Marketing Mix Modeling
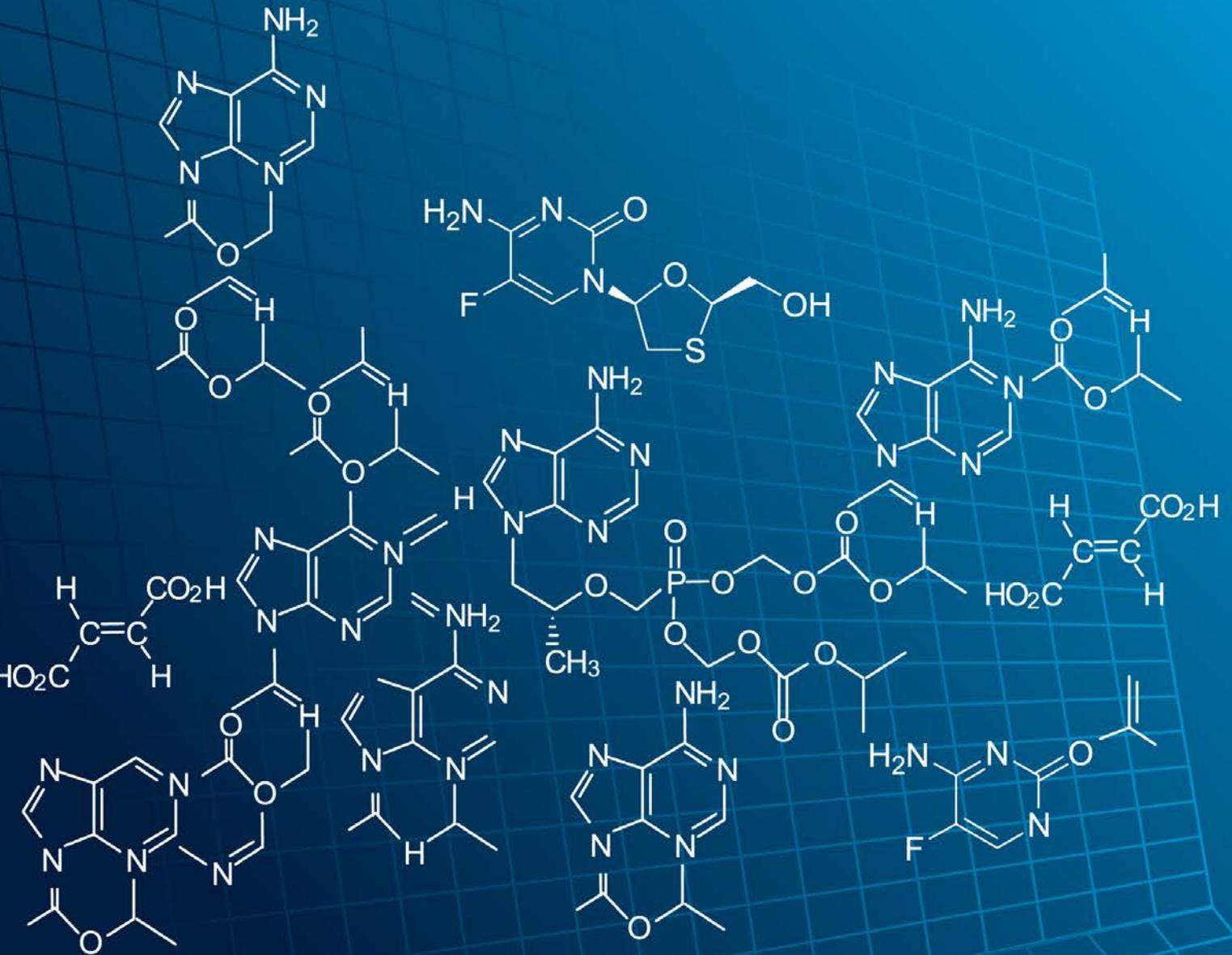## Using Marketing Mix Modeling to Avoid Wasting Precious Marketing Dollars
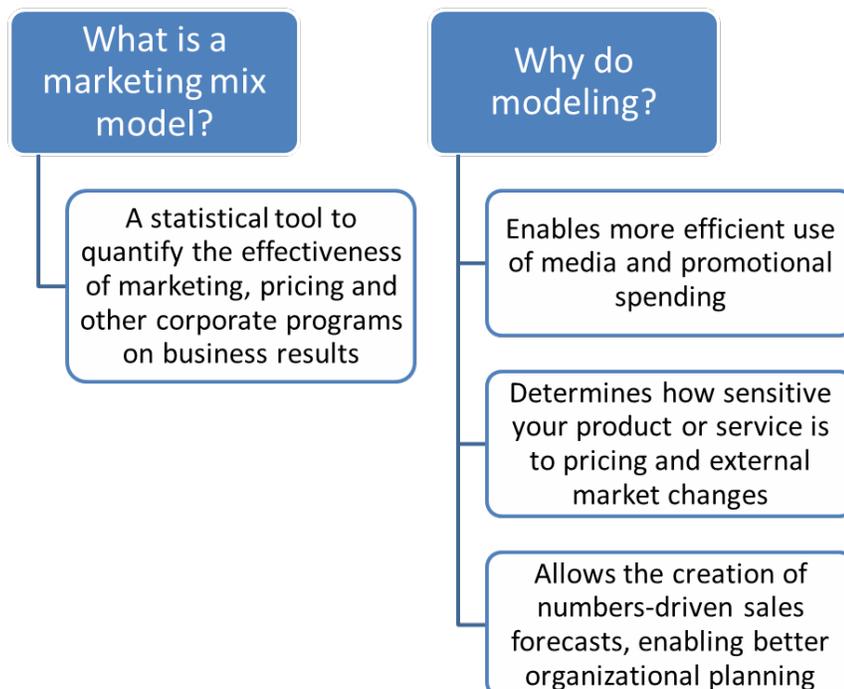
Gelb
An Endeavor Management Company

