Report on the 5th Working Group Meeting of AG MARKETING

Friederike Paetz and Raoul V. Kübler

Abstract This article reports on the 5th meeting of the working group AG MARKETING within the GfKl Data Science Society. The meeting was virtually held in two sessions on November 23, and 24, 2023, respectively. The presented talks included topics from a broad variety of fields from quantitative marketing, data analytics and operations management.

Friederike Paetz
Anhalt University of Applied Sciences, Strenzfelder Allee 28, 06406 Bernburg, Germany
✉ friederike.paetz@hs-anhalt.de

Raoul V. Kübler
ESSEC Business School France, 3 Av. Bernard Hirsch, 95000 Cergy, France
✉ b00806952@essec.edu

ARCHIVES OF DATA SCIENCE, SERIES A
(ONLINE FIRST)
KIT SCIENTIFIC PUBLISHING
Vol. 9, No. 1, 2024

DOI 10.5445/IR/1000171475
ISSN 2363-9881

1 Introduction

Although, the home measures in covid-19 that related to isolation of households, temporary closes of cultural facilities etc. are over, the pandemic still influences marketing research and interpretation of data collected before, within and after the pandemic. And even within our meeting, several talks where related to this issue to a narrower or broader sense. In addition, research focused on consumer behavior in digital shopping environments, assortment planning, consumer preferences for sustainable transportation and technology acceptance.

The invitation was accepted by up to 20 participants for each session. The discussions of the presentations were very vivid and provided helpful insights. In particular, the composition of attendees from varying disciplines, e.g., marketing, operations management, innovation management, contributed to a throughout understanding of different disciplines' views on specific (universal) topics. The first session was chaired by Prof. Dr. Marcel Lichters contained talks from the areas of tariffs of electric vehicles (Sperling, D., Woeste, R., and Lemathe, P., see section 2), patterns in pre-covid museum attendances (Hildebrand, L., and Paetz, F., see section 3), effects of shopping nudges (Winter, B., Schamp, C., Schröder, N., and Reutterer, T., see section 4) to voice shopping (Paetz, F., and Schultz, C.D., see section 5). The second session was chaired by Prof. Dr. Winfried Steiner and summarized talks about research on the measurement of technology acceptance over time by online customer reviews (Baier, D., Karasenko, A., and Rese, A., see section 6), incompletely specified products (Gönsch, J., see section 7), capacitated assortment optimization (Vetter, O., Sadeghi, N., and Schön, C., see section 8) and government advertise for support of its anti-pandemic actions (Welke, L., Kübler, R., and Pauwels, K., see section 9)

2 Conjoint Analysis on Charging Tariffs for EVs
Dustin Sperling, Richard Woeste, Peter Letmathe, RWTH Aachen

Electric vehicles are becoming increasingly popular. As the number of electric vehicles increases, so do the requirements for a reliable charging infrastructure. Current implementations do not always meet these complex requirements. For example, an average of 18% of public charging operations in Germany fail currently. Within the EMoT research project, a test center will be designed to address this issue. In the course of the project, user preferences for charging tariffs will be investigated. A particular focus is on the value attached to the accessibility of reliable charging infrastructure. Different tariff features are weighed against each other in order to determine the corresponding end-user benefits for different levels of tariff features (Backhaus et al, 2021). Finally, it will be determined which tariff features are of particular interest and what value is attached to the reliability of charging. The research questions are answered by conducting a discrete choice experiment, specifically a choice based conjoint analysis (CBC) (Baier and Brusch, 2021). The results are evaluated using a hierarchical Bayes (HB) model (Allenby et al, 2005).

