How quantitative marketing and management methodology is changing

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Abstract

In this editorial I review five key trends in quantitative methodology in Marketing and Management. The trends are (1) preregistration of behavioral experiments, (2) increasing focus on sources of endogeneity in strategy research, (3) a more evidentiary approach to the strength of evidence present in a study, (4) increasing use of Bayesian statistical inference, and (5) the introduction of computer science techniques into marketing.

1. Introduction

There is a saying, told by some Department Chairs, that if you don't like a professor, you assign him or her a class in Digital Marketing or Digital Strategy. In that way, the professor has to spend weeks and weeks every year updating the class in a laborious attempt to keep up with digital practice, which changes almost weekly. Conversely, if you like a professor, you assign him or her to teach a class in Research or Methodology, neither of which, as everybody knows, has changed in 50 years. It turns out that "50 years" is not literally true. The quantitative techniques used by Marketing and Management researchers have changed, are continuing to change, and are doing so faster than many realize. It is the purpose of this editorial to describe the various ways in which such techniques are changing.

Even those who do not specialize in methodology have a need to understand these changes. There are two reasons for this. All of us, no matter what our preferred methods, need to read the papers of others. We need to have some sense that the methods employed in those papers are appropriate, and to appreciate how such methods provide the knowledge that they provide. Secondly, we need to be able to guide students, especially PhD students, in what research techniques they should learn. If we don't know the methods employed in our field, we cannot guide our students very well.

I believe there are five key current trends in quantitative Marketing and Management methodology, and these five trends form the outline of this editorial. The trends are (1) preregistration of behavioral experiments, (2) increasing focus on sources of endogeneity in strategy research, (3) a more evidentiary approach to the strength of evidence present in a study, (4) increasing use of Bayesian statistical inference, and (5) the introduction of computer science techniques into marketing. Let us now proceed with the first trend.

2. Use of Preregistration

The failure to replicate a variety of experimental discoveries in the behavioral sciences has been much commented on over the years (a recent comment can be found in Haeffel 2022). This failure has been so jarring as to be named "the replication crisis". In order to incentivize principled researcher workflow, a movement has started where researchers publicly predict how their experiment will come out (Nosek *et al.*, 2018). In some cases a journal agrees to publish the work beforehand even if the prediction is disconfirmed. One benefit of preregistration is that if the manuscript were to be published no matter what, why not simply be honest in all research activities? In addition, forcing the researcher to make a prediction a priori means that they won't be able to retroactively change their hypotheses.

In addition to the authors cited above, benefits of preregistration are discussed by Gelman and Loken (2014) who emphasize that preregistration makes sense especially for fields like consumer behavior, or human relations, where collecting new data is not terribly difficult. When data are easy to come by, results might be subject to "hidden escalation of type I errors" (Ding *et al.*, 2020), which is to say an escalated probability of wrongly rejecting a null hypothesis. In addition to this advantage, Nosek and Lindsay (2018) point to the key distinction between confirmatory and exploratory research, which can be made when research is preregistered. Nosek and Lindsay also point out that to the extent that journals agree to publish the results no matter what, publication bias can be reduced.

3. Attention to Potential Endogeneity

Endogeneity can occur whenever an independent variable is potentially correlated with the error term in a model. The implications of this correlation are rather severe: the presence of endogeneity means that we cannot draw causal conclusions. In applied fields like Marketing and Management, where the goal is to help managers figure out how to act, the inability to draw causal conclusions renders our research meaningless.

Endogeneity can occur in any research situation, but is especially likely in non-laboratory settings, which is to say with field data. Endogeneity can result from any of the following three situations: a missing independent variable that has a causally important role with respect to the dependent variable; simultaneously causation between the observed independent and dependent variables; or error in measuring the independent variable (Hill *et al.*, 2021). One of the beauties of laboratory experiments that involve random assignment of subjects to conditions is the ability to rule out endogeneity.

While there are a variety of techniques for handling endogeneity for variables that are observed and not assigned, the most popular is instrumental variables (Angrist, Imbens, and Rubin 1996). Other related techniques include the control function (Wooldridge 2015), and difference-in-differences (Varian 2016). Readable introductions to the topic of endogeneity can be found in Goldfarb, Tucker, and Wang (2022);

Hill, Johnson, Greco, O'Boyle and Walter (2021); and Jean, Deng, Kim, and Yuan (2016). While many of us have been taught that "correlation is not the same thing as causation", we often instinctively write and think about observed variables using the language of causality. It is a major trend that such loose language is being increasingly flagged by reviewers.