Overview

"Half the money I spend on advertising is wasted; the trouble is I don't know which half."

This popular marketing quote, attributed to advertising pioneer John Wanamaker, represents a common challenge among marketing professionals. The question of marketing effectiveness persists not only for traditional advertising but for other elements of the marketing mix such as digital, direct marketing and pricing.

Test markets can be a good tool to predict the impact of a single marketing program, but are more difficult to implement when multiple elements are in place simultaneously. Fortunately, marketing mix modeling is an excellent way of deciphering the impact of multiple marketing elements at once in a real-world environment.

Marketing mix modeling uses advanced statistics (typically regression analysis) to quantify the impact of each marketing element on KPIs such as incremental sales volume, revenue, new customers or patient admissions. Results can be compared with spending to determine ROI, and future marketing spend can be used with model results to develop sales forecasts.

What is a marketing mix model?	Why do modeling?
A statistical tool to quantify the effectiveness of marketing, pricing and other corporate programs on business results	Enables more efficient use of media and promotional spending
	Determines how sensitive your product or service is to pricing and external market changes
	Allows the creation of numbers-driven sales forecasts, enabling better organizational planning

Gelb has extensive experience helping clients determine the impact of marketing activities. In this white paper, we outline herein the best practices for assembling an effective marketing mix model:

- Data Selection and Preparation
- Model Construction
- Model Outputs
- Forecasting
- Updating Models
- Our Solution

Data Selection and Preparation

Before modeling can begin, the organization needs to decide exactly what needs to be measured, and discover what sources of information are available to measure. Selection and preparation of data are usually the most time-consuming portion of a modeling project, but vital to ensure that the highest quality of results is achieved.

A key element of a marketing mix model is the **dependent variable**, which is the variable of interest to the organization. Dependent variables of interest to retailers typically include product volume, revenue, market share or customer count. In healthcare organizations, more typical dependent variables would be **patient inquiries or registrations**.

Healthcare Dependent Variables
Patient inquiries
Registrations
New patient volumes
Payer mix

Independent variables, also referred to as predictors, are other quantifiable measures which influence the dependent variable. Typical independent variables include marketing items such as advertising, promotions, direct mail, public relations, sponsorships and other ways to reach prospective patients or customers. Price and distribution can also be strong predictors of retail sales, while patient access to insurance coverage is a much better predictor of medical care than the actual price of the services rendered.

