Nielsen

Marketing mix modeling best practices: Understanding why regional data delivers more accurate results than national data

Summary

Organizations have been placing increasingly more emphasis on making data-driven marketing decisions in recent years. Especially since the onset of COVID-19, the demand for insights on how to craft the optimal marketing budget allocation plan has risen markedly. Marketers rely on guiding principles like Marketing Mix Modeling (MMM) to determine which marketing channels will drive the highest return and optimize marketing budget allocations to maximize business outcomes. However, a recent study from Nielsen that analyzed 19 MMM studies in Japan found that the accuracy of a MMM varies significantly depending on the granularity of the data that is input into it, including country- and regional-level sales and marketing data. Even with the small sample of MMM studies, we found clear evidence that MMM is more accurate and reliable when it uses regional data instead of national data. Whenever data is available, we strongly recommend marketers to conduct MMM analysis at the most granular geographical level.

Introduction

MMM is a statistical method used to measure the impact of marketing activities on the sales of a brand or a collection of brands, over the span of several years. While MMM is most commonly used to determine the impact of advertising, brand managers can also use MMM to measure the impact that in-store activities, promotional activities and macroeconomic trends can have on a business. For these reasons, many organizations around the world use MMM, while some even consider it the standard for measuring marketing effectiveness.

In addition to the breadth of insights that MMM can uncover, marketers also look to MMM because of its customizability. For example, apart from sales, MMM can measure the impact that marketing activities have on the number of online reservations, music streams, new customer acquisitions, product usages and more. As such, Nielsen's experience with MMM in Japan, and abroad, includes working with a variety of companies across a wide range of industries, such as fast moving consumer goods, automobile, IT, entertainment and human resources, to answer their most pressing business questions.

Because marketers use the insights derived from MMM during key strategic conversations, they should pay close attention to the inputs and setup of each model to ensure a high level of accuracy in the results. In one study, Nielsen found that a MMM that exclusively measured advertising activity overestimated sales growth by 47% and advertising ROI by 68% when compared with the results of a MMM that measured both marketing and non-marketing activities[1]. The reason for this disparity simply comes down to the lack of data. Seeing as the former MMM did not include non-marketing activity data, the model over-estimated how much of the brand's sales were caused by the marketing activities. Therefore, each MMM study should include a wide variety of inputs to ensure accurate outputs.

Data quality and granularity are also equally important to ensure that the results of each MMM study are reliable. The following research, organized and led by Nielsen, analyzed 19 MMM studies in Japan and found that the accuracy of a MMM varies significantly depending on the granularity of the data that is input into it, including country- and regional-level sales and marketing data. In this case, regional-level data refers to any data that is broken down geographically, such as digital impressions by each prefecture or region. This differs from national-level data, which refers to any data that is only available at the total country level. All in all, the results of Nielsen's research detailed below clearly indicate that MMM is more accurate and reliable when it uses regional data instead of national data.

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[1]Based on research summarized in "Nielsen 2020 Omitted Variable Bias Study" which showed that excluding non-media drivers produced vastly inferior MMM results. The results from the study indicated that when non-media drivers are excluded from MMM, average error in explanatory insights increased 102%, average error in forecasting ability increased by 80%, incremental volumes were inflated by 47%, and ROIs were also inflated by 68%. The study was conducted across 8 brands from a variety of industries including CPG, financial services, retail, gaming and travel.

Testing MMM with regional and national data

To arrive at our conclusion, Nielsen analyzed a sample of 19 Nielsen MMMs from Japan, over the last two years that used regional-level data. Once we completed the analyses, we conducted them again at a national level to understand the different outputs. The brands in these 19 models varied by brand size, industry and marketing budget size to control for bias (refer to table 2 below for more details).

