately limited, the ability of a given ad to inform or entertain may be short lived.

The second phase, described by Weilbacher (1970) as the "limbo" period, occurs when consumers stop responding to the ad. Consumers may stop responding because of problems inherent in the ad itself (e.g., poor copy or stale information) or because of consumer characteristics (e.g., self-confidence or self-esteem, see Wright 1975). Called the satiation phase by Grass and Wallace (1969), the limbo period marks the peak of attention and the onset of forgetting. Although recall of ad-related information decreases as attention wanes, attitude, for reasons not yet fully understood, tends to be maintained at its peak level (Weilbacher 1970).

The third phase, referred to by Weilbacher (1970) as the "cumulative reinforcing" stage, defines the period in which the consumer has seen the ad so often it becomes annoying or even offensive. All information has been extracted from the ad. Further repetition is counterproductive in the sense that it causes boredom or tedium arousal. The message is mentally tuned out.

Consumers differ in the number of exposures tolerated before an ad becomes annoying or offensive. For some, one exposure may be enough, for others the threshold may be much higher (Weilbacher 1970). But because the ad

continues to annoy or offend once the threshold is reached, the effect is cumulative.

2.2 Learning-based

Learning-based theories draw a parallel between mental processes involved in learning "nonsense" information (e.g., series of numbers, unrelated words) and in learning from television (Greenberg and Suttoni 1973). In both cases, the information acquired resides in short-term memory and will be quickly forgotten unless "practice" occurs through repeated exposure (Craig, Sternthal and Leavitt 1976).

Repetition of the stimulus initially produces a positive affect because repetition increases the opportunity to learn and reduces the uncertainty and conflict toward the stimulus (Rethans, Swasy and Marks 1986). This positive affect, however, is eventually dominated by a negative response as further repetitions lead to boredom, decreased incremental learning, satiation, reactance or tedium (Rethans, Swasy and Marks 1986).

Wearout occurs because continual repetition of the stimulus eventually causes a reduction in attention and motivation (reactance). Although repetition (practice) is necessary for learning, too much repetition can induce cognitive responses (e.g., inattention, reactance) or affective responses (e.g., boredom, tedium) that ultimately inhibit learning.

2.3 Information Processing

The information processing perspective states that message recipients rehearse two kinds of thoughts: message related and personal (Calder and Sternthal 1980). Message-related thoughts are stimulated by the message and reflect message content. Personal or "own" thoughts are based on associations that reflect personal experiences and may be topic irrelevant.

During initial exposures to a message, thoughts tend to be message related (Cacioppo and Petty 1979). After some amount of repetition, however, the thoughts that come to mind become increasingly own thoughts. These own thoughts, in general, are less positive toward the product than message-related thoughts, primarily because the latter were selected to be positive. The mechanism causing wearout is hypothesised to be the gradual supplanting of message-related thoughts with own thoughts as exposure increases.

2.4 Elaboration

Elaboration theory is a hybrid of the information processing and learning theories. Elaboration refers to the counter and support arguments that consumers generate when exposed to advertisements. Cacioppo and Petty (1979) postulate that elaboration mediates the attitudinal effects of message repetition.

Moderate exposure provides opportunity to attend to, think about and elaborate on message arguments. This additional processing opportunity affords evaluation of the ad's cogency and favorable implications which, in turn, enhances persuasion. High repetition, however, causes reactance and tedium to dominate information processing. Cognitive energies are diverted to counterarguing, which decreases persuasion and message acceptance (Wright 1975). In combination, the opposing processes of learning and tedium lead to the inverted-U relationship between repetition and message acceptance. Wearout occurs because elaborations induced by repeated exposure are increasingly composed of counter -argumentation, which reduces the ad's persuasive power.

3. Wearout and Generic Advertising

Although the foregoing wearout theories were developed to provide explanations for the declining effectiveness of individual commercials, Grass and Wallace (1969) argue that the theories can be extended to consider the effects of varying commercials within a campaign. For example, the theories all imply that repeated exposure to the same commercial eventually leads to satiation and a consequent loss of interest and attention. This suggests that introducing a new commercial, even though the approach or concept of the commercial is the same, may revive interest.

