Market response models and marketing practice

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SUMMARY

Market response models are intended to help scholars and managers understand how consumers individually and collectively respond to marketing activities, and how competitors interact. Appropriately estimated effects constitute a basis for improved decision making in marketing. We review the demand and supply of market response models and we highlight areas of future growth. We discuss two characteristics that favour model use in practice, *viz.* the supply of standardized models and the availability of empirical generalizations.

Marketing as a discipline and market response models as a technology may often not receive top management attention. In order to have enhanced relevance for senior management, we argue that marketing models should be cross-functional, include short- and long-term effects, and be considerate of capital markets. We also identify emerging opportunities for marketing model applications in areas such as public policy and litigation. Copyright © 2005 John Wiley & Sons, Ltd.

KEY WORDS: market response models; generalizations; standardized models; practice; public policy decisions; litigation

1. INTRODUCTION

In the past thirty years we have witnessed enormous productivity in model building in marketing. Models have been developed to advance marketing knowledge and to aid management decision making. Reviews and discussions of these models appear in Lilien *et al.* [1], Leeflang *et al.* [2], Hanssens *et al.* [3] and Lilien and Rangaswamy [4].

The fact that there is a great deal of research that advances model building still leaves open the question of business implementation and strategic impact. While management use of marketing models is on the rise, we reexamine the question posed by Little [5]: 'why are so many models developed but not used?' We consider this question for an important subset of marketing

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models, *viz*. market response models, using a supply and demand perspective. In particular, we address:

- What is the current state of supply and demand regarding market response models?
- What are the characteristics of models that gain industry implementation?
- How can market response models gain strategic impact at the senior-management level?
- What are emerging areas of application of market response models?

We propose answers to these questions, based on the extant literature and our collective experience in marketing model building of over a century [6, 7].

In Section 2 we describe the current demand and supply with respect to marketing models, and we suggest areas of promising future development. In Section 3 we argue that managers prefer standardized models and generalizations about how marketing works. In Section 4, we propose that senior managers need model-based support on questions about the long-term impact of marketing on their organization and about the relations between different business functions. Section 5 suggests that policy makers and attorneys represent emerging audiences for our methods, data, and knowledge. We summarize our conclusions in Section 6.

2. SUPPLY AND DEMAND OF MARKET RESPONSE MODELS

In the past thirty years market response models have diffused in the practioners' community. Leading firms, especially in consumer goods and services, database marketing companies and traditional market research companies develop and use increasingly sophisticated models and analyses. The successful implementation of models depends on data availability, the methodology used, and other characteristics. It appears, however, that sophistication in model specification and estimation are often not conducive to acceptance. On the other hand, standardization is an aspect that favours model use (we recognize that the demand for and supply of standardized models are closely linked). In addition, empirical generalizations (which are also easily generated based on standardized models) are favoured over idiosyncratic results. Both of these perspectives are consistent with the notion that 'averaging' tends to make results more palatable for decision-making purposes.

Research on actual model use is scarce. A recent study focused on the application of segmentation and response modelling in database marketing: its use is positively related to firm size, frequency of customer contact and the use of a direct channel of distribution but model acceptance is negatively related to model complexity [8]. Marketing practice commonly focuses on relatively simple approaches such as data splitting, cross-tabulations and/or univariate frequencies. See for example, the following services offered by AC Nielsen: 'Category Management', 'Direct Product Profitability', 'Out of Stock' and 'Shelf Metrics'.

It appears that many models appearing in the academic literature have little relation to marketing practice. Such models often deal with specific problems, are more descriptive than prescriptive, and include complexities that reduce the chance of implementation in practice. There is a tension between the objectives of academic research and the needs of managers. Research tends to be favoured for publication in the premier academic journals if it meets the standards of the academic community. Neither relevance to real-world problems nor likelihood of implementation is normally a critical consideration. To illustrate, consider a study in which the sales increase resulting from an item's promotion in a store is decomposed into (i) changes in

Table I. Demand and supply of market response models.

