Publishing research in marketing journals using structural equations modeling

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Abstract:

This paper takes an objective look at how papers using structural equation models are received in the review process of academic marketing research journals. The focus is examining whether or not papers with structural equation modeling (SEM) applications enjoy an advantage in the review process and what the nature of such an advantage may be. A sample of submission records from a top marketing research journal is used to examine this issue. Results suggest that papers with SEM applications enjoy a modest advantage in the review process but that this difference is partially due to the fact that papers with SEM applications are rated more highly on multiple paper characteristics. For example, authors using SEM tend to have their papers rated more highly than others on the theoretical and conceptual development attribute. Thus, learning and applying SEM may have advantages not directly related to the application of the statistical approach.

Keywords: structural equation modeling | marketing research | scholarly publication

Article:

Today's scholarly marketing journals are filled with articles describing sophisticated, quantitative methodologies. Interestingly, 50 years ago, the top marketing journals contained articles that were virtually free of mathematical or statistical inferences with significance tests or any form of multivariate data analysis. Statistical approaches were absent from the first marketing research texts as well with the exception of Ferber (1949), which included the innovative techniques of correlation and multiple correlation. In 1979, the *Journal of Marketing Research* published a paper containing an illustrative model positing the way salesperson characteristics such as job tension and self-esteem *cause* industrial sales outcomes (Aaker and Bagozzi 1979). This model was structural, meaning the links represented hypothesized causal processes. Today, using structural equation modeling (SEM) to examine causal processes is seen by some as a required tool for those seeking scholarly publication in marketing.

SEM's roots are not in marketing. Econometricians developed the conceptual foundations for SEM just two decades after the introduction of statistical correlation in the early twentieth century. At that time, one hope was that econometric models could be developed in which error terms of measured dependent variables could be analyzed for evidence of spuriousness (other potential causes) and thereby provide evidence of causality (see Wright 1921; 1934). Despite roots elsewhere, researchers in marketing embraced SEM techniques with vigor during the last part of the twentieth century. A special topic conference held during the early 1980s greatly advanced SEM in marketing and sent forth those who would become early publishers of SEM models and early teachers of students who would later publish research using SEM (Darden, Monroe, and Dillon 1983). Practically every issue of the major marketing academic journals today contains research employing SEM.

Researchers who do not have SEM in their toolbox may believe those who "Lisrelize" their research can use it as a way of seducing the editorial reviewers and getting an easy publication recommendation. Certainly, a considerable amount of rhetoric along these lines has been voiced in the past 25 years. The purpose of this paper is not to directly discuss the merits or drawbacks of SEM applications in marketing. Rather, this research focuses on the question: "Does SEM offer marketing authors an advantage in publishing their scholarly research relative to those who do not use SEM?" A sample of submission records from a well-known marketing journal is analyzed with this basic research question in mind. The results shed light on this interesting question.

BACKGROUND

SEM and Publication

Today, almost all terminally qualified assistant professors have had formal training on how to apply SEM and use SEM programs. Also, SEM software has become far more user-friendly, and anyone who can master the point-and-click SPSS can likely also get an SEM model to run. As a result, the frequency of scholarly marketing papers applying SEM has continued to rise. A quick business sources computer search using the key terms "structural equation modeling" and "marketing research" reveals that just over one-third of the articles appearing on the results list were published from 2006 to this date. Over two-thirds were published since 1995. Only nine articles were identified in this search as published prior to 1990.

In the early days, SEM applications may well have been reviewed by editorial review board members who were not fully knowledgeable or perhaps did not even have a working knowledge of SEM. This might have given authors some advantage, because these reviewers may have found it difficult to criticize an approach they did not truly understand. So, at least in the early days, simply using SEM might have created the impression of rigor and sophistication. Today, however, authors submitting work can hardly expect that reviewers will be unfamiliar with SEM. But does the use of SEM still impress reviewers and editors? Does using SEM lead to a greater likelihood of avoiding rejection, and does it impress the reviewers? The following hypotheses capture this idea:

Hypothesis 1: Papers not reporting an SEM model have a greater likelihood of getting rejected on the initial review than do papers that include an SEM model.

Hypothesis 2: Papers reporting an SEM model are rated more favorably by reviewers on key manuscript attributes than are papers without an SEM model.

Are SEM Researchers Better?

Assuming that some advantage exists for those using SEM, what is the reason? Is the reason truly because of the choice of this technique or is the reason more tied to the quality of the overall research paper or even the research skills of the author? Among key factors contributing to acceptance in scholarly journals, the writing ability of authors and the ability of authors to conceptualize and theoretically explain their ideas are certainly important. The typical editorial review rating sheet asks reviewers to consider factors such as this, as well as the research methodology, data analysis, and topical relevance of papers in making a recommendation to an editor. If SEM offers some unique advantage over these typical attributes, papers that use SEM should be evaluated more favorably and rated higher in quality even after controlling for characteristics such as these.