Empirical results support this hypothesis. Grass and Wallace (1969) found that loss of interest after five exposures was only 22 per cent for a campaign consisting of two commercials appearing alternately compared to 46 per cent for a one-commercial campaign. Similarly, introducing a new commercial at the fifth exposure increased interest to almost the same level achieved for the original ad's first showing. But the decay for the new ad was much more rapid than for the original. Grass and Wallace (1969) conclude from these results that wearout can be postponed and attention increased during a campaign by increasing the number of commercials used. In a similar vein, McCullough and Ostrom (1974) found that repetitions involving slightly different commercials were more effective at producing a favorable attitude change than repetitions involving the same commercial.

The importance of the foregoing discussion is that it illustrates how a campaign may be thought of as a single commercial in the sense that the basic message (e.g., drink more milk) is unchanged over time. If this is the case, the causal mechanisms identified by the theories, i.e, repetition-induced boredom, tedium, own thoughts or counterargumentation, are applicable to generic advertising campaigns taken as a whole.

The assumption that generic advertising campaigns represent a relatively homogeneous sequence of stimuli appears plausible. The objective of most generic advertising campaigns is to increase aggregate demand for the advertised commodity. There are only so many thematic approaches that can be taken to drive home this basic message. Once consumers are familiar with the basic thrust of the ads (drink more milk, eat more beef, etc.), repeated exposures are ignored or tuned out. This implies that market responses (advertising elasticities) are not constant but vary over time depending on the campaign's intensity and duration.

Specifically, we hypothesise that market responses to generic advertising campaigns exhibit an inverted-U shaped pattern over time. When the generic campaign is initially aired, response gradually increases as an increasing number of consumers see or hear the ads and absorb the message. Eventually, as the pool of unexposed (or infrequently exposed) consumers is exhausted, market responses attenuate. In the parlance of wearout theory, the market becomes satiated. Beyond the satiation stage, campaign effectiveness declines because of tedium arousal, boredom, counterargumentation or other overexposure effects identified by wearout theory.[1]

The extent to which a particular generic campaign displays the hypothesised inverted-U pattern will depend on such things as message

[1] In an insightful article, Rohloff (1966, p. 241) suggests that a better term for "commercial wearout" is "audience wearout" because the same commercial or set of commercials could perform better with another or broader audience. This is essentially what we are arguing in the case of generic advertising wearout. That is, after some point the market has extracted all the information available from the campaign and the incremental return to campaign continuation is relatively small.

complexity, frequency of exposure, number of different commercials used during the campaign, use characteristics or nature of the product, the advertising medium (print, radio, TV) used in the campaign and advertising copy quality. For example, when the stimulus is simple, repetition leads to a decrease in liking, which may or may not follow an initial increase (see Cacioppo and Petty 1979, and references cited therein). Krugman (1972) asserts that ads for low-cost, undifferentiated items of relatively little importance to the consumer should stress a single theme or product attribute, be repeated often, and use television as the delivery vehicle.

Greenberg and Suttoni (1973) suggest that ads for infrequently-purchased products may wear out more slowly than ads for everyday products because there is a natural turnover in the market and the commercial audience. Kinnucan (1982, p.7) reports that in an apparent effort to maintain audience interest, more than 61 different commercials were used in the New York City fluid milk campaign over a five year period. Krishnamurthi, Narayan and Raj (1986) found the buildup effect of advertising to be related to the purchase cycle of the good in question. For example, products with an average purchase cycle of 1.5 weeks had a buildup period of no more than 1.5 weeks. Appel (1971) found that commercials that initially made a vivid impression benefitted more from repeat exposure and wore out more slowly than less memorable commercials.