Demand	Supply			
	Standardized models	Generalizations	Models of the firm	Idiosyncratic models
Marketing management	+ +	+ +	−	±
Senior executives	±	+ +	+ +	+
Public policy and litigation	−	−	−	+ +

+ + highly relevant, + relevant, ± maybe relevant, − not relevant. The stated relevance originates from the authors.

sales of other items in the same category (cross-item effect), (ii) changes in sales in other periods (cross-period effect), and (iii) changes in sales of items in other categories (cross-category effect). These effects can be either positive (complementary) or negative (substitution). The results are based on models, with unique estimates for a single store, applied to daily data for two categories at a time [9]. Such a study is subject to many problems: multicollinearity, endogeneity, day-of-the-week effects, category-specific seasonalities, trends, etc. This study took about two years to complete. Extensive validation, cost-benefit analysis, and standardization will have to be done before model implementation can be expected.

In what follows we concentrate on market response models that may be used in marketing practice. We provide an overview of the demand and supply of these models in Table I.

We distinguish standardized models, empirical generalizations, and models of the firm idiosyncratic models at the supply side. Model outcomes are used by marketing managers, senior executives, researchers, public policy officials and attorneys. Most existing models are intended for the benefit of marketing managers who often work with internal researchers.

Much of marketing decision making is of a repetitive or tactical nature. For example, advertising expenditures, sales promotion budgets, shelf space allocations, prices, margins, etc. have to be determined for each period. The consideration of changes in decisions is facilitated by the development of ever more detailed databases, for example those developed by AC Nielsen, IRI (Information Resources Inc.), IMS Health the leading global provider of market information to the pharmaceutical and healthcare industries and GfK. The availability of these databases also makes it easier to justify the use of econometric modelling (e.g. bimonthly audit data would not permit the estimation of deal effect curves). And the increasing frequency and amount of marketplace feedback also demands a systematic approach for data analysis. Standardized models have become important tools to improve the quality of tactical marketing decisions at functional levels such as brand management. We explore the standardization of models further in Section 3.

In the academic literature, the following areas have received numerous contributions:

- the main own- and cross-brand effects of marketing mix elements;
- interaction effects between marketing mix instruments;
- competitive structures and competitive reaction effects;
- marketing effects on (cross) category demand;
- short-run vs long-run marketing effectiveness.

Innovation in research occurs when idiosyncratic models are developed to tackle new marketing problems. Examples of new problems include the customization of marketing efforts, the linkages between marketing efforts and behavioural, attitudinal and intention measures [6], the role of web sites in consumer decision-making processes [10], and an understanding of brand equity [11] and customer equity [12, 13]. Customer equity in particular is drawing increasing interest, consistent with a shift in marketing focus from products (brands) to customers. Vastly improved databases and improved tools allow researchers to estimate the value of customer loyalty. Loyal customers are attractive in terms of cost to serve and willingness to pay. Loyalty may be further enhanced if the characteristics of the offer are customized. Models, including those applicable to internet marketing and direct marketing, can support customization [8].

A large part of the empirical model-based research in marketing pertains to consumer products, and this area is an important source for the *supply* of models. The successful use of models for consumer packaged goods [14] may stimulate the adaptation of models for durables, services, retailing and B2B marketing. Although these areas have unique characteristics, a common trend is the greater emphasis on customer satisfaction [15]. The shift toward the use of customer-centric databases allows also for the integration of customer satisfaction data with models of customer acquisition and retention.

Models have been developed to support strategic decisions with respect to, for example new-product development, high–low (HiLo) versus every day low price (EDLP) pricing strategies [16], and corporate branding. The more strategic the marketing decision, the more important it is: (1) to gauge its long-term consequences on demand, and (2) to gauge its impact on other parts of the organization such as finance and operations (models of the firm). Models of the firm are of particular relevance for senior executives. We discuss these issues in Section 4.

Several applications of strategic marketing problems are in the domain of public policy and litigation. For example, in public policy, questions regarding mergers or acquisitions used to focus on the changes in industry measures such as the concentration ratio. New databases facilitate the direct focus on the demand side so that policy decisions now often hinge on cross brand-price elasticities (to determine market boundaries). For pharmaceutical products, public policy concerns often focus on prices and price elasticities. Of particular interest is the effect of advertising and other marketing activities on price sensitivities. Given the relaxation of the restriction in the U.S. on direct-to-consumer advertising in 1997, an important question is whether health outcomes improve due to, for example, improved patient awareness and compliance [17, 18]. In litigation, market response models are used to estimate, for example, whether a defendant's contested marketing strategy had an adverse impact on a plaintiff's business performance. We address these issues in Section 5.

