Advertising effects on awareness, consideration and brand choice using tracking data

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Abstract

Using weekly data on advertising expenditures in various media and response data on awareness, consideration and choice, we test the hierarchy of effects hypothesis. Our empirical results, based on a simultaneous equations model with pooled parameters across brands, suggest that we can reject this hypothesis convincingly. Next, we consider a vector error correction model, again with pooled parameters, to see if there are dynamic effects of advertising. For the category under scrutiny, we find that most advertising effects exist for awareness, although at the same time there are effects for choice. Newspaper advertising turns out to be most influential.

Key words: Advertising, awareness, consideration, choice.

1 Introduction

Advertising expenditures in the U.S. exceeded the 200 billion dollars threshold in 1998 and stayed above that level in the years after that. The amount of money companies allocate to advertising often surpasses the net after tax profits these companies made. We do not know whether these investments paid off or not. A look at the current literature reveals our incomplete knowledge about what advertising really does in the marketplace (for example, Vakratsas and Ambler, 1999; Lodish et al., 1995). Without knowing what the return is on advertising expenditures, not only in terms of sales but also in terms of potential increases in awareness and consideration, and in some cases penetration, it is difficult to appropriately allocate budget dollars to it.

In this paper we outline an approach that can determine whether a company or brand is overspending or underspending and whether media allocations are fully leveraging the advertising budget. We summarize a conceptual framework that identifies the possible relevant advertising effects, the specific marketing research data requirements, and the required dynamic econometric modeling techniques that are needed to identify these relevant advertising effects. We illustrate how we can determine the efficiency of advertising expenditures. We also show how this same information can be utilized to improve various tactical and strategic decisions that can be made based on this knowledge.

2 Advertising effects

Understanding how advertising affects consumers involves an understanding of (i) the basic process by which advertising affects consumers and leads to brand awareness, brand image, brand consideration, brand choice, and sales, (ii) how the effects of advertising are spread out over time, (iii) the role of

different advertising media (for example, TV versus print advertising), how differentially efficient these vehicles are, how their interaction may lead to synergy effects, and (iv) the role and impact of competitive advertising.

Based on a literature review of more than 250 journal articles and books, Vakratsas and Ambler (1999) propose a basic process by which advertising leads to brand choice and sales. Their Exhibit 1 shows the basic process as we use it. Ours is similar to the framework by Vakratsas and Ambler but instead of cognition we use awareness, and instead of "affect" we use image and brand positioning (which contains both affective and cognitive elements; see Vriens and ter Hofstede, 2000), and instead of consumer behavior we use brand choice.

Advertising dollars are spent to generate specific advertising messages, PR copy, or promotional activities. For example, for a manufacturer of desktop PCs we might distinguish between spending on television advertising, radio advertising, newspaper advertising and vertical trade advertising. All this activity reaches some consumers at some point, and they will or will not pay attention and process these messages. This then may lead to a number of advertising effects. Three types of effects are possible: (1) cognitive effects, (2) affective effects and (3) behavioral effects. Specific examples in these categories are "brand awareness" (cognitive), "brand positioning" (cognitive, affective), consideration-liking (affective), and "brand choice" (behavioral) respectively. The extent to which consumers who are exposed to advertising will go through these stages will depend on their ability and motivation to process the information and messages offered to them (Petty, Cacioppo and Schumann, 1985). Awareness has been found to be a necessary condition for advertising effectiveness. For example, when consumers who are unfamiliar with a product category have to choose between a well-known brand and an unknown brand they are more likely to choose the well-known brand.

Whether behavior such as brand choice and purchasing is preceded by brand positioning and brand consideration depends on the context. For example, in a low-involvement low-risk category it is not uncommon for sales to precede any affective response. In situations where involvement and risk are higher it has been shown that brand differentiation and consideration precede sales. It is beyond the scope of this article to discuss how the context can impact the order in which the various effects are hierarchically related. We refer to the article of Vakratsas and Ambler to find additional details on this.

A second component describes if and how the impact of advertising on the various metrics (such as awareness, consideration, and purchase) is spread out over time. It is generally assumed that a specific advertisement that appears this week will have an effect not only this week, but also next week, and its effect will gradually decrease over the following weeks. This can be due to memory effects or it can be the result of media being consumed on more than one occasion. An example of how advertising can work over time can be found in Buzzell and Baker (1972), who found in one case that when the advertising was cut by 40% sales was not affected in the first month after the advertising budget was cut, but sales decreases were felt during the second and third month after the budget cut. Image and brand positioning (re-positioning) effects may take longer to change as a result of an advertising campaign than changes in brand awareness or sales.