Hypothesis 3: The use of SEM influences reviewer recommendations and paper quality while controlling for the writing quality, research methodology, and contribution rating of a manuscript.

Choice of Software

LISREL is the Opus I of SEM programs for many marketing researchers with 10 to 20 years of SEM experience. For those researchers, clicking on a truck or abacus icon as one commonly does to execute a command with AMOS can seem a little unsettling at first. During the 1980s and 1990s, LISREL applications dominated SEM usage in marketing. Some EQS applications have always been present among SEM applications, but today journal submissions using AMOS are growing rapidly and are fast approaching equality in numbers with LISREL applications.

The AMOS software has two big advantages. First, AMOS can be added to the basic SPSS setup that is familiar to most researchers in marketing. So AMOS in this sense is the channel captain of SEM applications. Second, AMOS is user-friendly for simple applications with an easy-to-use graphical communication interface and the ability for the user to estimate SEM models without ever even thinking about writing syntax or programming statements. Even though LISREL can now be executed using relatively convenient drop-down menus, most LISREL users still operate the system through its *simple* programming syntax. Well, perhaps *simple* is qualified as simple if one knows it.

AMOS has clearly expanded the universe of SEM users. Because of this, the likelihood exists that less sophisticated researchers may opt for AMOS. If so, their research may also be less sophisticated and more prone to problems, resulting in lower evaluations and a higher rejection ratio. In truth, SEM is SEM and, although under most conditions AMOS and LISREL will

provide the same results, many authors do report which program they use. This enables us to investigate the following hypothesis:

> *Hypothesis 4: AMOS applications in marketing have a greater chance of being rejected on initial submission than do other SEM software applications.*

Fit and SEM

An interesting extended discussion on the emphasis, or perhaps overemphasis, on fit statistics is available elsewhere (Hair et al. 2006, pp. 752–754). SEM users have always searched for the illusive hurdle of fit that must be cleared for publication. Others have referred to this as the search for "golden rules" or the "golden fleece" (Marsh, Hau, and Wen 2004). The reality is that if an academic journal publishes a concrete fit standard (i.e., FIT = 0.98), then voila, practically every SEM model submitted to a marketing journal would miraculously produce that exact number. Today, researchers recognize that a "one-size-fits-all" standard for fit does not apply. In fact, an overemphasis on a concrete fit standard may well cause some of the most insightful results from a model to be left unreported. If reviewers are sensitive to model fits, however, then perhaps the fit of a model will help improve its quality and evaluations by reviewers.

> *Hypothesis 5: Goodness (badness) of fit indices are positively (negatively) related to paper quality and reviewer recommendations.*

SEM and U.S. Authors Versus Others

The top marketing journals can be described as predominantly U.S. journals. Most originated in the United States and almost all have editors based in the United States. Researchers from other parts of the world are increasingly interested in publishing in top marketing journals, however, and this interest is reflected both in terms of the papers that are published and those that are submitted to high-quality marketing journals. Given that SEM applications in marketing have largely, but not entirely, originated in the United States at U.S. universities, perhaps these authors are more advanced and better able to employ SEM than authors from other countries. Students trained in the United States within the recent past have had one or more courses in SEM and would be expected to have more experience in using the technique than those trained elsewhere. Thus, one might question whether the frequency of conducting research designed to apply SEM differs between U.S. and non-U.S. authors, and if the application of SEM provides an advantage for authors from different countries.

> *Hypothesis 6: U.S. authors will use SEM more frequently than authors from other countries.*

> *Hypothesis 7: Papers by U.S. authors will experience a greater advantage from using SEM than will papers with authors from other countries.*

RESEARCH METHODS

The literature that focuses on scholarly publication all too often draws conclusions on what appears in academic journals. This might contain a content analysis of tables of contents of journals where all of the papers, of course, have been accepted for publication. Although this does provide a picture of what gets published, what type of research is being done is not represented equally well because all rejected papers are excluded. The relative odds of publishing a particular type of research cannot be examined without knowing what actually gets submitted. Submissions represent a more accurate profile of the types of research performed and written up by basic scholars. To obtain access to such data, editorial cooperation was sought to examine data (without any identifying marks for authors) from 120 submissions to a high-quality, scholarly marketing journal. This sample represents submissions for about six months but was considered representative of papers submitted in recent years. Desk rejections were excluded from the sample.