3. DECISION SUPPORT NEEDS OF MARKETING MANAGERS

Standardized models: We define a standardized model as a set of one or more relations where the mathematical form and the relevant variables are fixed. A variation consists of the use of subsets of relations as modules. This is attractive if the relevance of modules depends on, say, client factors. In a module-based approach, the structure of each module is fixed. Of course the estimated equations will often still vary somewhat between applications. For example, predictor variables can be deleted from the relations based on initial empirical results. Standardized models are calibrated with data obtained in a standardized way (audits, panels, surveys),

covering standardized time periods. Outcomes are reported in a standardized format such as tables with predicted own-item sales indices for all possible combinations of display/feature and specific price points (SCAN*PRO, [19]) or predicted market shares for new products (ASSESSOR, [20]). SCAN*PRO was developed by Nielsen based on clients' needs for quantified expressions of the impact of temporary price cuts. The availability of more detailed data (at the UPC level for many metropolitan areas) at more frequent intervals (weekly versus bimonthly) avoided many aggregation concerns that used to hamper model estimation, and at the same time mandated a different approach for managers to interpret market feedback. IRI created similar models [21].

Wide applicability of these models is not possible without the availability of detailed data sets for many products and access to appropriate software and estimation methods. The model building often is a compromise between a desire to have complete representations of marketplace phenomena and the need to have simplified equations. The model builder and the model user must understand how results can be interpreted, what limitations pertain to the model, and in what manner the model can be extended to accommodate unique circumstances. To achieve implementation of model results, the structure of standardized models is often simple and robust. Simple means that a user can easily obtain a basic understanding of the model and its proper use. Robustness means that the model structure makes it difficult for users to obtain poor answers (e.g. implausible outcomes). We provide a few examples of standardized models in Table II.

One benefit of standardization is that both model builders and users can learn under which conditions the model fails so that the base model can be adjusted over time: evolutionary model building [22]. For an evolutionary perspective on SCAN*PRO-based modelling see Reference [23].

Generalizations: Managers benefit from having performance *benchmarks* relative to the competition. The use of benchmarks in market response is subject to the uncertainty inherent in parameter estimates. Empirical generalizations, derived from meta-analyses of market response estimates, provide one basis for benchmarks. For example, extant research includes average price and advertising elasticities, and decompositions of sales effects resulting from temporary price cuts. The assumption is that brands, product categories and markets are comparable at a general level. However, the analyses also allow for systematic variation across brand/model

Table II. Supply (1): examples of standardized models.

Questions	Models	Suppliers
1. Sales effects	SCAN*PRO [18]	AC Nielsen
	PROMOTION SCAN [21]	IRI
	MICRO TEST (new product)	Research International
	BPTO (Brand Price Trade Off-analysis)	Research International
	MEDIA DRIVER	IRI
2. Interaction effects	SCAN*PRO [18]	AC Nielsen
	PROMOTION SCAN [21]	IRI
3. Competition	SCAN*PRO [18]	AC Nielsen
4. Category demand	ASSORTMAN	AC Nielsen
	RANGE OPTIMIZER	Research International
5. Short versus long term effects	EQUITY ENGINE	Research International
	LT MEDIA DRIVER	IRI

Table III. Supply (2): empirical generalizations.

Questions	Examples	References
1. Sales effects	• How advertising works • How sales promotions work	Vakratsas and Ambler [43] Blattberg et al. [44]; Van Heerde et al. [23]; Neslin [45]
2. Interaction effects	• Advertising elasticities are higher for new than for established brands	Vakratsas and Ambler [43]
	• Price advertising increases price sensitivity and non-price advertising leads to lower price sensitivity	Kaul and Wittink [46]
	• Supported price discounts are more effective than non-supported price discounts	Van Heerde et al. [47, 28]
3. Competition	• More overreactions than underreactions	Leeflang and Wittink [48, 49] Steenkamp et al. [50]
4. (Cross) Category sales effects	• Decompositions:	Gupta [51]; Bell et al. [52];
	• Own brand unit sales due to discounts are decomposed in $\frac{1}{3}$ cross-brand, $\frac{1}{3}$ cross-period and $\frac{1}{3}$ category expansion effects	Van Heerde et al. [54]; household data; Van Heerde et al. [28]: store data
	• Cross-effects: relatively low	Manchanda et al. [53]
5. Short versus long term effects	• Many marketing investments show little persistence	Dekimpe and Hanssens [55]
	• Although there are several evolving markets, there are few evolving market shares	Dekimpe and Hanssens [56]