Time-delayed effects of advertising are called carry-over effects and the type and duration of these carry-over effects may vary across brands and product categories. Leone (1995) re-analyzing two large meta-analyses studies, finds that after adjusting for aggregation bias the 90% duration interval for advertising averages between six to nine months. In some cases the long-term effect of advertising can dramatically outweigh the short-term effect of advertising. Taking the long-term effects of advertising into account can

make the difference between having a positive return on advertising investment versus not.

A third component involves the role of different media. Different media such as television, radio, and magazines are used and consumed differently. Different media have a different short-term impact (see Doyle and Saunders, 1990). As Berkowitz, Allaway, and D'Souza (2001a,b) argue, different short-term effects will likely result in memory traces of different strength. Stronger memory traces decay more slowly than weaker memory traces and hence it is likely that the way the effects of various media are spread out over time is different and that the overall impact of different media will be different. For example, a TV ad may have a relatively big impact in the period it appears, having its impact quickly fade away over the subsequent periods whereas a magazine ad could have a lower initial impact, but show a sustained impact over a number of periods because the magazine can be read over time, picked up again, used by other people, and so on.

A fourth component involves the effects of competitor advertising spending. If the advertising spending of any direct competitor increases or decreases significantly in relation to a firm's own advertising this may substantially alter the effectiveness of the firm's advertising. For example, Aaker and Carman (1982) cite an example involving two brands. The advertising of brand 1 had a positive effect on its own sales but had no effect on the sales of brand 2. The advertising of brand 2 had a negative significant effect on the sales of brand 1 but had no positive effect on its own sales.

There has been much empirical modeling relating advertising expenditures to sales. Some marketing generalizations are available in this area. It is beyond the purpose of this paper to review previous studies ((see Leone, 1995, and Lodish et al., 1995). A look at the literature however, reveals that relevant data to study the full scope and impact of advertising expenditures

is largely lacking. We are not aware of any studies that show the effects of advertising expenditures on awareness, consideration and brand choice, identified in an integrated system.

3 The data

A dataset that can be used to study the full impact advertising expenditures have on awareness, consideration, and brand choice is the IntelliTrack database: a Millward Brown IntelliQuest syndicated product. Over the past 10 year data has been collected for a number of Technology products on an on-going, daily, basis and reported monthly. Approximately 500 interviews a month were conducted on a continuous basis. A sample from Dun and Bradstreet's database was used. A sample of Technology Influencers was interviewed about brand awareness, perception on brand imagery attributes, brand consideration and brand choice.

For our analyses we use a dataset that covers a time period of three years: Hence, we have 36 data-points. One of the involved brands made available advertising expenditures (in dollars) for four media, that is, TV, vertical trade, magazines and newspapers for each of five brands for each of the 36 time periods. The product category of the current dataset and the brands involved are not disclosed in this study for confidentiality reasons. Furthermore, the results of our analyses are disguised to further protect the confidential nature of this study.

4 Models and results

The data concerns monthly data for three years, hence the time series sample is 36 observations. There are five brands. The dependent variable is unaided awareness $a_{i,t}$, future consideration $c_{i,t}$, and final brand choice $p_{i,t}$, where i

runs from 1 to 5, and where t runs from 1 to $T = 36$. This report concerns models for these three variables.

It is of interest to link the explanatory variables to advertising expenditures. These variables are also scaled to the 0-1 interval, to facilitate estimation and the interpretation of the parameters. There are four types of advertising used here, that is, magazine advertising, newspaper advertising, TV advertising and vertical trade, whereas we also consider models with total advertising.

With five brands and four types of advertising, it is impossible to include all variables in each equation. It is therefore decided to include in each equation the expenditures on own advertising, say, $xo_{i,t}$, and the total amount that the competitors spend, say, $xc_{i,t}$. Next, each model contains five equations, one for each brand, where each time only one type of advertising is included. Cross-equation parameter restrictions are imposed in order to gain efficiency by reducing the number of parameters. In what follows, we assume that all parameters have been pooled.

4.1 Hierarchy of effects

The first topic we address for these data is the hypothesis of the hierarchy of effects. This says that advertising first exercises its influence, if there is any, on awareness. Via awareness, there is an effect on consideration, and finally on actual purchase. To empirically test this hypothesis, we stack the three series $a_{i,t}$, $c_{i,t}$ and $p_{i,t}$ into the 3×1 vector $y_{i,t}$, and we consider the simultaneous equation model, with first order lags, that is,

$$A_1 y_{i,t} = A_2 y_{i,t-1} + B_1 x_{i,t} + B_2 x_{i,t-1} + \varepsilon_{i,t}, \tag{1}$$

where A_1 and A_2 are 3×3 matrices with parameters, where $x_{i,t}$ is a 4×1 vector containing the advertising spending in the four media types, and where

B_1 and B_2 are hence 4×1 parameter vectors. The matrix of interest is A_1, which looks like

$$A_1 = \begin{bmatrix} 1 & \alpha_1 & \alpha_2 \\ \beta_1 & 1 & \beta_2 \\ \gamma_1 & \gamma_2 & 1 \end{bmatrix} \tag{2}$$

In order to identify the model parameters, we impose the restriction that the A_2 matrix is a diagonal matrix, that is, only elements on the diagonal are non-zero. We include first-order dynamics as a preliminary analysis suggested that there are strong signs of autocorrelation in various variables. Notice that we only include the own brand advertising series, as otherwise the model would become too large to get sensible parameter estimates using two-stage least squares.

