

Course Description

Emperical Methods for Marketing Research and Analytics Using .

Prof. Dr. Martin Wetzels

Introduction

For academic researchers, it is crucial nowadays to be familiar with a large number of data analysis techniques and methodological approaches. Not only has the availability of data increased dramatically, IBM (www.ibm.com) for instance predicts that every day, 2.5 quintillion bytes of data is created, so much indeed that 90% of the data in the world today has been created in the last two years alone, also the data is predominantly getting unstructured in nature. Moreover, for most research disciplines in business and economics, novel analysis techniques and methodological approaches are very rapidly evolving. This implies that studying *state-of-the-art* analysis techniques and methodological approaches have become an essential part of a PhD training, and indeed for many management and research-oriented jobs in industry. Actually, in their 2012 seminal Harvard Business Review article Davenport and Patil exclaim that the data scientist might well evolve into "...*the sexiest job of the 21st century.*"

Course Philosophy

This course aims at providing the participants with a number of introductory sessions to different state-of-the-art analysis techniques and methodological approaches. Rather than focusing on every technical detail, this course will provide you with the general idea underlying different analysis techniques and methodological approaches. In addition, you will learn how to apply the different analysis techniques "hands-on" using structured data analysis assignments. We will use R (<https://cran.r-project.org/>) as the core analysis platform for this course, complemented by SPSS as an alternative analysis platform.

R is an integral and open source analysis platform and has evolved into the global *lingua franca* of the data analytics community. Currently, R features 13342 packages covering a plethora of applications for almost any conceivable scientific discipline (<https://cran.r-project.org/web/packages/>). Generally, R requires a steep learning curve, but is increasingly gaining market share and popularity in the academic community due to its flexibility, universal applicability and open source nature. In the workshop we will be showing R side-by-side with its main competitors, SPSS (basic analysis, regression analysis, scaling and exploratory factor analysis), LISREL (confirmatory factor analysis and structural equation modeling) and SmartPLS (PLS path modeling). Recently, graphical user interfaces (GUI) have been developed for R, such as R commander (uses and almost SPSS-like menu structure) and Rstudio, a more advanced GUI for R.

Course Objectives

The goal of this course is to introduce the participants to a number of relevant analysis techniques and methodological approaches, and applying them “hands-on.” Participants will not only acquire an introduction to the analysis techniques and methodological approaches, they will also have the opportunity to apply them to real-life problems using structured data assignments. The course will not only focus on “hard skills,” but also on “soft skills,” such as creativity in problem solving, collaboration and teamwork and providing a research “narrative” on the basis of the extant literature. The course objectives of this course can be summarized as follows:

- ▶ Introduce participants to key data analysis techniques and methodological approaches that are an essential part of a PhD training, and indeed for many management and research-oriented jobs in industry;
- ▶ Participants will apply these key data analysis techniques and methodological approaches using real-life problems using structured data assignments as teamwork;
- ▶ Apart from the data analysis and methodological skills the participants will also gain further experience in the application of R complemented by SPSS as alternative analysis platform and
- ▶ “Soft” skills to complement the data analysis and methodological skills of the participants, such as creativity in problem solving, collaboration and teamwork, providing a research “narrative” on the basis of the extant literature communication of findings and in-class interaction

Prerequisites

The participants need an intermediate level of understanding of the statistical methods being highlighted in R, as reflected in Malhotra (2010), chapter 16 (Basic Analysis and AN(C)OVA), chapter 17 (Correlation and Regression Analysis), chapter 19 (Exploratory Factor Analysis) and chapter 22 (Structural Equation Modeling). The workshop will mainly focus on the hands-on application of R and contrast it with applications for its main competitors. An in-depth treatment of the analysis methods is not part of the workshop, as we assume an intermediate level of familiarity with these methods. More insight in the nature of R versus SPSS can be obtained by consulting Muenchen (2009).

References

- Malhotra, N. (2010). *Marketing Research: An Applied Orientation*. Upper Saddle River: Pearson/Prentice-Hall.
- Muenchen, R.A. (2009). *R for SAS and SPSS Users*. New York, NY: Springer Science and Business Media.