settings in an identifiable manner [24]. For examples of such generalizations based on marketing models, see Leeflang and colleagues [2, Chapter 3], and Hanssens et al. [3, Chapter 8] and the special issue of Marketing Science, vol. 14.

We provide a few generalizations in Table III. Although Table III is not exhaustive, it shows a broad spectrum of methods, models and findings from studies across multiple brands and markets.

4. DECISION SUPPORT NEEDS OF SENIOR EXECUTIVES

The empowerment of consumers as active parties in the customization of products and services and the increasing focus on the creation of customer value bode well for the strategic importance of marketing. This evolution also poses a new challenge for market response modellers. Recognition of the value of models in the boardroom requires a broader focus that includes the long-term sales impact, cross-functional relations, such as supply-chain effects that facilitate consideration of profit, and the impact on *capital markets*.

Capital markets: The market response literature has focused primarily on consumer and competitor response to marketing actions. However, senior executives are concerned with investor response as well. Research on how marketing actions influence investor behaviour is still in its infancy. In an efficient market, investors react quickly to new information about, for

example, earnings or revenues. Little is known about the stock-market effects of new advertising campaigns, changes in advertising expenditures, product innovation, price and promotional activities, changes in distribution coverage or changes in customer satisfaction.

The finance discipline has long established that stock prices follow *random walks*, as new information that is profit relevant is incorporated in valuation. However, marketing signals such as advertising campaigns and new-product introductions are profit-ambiguous, i.e. they may or may not result in higher cash flows that could increase firm valuation. Often, the results of successful marketing initiatives unfold gradually over time. Therefore, one should not expect that investors will immediately incorporate the effects of marketing actions in stock prices, especially since these effects may depend on brand-, firm- and industry characteristics.

A few studies have addressed the marketing-finance interface. Chaney *et al*. [25] found that new-product announcements can generate excess stock returns. Pauwels and colleagues [26] examined investor reactions to auto companies' new-product introductions and price promotions over a five-year period. They found that new-product introductions tend to have a gradually increasing influence on equity. On the other hand, price promotions generally decrease firm value, even if promotions successfully stimulate demand. Thus investors appear to view new-product activity as long-term value generating, and promotions as long-term value destroying. Pauwels and colleagues [26] estimated the net market value addition/subtraction of each innovation/promotion shock to be in the tens to hundreds of millions of dollars. Similarly, Joshi and Hanssens [27] examined the influence of advertising campaigns on the valuation of firms in the personal computer market over a ten-year period. They found that advertising has a small, but positive, long-term effect on stock prices, after controlling for its direct impact on sales and profits. Thus investors tend to view advertising as a signal of firm strength. The market value addition of an advertising shock in the personal computer market is estimated at several tens of millions of dollars.

Other business functions: The consideration of marketing models by senior executives requires that the work is closely aligned with other business functions, in particular with operations management. For example, response models have been used extensively to estimate the impact of sales promotions on sales. The short-term effects are found to be quite strong. Yet much of the sales gain is illusory [28], long-term sales effects tend to be zero [29] and long-term effects on brand equity tend to be negative [30]. Thus, it is doubtful that the short-term effects translate in higher profits for the promoted brand [21], even if one ignores the negative impact on the supply chain that occurs in a high–low pricing environment. For a discussion of the challenges in the integration of marketing and operations management, see Karmarkar [31] and the Special Issue on Marketing and Operations Management Interfaces and Coordination of *Management Science* **50**:4.

5. NEW AUDIENCES: PUBLIC POLICY AND LITIGATION

Public policy: Due to increased sophistication in marketing models and access to unique databases, academic researchers in marketing have an enhanced opportunity to contribute to the resolution of policy issues. We provide a perspective on this question by using the same topics introduced earlier (see Table IV).