If there would be a hierarchy of effects of advertising, then advertising would work directly on awareness. Next, additional to advertising, awareness would influence consideration, and finally, advertising, awareness and consideration would all influence purchase. If this would be true, then three parameters in A_1, to wit α_1, α_2 and β_2 would all be equal to zero. Hence, the hierarchy of effects hypothesis implies a recursive system. It is also possible to derive the consequences of this hypothesis for the error covariance matrix, but we abstain for this, rather cumbersome analysis, for reasons that are apparent from the results in Table 1.

Table 1 displays the Wald test values for the joint hypothesis that the above three parameters are equal to zero. We discern two situations. The first considers two-period lagged awareness, consideration and purchase as the instrumental variables. The second does the same, but with excluding the own lags. Hence, the awareness equation then does not consider two-period lagged awareness as an instrument. Although, strictly speaking, we are only partially testing this model, the Wald test values in Table 1 convincingly indicate that the hierarchy of effects hypothesis can be rejected with great

confidence.

4.2 Dynamic effects of advertising

To explore the dynamic effects of advertising, we aim to use an error correction model, where we allow for the absence of a hierarchy of effects. In the appendix, we outline why we rely on this error correction model, and, in brief, the main motivation is that it allows for disentangling short-run from long-run effects. Again, we pool the parameters across the five brand equations. To explicitly allow for competitive effects, we now include competitive advertising. Finally, to see if any dynamic effects of advertising vary over the types of advertising, we four times consider the following model, that is,

$$y_{i,t} - y_{i,t-1} = \mu_i + \Lambda_1(xo_{i,t} - xo_{i,t-1}) + \Lambda_2(xc_{i,t} - xc_{i,t-1}) + \Gamma_i(y_{i,t-1} - \Pi_1 xo_{i,t-1} - \Pi_2 xc_{i,t-1}) + \eta_{i,t}. \quad (3)$$

The interest lies in the short-run effects parameters in Λ_1 and Λ_2 and in the long-run parameters Π_1 and Π_2.

An application of the seemingly unrelated regression technique results in the parameter estimates given in Tables 2 and 3. It is clear that most advertising effects run through awareness, although own magazine advertising can have a long-run effect on purchase and own newspaper advertising has a (negative!) effect on consideration. From Table 2, we see that own television and vertical trade have no effect at all.

The most interesting results from Table 3 are that competitive advertising can increase the own brand awareness and purchases. Finally, we see that long-run effects are generally larger than short-run effects, which was to be expected.

5 Conclusions

Using weekly data on advertising expenditures in various media and response data on awareness, consideration and choice, we test the hierarchy of effects hypothesis. Our empirical results, based on a simultaneous equations model with pooled parameters across brands, suggest that we can reject this hypothesis convincingly, thereby reiterating an early result in Aaker and Day (1974). Next, using a vector error correction model we find that most advertising effects exist for awareness, although there are effects on choice. Newspaper advertising turns out to be most influential. Interestingly, competitive advertising can also create extra own brand awareness and purchases.

Appendix

What are the advantages of using an error correction model? It is a useful model to understand dynamic effects. The model should allow for an interpretation of short-run and long-run effects of advertising. This is most easily pursued by considering the so-called error correction model. Consider two variables y_t and x_t, where y_t might be associated with log sales and x_t with log advertising spending, and assume that they are linked by

$$y_t = \alpha_1 + \alpha_2 y_{t-1} + \alpha_3 x_t + \alpha_4 x_{t-1} + \varepsilon_t, \tag{4}$$

This is called an autoregressive distributed lag (ADL) model. The model in (4) can also be written as

$$y_t - y_{t-1} = \alpha_1 + \alpha_3(x_t - x_{t-1}) + (\alpha_2 - 1)(y_{t-1} - \frac{\alpha_3 + \alpha_4}{1 - \alpha_2} x_{t-1}) + \varepsilon_t, \tag{5}$$

which is called an error-correction model.

The parameter α_3 can be interpreted as the short-run effect of x_t on y_t as it is easy to see that

$$\frac{\partial y_t}{\partial x_t} = \alpha_3. \tag{6}$$

Hence, an ε change in advertising x_t results in an immediate $\varepsilon\alpha_3$ change in y_t.