3 Towards Understanding Patterns in Museum Attendance: Applying Time Series Analysis to German Museum Panel Data

Lea Hildebrand, Ostfalia University of Applied Sciences
Friederike Paetz, Clausthal University of Technology

Visitor numbers are of superior importance when evaluating a museum's economic performance (Hildebrand, Paetz & Küblböck (Hildebrand et al, 2022)). The ability to detect patterns in visitation is a crucial managerial issue when assessing previous museum performance. Aside from that, a sound understanding of temporal patterns in visitor numbers is even more fundamental for forecasting prospective visitation. However, only few research articles exist investigating museum attendance under explicit consideration of the aspect of time (see e.g. Cellini and Cuccia, 2013; Cuffe, 2018). This contribution aims to take up this research demand. The present study initially applies time series analysis to German museum panel data in order to contribute to a better understanding of the temporal distribution of museum attendance. Our study is based on panel data containing information on the attendance of 95 German publicly funded museums such as corresponding site information from 1999 to 2019. In a first step of data processing, we scrutinized the individual statistical properties of each time series on record for a systematic derivation of forecasting requirements. The analysis revealed a non-stationary nature for the great majority of examined time series and, therefore the particular necessity of employing detrending transformations. In the next step, we evaluated and compared the forecast accuracy of four widely applied methods in time series modelling. With respect to the evaluation of several accuracy measures, we find rolling window forecasts yielding the best quality in visitor forecasting. Further investigations of the gathered accuracy measures and site data imply not to assume that dynamics in the respective museum location have an impact on the output of any of the applied forecasting technique. The talk aims to present primary study results and intends discussing methodical challenges in time series modelling due to the determined particularity of the underlying data set.

4 Nudge or Necessity? Exploring the Effects of Shopping Nudges along the Consumer Journey

Bernhard Winter, Christina Schamp, Nadine Schröder, Thomas Reutterer, Vienna University of Economics and Business, Austria

In the domain of online shopping, retailers often use behavioral nudges such as time scarcity (e.g., x% off for a limited time), quantity scarcity (e.g., only a few items left), or social proof (e.g., most popular choices), to engage customers and increase sales. Despite their widespread use in marketing practice, previous research has primarily focused on isolated versions of specific nudges and compares up to only two distinct nudges in experimental lab settings, resulting in a limited view of the complex landscape of online shopping nudges (e.g., Howard and Kerin, 2006; Hmurovic et al, 2022). Moreover, these studies study the influence of these nudges on the purchase phase of the consumer journey by exploring choices or willingness to purchase for specific products, whereas in practice the nudges are used along various stages of the consumer journey. Our research tries to provide a comprehensive perspective on nudges in online shopping environments. Unlike prior studies that rely on short-term experimental data, our analysis combines conjoint analysis with real-world sales and campaign-specific data gathered from an international online shopping club in the fashion industry. The dataset on more than 100,000 customers, which spans over a period of a few years, allows us to uncover the effects of various nudges throughout the customer journey, revealing their various effects and how customer responses evolve over time. Contrary to the common belief that nudges exert a consistent influence on online shoppers across all stages of the decision journey, our preliminary findings challenge this notion. Specifically, we discover that scarcity – in contrast to other nudges like social proof – has a detrimental effect on customers during earlier stages of the consumer funnel. It seems that whereas scarcity effects induce feelings of loss aversion for dedicated product decisions, these nudges provide negative signals in the consideration phase (e.g., clicking on an advertised campaign). This crucial insight emphasizes the need to understand the temporal and situational dynamics of nudges. Recognizing how these influences transform as customers progress from awareness to post-purchase stages is vital for retailers and marketers aiming to optimize their nudge strategies and enhance the overall online shopping experience. For additional information see Gierl and Huettl (2010).

5 Determinants for Voice Shopping via Digital Voice Assistants: An Empirical Study

Friederike Paetz, Anhalt University of Applied Sciences
Carsten D. Schultz, University of Hagen