Software Requirements

Participants should bring their laptop and install R and Rstudio, which are both open source software and can be freely downloaded and installed, before the session. R can be downloaded for Windows from: <http://cran.r-project.org/bin/windows/base/>, or alternatively for MAC from: (<http://cran.r-project.org/bin/macosx/>). A LINUX version of R is also available. More detailed information on the installation and administration of R can be found under:

<http://cran.r-project.org/doc/manuals/R-admin.html>. Rstudio (for desktop) can be downloaded from: <https://www.rstudio.com/products/rstudio/download/>. There is a version for Windows, MAC and LINUX. Installing R and Rstudio on MAC can be somewhat challenging. An installation instruction can be found on: <https://www.r-bloggers.com/installing-r-on-os-x/>.

Course Structure

The workshop will be hands-on, and it is therefore essential to bring a laptop. Handouts of the slides and additional materials will be provided electronically. Most of the R documentation and additional materials are freely available and can be downloaded free of cost. A time line of the workshop is provided below.

Session:

DAY 1

(Arkadia Building, E-125)

9:00-12:00: Session 1

14:00-17:00: Session 2

DAY 2

(Arkadia Building, E-125)

9:00-12:00: Session 3

14:00-17:00: Session 4

DAY 3

(Arkadia Building, E-125)

9:00-12:00: Session 5

14:00-17:00: Session 6

TOPIC:

INTRODUCING MULTIVARIATE ANALYSIS AND R

USING R FOR BASIC ANALYSIS

USING R FOR AN(C)OVA

USING R FOR REGRESSION ANALYSIS

USING R FOR SCALING AND FACTOR ANALYSIS

USING R FOR SEM and PLS PATH MODELING

Workshop Outline

A more detailed outline of the workshop with suggested readings is provided below.

SESSION 1

Introducing Multivariate Analysis and R



The most current version of R (Version 3.5.1, "Feather Spray") for Windows can be downloaded from: <http://cran.r-project.org/bin/windows/base/>, or alternatively for MAC from: (<http://cran.r-project.org/bin/macosx/>). More detailed information on the installation and administration of R can be found under: <http://cran.r-project.org/doc/manuals/R-admin.html>. A condensed introduction to R can be obtained from: <http://cran.r-project.org/doc/manuals/r-release/R-intro.pdf> and <https://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf>. Many more helpful sources can be "googled". A really helpful online resource on R (*my opinion*) is Quick-R: <http://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>.

Some more extensive introductions on R are also available and can be downloaded as pdf:

- *R Cookbook* (Link: <http://ase.tufts.edu/bugs/guide/assets/R%20Cookbook.pdf>).
- *R Graphics Cookbook* (Link: <http://ase.tufts.edu/bugs/guide/assets/R%20Graphics%20Cookbook.pdf>).
- *R Graphics* (Murrell, Paul; Link: http://www.e-reading.club/bookreader.php/137370/C486x_APPb.pdf).
- *Using R for Introductory Statistics* (Verzani, John; Link: <http://cbb.sjtu.edu.cn/~mywu/bi217/usingR.pdf>).

Moreover, you can find a repository of freely available ebooks on statistics and R on: <https://www.r-statistics.com/2009/10/free-statistics-e-books-for-download/>.

More detailed information on R is also available in a (rather large) number of books. Find a (very) short list of books (certainly not exhaustive) below.

Literature and Suggested Readings

- Chapman, C., & Feit, E. M. (2015). *R for Marketing Research and Analytics*. New York, NY: Springer.
- Crawley, M.J. (2013). *The R Book*. Chichester, UK: John Wiley and Sons.
- Everitt, B.S. and Hothorn, T. (2006). *A Handbook of Statistical Analysis Using R*. Boca Raton, FL: Chapman and Hall/CRC.
- Field, A., Miles, J. and Field, Z. (2012). *Discovering Statistics using R*. Los Angeles, CA: Sage Publications.
- Kabacoff, R.I. (2011). *R in Action*. Shelter Island, NY: Manning.
- Muenchen, R.A. (2009). *R for SAS and SPSS Users*. New York, NY; Springer Science and Business Media.

SESSION 2: Using R for Basic Analysis



The most current version of R (Version 3.5.1, "Feather Spray") for Windows can be downloaded from: <http://cran.r-project.org/bin/windows/base/>, or alternatively for MAC from: (<http://cran.r-project.org/bin/macosx/>). More detailed information on the installation and administration of R can be found under: <http://cran.r-project.org/doc/manuals/R-admin.html>. A condensed introduction to R can be obtained from: <http://cran.r-project.org/doc/manuals/r-release/R-intro.pdf> and <https://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf>.