Although these factors, or skillful handling thereof, may attenuate or accentuate the hypothesised pattern, theory posits that advertising elasticities for a particular generic advertising campaign will vary over time, at first increasing and then decreasing as the campaign unfolds.

4. Model

In terms of the research objectives of this study, the essence of the foregoing theories is the hypothesis that advertising responses vary over time. Time-varying parameter problems may be represented by random-coefficient models, Kalman-filter models, or systematic (non-random) variation models (Greene 1990, pp. 577-585; Kmenta 1986, p.566). Because the wearout hypothesis posits a particular pattern in the advertising coefficients over time, we select the systematic time-varying parameter model.

Consider a linear model with systematic (non-random) parameter variation:

$$(1) \qquad Y_t = \alpha + \beta Z_t + \gamma_t K_t + \mu_t,$$

where Y_t is sales, Z_t is a vector of exogenous variables, K_t is advertising goodwill, α, β, and γ_t are parameters to be estimated, and μ_t is a random error term. γ_t measures the long-run sales effect of advertising[2]. Note that α and β are constants while the goodwill coefficient, γ_t, has a subscript t, reflecting the (null) hypothesis of time-variance suggested by wearout theory.

Advertising goodwill, K_t, which is considered an intangible demand-generating asset (Nerlove and Waugh 1961), is defined as:

$$(2) \qquad K_t = \sum_{k=0}^{m} \lambda_k AD_{t-k},$$

where AD_{t-k} is advertising expenditures in period t-k, m is the length (assumed to be finite) of the weighting period, and the λ_k's are the lag weights.

[2] Note that because K_t indicates the stock of goodwill at time period t, γ_t measures the long-run response to advertising regardless of the data interval (monthly, quarterly, annual) used to estimate the equation.

In their study of citrus advertising, Nerlove and Waugh (1961) assigned m a value of 10 and each of the λ_k's a value of 1/10. Kinnucan and Forker (1986) used a Pascal distribution to represent the weighting pattern. The parameters of the Pascal distribution were estimated by inserting equation (2) into equation (1) and running iterative-OLS regression on the resulting demand equation. More recently, Ward and Dixon (1989) computed the weights using an Almon lag specification with tail-point constraints.

A hybrid of the foregoing is adopted here. In particular, substituting equation (2) into equation (1) yields:

$$(3) \quad Y_t = \alpha + \beta Z_t + \gamma_t (\Sigma_{k=0m} \lambda_k AD_{t-k}) + \mu_t.$$

In equation (3), the weights to be used in the goodwill variable construction are estimated jointly with α and β. In the estimation, the Almon (1965) procedure (without tail-point constraints) is used to restrict the weights to follow a second degree polynomial.

To test the wearout hypothesis, the goodwill coefficient in equation (3) is expressed as a function of time:

$$(4) \quad \gamma_t = g(T)$$

where T is a time trend and g is an as yet unspecified functional form. The wearout hypothesis is rejected if the coefficients associated with T are zero.

5. Empirical Specification

Economic theory and empirical evidence indicate that advertising is subject to diminishing marginal returns (e.g., Simon and Arndt 1980; Venkateswaran and Kinnucan 1990). The double-log model is consistent with the diminishing returns hypothesis and has the added virtue of revealing goodwill elasticities directly. The empirical version of equation (1), therefore, is specified as:

$$(5) \quad \ln Q_t = \alpha_0 + \Sigma_{k=1}3\, B_k QTR_k + \alpha_1 \ln PM_t + \alpha_2 \ln PC_t + \alpha_3 \ln PCF_t + \alpha_4 \ln I_t + \alpha_5 T + \Sigma_{l=1}5\, \gamma_{lt} \ln GW_t * THEME_l + \varepsilon_t$$