Healthcare Independent Variables
Outdoor/location advertising
Broadcast media (TV/Radio)
Public relations and sponsorships
Direct marketing
Online advertising/paid search
Physician relations
Insurance plans accepted

Once the criteria for model variables have been specified, the first place to look for this information is internal records. Organizations with direct end-user contact, such as hospitals, retailers and B2B services, typically have comprehensive customer databases. Manufacturers who sell through retail channels will often rely on the ability (and willingness) of their retail customers to share sales data, or will need to rely on third-party vendors to provide the needed information.

The quality and depth of internal sales metrics will vary widely by organization and various records may be held on multiple databases - sometimes with incompatible formats.   Organizing the data into a useable format for modeling often requires a great deal of data cleansing, but is not an impossible task. The more complete the total data set, the better. The ideal model considers the most recent 2 - 3 years of sales data, as less time may not allow the modeler to incorporate seasonality and longer time frames may inadvertently consider business conditions that no longer are relevant.

Internal data is usually sufficient for measuring sales or other dependent variables, but supplemental sources may be needed for causal variables such as marketing spend. Media agencies and their data providers are a good source of advertising information for client and competitive ad spend and GRPs. Other data suppliers can provide information on other types of marketing programs.

Once an integrated, cleansed data set is complete, a correlation analysis should be done. This will reveal independent variables that are closely related to each other. Multicollinearity (a condition in which predictor variables are related among themselves) can skew the model to make some variables appear more or less impactful than they really are. Care must be taken to eliminate highly inter-related variables from the model, using a smaller number of relatively unrelated predictors to achieve a more robust model.

Model Construction

Now that data preparation is complete, modeling can begin. One model may be sufficient to achieve the measurement goals of a study, but often multiple models may need to be considered. This is especially true if promotional strategy varies by region or sales channel. Results from multiple models can be consolidated to create a system-wide view of marketing effectiveness. Regression analysis, commonly found on standard statistical software packages, is usually the tool of choice for marketing mix modeling. Linear regression (where predictor variables are treated as having a constant impact on the dependent, i.e. a "straight line" relationship) is the simplest method to use and to interpret, but non-linear regression methods can also be helpful in some situations.

Most predictors in a linear model are treated as though they have a steady impact on the dependent variable, but this is not always true. The relationship between a product's price and quantity sold is often not linear, as raising the price beyond a certain point will cause sales to be nearly non-existent - and raising the price further will not decrease sales below zero units. Another example is advertising, which can have diminishing returns beyond a certain saturation level. In these cases, a logarithmic or other type of transformation to the predictor variable can reflect a more realistic situation in the marketplace. The following example shows results of a

variable transformation for advertising, taking into account minimum threshold and saturation points to reveal the optimum level of advertising as part of modeling results.
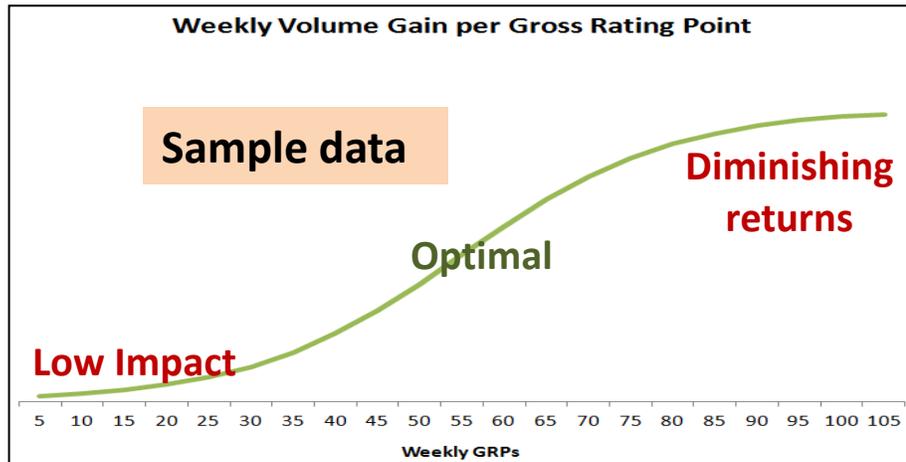

Several iterations of regression analysis are typically required to create a robust model. Measures of statistical fit such as R^2, MAPE (mean absolute percent error) and significance testing for individual predictors are essential to determine the accuracy of a model. However, "common sense" considerations also are important. For instance, price should have a negative impact on sales, while advertising or direct mail should have a positive impact. If a model produces nonsensical relationships between a predictor and the dependent variable, the modeler must investigate relationships within the data to determine why data output is not as expected. Validation is the final step in model-building. This involved applying model coefficients to a subset of data not included in the model. This step confirms that the model is accurate with additional data points, and ensures that over-fitting of the model had not occurred.