4. Evidentiary Approaches

At the time statistical analysis was being adopted by the social and biological sciences in the early part of the 20th century, there were three paradigms competing for attention. These were the approach of Thomas Bayes and Pierre Laplace, that of Ronald Fisher, and that of Jerzy Neyman and Egon Pearson (Fienberg 2006). The first two of these proposed that researchers should present the strength of evidence for a model or hypothesis, while the third argued that hypotheses should be rejected or not in a dichotomous fashion. Historically, the third approach was widely adopted and remains the dominant analytical framework till this day. At this time, a number of authors have proposed that we take a more "evidentiary" or continuous approach to models and hypotheses (Matthews 2011; McShane *et al.*, 2023; Wedel and Gal in press).

Dichotomous decision-making by authors and editors, contributes to what is known as publication bias (Brodeur *et al.*, 2020), otherwise known as the "file drawer problem" (McElreath and Smaldino 2015), When studies do not achieve a p-value of .05, they are placed in a file drawer and forgotten, despite the fact that such results might be telling us something important about the empirical phenomenon being investigated. Journals only publish results with p-value less than .05, leading to a biased sample of studies being published. This problem has likely contributed to the replication crisis mentioned earlier, and also causes scientists to overestimate effect sizes (Gelman 2018).

Wedel and Gal (in press) propose three principles: that authors should (1) apply their judgment to the strength of evidence that exists in a study, (2) keep in mind that p-values are sensitive to violations of model assumptions, and (3) emphasize the experimental setting rather than p-values to get a sense of the generalizability of a finding.

5. Bayesian Inference in Marketing

Recent computational breakthroughs (van Ravenzwaaij *et al.*, 2018) have led to an explosion of Bayesian methods in Marketing and Management. The advantages of Bayesian inference over traditional methods, such as those proposed by Fisher or Neyman-Pearson, include a more intuitive interpretation of research results (Wedel and Dong 2020) and axiomatic connections to optimal decision-making (Berger 1985), this latter advantage being especially appealing to fields claiming managerial relevance.

The intuitive advantage of Bayesian inference flows from Bayesians' willingness to apply the laws of probability to epistemic uncertainty, defined as uncertainty resulting from lack of knowledge. For researchers and practitioners who lack knowledge about the true value of an unknown parameter in a model, this enables direct probability statements about that unknown. By "unknown parameter", I mean the true difference between two means in an experimental condition or a regression slope in an observational study. By "direct probability statements", I mean statements of the form, "the probability that this slope is negative, given our observed data, is equal to *p*." Note how different this is from classical statistical reasoning, which goes like the following: "the probability of finding a data set for which the result is this extreme or more extreme given infinite sampling, given a specific hypothesis, is *p*."

Axiomatic connections to optimal decision-making confer many practical advantages to Bayesian reasoning. We can highlight these advantages by talking about what happens to those who do not adopt the Bayesian point of view towards unknown parameters, i. e., those who would not apply the laws of probability to epistemic uncertainty. If you do not apply those laws your behavior can be "incoherent". In essence, if your beliefs about unknown parameters do not obey the laws of probability you run the risk of inevitably losing money (Galavotti 2015).

There are many user-friendly introductions to Bayesian inference relevant to Marketing and Management scholars. Good starting points include Muthén and Asparouhov (2012); Jebb and Woo (2015); van den Bergh *et al.*, (2020); Otter (2022); and McCann and Schwab (in press).

6. The Computer Science Invasion

Over the decades, Marketing and Management have borrowed many quantitative research techniques from psychometrics and econometrics, among other fields. At this time there is an onrush of techniques entering our fields from computer science. It so happens that many of these techniques are special cases of, or applications of, Bayesian inference (van de Schoot *et al.*, 2021), which has been already covered above. Nevertheless, it seems pertinent to include techniques that have emerged from computer science as a separate and final trend. A partial list of such techniques would be data mining (Cooper and Giuffrida 2000); text mining (Humphreys and Wang 2018); machine learning (Loh 2011); big data (Vanhala *et al.*, 2020), (Antons and Breidbach 2018); and the emerging field of artificial intelligence, covered by Overgoor, Chica, Rand, and Weishampel (2019) as well as Balducci and Marinova (2018). A good review is given by Xiao (2023).

7. Conclusion

A powerful benefit of human culture is that many forms of knowledge, including academic knowledge, are cumulative, passed down from

professor to student. The cumulative nature of knowledge presents a difficult challenge for the student, however. Students are still required to be familiar with older techniques, even as we add new methodologies! The increasing methodological sophistication in business-related fields places an ever heavier burden on students, especially PhD students. What's more, articles accepted at the best journals often use more than one method. One helpful trend in the face of these challenges is that author teams are getting larger and more diverse, methods-wise. Nevertheless, it is important to at least know what the trends are within our fields. I hope this brief note is helpful in that regard.

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