Marketing Mix Modeling

Modelling Carry-Over and Shape Effects in the Marketing Mix Model

last update: 11.07.2023 from Hendrik Huening

Marketing investments usually have diminishing returns and lag effects, which makes it hard to capture and measure their effectiveness using a linear model (e.g., regression). Marketing literature discusses carryover and shape effects in this regard. **Shape effect** stands for *ad saturation and diminishing returns* at high levels of spend and a **carryover effect** stands for a *lag* that the advertising has, because the portion of its effect occurs in time periods following the pulse of advertising. The latter may be due to delayed consumer response, delayed purchase due to consumers' inventory, or purchases from consumers who have heard from those who first saw the ad.

Carryover effects can be modelled with the help of*(geometric) adstock*and*delayed adstock*. The former represents the cumulative marketing channel effect as a weighted average spend on a given day t and previous L - 1 days and is formalized as follows:

$$adstock\left(x_{t-L+1},\ldots,x_t;a,L\right)=\frac{\left(\sum_{l=0}^{L-1}a^l * x_{t-l}\right)}{\left(\sum_{l=0}^{L-1}a^l\right)}$$

where a is the adstock retention rate, such that $0 < a < 1$; L is the maximum duration of adstock assumed for a given marketing channel. The use of adstock is justified for the cases, in which marketing invests are supposed to have the effect on consumers beginning from the day, on which marketing invests were made (a radio media campaign is assumed to influence the consumers behavior from the day of the first broadcast).

How wavelets approach is used in MMM

last update: 01.06.2023 from Hendrik Huening

After multiple robustness checks of the wavelets approach, the approach that reconciles the *wavelet transformation* for the calculation of media effect and *optimize* for the estimation of transformation parameters for (delayed) adstock and saturation functions for catalogue and digital marketing has been proposed. Roughly, it consists of the following steps:

1. Calculation the effect of media (ROAS for media) in a complete model with a target variable "demand in low frequency" (typically 32 or 64 days) with raw marketing channel costs and control variables as independent variables.
2. Subtraction of media effect from demand on a daily basis (high frequency) → demand without media effect
3. Fitting a regression model with a target variable "demand without media effect" without media as an independent variable (in this step catalogue and digital marketing costs are transformed to account for (delayed) adstock and saturation effects using *optimize*).
4. Calculation of catalogue and digital marketing effects (along with the effects of other control variables) and calculation of ROAS for catalogue and digital marketing on the basis of their effects.

Regression model

last update: 06.01.2023 from Hendrik Huening

We choose a linear regression as the tool to find the optimal marketing mix for the channels OMA, Catalogue and Media. A linear regression models one dependent variable (in our case demand at day t) as a linear function of explanatory (or independent) variables. Explanatory variables are investments (spendings) in media, oma and catalogue as well as control variables such as a seasonality variable and information on competitors spendings (see subchapter "Competitors in the MMM"). Formally, the model can be summarized as follows:

$$\Delta demand_t = \alpha + \beta_1 * \Delta invest\_media_t + ... + \beta_n * \Delta Saisonality_t + \epsilon_t$$

Reasons for the use of the regression model approach

Linear regressions have advantages and disadvantages. We opted for a linear regression because results of the approach are easy to interpret and the model ist relatively easy to implement and to estimate. This question was also discussed within a ticket. If the true relationship of the modeled variables is non-linear, linear regression will perform sub-optimal compared to more sophisticated methods.

Marketing Mix Modeling at bonprix

last update: 14.02.2023 from Sandra Kleinewalter