Book review

Regression Analysis for Categorical Moderators. Herman Aguinis (2004). New York, USA. Published by The Guilford Press (pages 202 + xxi). ISBN 1-57230-969-5. $US32.00. http://www.guilford.com/ (800) 365-7006 info@guilford.com.

As Book Review Editor, I am pleased to introduce Dr Ron Goldsmith from Florida State University. Ron is going to review three new marketing research books for the journal and this is the first one for your reading pleasure.

For we *stats-neophytes*, I offer this introduction of Aguinis's book on *Regression Analysis for Categorical Moderators*. 'This book was written to help researchers determine when, and under what conditions, x causes y (moderators) rather than why or by which mechanism x effects y (mediators). Whereas moderator variables specify when a certain effect will exist and be stronger, the mediator variable speaks to why or how the effect occurs in the first place. Moderator variables are concerned with context and mediator variables are concerned with process. Put simply, if the relationship between two factors is not the same across various groups, the things that make the group unique are "moderating" the relationship. That is why the title of this book contains the adjective *categorical* moderators. A category is a subdivision of a larger group'.

Now, Ron continues.

Researchers in the social sciences, especially consumer and marketing researchers, face many challenges in data analysis. There are intimate relationships among the theories guiding our research, the models and hypotheses we test in our studies, and the statistical methods we should use to adequately represent the fit of these models to the data we collect. The links among these three levels of procedure must be congruent for science to progress in its task of explaining phenomena. For the data analyst this means that sometimes the hypotheses and corresponding statistics involve, not just a univariate relationship, or multivariate relationships, but relationships among independent and dependent variables that depend on the effects of third variables. For example, peer pressure may lead to increased smoking among adolescents in one culture, but *decreased* smoking in another culture. Thus, the generalization

describing the effects of peer pressure on smoking among adolescents *depends* on the culture in which they live. In this case, the amount of peer pressure is the independent variable, the amount of smoking is the dependent variable, and culture (e.g. Canada vs. Korea) is a moderator variable. Such a situation is one in which 'the relationship between two variables changes depending on the value of a discrete grouping variable' (p. 1). These grouping variables are termed 'moderators' and represent a prevalent, important, and often overlooked interaction or second-order effect in social science research.

Analysing the effects of categorical moderator variables requires special regression techniques that often are not described in statistics texts or in social science methodology books. This vital gap has now been filled most effectively by Herman Aguinis, whose monograph, *Regression Analysis for Categorical Moderators*, is a masterful presentation reflecting many years of research and study. It should prove to be valuable to any researcher who has even a basic understanding of statistical analysis.

The design of the book is quite appropriate for its purpose. There are 10 chapters, five appendices, References, and both author and subject indices. The first chapter introduces the reader to the concept of moderators by presenting examples, explaining their theoretical structure and justifying the use of special statistical analysis. This chapter clearly explains both the theoretical and practical importance of moderator analysis. The next chapter presents the technique of moderated multiple regression or MMR. The subsequent chapter shows how to perform MMR using standard statistical packages, SPSS and SAS. The details are presented, justified and illustrated using the SPSS program. So far so good. The reader feels confident that he or she can now tackle moderators.

However, Aguinis is just getting started. One of the especially valuable features of his book is the detail with which he examines the assumptions behind MMR. The first of these is the 'homogeneity of (within-group) error variance', which means that the predicted scores for Y should be similarly distributed about the regression line for each of the moderator-based populations. Aguinis

points out that many users of MMR are either unaware of this assumption or ignore it. This is unfortunate because violating this assumption has important consequences for the interpretation of MMR analysis. Aguinis carefully documents the violation of this assumption in published research and shows how easy it is to assess whether the assumption is correct. But what if the assumption is not met? How should the researcher proceed? In this eventuality, Aguinis has created a computer program (available both online and stand alone) that is easy to use and provides the appropriate diagnostics to assess the impact of violating the homogeneity assumption along with corrected statistics to estimate the correct moderating influence. For the program, see: http://carbon.cudenver.edu/~haguinis/mmr/.

Having dealt with a major assumption of MMR and its solution, Aguinis proceeds to take on another problem: MMR's low power. He provides a clear explanation of the concept of statistical power as a background and then proceeds to demonstrate that studies of moderators often suffer from low power and what this means for their conclusions. All is not lost, however. As with the homogeneity assumption problem, Aguinis provides remedies for the low-power problem, 16 of them in fact! A useful table summarizes these so that the researcher embarking on a study of moderators should be well prepared to avoid any low power problems that could arise.

This leads to a discussion of computing statistical power. Aguinis discusses the importance of this step to conducting valid research. To help researchers, he also presents two computer programs that can assist in this task. These are available at http://www.cudenver.edu/~haguinis/mmr. Clear instructions are given for using and interpreting the programs.

The monograph concludes with two valuable chapters. The first is devoted to complex MMR models where coding issues, non-linear effects and interactions are discussed. Again, the presentation is logical and clear so that the reader is never left confused by the details or intricacy of the material. The penultimate chapter addresses additional issues in interpreting moderating effects. The focus is on distinguishing improvement in model fit and improvement in prediction. Although much of this material is quite technical, it is worth the effort to follow the details.

The final chapter presents a summary and conclusions that cap the text off nicely. Novice readers, as well as those with more experience, will find it a useful review. Aguinis stresses the major points of the book, reminding readers of both the technical and statistical issues, as well as the importance of interpreting moderator effects correctly. His emphasis on the interactions among theories and data analyses is an excellent statement of this issue of major importance to researchers.

Regression Analysis for Categorical Moderators is logical, thorough, and methodical. It makes good use of examples and presents the right amount of formulas to explain the mathematics behind the procedure without overwhelming the reader with little experience in mathematical statistics. Many technical details appear in the appendices. There are useful indexes for subjects and authors. It is very appropriate for graduate seminars in regression, research methods, or multivariate data analysis. It belongs in the library of every graduate student or professor who is serious about adequately testing theories by performing the appropriate statistical analyses. The next step is to see more (correct) use of MMR in published studies of moderator effects. Finally, the next task for Herman Aguinis is to write the companion volume on regression analysis for continuously distributed moderators.

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