where t = 7, 8,..., 168 (July 1971 through December 1984)[3]; Q_t is per capita monthly milk consumption expressed in average daily consumption units; QTR_k are binary variables to indicate seasonal shifts in milk demand with the fourth calendar quarter the omitted category; PM_t, PC_t, PCF_t and I_t are, respectively, monthly milk price, cola price, coffee price, and monthly income (expressed in average weekly earnings) all deflated by the monthly CPI for all items (1981 = 100); T is a time trend specified in linear form so that its coefficient represents the instantaneous rate of change in milk sales due to time-related changes in demographics and other factors[4]; GW_t is the empirical counterpart of K_t in equation (1) expressed in real per capita terms as described later; $THEME_l$ are binary variables to indicate theme changes in the advertising copy as indicated in Table 1 (e.g., $THEME_1 = 1$ if $t \leq 36$, zero otherwise; $THEME_2 = 1$ if $37 \leq t \leq 84$, zero otherwise; etc.); and ε_t is a random error term.[5]

[3] The first six observations are lost due to estimation of the lag structure for goodwill. See below.

[4] In addition to demographic change, Kinnucan (1986, p. 68) identifies three other time-related factors affecting milk demand in the New York City market: (i) non-media promotional expenditures for milk, (ii) nutrition education funded by the New York Dairy Council, and (iii) secular improvements in milk quality.

[5] Advertising expenditures for competing beverages, e.g., soft drinks, juices and coffee, theoretically should be specified in the milk sales response function. However, previous attempts to do so resulted in signs that were inconsistent with economic theory (Thompson, Eiler and Forker 1976, pp. 4-5).

Table 1. Fluid Milk Advertising Themes, New York City, 1971-84

Period	Theme	Emphasis	Advertising Agency
1971-73	"There's a New You Coming -- Milk the Grade A Way"	Physical fitness	Leo Burnett, Inc.
1974-77	"Milk is a Natural"	Cost effectiveness as a source of protein	D'Arcy - MacManus & Masius
1978-80	"Milk's the One"	Milk as a beverage of choice	D'Arcy - MacManus & Masius
1981-82	"Milk. The Fresher Refresher"	Sensory appeal of milk	D'Arcy - MacManus & Masius
1983-84	"Milk's Got More"	Healthy lifestyle	D'Arcy - MacManus & Masius

Source: Tauer and Forker (1987, p.68).

Equation (5) permits goodwill elasticities to differ depending on campaign theme. Wearout is introduced into the model by specifying each theme-specific goodwill elasticity to be a quadratic function of time:

$$(6) \qquad \gamma_{lt} = \Psi_{0l} + \Psi_{1l} T_l + \Psi_{2l} T_l^2$$

where $l = 1, 2,..., 5$ denotes campaign themes and T_l are trend terms defined as follows:

$T_1 = 1, 2,...,36$ for $t = 1, 2,...,36$, zero otherwise (theme 1);

$T_2 = 1, 2,...,48$ for $t = 37, 38,...,84$, zero otherwise (theme 2);

$T_3 = 1, 2,...,36$ for $t = 85, 86,...,120$, zero otherwise (theme 3);

$T_4 = 1, 2,...,24$ for $t = 121, 122,..., 144$, zero otherwise (theme 4);

$T_5 = 1, 2,...,24$ for $t = 145, 146,...,168$, zero otherwise (theme 5).

The inverted U-shape pattern posited by wearout theory implies positive signs for the coefficients of the linear terms in equation (6) and negative signs for the quadratic terms, i.e., $\Psi_{1l} > 0$ and $\Psi_{2l} < 0$ for all l. Substituting equation (6) into equation (5) yields the unrestricted model for testing this hypothesis:

$$(7) \qquad \ln Q_t = \alpha_0 + \sum_{k=1}^{3} B_k QTR_k + \alpha_1 \ln PM_t + \alpha_2 \ln PC_t + \alpha_3 \ln PCF_t + \alpha_4 \ln I_t + \alpha_5 T + \sum_{l=1}^{5} \Psi_{0l} \ln GW_t * THEME_l) + \sum_{l=1}^{5} \Psi_{1l} (\ln GW_t * THEME_l * T_l) + \sum_{l=1}^{5} \Psi_{2l} (\ln GW_t * THEME_l * T_l^2) + \varepsilon'_t.$$

