

Compositional data modeling of the French automobile market: how do media investments impact brand market-shares?

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Abstract

This contribution aims to present an innovative application of compositional data analysis to the marketing framework. Media investments in the automobile market represent a very large amount of money allocated to different channels: TV, radio, press, outdoor, digital and cinema. A car manufacturer may want to analyze the impact of media investments on its sales in order to optimize the amount spent and the allocation across channels. This cannot be done without accounting for competition which is prominent in this market. Thus the modeling of market-shares is of interest. Our goal is to measure the impact of brand media investments on brand market-shares in the French automobile market, from 2003 to 2015. The vector of brand market-shares at time t is the dependent composition; the vector of brand media investments (by channel) and the vector of brand prices are the explanatory compositions. Other real variables can also be used as explanatory variables (e.g. scrapping incentive).

We compare the compositional model proposed by the CODA literature when both dependent and explanatory variables are compositional, to other models coming from different literatures like the aggregated multinomial logit (Haaf and others, 2014), the Dirichlet covariate model (Hijazi and Jernigan, 2009), the market-shares models (Cooper and Nakanishi, 1988) or the compositional model with non-component specific parameters (Wang and others, 2013).

We demonstrate how to interpret the parameters of this model in terms of direct and cross elasticity (Morais and others, 2016). The elasticity of the market-share of brand j to media investments of brand l is the relative change of the market-share j to an increase of 1% of the volume of media investments of brand l , ceteris paribus. These elasticities can be computed using the parameters of the transformed model (in ILR for example) or using the parameters of the model in the simplex. This type of results, widely used in marketing and econometrics, can be very valuable to enhance the interpretability of CODA models.

Other issues are covered, like the potential autocorrelation of error terms when compositions are time series, and the use of an “adstock” function to summarize past and present media investments.

References

- Cooper, L.G. and Nakanishi, M. (1988). *Market-Share Analysis: Evaluating Competitive Marketing Effectiveness*. International Series in Quantitative Marketing. Springer.
- Haaf, C.G.; Michalek, J.; Morrow, W.R. and Liu, Y. (2014). Sensitivity of Vehicle Market Share Predictions to Discrete Choice Model Specification. *Journal of Mechanical Design* 136.
- Hijazi, R.H. and Jernigan, R.W. (2009). Modelling compositional data using Dirichlet regression models. *Journal of Applied Probability and Statistics* 4(1), pp. 77–91.
- Morais, J.; Thomas-Agnan, C. and Simioni, M. (2016). A tour of regression models for explaining shares. *TSE Working Paper*(16-742).
- Wang, H.; Shangquan, L.; Wu, J. and Guan, R. (2016). Multiple linear regression modeling for compositional data. *Neurocomputing* 122, pp. 490–500.