To understand the effects of changes in advertising x_t on future sales y_t, one can consider

$$\frac{\partial y_{t+1}}{\partial x_t} = -\alpha_3 - (\alpha_2 - 1)\frac{\alpha_3 + \alpha_4}{1 - \alpha_2} + \alpha_2 \frac{\partial y_t}{\partial x_t} = (\alpha_2 - 1)(\alpha_3 - \frac{\alpha_3 + \alpha_4}{1 - \alpha_2}). \tag{7}$$

Hence, an ε change in advertising x_t results in an $\varepsilon(\alpha_2 - 1)(\alpha_3 - \frac{\alpha_3+\alpha_4}{1-\alpha_2})$ change in y_{t+1}. As it holds that

$$\frac{\partial y_{t+r}}{\partial x_t} = \alpha_2 \frac{\partial y_{t+r-1}}{\partial x_t}, \tag{8}$$

it is easy to see that

$$\frac{\partial y_{t+r}}{\partial x_t} = \alpha_2^{r-1}(\alpha_2 - 1)(\alpha_3 - \frac{\alpha_3 + \alpha_4}{1 - \alpha_2}). \tag{9}$$

This expression shows that permanent changes in sales y_t can only be established by permanent changes in advertising x_t. In case of such permanent changes, the parameter $\frac{\alpha_3+\alpha_4}{1-\alpha_2}$ can be interpreted as the long-run effect of x_t on y_t. It is this model that will be considered throughout this paper.

There are various other models that can be considered for understanding the dynamics of advertising effects, but these are mainly simplified versions of the above error-correction model. For example, a commonly considered model is

$$y_t = \alpha_1 + \alpha_3 x_t + u_t, \tag{10}$$

where it is assumed that

$$u_t = \alpha_2 u_{t-1} + \varepsilon_t. \tag{11}$$

Clearly, this model can be written as (4) with $\alpha_4 = -\alpha_2\alpha_3$. It is easy to see that this restriction entails that

$$\alpha_3 - \frac{\alpha_3 + \alpha_4}{1 - \alpha_2} = 0, \tag{12}$$

and hence that there is no dynamic impact of changes in advertising on sales.

A second popular model in the advertising literature is the so-called Koyck model, which basically is

$$y_t = \alpha_1 + \alpha_2 y_{t-1} + \alpha_3 x_t + u_t, \tag{13}$$

where u_t is a moving average term of order 1, but it seems that this is often overlooked in practice. Hence, the Koyck model essentially assumes that α_4 is equal to zero. This can be the case of course in practice, but there seems to be no reason to assume that from the outset.

Finally, note that when α_2 and α_4 are both equal to zero, the original model boils down to the static model

$$y_t = \alpha_1 + \alpha_3 x_t + \varepsilon_t. \tag{14}$$

In the error-correction model, which is the model we start with, these restrictions appears as that $\alpha_2 - 1$ is -1 and that it the same time it holds that

$$\alpha_3 = \frac{\alpha_3 + \alpha_4}{1 - \alpha_2}, \tag{15}$$

which in words means that the short-term and longer-term effects are equal.

Table 1: Testing the hierarchy of effects hypothesis, using two sets of instruments, using a Wald test

Advertising	IV-1	IV-2
Magazines		
	126.59	86.95
Newspapers		
	130.86	84.88
Television		
	142.92	88.15
Vertical trade		
	68.24	49.14

Table 2: Effects of own advertising on awareness, consideration and purchase, where * means significant at the 10 per cent level

Advertising	Variables	Short-run effect	Long-run effect
Magazines			
	Awareness	0.050	0.178
	Consideration	-0.010	0.030
	Purchase	0.028	0.077*
Newspapers			
	Awareness	0.114*	0.270*
	Consideration	−0.099*	−0.039*
	Purchase	-0.012	0.001
Television			
	Awareness	0.029	0.108
	Consideration	-0.017	-0.025
	Purchase	-0.005	0.000
Vertical trade			
	Awareness	0.016	0.096
	Consideration	0.070	-0.061
	Purchase	0.008	0.018

Table 3: Effects of competitive advertising on awareness, consideration and purchase, where * means significant at the 10 per cent level

Advertising	Variables	Short-run effect	Long-run effect
Magazines			
	Awareness	0.093*	0.266*
	Consideration	0.005	0.108*
	Purchase	-0.010	-0.011
Newspapers			
	Awareness	0.078*	0.110*
	Consideration	−0.147*	0.021
	Purchase	0.013	0.028*
Television			
	Awareness	0.034*	0.055*
	Consideration	-0.002	0.016
	Purchase	0.008*	0.010*
Vertical trade			
	Awareness	0.026	0.107*
	Consideration	0.007	-0.051
	Purchase	0.009	0.007

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