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- *R Graphics Cookbook* (Link: <http://ase.tufts.edu/bugs/guide/assets/R%20Graphics%20Cookbook.pdf>).
- *R Graphics* (Murrell, Paul; Link: http://www.e-reading.club/bookreader.php/137370/C486x_APPb.pdf).
- *Using R for Introductory Statistics* (Verzani, John; Link: <http://cbb.sjtu.edu.cn/~mywu/bi217/usingR.pdf>).

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- Faraway, J. (2005). *Linear Models with R*. Boca Raton, FL: Chapman & Hall/CRC.
- Field, A., Miles, J. and Field, Z. (2012). *Discovering Statistics using R*. Los Angeles, CA: Sage Publications.
- Kabacoff, R.I. (2011). *R in Action*. Shelter Island, NY: Manning.
- Muenchen, R.A. (2009). *R for SAS and SPSS Users*. New York, NY; Springer Science and Business Media.

**SESSION 3:
Using R for AN(C)OVA**


The most current version of R (Version 3.5.1, "Feather Spray") for Windows can be downloaded from: <http://cran.r-project.org/bin/windows/base/>, or alternatively for MAC from: (<http://cran.r-project.org/bin/macosx/>). More detailed information on the installation and administration of R can be found under: <http://cran.r-project.org/doc/manuals/R-admin.html>. A condensed introduction to R can be obtained from: <http://cran.r-project.org/doc/manuals/r-release/R-intro.pdf> and <https://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf>. For AN(C)OVA you may consult in Faraway (2002) (<http://cran.r-project.org/doc/contrib/Faraway-PRA.pdf>). Many more helpful sources can be "googled". A really helpful online resource on R (*my opinion*) is Quick-R: <http://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>.

Some more extensive introductions on R are also available and can be downloaded as pdf:

- *R Cookbook* (Link: <http://ase.tufts.edu/bugs/guide/assets/R%20Cookbook.pdf>).
- *R Graphics Cookbook* (Link: <http://ase.tufts.edu/bugs/guide/assets/R%20Graphics%20Cookbook.pdf>).
- *R Graphics* (Murrell, Paul; Link: http://www.e-reading.club/bookreader.php/137370/C486x_APPb.pdf).
- *Using R for Introductory Statistics* (Verzani, John; Link: <http://cbb.sjtu.edu.cn/~mywu/bi217/usingR.pdf>).

Moreover, you can find a repository of freely available ebooks on statistics and R on: <https://www.r-statistics.com/2009/10/free-statistics-e-books-for-download/>.

More detailed information on R is also available in a (rather large) number of books. Find a (very) short list of books (certainly not exhaustive) below.

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- Crawley, M.J. (2013). *The R Book*. Chichester, UK: John Wiley and Sons.
- Everitt, B.S. and Hothorn, T. (2006). *A Handbook of Statistical Analysis Using R*. Boca Raton, FL: Chapman and Hall/CRC.
- Faraway, J. (2005). *Linear Models with R*. Boca Raton, FL: Chapman & Hall/CRC.
- Field, A., Miles, J. and Field, Z. (2012). *Discovering Statistics using R*. Los Angeles, CA: Sage Publications.
- Kabacoff, R.I. (2011). *R in Action*. Shelter Island, NY: Manning.
- Muenchen, R.A. (2009). *R for SAS and SPSS Users*. New York, NY; Springer Science and Business Media.

SESSION 4:
Using R for Regression Analysis


The most current version of R (Version 3.5.1, "Feather Spray") for Windows can be downloaded from: <http://cran.r-project.org/bin/windows/base/>, or alternatively for MAC from: (<http://cran.r-project.org/bin/macosx/>). For regression analysis we will rely mainly on the R Base package. More information on the use of regression analysis in R is available in Faraway (2002) (<http://cran.r-project.org/doc/contrib/Faraway-PRA.pdf>) and on the Quick-R website (<http://www.statmethods.net/stats/regression.html>).

Literature and Suggested Readings

- Chapman, C., & Feit, E. M. (2015). *R for Marketing Research and Analytics*. New York, NY: Springer.
- Everitt, B.S. and Hothorn, T. (2006). *A Handbook of Statistical Analysis Using R*. Boca Raton, FL: Chapman and Hall/CRC.
- Field, A., Miles, J. and Field, Z. (2012). *Discovering Statistics using R*. Los Angeles, CA: Sage Publications.
- Faraway, J. (2005). *Linear Models with R*. Boca Raton, FL: Chapman & Hall/CRC.
- Fox, J. and Weisberg, S (2011). *An R Companion to Applied Regression*. Los Angeles, CA: Sage Publications.