Nowadays, voice shopping, i.e., shopping via conversational interactions with digital voice assistants is on the rise (Halbauer and Klarmann, 2022). The digital voice assistants Amazon's Alexa, Apple's Siri, Microsoft‘s Cortana, Google's Assistant, and Samsung's Bixby are well-known and widely used. The interaction with digital voice assistants is done verbally with technical devices without haptic contact. Therefore, voice commands need microphones that must continuously monitor the environment and process all sound inputs via an active Internet connection. When voice assistants are placed within the personal environment, it raises questions about what is recorded from private conversations, how the collected information is used and protected, and whether the information is used to pursue business purposes. So far, German customers are quite reluctant to voice shopping. This behavior may be traced back to Germans' privacy and security concerns. However, other factors that impact customers' attitude or behavioral intention to use digital voice assistants are less known and researched so far. However, the knowledge of these determinants are quite important for an entrepreneurial understanding of customers to (subsequently) enter voice shopping. This, in turn, has significant impacts on entrepreneurial decisions towards specific business plans, e.g., the integration of voice commerce. In our study, we rely on the well-known technology acceptance model (TAM) of Davis (1989) for determining the acceptance and use of digital voice assistants. In particular, we focus on the relevance of perceived privacy and safety risks as determinants to use digital voice assistants and investigate these concerns and the corresponding level of trust. We create several hypotheses from recent thematically related literature and test our model in an empirical study with 207 respondents. In particular, we conducted a variance-based structural equation analysis and used the R package plspm for partial least square modeling. The empirical results showed support for almost all hypotheses and support the proposed research model, thus, validating the corresponding extension of the TAM. For example, we found that safety and privacy risks actually emerged. Furthermore, trust positively forms the attitude towards the technology and subsequently creates users' intention to use and actual use of digital voice assistants. We conclude that emerging technologies like digital voice assistants need a threshold level of trust. Since digital voice assistants lack visual clues, other means need to communicate trusthworthiness. For example, easy accessible and comprehensible information are key to strengthen customers trust. This may be accomplished by seals, policies or trusted third parties. For additional information see Schultz and Paetz (2023).

6 Measuring Technology Acceptance over Time by Online Customer Reviews Based Transfer Learning

Daniel Baier, Andreas Karasenko, Alexandra Rese, University of Bayreuth

Online Customer Reviews (OCRs) are user-generated semi-formal evaluations of objects (brands, companies, products, services, technologies). They typically consist of a time stamp, a star rating (1 to 5 stars) of the evaluated object and – in many cases – a natural language comment that details the perceived strengths and weaknesses (Yang et al, 2019). Up to now, many methodological approaches have been developed and applied to analyze and aggregate OCRs as well as to improve products and services based on this knowledge (see, e.g., Decker and Trusov, 2010; Rese et al, 2014; Yang et al, 2019; Hartmann et al, 2023). So, Rese et al (2014) applied a lexicographic text mining approach similar to sentiment analysis to OCRs of IKEA's augmented reality app. They predicted construct scores for the extended technology acceptance model (TAM) and validated these predictions by an additionally conducted extended TAM survey among app users. In this paper, we present a new transformer based approach for the same purpose. We train, test, and validate a transfer learning model based on large samples of OCRs and corresponding extended TAM construct scores given by experts. The results are promising. They go beyond conducting an extended TAM survey for an object by validly predicting the development of construct scores over time.

7 How Much to Tell Your Customer? – A Survey of Three Perspectives on Selling Strategies with Incompletely Specified Products

Jochen Gönsch, University of Duisburg-Essen

Today's technology facilitates selling strategies that were unthinkable only a few years ago. One increasingly popular strategy uses incompletely specified products (ICSPs). The seller retains the right to specify some details of the product or service after the sale. The selling strategies' main advantages are an additional dimension for market segmentation and operational flexibility due to supply-side substitution possibilities. Since the strategy became popular with Priceline and Hotwire in the travel industry about two decades ago, it has increasingly been adopted by other industries with stochastic demand and limited capacity as well. At the same time, it is actively researched from the perspectives of strategic operations management, empirics, and revenue management. This presentation first describes the application of ICSPs in practice. Then, we introduce the different research communities that are active in this comparably new field and relate the terminology they use. In Strategic Operations Management, Jiang (2007) is one of the first authors who considers selling ICSPs. Regarding empirics, research started with Granados et al (2008) who analyze the prices posted for regular and opaque airline tickets with a special focus on the price difference. In operational Revenue Management, one of the first authors is Talluri (2001). The next part is an overview of the literature on selling ICSPs from the different perspectives. Here, we complement a tabular overview with an introduction into the community. Finally, possible directions for future research are outlined. We see that strategic operations management has described advantages of ICSPs over other strategies in a variety of settings, but also identified countervailing effects. Today, empirical research is confined to hotels and airlines and largely disconnected from the other perspectives. Operational papers are ample, but mostly concerned with the availability of ICSPs. Research on operational (dynamic) pricing is surprisingly scarce.