Whether wearout occurs can be tested by imposing the zero restrictions $\Psi_{1l} = \Psi_{2l} = 0$ for $l = 1, 2, ..., 5$, in equation (7), which yields the restricted model given by:

$$(8) \qquad \ln Q_t = \alpha_0 + \sum_{k=1}^{3} B_k QTR_k + \alpha_1 \ln PM_t + \alpha_2 \ln PC_t + \alpha_3 \ln PCF_t + \alpha_4 \ln I_t + \alpha_5 T + \sum_{l=1}^{5} \Psi_{0l} (\ln GW_t * THEME_l) + \varepsilon''_t.$$

That goodwill elasticities are completely time-invariant, i.e., that no theme or wearout effects exist, is tested by imposing the null hypothesis

$\Psi_{0l} = \Psi^*$, $\Psi_{1l} = \Psi_{2l} = 0$ (for all l) in equation (7). These restrictions imply that $\gamma_{lt} = \Psi^*$ for all l. Under the restrictions, the model becomes:

$$(9) \quad ln\ Q_t = \alpha_0 + \sum_{k=1}^{3} B_k\ QTR_k + \alpha_1\ ln\ PM_t + \alpha_2\ ln\ PC_t + \alpha_3\ ln\ PCF_t + \alpha_4\ ln\ I_t + \alpha_5\ T + \Psi^*\ ln\ GW_t + \varepsilon'''_t$$

A standard F-test can be used to discriminate between equations (7), (8) and (9).

6. Estimation Procedures and Data

Estimation proceeded in two stages. First, equation (3) was estimated by ordinary least squares to obtain the weights needed for the goodwill variable. In so doing, the variables indicated in equation (5), with the exception of GW_t, were specified as exogenous and γ_t was treated as a constant. A second-degree Almon polynomial without endpoint constraints was imposed on the lag distribution, and the lag length m was set to six. A carry-over period of six months is consistent with previous research (Kinnucan 1986; Kinnucan and Forker 1986) and with Clarke's (1976) finding that "...90 per cent of the cumulative effect of advertising on sales of mature, frequently purchased, low-priced products occurs within 3 to 9 months of the advertisement" (p.355).

The weights obtained from the first-stage regression, rounded to the third decimal point and normalised to sum to one, are approximately 1/7 for each period. The estimated weights suggest goodwill decays at a constant rate of about 14.3 per cent per month. This constant rate of decay is consistent with the findings of Nerlove and Waugh (1961) for citrus and more recently by Chang and Kinnucan (1991) for butter. Based on these weights, the goodwill variable (GW_t) was constructed using equation (2).

In the second stage, equations (7), (8) and (9) (hereafter called models A, B and C respectively) were estimated by OLS. Single-equation estimation is justified if retail fluid milk supply in New York City is perfectly elastic.[6]

The data used to estimate the models cover the 14-year period 1971-84 from campaign commencement to initiation of the national fluid milk campaign by the National Dairy Board in late 1984. Data for milk sales and advertising were obtained from the New York State Department of Agriculture and Markets. Data for prices, income, and population were obtained from government statistics. A data appendix containing specific references for data sources is available upon request from the authors.

The (per capita) income and price data were deflated using the CPI for all items (1981 = 100). The advertising data are the actual (not budgeted) total expenditures for all media, i.e., television, radio, print, and outdoor advertising. The advertising expenditure data were deflated by a media cost index specific to the New York City media coverage area and were placed on a per capita basis by dividing by the media coverage area population. Summary statistics showing the trends in the data over the sample period are provided in Table 2.

7. Results

Regression results overall are satisfactory. None of the models exhibits serial correlation, R^2's indicate relatively good explanatory power, and the F-statistics show significant relationships between the explanatory variables and the dependent variable (Table 3).

6 Milk supply at the retail level, even over relatively short periods, may be considered perfectly elastic because milk in the rest of the Federal Order 2 marketing area could be readily diverted to New York City in the event of a price increase.