Table 1: Breakdown of models by industry, size of business and marketing budget

Industry	Yearly revenue	Marketing budget
FMCG = 12	< 1 Billion yen = 10	< 1 Billion yen = 12
E-commerce = 7	> 1 Billion yen = 9	> 1 Billion yen = 7

n=19

We used R^2 and the mean absolute percentage error (MAPE) as the KPIs to compare the different model outputs. R2 is a common statistical measure that indicates how much variation of the dependent variable is explained by the independent variable in a regression model. Simply put, it measures how well the model predicts the actual trend. The scale of R^2 ranges from 0% to 100%, and higher values on this scale are considered more favorable because they show that the modeled (i.e., predicted) results more closely resemble the actual results. The MAPE, on the other hand, is a measure of prediction accuracy that takes an average of the differences between the predicted and actual model results. In short, it tells us how well we are able to explain the variation in the model. Unlike R2, the lower the MAPE, the better the prediction of the model.
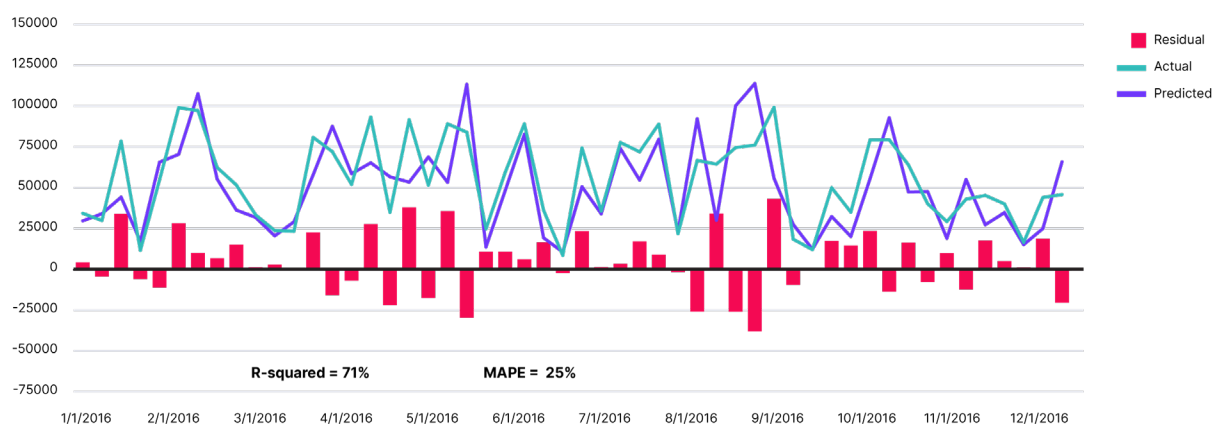
The graph below is an example of a model with a high R^2 value and a low MAPE.

Chart 1: Example regression model that exhibits good fit

R-squared = 98%   MAPE = 2%
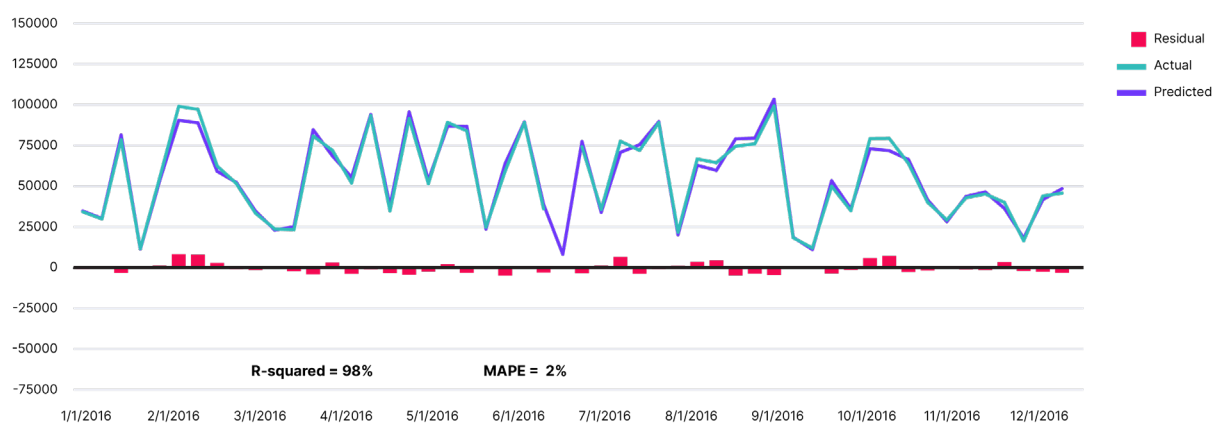
Conversely, the graph below shows an example of a model with a lower R2 value and a higher MAPE.