8 Capacitated Assortment Optimization under the Mixed Multinomial Logit Model

Oliver Vetter, Niloufar Sadeghi, Cornelia Schön, Business School of Mannheim

A key strategic decision for any company is the positioning and design of its product line. It is concerned with questions like "How many products to offer?", "Which products to offer?", and "How to differentiate and price the products in our line?". On the one hand, the implementation of product line decisions, like introducing new or redesigning existing products, is typically very costly. On the other hand, product line decisions determine the market success of the company. Only with a sufficiently differentiated product portfolio, diverse customer needs can be satisfied, and additional customers may be attracted. The problem of finding the most profitable product line under customer choice behavior has been separately addressed in the product line design (PLD) as well as in the assortment optimization (AO) literature. The AO problem under the mixed multinomial logit (MMNL) demand model is NP-hard. Existing exact methods for AO problems are suitable for small instances but computationally inefficient when applied to larger real-world instances. These instances can only be tackled with heuristic methods. We present novel exact solution procedures, an approximation scheme, and heuristic methods to solve the capacitated AO problem with discrete pricing under MMNL demand. We contribute to the existing literature in the following ways:

- We improve the state-of-the-art approach of Şen et al (2018) by adopting valid constraints from Méndez-Díaz et al (2014) and applying a branch and cut technique. Computational tests show that this enhancement solves our problem instances on average between 32 % - 56 % faster.
- We show that a fully polynomial-time approximation scheme (FTPAS) algorithm exists for the AO problem even if the discrete pricing decision is included. The algorithm is based on the work of Désir et al (2022) with three changes. First, we include the pricing constraints. Second, we reduce the number of grid points by decomposing each fraction with a single variable (like in Shen et al (2017)). Third, we allow that the weights in the capacity constraints can have negative values which is a more general version of Désir et al (2022). This allows the model to reflect situations where a lower bound on the capacity exists.

- We review the current PLD and AO literature and show that under two conditions, the PLD and the AO problem formulations are equivalent, such that their solution results in the same product line. In addition, we propose three heuristics. As GAs are prominently used across both literature streams, we apply two different versions of GAs. The first uses the AO model and the second uses the PLD model formulation. The third heuristic is a hybrid approach that takes advantage of both the PLD and AO formulations. We name this approach two-step, and the others GA-AO and GA-PLD, respectively. Then, we test in a numerical performance analysis of solution quality and time whether solving the AO problem formulation is advantageous over solving the equivalent PLD problem formulation with state-of-the-art methods, or vice versa. The heuristics and exact methods are tested on synthetical and seven real-world conjoint studies.

9 When and Where Should the Government Advertise for Support of Its Anti-Pandemic Actions

Lina Welke, Raoul Kübler, Essec Business School, Paris, France
Koen Pauwels, Northeastern University, Boston

The COVID-19 pandemic, which began in Wuhan, China, has left an indelible mark on the world, with over 208 million infections and 4.3 million deaths. During the initial phase of the pandemic, when vaccines and antiviral medications were unavailable, governments implemented Non-Pharmaceutical Interventions (NPIs) to curb the spread of the virus, ranging from border checks to complete lockdowns. While NPIs have been effective in reducing transmission (Chiu et al, 2020), the associated economic and psychological impacts have sparked debate (Hale et al, 2021; Sukhwal and Kankanhalli, 2022). This study addresses the debate around the psychological effects of NPIs, such as stress, anxiety, and depression, by examining emotional responses to these measures among different population groups in the United States during the early stages of the pandemic.

We rely on a set of transformer-based emotion classifiers to assess emotions within tweets, including anxiety, fear, sadness, anger, joy, and surprise. Additionally, a self-tuned transformer model is employed to detect stress and depression levels in tweets. Interrupted time series models are used to analyze the impact of reaching COVID-19 awareness and implementing NPIs on various emotions for each city.