Table 2. Milk Consumption, Advertising Expenditures, Prices, and Income, New York City Metro Area, 1971-84

Year	Per Capita Milk Consumption[1] (quarts)	Per Capita Advertising Expenditure 1981 Dollars[2] (cents)	Retail Milk Price 1981 Dollars[2] ($/qt)	Cola Price Index 1981 Dollars[2] (%)	Coffee Price Index 1981 Dollars[2] (%)	Per Capita Personal Income 1981 Dollars[3] (dollars)
1971	0.2690	0.28	0.2477	99.98	96.80	110.727
1972	0.2747	0.48	0.2451	97.68	90.80	112.848
1973	0.2827	0.74	0.2514	94.33	96.60	111.686
1974	0.2809	0.75	0.2726	105.29	103.70	106.852
1975	0.2833	0.79	0.2561	120.51	103.73	106.794
1976	0.2763	0.68	0.2543	110.14	137.88	106.982
1977	0.2802	0.51	0.2476	109.64	242.96	108.631
1978	0.2922	0.46	0.2407	111.65	209.61	108.258
1979	0.2845	0.41	0.2498	112.38	180.87	106.807
1980	0.2846	0.32	0.2415	113.11	180.33	104.712
1981	0.2810	0.70	0.2381	114.12	136.12	103.934
1982	0.2765	0.59	0.2270	111.61	132.83	104.691
1983	0.2773	0.51	0.2166	108.59	124.33	107.108
1984	0.2759	0.64	0.2085	104.80	122.24	107.869

1 Daily average figure adjusted for day of the week effect.
2 Monthly average figures.
3 Average weekly earnings.

All the coefficients of the restricted model (Model C) have the correct sign and most are significant. Consistent with other studies (Liu and Forker 1990; Kinnucan 1986), all models indicate fluid milk demand in New York City is price and income inelastic. Estimated cross-price effects in general are positive, indicating that cola and coffee are substitutes for fluid milk. The estimated trend coefficient is negative in Model C but turns positive in Model A.[7] Seasonality effects are significant and robust across model specifications: per capita milk consumption in New York City increases in the first calendar quarter and drops in the third quarter.

The estimated goodwill elasticity in Model C is highly significant (p <0.01 per cent). A goodwill elasticity of 0.016 obtained from Model C is smaller than Liu, Conrad and Forker's (1992) estimates for this market of 0.029 to 0.031 for the 1984-87 period and Kinnucan's (1986) estimates of 0.030 to 0.051 for the 1971-80 period. But the 0.016 estimate is consistent with Liu *et al.*'s (1990) estimate of 0.018 for fluid milk advertising for the 1975-87 period for the nation as a whole.

[7] Kinnucan (1986) specified separate variables for age, race and trend and found the coefficients for the demographic and trend variables to have opposite signs. Thus, when using a single variable to capture all the time-related forces affecting New York City milk demand (see footnote 4), it is difficult to sort out which effect is being represented by the estimated coefficient. Moreover, as suggested by a reviewer, in addition to demographics, the trend term could be accounting for a long-term or average rate of wearout, with the theme-related variables accounting for shorter term variations around that trend.

Table 3. Regression Results for the Time-Varying Parameter Models, New York City Fluid Milk Advertising Campaign, 1971-84 Monthly Data