Chart 2: Example regression model that exhibits poor fit

Exploring the results

In our study, the regional-level models were considerably more robust than the national-level models. Referring to the table of outputs below, we found that models using regional data generated an average R^2 of 96%, with an average MAPE of 4%. Comparatively, the models that used national data produced an average R2 of 86%, with an average MAPE of 7%, validating the higher accuracy of the models that used regional data.

Moreover, both the minimum and maximum R^2 values and MAPE observed across all 19 models further showcase disparities between regional-level and national-level results. For example, the minimum R^2 observed across the regional-level models was 92%, versus 66% in the national-level model results. This indicates that all 19 regional-level models observed an R^2 above 90%, whereas national-level models presented greater variability and less consistency.

Table 2: Differences in the robustness of regional-level and national-level models

Differences in model robustness	Regional-level models		National-level models	
	R^2	MAPE	R^2	MAPE
Average	96%	4%	86%	7%
Observed minimum	92%	2%	66%	4%
Observed maximum	99%	5%	97%	14%

n=19

Chart 3: Distribution of R² and MAPE for regional and national models
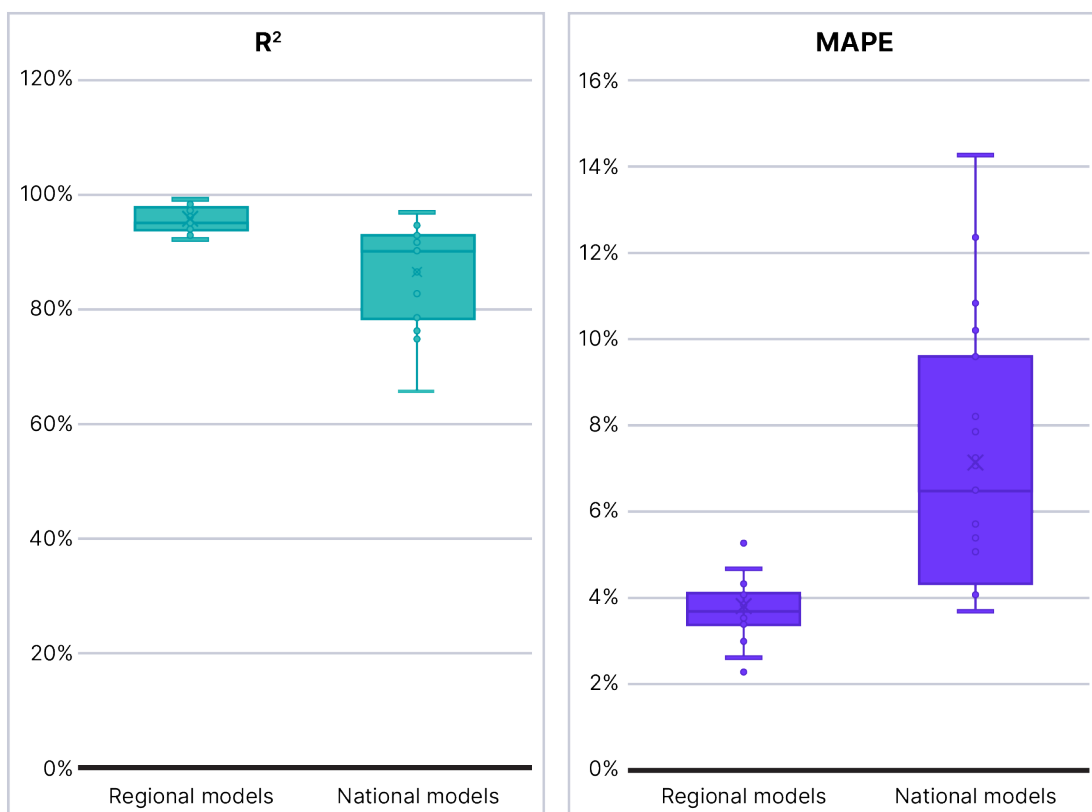
In addition to comparing the granularity of the regional and national outputs, Nielsen analyzed the number of variables that produced a significant lift in each type of model. In other words, Nielsen investigated to what extent each type of model was able to predict incremental sales for each media channel or marketing campaign that was measured.