The effect of advertising on consumer demand for products deemed to be harmful to social interests (public health, consumer safety, etc.) has received much attention [32]. Examples of such products are tobacco and alcoholic drinks. Models used by public-policy makers have been

Table IV. Public policy issues and market response models.

Questions	Public policy issue	Methods/models
1. Sales effects	• Effects of advertising bans	• Brand sales model
2. Interaction effects	• Effects of 'marketing' restrictions on price elasticies	• Varying parameter models
3. Competition	• Mergers • Unfair competition • Entry effects	• Comp. reaction functions • VAR models • Simulations • Analysis of the effects of market shake ups
4a. Category sales effects	• Effects of advertising bans on category sales • Effects of price increases (taxes) on revenues	• Industry sales model
4b. Cross category effects	• Effects of 'marketing' restrictions on other categories	• Industry sales model • Decompositions
5. Short versus long term effects	• Long term effects of bans and price regulations	• Impulse response analysis

critically evaluated by marketing model builders [33]. Such models may apply to several levels of demand. For example, *brand sales models* are used to estimate the effects of advertising bans, sales promotion bans, price regulations, etc. on brand sales. It is often particularly relevant to determine differences in effects between smaller or newer brands and market leaders. A recurring question in the litigation of advertising and tobacco products is whether manufacturers are accountable for damages in proportion to their brands' market shares or to their advertising spending levels.

Industry sales models have been used to estimate the effects of public policy decisions at a broader level. Relevant questions are:

- what is the effect of an advertising ban on total category consumer demand?
- what is the effect of a taxation-induced price increase on demand and on tax revenues?

These questions apply readily to tobacco products and alcoholic drinks, but also to gasoline and electricity markets. Examples of published market response models include Hu *et al.* [34] for cigarettes, and Ornstein and Hanssens [35] for distilled sprits and beer.

Interaction effects such as the effect of advertising on price sensitivity are relevant to public policy questions as well. The Netherlands' Bureau for Economic Policy Analysis [36] performed a study of the effect of marketing expenditures for prescription drugs on the price-elasticity of demand in the short- and the long-term. If marketing dampens the price elasticity, policy makers are inclined to believe that marketing should be restricted. However, if marketing improves the ability of a physician to identify the most suitable treatment for the disease of a particular patient, the price elasticity should also move toward zero. Thus, it is not straightforward to distinguish between beneficial (information) and artificial differentiation effects of marketing based on traditional approaches. Additional research is required to distinguish between alternative interpretations of empirical results.

Models of competitive reaction effects, possibly combined with consumer demand functions, are useful tools to describe competitive structures. These structures may change, for example,

due to mergers, acquisitions or the introduction of a radically-new brand. Mergers and acquisitions may change the nature of competitive reactions if existing brands come under the control of a single decision maker. The resulting joint decision making may also affect the cross-brand elasticities between the 'merged' brands. Market simulations based on dynamic, structural models of demand and reaction functions may provide a valid prediction of the post-merger competitive landscape.

Relatively little attention so far has been given to cross-category effects of an advertising ban. Duffy [37] examined this by calibrating a model that accounts for interactions between beer, spirits, wine, and tobacco. He found a strong negative relation between tobacco and beer consumption. Thus, the reduced consumption of tobacco that might follow an advertising ban would be expected to result in a consumption increase in another 'harmful' product category.

Recent time-series models focus on the effects of market shake-ups. Market shake-ups are events that are expected to change the market structure such as future values of relevant variables (sales, market shares) and/or relationships between variables (such as competitive reaction functions). Market shake-ups may appear at different levels of aggregation. A change in legislation (macro level), the acceptance of a new technology (industry level) or the entry of a 'radical' new entrant (brand level) may have a permanent effect on the market structure. Time series models are useful to detect the long-run consequences of such events [38].