Using a unique dataset of over 50 million geolocated tweets from 45 major U.S. cities from December 2019 to June 2020, the study employs interrupted time series models (Ejlerskov et al, 2018; Cook, 2008) to explore the impact of the COVID-19 pandemic and various NPIs on daily user stress and depression levels. The analysis also considers the moderating effect of the socio-economic context of each city to understand and explain variance in emotional responses.

Our study finds that in general COVID-19 is the largest stress driver. Once administrative entities decide on NPIs, we observe a significant reduction in stress. We further find that the impact of NPIs on emotions varies across cities, with some showing large effects upon implementing lockdowns while others show no immediate response. Long-term emotional responses also differ, with some cities experiencing a decline in fear after NPIs were put in place, challenging the notion that lockdowns universally negatively affect emotional well-being. The effects on other emotions show similar idiosyncrasies, highlighting the need for a deeper understanding of the socio-economic factors contributing to these variations.

The results provide valuable insights for policymakers, healthcare professionals, and communication managers, enabling them to better plan and forecast emotional responses among specific population groups when implementing NPIs. Our findings indicate that especially wealthier, more educated and whiter neighborhoods showed stronger negative reactions to NPIs, while poorer, less educated, and economically challenged areas, do not show significant changes in stress and well-being. Finally, we find that areas with higher levels of vulnerable citizens, which share higher levels of medical pre-conditions, similarly show more stressed reactions at the beginning of the COVID-19 pandemic, but ultimately show a significant decrease of stress, once NPIs are enacted. Our study's findings underscore the need for a nuanced understanding of how NPIs affect emotional well-being, emphasizing the importance of considering socio-economic factors in future planning and decision-making. This research contributes to a more comprehensive understanding of the psychological impact of NPIs during a public health crisis, highlighting the need for tailored strategies to address the emotional well-being of different population groups.

Further investigations are required to explore the socio-economic nuances and contingencies that explain the variations in emotional responses to NPIs, with the goal of providing more targeted support and care in future crises.

References

Allenby GM, Rossi PE, McCulloch RE (2005) Hierarchical bayes models: A practitioners guide. SSRN 2005:1 – 44, DOI 10.2139/ssrn.655541

Backhaus K, Erichson B, Gensler S, Weiber R, Weiber T (2021) Multivariate Analysemethoden. Eine Anwendungsorientierte Einführung, 16th edn. Springer, Wiesbaden, DOI 10.1007/978-3-658-32425-4

Baier D, Brusch M (eds) (2021) Conjointanalyse: Methoden – Anwendungen – Praxisbeispiele, 2nd edn. Springer, Berlin, Heidelberg, DOI 10.1007/978-3-662-63364-9

Cellini R, Cuccia T (2013) Museum and monument attendance and tourism flow: A time series analysis approach. Applied Economics 45(24):3473 – 3482, DOI 10.1080/00036846.2012.716150

Chiu WA, Fischer R, Ndeffo-Mbah ML (2020) State-level needs for social distancing and contact tracing to contain COVID-19 in the united states. Nature Human Behaviour 4(10):1080 – 1090, DOI 10.1038/s41562-020-00969-7

Cook TD (2008) "Waiting for life to arrive": A history of the regression-discontinuity design in psychology, statistics and economics. Journal of Econometrics 142(2):636 – 654, DOI 10.1016/j.jeconom.2007.05.002

Cuffe HE (2018) Rain and museum attendance: Are daily data fine enough? Journal of Cultural Economics 42:213 – 241, DOI 10.1007/s10824-017-9298-9

Davis FD (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 13(3):319 – 340, DOI 10.2307/249008

Decker R, Trusov M (2010) Estimating aggregate consumer preferences from online product reviews. International Journal of Research in Marketing 27(4):293 – 307, DOI 10.1016/j.ijresmar.2010.09.001

Désir A, Goyal V, Zhang J (2022) Technical note—capacitated assortment optimization: Hardness and approximation. Operations Research 70(2):893, DOI 10.1287/opre.2021.2142

Ejlerskov KT, Sharp SJ, Stead M, Adamson AJ, White M, Adams J (2018) Supermarket policies on less-healthy food at checkouts: Natural experimental evaluation using interrupted time series analyses of purchases. PLOS Medicine 15(12):1 – 20, DOI 10.1371/journal.pmed.1002712