Across the 19 models, we measured hundreds of variables, many of which represented a media channel or a marketing campaign. According to the results, models that used regional-level data were significantly more likely to capture the sales lift of each variable. That's because regional-level models have considerably more data points and variation in the dependent variable, making it easier to disseminate whether a change in a brands' sales volume from one week to the next was a result of a specific marketing activity.

Table 3: Number of variables with measured sales lift by model type[2]

	Regional-Level Models			National-Level Models		
	Variables with sales lift	Variables with no sales lift	Total variables measured	Variables with sales lift	Variables with no sales lift	Total variables measured
Number of variables	1251	645	1896	305	1591	1896
Percentage of variables	66%	34%	100%	16%	84%	100%

Conducting MMM at regional level is very important from both methodological and business perspectives. The regional level data has a larger effective sample size compared to the national level data. The marketing spend at the regional level has a wider range compared to the spend at national level. This is very important to help response curves in MMM "learn" better. Moreover, geo-based MMM can be combined with geo-experiments, such as Nielsen's MPA, so that the results in MMM can be validated or calibrated.

Most business data are time-series data with geographical dimensions. The data includes sales or store visits of offline stores and sales of online shops associated with delivery addresses. Many marketing tactics take place at the store, such as in-store promotions, coupons, leaflets, etc. In MMM analysis, the model should be constructed at store level and then be aggregated to regional level so that it can measure the effectiveness of those kinds of interventions.

Regional MMM can provide business insights on the impact of all of the marketing tactics holistically at a regional level. MMM also takes into consideration the impact from external factors like COVID-19, temperature, holidays, and competition in order to have a comprehensive understanding of sales drivers. Given that regional differences can exist across a variety of factors such as competitive landscape, product distribution and marketing partnerships and more, regional MMM is very important for each company to create better business and marketing strategies.

[2]Under normal circumstances Nielsen employs its own patented intelligent prior system to better inform models and improve a model's ability to capture the sales lift of each measured variable. However, this patented technology was not used for this research to produce insights that would more adequately reflect the results of the overall MMM industry, as other MMM vendors may not employ a similar modeling technique.

Conclusion

Together, the results from our study clearly illustrate how differences in the granularity of MMM inputs produces significant differences in the MMM outputs. Specifically, the results show that the more granular the inputs, the more accurate the results, which is important because these outputs may be leveraged to make important strategic decisions for a future marketing plan.

When conducting an MMM for the first time, it may initially be challenging to gather all the required inputs. However, as the results of this study show, any additional time spent in collecting the most granular and comprehensive data can have a large pay off, as it will increase the chances that the insights will be more consistently reliable and actionable to all involved stakeholders. Continuously fine-tuning marketing activities through the implementation of MMM is key to making the best choices in an ever-changing business environment, and MMM enables the modern marketer to achieve data-driven marketing.

Nielsen has more than 25 years of experience in MMM and executes hundreds of projects per year globally. Nielsen MMMs are used by companies in a wide range of industries including consumer goods, automotive, retail, pharmaceutical, telecommunications, and e-commerce, just to name a few.

As a global leader in marketing mix modeling, Nielsen started the collaboration with Meta and Google in December 2009, and has since been working to expand its services to more regions.

Minh Nguyen

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Google APAC

Google has partnered with advertisers and their MMM partners to provide granular Google data broken down by key elements to increase the accuracy and viability of MMM outputs. Through our partnership with Nielsen Media Japan and the Japan Marketing Mix Consortium, we hope to increase the visibility and importance of MMM in the Japanese market.

Georges Mao

Director, Head of Global Business Group, APAC
Meta, APA

The Marketing Science team at Meta has been working on MMM projects with advertisers and agencies to ensure that MMM is the right tool to guide marketing strategy and media investment decisions. As a result, Meta has partnered with Nielsen globally to provide advertising data to achieve the goal of providing comprehensive, accurate and unbiased MMMs. We believe that the systematic use of such data in MMM will enable marketers and agencies to build and evaluate more effective media and marketing plans in the most efficient and comprehensive manner, allowing them to focus on the factors that impact marketing effectiveness to make better investment decisions. We are confident that this white paper will help advertisers build and evaluate more effective media and marketing plans and focus on driving more effective business results. We hope that this white paper will provide advertisers with information about MMM and help them prepare to make the most of MMM in their strategic decisions.

About Nielsen

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