SESSION 5:
Using R for Scaling and Exploratory Factor Analysis


The most current version of R (Version 3.5.1, "Feather Spray") for Windows can be downloaded from: <http://cran.r-project.org/bin/windows/base/>, or alternatively for MAC from: (<http://cran.r-project.org/bin/macosx/>). As far as exploratory factor analysis is concerned we will mainly rely on the R package psych (<https://personality-project.org/r/psych/>). This website provides also additional information how to install R on your system including how to install packages, such as psych (https://personality-project.org/r/psych/HowTo/getting_started.pdf). More information about the R package psych is available at <http://cran.r-project.org/web/packages/psych/vignettes/overview.pdf> and <https://personality-project.org/r/book/>.

Literature and Suggested Readings

- Chapman, C., & Feit, E. M. (2015). *R for Marketing Research and Analytics*. New York, NY: Springer.
- Everitt, B.S. and Hothorn, T. (2006). *A Handbook of Statistical Analysis Using R*. Boca Raton, FL: Chapman and Hall/CRC.
- Field, A., Miles, J. and Field, Z. (2012). *Discovering Statistics using R*. Los Angeles, CA: Sage Publications.
- Finch, W.H., Jr. and French, B.F. (2015). *Latent Variable Modeling with R*. New York: Routledge.

SESSION 6: Using R for SEM and PLS Path Modeling



The most current version of R (Version 3.5.1, "Feather Spray") for Windows can be downloaded from: <http://cran.r-project.org/bin/windows/base/>, or alternatively for MAC from: (<http://cran.r-project.org/bin/macosx/>). For confirmatory factor analysis we will rely mainly on the R package lavaan (<http://lavaan.ugent.be/>). Under getting started the lavaan tutorial (<http://lavaan.ugent.be/tutorial/tutorial.pdf>) and the lavaan paper in the Journal of Statistical Software (<http://www.jstatsoft.org/v48/i02/>) can be obtained.

For structural equation modeling we will rely on the R package lavaan (<http://lavaan.ugent.be/>). Under getting started the lavaan tutorial (<http://lavaan.ugent.be/tutorial/tutorial.pdf>) and the lavaan paper in the Journal of Statistical Software (<http://www.jstatsoft.org/v48/i02/>) can be obtained. For partial least squares (PLS) path modeling we will rely on the R package plspm (<http://www.plsmodeling.com/>). A vignette introducing the R package plspm is available at (http://cran.r-project.org/web/packages/plspm/vignettes/plspm_introduction.pdf).

Literature and Suggested Readings

- Beaujean, A.A. (2014). *Latent Variable Modeling Using R: A Step-by-Step Guide*. New York: Routledge.
- Finch, W.H., Jr. and French, B.F. (2015). *Latent Variable Modeling with R*. New York: Routledge.
- Tenenhaus, M., Vinzi, V.E., Chatelin, Y.-M. & Lauro, C (2005). PLS Path Modeling. *Computational Statistics & Data Analysis*, 48, 159-205.

Instructor



Prof. Dr. Martin Wetzels is Professor in Marketing and Supply Chain Research at the School of Business and Economics, Maastricht University, the Netherlands. He currently serves as Director MSc Programmes and Research Theme Leader Data-Driven Decision-Making (D3M). His main research interests are services marketing, marketing research, B2B marketing, marketing channels and digital marketing. His work has resulted in more than 90 articles in international journals, such as, *MIS Quarterly*, *Journal of Marketing*, *Management Science*, *Journal of Operations Management*, *Journal of Consumer Research*, *Accounting, Organizations and Society*, *Journal of the Academy of Marketing Science*, *Journal of Retailing*, *Journal of Service Research*, *Long Range Planning*, *Industrial Marketing Management*, *Journal of Product Innovation Management*, *Journal of Consumer Psychology*, *Journal of Management Studies*, *Journal of Business Research*, *Psychology and Marketing*, *Marketing Letters*, *European Journal of Marketing*, and *International Journal of Research in Marketing*. He has contributed more than 130 papers to conference proceedings and presentations. His work has received more than 16500 citations on Google Scholar resulting in an h-index of 51 and a g-index of 129 putting him in the top tier of marketing scholars worldwide. He has supervised more than 20 PhD candidates to completion. He actively serves as a reviewer for numerous leading international journals and he chaired a number of international conferences, such as IPSERA and SERVSIG.

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