Each data record includes the paper's research methodology (qualitative, quantitative), two reviewers' ratings—including their recommendation scores, a quality score obtained through a content analysis of the editor's letter to the author explaining the outcome of the review process (independently coded by two uninvolved raters on a 100 point scale with 100 indicating higher quality; $r = 0.70$), whether or not the paper reported an SEM application, which software was reported (if any is listed), whether the corresponding author was affiliated with a U.S. university or not, and whether the paper was rejected as a result of this first review.

A series of statistical analyses were used to test the hypotheses and further examine the key research questions. Frequency counts, cross-tabulation, and the general linear model were used in the analyses. Note, SEM was not employed in this analysis.

RESULTS

An initial analysis examined what portion of submitted manuscripts report any type of SEM analysis. Results suggest that approximately half (48 percent) of submitted papers include SEM results. Thus, SEM certainly is an important tool based on the frequency of use. This number suggests an increasing SEM frequency compared to a previous estimate that suggested that 25.3 percent of articles published in top marketing journals include an SEM application (Steenkamp and Baumgartner 2000). Moreover, a frequency count was conducted to examine the overall reject ratio of this journal. Excluding desk rejects, the count suggests that 78 percent of submissions are rejected on initial submission.

Hypothesis 1: The SEM Advantage

H1 is examined using a cross-classification of the use of SEM (yes or no) with the submission result (rejected, not rejected). The results suggest that papers with an SEM application are rejected 70.2 percent of the time, whereas papers without a SEM application are rejected 84.1 percent of the time. This result produced a χ^2 of 3.34 with 1 degree of freedom (df) ($p = 0.034$). Thus, SEM applications appear to have a relatively modest but statistically significant (at one-tailed type I error rate of 0.05) advantage over other papers.

Hypothesis 2: SEM Paper Ratings

H2 posits that papers with SEM applications will generally be evaluated more favorably than other papers. Table 1 provides the average ratings from the reviews for each submission. The scale range is 1 to 5, with 1 being the poorest score and 5 being the best. Independent sample t-tests are used to see if the means vary between the groups of papers. As can be seen, significant differences ($p < 0.05$) emerge on four characteristics. SEM papers receive higher average ratings for the research methods, data analysis, conceptualization/theory, and writing quality. Reviewers do not rate SEM papers as significantly better than other papers on either the topical relevance or potential contribution attributes. Papers without an SEM model did not outscore papers with SEM models on any characteristic. Thus, H2, suggesting higher scores on manuscript attributes for SEM papers, is at least partially supported.

Table 1. Mean Scores Comparing SEM and Non-SEM Submissions

	Group		t-Value	p-Value
	SEM	**No SEM**		
Topic Relevance	4.2	3.8	1.35	0.182
Research Methods	3.5	2.7	2.81	0.006
Data Analysis	3.5	2.8	2.28	0.025
Conceptualization	3.1	2.5	2.41	0.018
Writing Quality	3.9	3.0	2.84	0.006
Contribution	3.1	2.8	0.98	0.328

Hypothesis 3: The SEM Advantage Controlling for Other Characteristics

H3 further examines the potential advantage of including an SEM model by positing an advantage for SEM papers even after controlling for other ratings. This hypothesis was examined using a multivariate general linear model regression approach. The dependent variables included each reviewer's recommendation score (1–5, with 5 being a better rating) and the overall quality score resulting from the content analysis of the letters to the authors. Significant multivariate effects (Wilkes's Λ, multivariate F) were observed for reviewer ratings of data analysis, contribution, and most notably, for the dummy variable indicating the use of SEM ($\Lambda = 0.86$; $F = 2.91$; $p = 0.042$). The significant multivariate effects were interpreted more specifically with results from univariate analyses.

Table 2 summarizes the associated univariate results examining the effect of SEM on the dependent variables while controlling for the reviewer ratings. The overall effect as suggested by the differences in means is consistent with H1 in showing an advantage for SEM papers. Only the effect on reviewer B's recommendation remains significant when controlling for other variables.

Table 2. Partial Effect of SEM on Reviewer Recommendations and Quality Rating of Paper

Dependent Variable	Mean		F	p-Value
	SEM	**No SEM**		
Reviewer A Recommendation	2.49	2.18	0.25	0.620
Reviewer B Recommendation	2.57	2.25	4.48	0.039
Quality Score	49.4	33.5	2.84	0.100

Another overall look at potential SEM advantages was performed by using logistic regression to predict the outcome (reject, not reject) using the SEM variable (yes or no) and reviewer ratings on relevance, data analysis, and contribution (the predictors with the most unique variance). The results of the model are statistically significant ($\chi^2 = 35.9$, $p < 0.001$). The ratings of data analysis and contribution each strongly influence the outcome (prevent it from being rejected). Although not as strong, the use of SEM, after controlling for these variables, remains significant ($b = 0.76$, Wald = 5.3, $p = 0.022$) when controlling for key attribute ratings. Therefore, this analysis also suggests a small advantage for using SEM over not using SEM. Therefore, partial support is found for H3.

