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Sara Dolnicar • Bettina Grün • Friedrich Leisch

Market Segmentation Analysis

Understanding It, Doing It, and Making
It Useful

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Preface

‘Another book on market segmentation’ you think. Many outstanding marketing scientists, scholars and consultants have written excellent books on market segmentation. Some books offer practical advice to managers on how to best implement market segmentation in an organisation to ensure that the segmentation strategy is a success. Other books present sophisticated algorithms to extract market segments from consumer data. Our excuse for writing yet another book on market segmentation is to bridge the gap between the managerial and the statistical aspects of market segmentation analysis. We also want to give readers the opportunity to replicate every single calculation and visualisation we discuss in the book. We achieve this by making data sets used in the book available online (<http://www.MarketSegmentationAnalysis.org>) and by accompanying each section with R code. R is an open source environment for statistical computing and graphics, which is freely available for Linux, MacOS and Windows.

Most of the examples used in the book relate to tourism. We have chosen tourism because most people go on vacation and, as a consequence, can relate to the examples, even if professionally they market an entirely different product. Tourism is also very complex compared to other products: a trip consists of many different elements, typically a number of decision makers are involved in the planning process, travel can be motivated by a wide range of motives, and manifests in tourists engaging in an even wider range of activities. Tourists can plan their trip of a lifetime for decades or ‘impulse purchase’ a city trip a few hours before departure. As a consequence of the complexity of tourism as a product, many alternative market segmentation approaches can be used to break the market down into smaller, more homogeneous consumer groups or market segments. In the case of marketing toothpaste, for example, consumers can be segmented by their willingness to pay or by benefits sought. Tourists can, in addition, be grouped based on their preferences for vacation activities, the people they travel with, how long they travel, whether or not they stay at the same destination or visit a number of destinations, the degree to which they perceive risks to be associated with their trip, their expenditure patterns, their level of variety seeking and so on.

The fact that we use many tourism examples does not mean, however, that this is a book on tourism market segmentation. Market segmentation is a framework that is independent of the nature of the product or service being marketed. Everything we discuss in the book can be used in tourism, but also to market fast moving consumer goods or to try to attract excellent foster carers. The principles and techniques covered in this book can be applied across a variety of industries and geographic markets. This is also reflected by our use of the terms *organisation* and *user* to signal that market segmentation is of value to organisations aimed primarily at generating profits, as well as organisations aimed at achieving other missions.

We have structured the book in a way that makes it possible to use it as a companion throughout the entire journey of market segmentation analysis. In this case, each of the steps can be processed one after the other. Alternatively, it is also possible to just learn more about one specific step of market segmentation analysis. We have broken down the process of market segmentation analysis into ten steps. For each step we discuss the aims, point to potential pitfalls, and offer a range of approaches that can be used. All proposed approaches are accompanied by R code allowing replication of all analyses.

R started in 1992. Over the last two decades, R has developed to become the lingua franca of computational statistics (de Leeuw and Mair 2007, p. 2). It is used for teaching and research in universities all over the world and has been adopted by many non-academic organisations. R is open source software. The source code can be downloaded from the Comprehensive R Archive Network (CRAN) at <https://CRAN.R-project.org> for free. The backbone of R's success is that everybody can contribute extension packages. In April 2018 some 12,500 extension packages were available on CRAN. Many more R packages are available on private web pages and in other repositories. Many of these packages can be used for market segmentation, and some will be introduced in this book.

One of the extension packages is called **MSA** (for Market Segmentation Analysis) and contains all data sets used in this book. The package also contains all analyses shown in the book as R demonstrations that can be run directly using commands like `demo("step-4", package = "MSA")` to run the code from Step 4. For users of other statistical software packages, the data sets are also available at <http://www.MarketSegmentationAnalysis.org>.

This book is not an introduction to R. Readers who are not familiar with R can

1. Ignore the R commands shown throughout the book, and concentrate on the results. Many of the algorithms presented are available in other statistical software packages like SPSS or SAS.
2. Use a companion R package written by Putler and Krider (2012) called `RcmdrPlugin.BCA` that implements a graphical user interface (GUI) through the R Commander (Fox 2017) point-and-click interface to R. Starting with a GUI makes it easier to learn R initially.

3. Learn R from an introductory R textbook. Dalgaard (2008), Hothorn and Everitt (2014) and Kabacoff (2015) offer general introductions to R; Chapman and Feit (2015) and Putler and Krider (2012) discuss marketing and business-related analyses more specifically.

At the end of each of the ten steps of market segmentation analysis, we offer a checklist. These checklists are a starting point for organisations to structure their market segmentation analysis procedure. They can easily be modified, refined and extended to best suit the organisation's needs.

At a practical level, this book is the result of two decades of cross-disciplinary research into market segmentation facilitated by the research agencies of Australia and Austria. We are grateful to the Australian Research Council (ARC) and the Austrian Science Fund (FWF) for supporting our research programme on market segmentation analysis under ARC project numbers DP0557769, DP110101347, LX0559628 and LX0881890 and FWF project numbers P17382-N12, T351-N18 and V170-N18. Computations were partially run on the Vienna Scientific Cluster (VSC) under approval number 70419. We thank our industry partners for making available data sets, including the Austrian National Tourism Organisation (Österreich Werbung) and the Australian National Tourism Organisation (Tourism Australia). We thank Homa Hajibaba, Dominik Ernst and Syma Ahmed for technical support and feedback on earlier versions of the manuscript. We thank the Springer reviewers for recommendations for improvement and Joshua Hartmann for his assistance with illustrations.

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References

- Chapman CN, McDonnell Feit E (2015) R for marketing research and analytics. UseR!. Springer International Publishing
- Dalgaard P (2008) Introductory statistics with R, 2nd edn. Springer, New York
- de Leeuw J, Mair P (2007) An introduction to the special volume on "Psychometrics in R". *J Stat Softw* 20(1):1–5
- Fox J (2017) Using the R Commander: a point-and-click interface for R. Chapman & Hall/CRC Press, Boca Raton
- Hothorn T, Everitt BS (2014) A handbook of statistical analyses using R, 3rd edn. Chapman & Hall/CRC Press, Boca Raton
- Kabacoff RI (2015) R in action: data analysis and graphics with R, 2nd edn. Manning Publications, Shelter Island
- Putler DS, Krider RE (2012) Customer and business analytics: applied data mining for business decision making using R. Chapman & Hall/CRC Press, Boca Raton

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