Model Outputs

Common reporting from a marketing mix model includes trends attributing sources of volume over time. The sample chart below shows hypothetical weekly sales data. Most of the volume comes from base (non-marketing) volume but various marketing programs generate incremental volume.
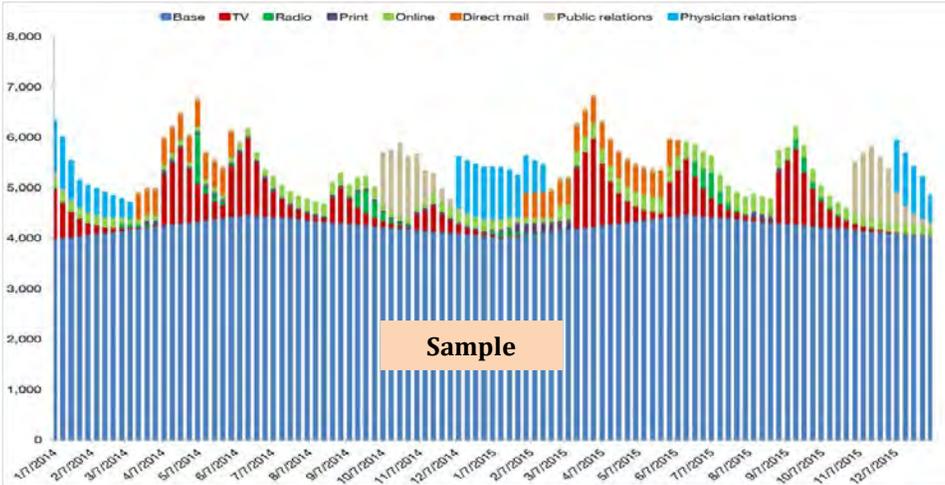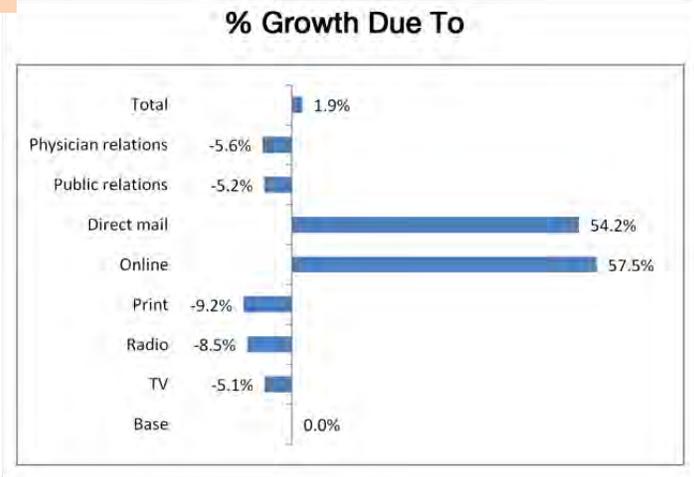
Volume contribution information can be summarized annually, quantifying sources of volume change.
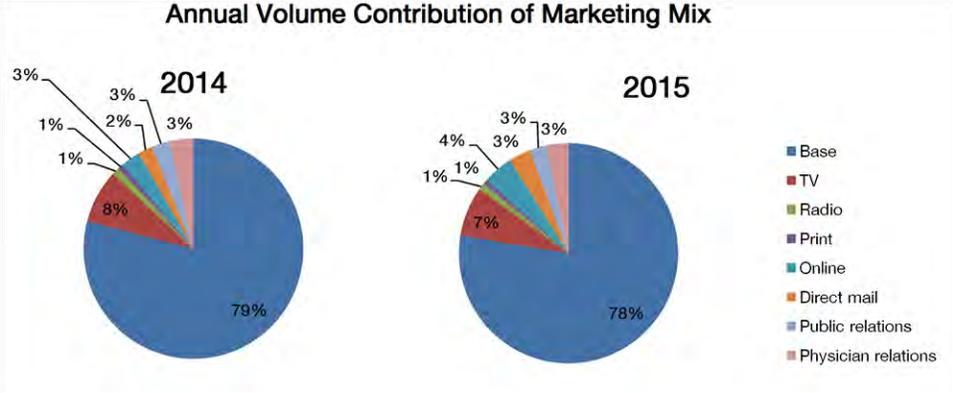
Price elasticity - sensitivity to changes in price changes - can also be obtained from model results.