Variables/Statistics	Model A	Model B	Model C
CONSTANT	-3.4956 (-3.65)	-3.1363 (-4.20)	-3.0036 (-4.42)[a]
QTR_1	0.0164 (2.13)	0.0087 (1.21)	0.0083 (1.27)
QTR_2	-0.0052 (-0.68)	-0.0133 (-1.92)	-0.0138 (-2.10)
QTR_3	-0.0599 (-8.11)	-0.0625 (-8.48)	-0.0636 (-8.81)
ln PM	-0.3226 (-2.54)	-0.0881 (-0.99)	-0.0782 (-1.05)
ln PC	0.1080 (1.47)	0.1620 (2.90)	0.1684 (3.76)
ln PCF	-0.0353 (-0.75)	0.0246 (1.68)	0.0397 (4.27)
ln I	0.406 (2.15)	0.3709 (2.21)	0.3325 (2.13)
T	0.0024 (2.75)	-0.0003 (-0.85)	-0.0004 (-2.34)
ln GW	--	--	0.0161 (8.27)
*ln GW * THEME1*	0.0034 (0.54)	0.0153 (7.20)	--
*ln GW * THEME2*	-0.0019 (-0.27)	0.0154 (5.42)	--
*ln GW * THEME3*	0.0172 (2.45)	0.0129 (2.86)	--
*ln GW * THEME4*	0.0359 (3.86)	0.0155 (2.66)	--
*ln GW * THEME5*	0.0675 (4.10)	0.0171 (2.60)	--
*ln GW * THEME1 * T1*	0.0002 (0.37)	--	--
*ln GW * THEME2 * T2*	0.0011 (2.91)	--	--

Table 3 continued

Variables/Statistics	Model A	Model B	Model C
*ln GW * THEME3 * T3*	0.0011 (2.56)	--	--
*ln GW * THEME4 * T4*	0.0022 (2.68)	--	--
*ln GW * THEME5 * T5*	0.0002 (0.31)	--	--
In GW * THEME1 * T_1^2	-0.000004 (-0.34)	--	--
*ln GW * THEME2 * T_2^2*	-0.000016 (-1.90)	--	--
*ln GW * THEME3 * T_3^2*	-0.000016 (-1.82)	--	--
*ln GW * THEME4 * T_4^2*	-0.000046 (-1.68)	--	--
*ln GW * THEME5 * T_5^2*	0.000016 (0.63)	--	--
R^2	0.707	0.668	0.656
Adjusted R^2	0.659	0.639	0.635
D. W.	2.01	1.80	1.74
RSS	0.10016	0.11339	0.11776
F-value	14.507	22.987	32.209

Numbers in parentheses are *t*-ratios. The critical values for the 5 and 10 % significance levels are 1.96 and 1.64 respectively.

F-tests comparing the models are given in Table 4. The models disallowing wearout effects (Model B) and theme and wearout effects (Model C) are both rejected at close to the 5 per cent level. Thus, there is a high degree of probability that Model A is superior to constant-parameter representations of advertising response as indicated by Models C and B. Model A's time-varying coefficients, moreover, in general are significant and of the correct sign (see Table 3) In particular, the coefficients involving linear and quadratic trends largely have positive and negative signs, respectively, as required for a hump-shaped wearout pattern. Note, too, that in contrast to Models C and B, Model A's estimated own-price coefficient is significant.

Evaluation of Model A's goodwill elasticities provides a basis for determining the potential importance of the wearout hypothesis in terms of resource allocation and promotion policy.

Table 4. Model *F*-tests

Model Comparison	Computed *F*-value	Critical *F*-value 10% level	Critical *F*-value 5% level	Result
A vs. B	1.84	1.63	1.88	Reject B at 10% level
A vs. C	1.72	1.55	1.76	Reject C at 10% level

In Table 5 we have computed theme-specific elasticities evaluated at theme commencement, at theme termination and at peak response.[8] Although the hypothesised hump-shaped pattern is evident within specific themes, the most striking aspect of the estimates is the apparent overall increase in the goodwill elasticities over time. Taking the end-of-theme estimates as an example, period-to-period increases in goodwill elasticities coinciding with theme changes are: 316 per cent, 226 per cent, 85 per cent and 15 per cent. The estimated end-of-theme goodwill elasticity (0.0720) for the 1983-84 theme is fifteen times larger than the corresponding elasticity (0.0048) for the 1971-73 theme. Thus, the results suggest that in addition to wearout other forces are affecting the time pattern of response to generic advertising.[9]

[8] The month of peak response within each theme period was obtained by setting the first derivative of equation (6) with respect to T_l equal to zero and solving for T_l.