Gierl H, Huettl V (2010) Are scarce products always more attractive? the interaction of different types of scarcity signals with products' suitability for conspicuous consumption. International Journal of Research in Marketing 27(3):225 – 235, DOI 10.1016/j.ijresmar.2010.02.002

Granados N, Gupta A, Kauffman RJ (2008) Designing online selling mechanisms: Transparency levels and prices. Decision Support Systems 45(4):729 – 745, DOI 10.1016/j.dss.2007.12.005

Halbauer I, Klarmann M (2022) How voice retailers can predict customer mood and how they can use that information. International Journal of Research in Marketing 39(1):77 – 95, DOI 10.1016/j.ijresmar.2021.09.008

Hale T, Angrist N, Goldszmidt R, Kira B, Petherick A, Phillips T, Webster S, Cameron-Blake E, Hallas L, Majumdar S, Tatlow H (2021) A global panel database of pandemic policies (Oxford COVID-19 government response tracker). Nature Human Behaviour 5(4):529 – 538, DOI 10.1038/s41562-021-01079-8

Hartmann J, Heitmann M, Siebert C, Schamp C (2023) More than a feeling: Accuracy and application of sentiment analysis. International Journal of Research in Marketing 40(1):75 – 87, DOI 10.1016/j.ijresmar.2022.05.005

Hildebrand L, Paetz F, Küblböck S (2022) Museales Performance-Measurement in Krisenzeiten [Performance measurement of museums in times of crisis]. Zeitschrift für Tourismuswissenschaft [Journal of Tourism Science] 14(2):107 – 133, DOI 10.1515/tw-2022-0003

Hmurovic J, Lamberton C, Goldsmith K (2022) Examining the efficacy of time scarcity marketing promotions in online retail. Journal of Marketing Research 60(2), DOI 10.1177/00222437221118856

Howard DJ, Kerin RA (2006) Broadening the scope of reference price advertising research: A field study of consumer shopping involvement. Journal of Marketing 70(4):185 – 204, DOI 10.1509/jmkg.70.4.185

Jiang Y (2007) Price discrimination with opaque products. Journal of Revenue and Pricing Management 6(2):118 – 134, DOI 10.1057/palgrave.rpm.5160073

Méndez-Díaz I, Miranda-Bront JJ, Vulcano G, Zabala P (2014) A branch-and-cut algorithm for the latent-class logit assortment problem. Discrete Applied Mathematics 164(1):246 – 263, DOI 10.1016/j.dam.2012.03.003

Rese A, Schreiber S, Baier D (2014) Technology acceptance modeling of augmented reality at the point of sale: Can surveys be replaced by an analysis of online reviews? Journal of Retailing and Consumer Services 21(5):869 – 876, DOI 10.1016/j.jretconser.2014.02.011

Schultz CD, Paetz F (2023) Trust in digital voice assistants: A fundamental determinant for companies' and customers' engagement in voice commerce.

Marketing ZFP – Journal of Research and Management 45(2):2 – 21, DOI 10.15358/0344-1369-2023-2-4

Shen P, Zhang T, Wang C (2017) Solving a class of generalized fractional programming problems using the feasibility of linear programs. Journal of Inequalities and Applications 2017(147):1 – 16, DOI 10.1186/s13660-017-1420-1

Sukhwal PC, Kankanhalli A (2022) Determining containment policy impacts on public sentimentdduring the pandemic using social media data. Proceedings of the National Academy of Sciences of the United States of America 119(19):1 – 8, DOI 10.1073/pnas.2117292119

Talluri KT (2001) Airline revenue management with passenger routing control: A new model with solution approaches. International Journal of Services Technology and Management 2:102 – 115, DOI 10.1504/IJSTM.2001.001593

Yang M, Ren Y, Adomavicius G (2019) Understanding user-generated content and customer engagement on facebook business pages. Information Systems Research 30(3):839 – 855, DOI 10.1287/isre.2019.0834

Şen A, Atamtürk A, Kaminsky P (2018) Technical note—a conic integer optimization approach to the constrained assortment problem under the mixed multinomial logit model. Operations Research 66(4):994, DOI 10.1287/opre.2017.1703