Forecasting

Modeling coefficients not only reveal sources of past performance, but can also be used to create forecasts for future sales/patient admissions, and other performance metrics. Models can be incorporated into a forecast simulator, which can be either Excel-based or as part of an online dashboard.

To create a forecast, predictors must also be input into the simulation tool. Marketing calendars, planned spend/GRPs and other inputs can be used, so it is important during the model-building process to use predictors that are also available as forecast inputs. What-if scenarios are a key part of a forecast simulator, enabling marketers to experiment with various changes to the marketing mix to create an optimized spending plan.

Updating Models

Models are useful for forecasting when the marketing mix is somewhat similar to those in place when the original model was developed. However, models cannot be used to predict what will happen when a new tactic is used, as that was not considered as part of the original model. Changes to business conditions may also require updates to forecasting models. Generally it is best to update models no less frequently than every two years, as the prior model may become outdated.

Our Solution

Gelb Consulting offers a comprehensive suite of predictive modeling solutions, including expertise with marketing mix modeling in multiple industries. Our solutions offer these steps:

Customized Strategic Planning: Since each client has its own unique business and marketing issues, Gelb uses a consultative approach to plan a custom analytical solution for each project. We work together with clients to determine organizational priorities and key business metrics, along with available internal and external information required to build an optimal modeling solution.
Once a plan is agreed upon, Gelb works closely with client personnel (analytical and marketing) throughout the process of data compilation and model building to ensure that results are in alignment with client needs and expectations.

Key deliverables include a full executive report and presentation, focusing on actionability of modeling results. Reports have an emphasis on strategic marketing focus, using layman's terms rather than statistical jargon. However, a detailed technical appendix is available for those in the client organization with an interest in specific methodological details.

A marketing simulator that can produce what-if scenarios is another key deliverable. Gelb's Insights|360 dashboard platform provides an easy online interface where various marketing scenarios can be explored.

 You can read more about Insights|360 at http://endeavormgmt.com/digitalinsights/.

About Endeavor

Endeavor Management, is an international management consulting firm that collaboratively works with their clients to achieve greater value from their transformational business initiatives. Endeavor serves as a catalyst by providing pragmatic methodologies and industry expertise in Transformational Strategies, Operational Excellence, Organizational Effectiveness, and Transformational Leadership. Our clients include those responsible for:

- Business Strategy
- Marketing and Brand Strategy
- Operations
- Technology Deployment
- Strategic Human Capital
- Corporate Finance

The firm's 50 year heritage has produced a substantial portfolio of proven methodologies, deep operational insight and broad industry experience. This experience enables our team to quickly understand the dynamics of client companies and markets. Endeavor's clients span the globe and are typically leaders in their industry.

Gelb Consulting Group, a wholly owned subsidiary, monitors organizational performance and designs winning marketing strategies. Gelb helps organizations focus their marketing initiatives by fully understanding customer needs through proven strategic frameworks to guide marketing strategies, build trusted brands, deliver exceptional experiences and launch new products. Gelb can help you to develop and implement the right strategies. Using advanced research techniques, Gelb can help you to understand the complexities of your market, to develop your strategic decision frameworks and to determine the best deployment of your resources and technology to monitor your successes. For over 50 years, Gelb has worked with marketing leaders on:

- Strategic Marketing
- Brand Building
- Customer Experience Management
- Go to Market
- Product Innovation
- Trademark/Trade Dress Protection

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