The Federal Trade Commission (FTC) considers the impact on competition of potential mergers and acquisitions. For example, whether Nestle's acquisition of Dreyer's premium ice cream would have deleterious effects on competition was considered by economists in terms of whether premium ice cream constituted a separate market. Market-level scanner data were used to estimate own- and cross-brand price elasticities. However, since most of the price variation represents temporary discounting, adjustments should be made for cross-period (or stockpiling) effects. To estimate cross-period effects, the FTC could use the approach developed by Van Heerde *et al.* [28] in which the own-brand unit sales effect due to a temporary price cut is decomposed into cross-brand, cross-period and category expansion effects. They find that on average one-third of the unit sales increase is due to losses by other brands within the category, and other one-third due to other periods. Thus, to obtain estimates of regular price elasticities, one could reduce the elasticities by one third. This model is also suitable for the delineation of category or sub-category effects.

Litigation: Market response models have been used in litigation for a long time. For example, in the 1960s, the Lydia Pinkham vegetable compound sales and advertising data became available for research due to a court case [39]. See Table V for an overview of examples pertaining to litigation. Rumors about a brand, catastrophic events and unfair competition are examples of factors that may have a negative effect on brand sales. Marketing mix models provide a basis for estimation of damage caused by these factors. In one case a broadcasting station spread improper news about a brand and was found liable by the court. Damage to the brand was to be estimated based on a marketing mix model. However, the model result revealed that increased competition and lower marketing investments were the critical factors that accounted for the decrease in brand sales. Thus, the news item had little negative effect on sales (Exota, Netherlands). In contrast, the well-publicized 'sudden acceleration' rumor around the Audi 5000 in the U.S. had a strongly negative sales impact, not only on sales of this product, but on the entire Audi brand [40].

In another case, AKZO(-Nobel) (Germany) was alleged to have supplied harmful 'ingredients' to a Unilever subsidiary for the production of the brand Iglo (frozen food, ice

Table V. Litigation and market response models.

Questions	Litigation issue	Example
1. Sales effects	• Effects of spreading rumors around the brand	Audi (U.S.A.) Exota (NL)
	• Effects of catastrophic events on: category sales, brand sales, cross category sales brand, equity	Iglo (NL)
2. Interaction effects		
3. Competition	• Effects of unfair competition	FTC (ice cream)
4. (Cross) Category sales effects	• Effects of catastrophic events (see 1) on category sales, cross-category sales	Iglo (NL)
5. Short versus long term effects	• Effects on brand equity	Iglo (NL)

creams). Two people were poisoned after consuming Iglo's frozen food. Due to an incomplete recall procedure, two more people became sick from Iglo's products in a subsequent period. Hence the manufacturer of Iglo incurred two successive catastrophic events, both of which could affect the brand's sales, category sales (frozen food), sales of other Iglo products (cross-category effects) and Iglo's brand equity. For the estimation of impact, no data on marketing variables were available so that time series models were applied to category sales, brand sales and market shares with two intervention dummy variables. The separation of the two events provided the basis for the allocation of the total damage between the supplier and the manufacturer [2, pp. 471–473], [41]).

Finally, consider the case of a consumer goods firm alleging patent infringement by a competitor. The legal team asked if scanner data could be used to estimate damages, assuming patent infringement. To do this meaningfully, one would have to relate the new-product change involving the alleged infringement to sales. In a promotion-heavy environment, and with multiple marketing activities changing along with the product modification, the potential for an econometric model to provide reliable estimates was severely limited. Instead, the attorneys and executives accepted a proposal to use conjoint analysis. One advantage of conjoint is that one can also pursue any number of 'what if' scenarios that the opposing side might propose in market simulations. The drawback of survey responses to hypothetical questions is mitigated by the published evidence on external validation [42]. Thus, it is possible to address litigation questions with different types of data.

6. CONCLUSIONS

The use of econometric models of marketing effectiveness has grown substantially over the last few decades. At the same time, we surmise that only a small fraction of the published models is used in actual business decisions. We identify and address key issues related to present and future implementation of marketing models.

First, we have reviewed extant market response models, and indicated areas in which these models have been particularly successful. We have also suggested areas of potential growth in model use for which existing models need to be modified or replaced. Second, we have discussed two key characteristics of successful implementation, standardization

and empirical generalization. We believe that implementation depends critically on two characteristics of a standardized model: simplicity and robustness. Standardized models tend to have high face validity and facile interpretability. Third, we have addressed the needs of senior managers and argue that market response models should be expanded to include cross-functional, long-term, and investor response components. Finally, we have identified promising areas of model implementation outside marketing management: public policy and litigation support.

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