[9] The increasing effectiveness cannot be attributed to increased spending as per capita expenditures for advertising over the sample period stayed relatively constant in real terms (see Table 2).

Table 5. Time-Varying Goodwill Elasticities for Fluid Milk Advertising Implied by Model A, New York City, Five Themes 1971-84

Theme	Time Period	Estimated Goodwill Elasticity at: Beginning of Theme	Peak Response	End of Theme
"New You"	1971-73	0.0046	0.0055	0.0048
"Natural"	1974-77	0.0003[a]	0.0179	0.0152
"The One"	1978-80	0.0182	0.0346	0.0344
"Fresher"	1981-82	0.0381	0.0635	0.0635
"More"	1983-84	0.0676	--[b]	0.0720

[a] Computed for the second month of the campaign; the elasticity was negative for $T_2 = 1$.
[b] Not calculated due to a positive sign for the quadratic term.

One possible factor is the existence of a "learning curve" in which campaign managers become more astute at selecting advertising copy, media mix, target audience and so forth as they gain experience. Since in the case of the New York campaign the board managing the program is comprised of dairy farmers rather than marketing men *per se*, this seems to be a distinct possibility. In any event, what is clear from Table 5 is that advertising responses appear to be highly dynamic, changing both within thematic periods due to wearout and across themes as the campaign unfolds. The overall increase in goodwill elasticities over the 14-year study period is consistent with Ward and Myer's (1979) findings of a positive trend in consumer responses to eight years of Florida citrus advertising and to Ward and Dixon's (1989) finding of an increase in milk advertising effectiveness following commencement of the national campaign in late 1984.

8. Conclusions

Wearout theory posits that an advertising campaign or set of commercials will eventually lose its effectiveness as consumers absorb the information and find further repetitions boring or even annoying. Applying the wearout hypothesis to generic advertising campaigns, there are two questions that are of interest. One question relates to the time pattern of responses elicited by a specific commercial or copy theme. Wearout theory implies that these patterns should exhibit a hump-shaped pattern to reflect the posited generation-satiation-decay cycles associated with a specific commercial or creative appeal.

A second and more important question from the standpoint of program management and policy has to do with the time pattern of responses overall. At issue is whether consumer interest in a generic message (e.g., drink more milk, eat more beef, etc.) can be maintained by varying advertising copy or theme. In other words, do consumers view generic advertising as a homogenous sequence of stimuli and thus, after some period of exposure, tune it out? Or is it possible to sustain interest by judicious adjustments in creative approach or thematic appeal? This latter question is addressed by looking at the broader pattern of advertising responses as the campaign unfolds. Wearout of the basic (generic) message would be indicated by a general decline in the size of estimated goodwill elasticities over time.

Results based on the time-varying parameter models estimated in this study suggest individual campaign themes are subject to the inverted U-shaped response patterns predicted by wearout theory. However, there was no evidence of diminished campaign effectiveness. In fact, the results suggest *increasing* effectiveness over time in the case of the New York City fluid milk campaign. Because the study period covers the campaign's first fourteen years, one interpretation of the latter finding is that the dairy-farmer board responsible for managing the campaign and/or the advertising agency handling the account became more adept as they gained experience. In any event, results showing goodwill elasticities increasing fifteen-fold suggest advertising responses are dynamic and that wearout may be an epiphenomenon relative to other forces governing response patterns.

Given the importance of goodwill elasticities in advertising decision models (e.g., Nerlove and Waugh 1961; Goddard, Griffith and Quilkey 1992) and the growing evidence of time-varying response (Ward and Myers 1979; Ward and Dixon 1989; Kinnucan and Forker 1986), models that permit advertising parameters to change over time should lead to improved allocations of marketing resources. In addition to providing quantitative information to support copy replacement and budgeting decisions, time-varying parameter models could serve as a useful diagnostic tool in assessing overall campaign effectiveness.

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