Hypothesis 4: Software Decision

H4 asks the question of whether or not AMOS users and LISREL users have equal success in publishing their research. A cross-classification analysis revealed the following results. LISREL users' submissions are rejected 69 percent of the time. AMOS users' papers are rejected 86 percent of the time. EQS users were also examined, although there were only five total EQS submissions with three being rejected. The $\chi^2 = 3.7$ with 3 df ($p = 0.22$).[1] Although results are directionally consistent with the hypothesis, the difference is not significant and therefore the hypothesis is not supported. Perhaps the result would be different with more statistical power, but that test will have to wait for future research.

Hypothesis 5: Goodness of Fit and Fit

H5 puts forth an interesting question of whether or not statistical fit matters among submissions. Multivariate regression models were estimated to examine this hypothesis. Given that all fit indices are either a direct or indirect function of the maximum likelihood loss function, multicollinearity is expected. For example, the comparative fit index (CFI) is a direct mathematical derivative of the χ^2 residual. Thus, the variance inflation factors were first analyzed to identify the fit statistics that offered the most uniqueness. In no case, however, did any of the regression models reach statistical significance. Reviewer A's recommendation, reviewer B's recommendation, and the quality score were all unaffected by any of the fit statistics. Thus, H5 is not supported, and we conclude that fit statistics do not influence reviewer recommendations, at least for submitted manuscripts.

Hypotheses 6 and 7: Country Effects on the SEM–Rejection Relationship

H6 deals with the internationalization of SEM in the marketing discipline. A cross-tabulation of country of lead author (United States or other country) was conducted with the dichotomous variable indicating whether or not SEM was used. This test suggests that U.S. authors employ SEM to a significantly greater degree than other authors. Papers with non-U.S. authors employ SEM in their research 41 percent of the time, whereas papers with U.S. authors employ SEM 62 percent of the time. The resulting χ^2 statistic of 4.6 is significant, with 1 df ($p < 0.05$). This supports the idea that U.S. authors are employing this particular quantitative tool to a greater degree than authors from other countries.

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[1] Removing the EQS users did not change the result.

H7 asks whether authors from the United States enjoy an advantage over non-U.S. authors when submitting a paper containing an SEM application. This was tested using a general linear model multiple regression predicting the quality of the paper (dependent variable) with the dichotomous variable indicating use of an SEM model and a dichotomous country of origin variable (U.S. or not U.S.), as well as the interaction between the two independent variables. Table 3 displays these results. As can be seen, both SEM and country have significant main effects, but the interaction between the two variables is not significant ($F = 0.08$, $p = 0.773$), suggesting that papers from U.S. authors with SEM applications are of comparable quality to those papers from non-U.S. authors with SEM applications. Table 4 displays the means corresponding to this analysis. This result suggests that both authors from the United States and authors using SEM are producing papers with higher quality, but that the advantage of using SEM is the same whether or not the author is based in the United States. Thus, H7 is not supported.

Table 3. General Linear Model Results Predicting Paper Quality with SEM and Country of Author

Independent Variable	b	F	p-Value
SEM (Yes or No)	16.0	6.0	0.016
Country (United States or Other)	20.0	9.8	0.014
SEM × Country	−3.4	0.08	0.773

Table 4. Mean Quality Scores for Submitted Papers by Analytical Choice and Author Country

Country	SEM		Totals
	SEM	No SEM	
United States	59.4	43.5	52.7
Other	39.5	26.9	32.5
Totals	47.0	31.2	38.9

DISCUSSION

Marketing research has evolved quickly, and along with this, evolution researchers have adopted an ever-increasing array of analytical tools. Within the last quarter century, perhaps no tool has had a greater impact on what appears in scholarly marketing journals than SEM. This research does not debate the merits or lack thereof of using SEM techniques (see Steenkamp and Baumgartner 2000). Rather, the results examine what happens when an SEM manuscript is submitted to a quality journal relative to manuscripts that do not employ the technique. Thus, the research explores the potential SEM advantage.

Taken together, several findings relevant to marketing research practice are suggested:

- SEM is a widely applied tool with just less than half of submissions including an SEM application.
- SEM applications do enjoy a modest competitive advantage over papers using other tools.
- This SEM advantage is not due fully to the use of SEM. Rather, the relationship is at least partially spurious in that papers with SEM are rated relatively high compared to other papers on multiple manuscript characteristics.

- The relative goodness of fit of a model is not related to the quality ratings or reviewer ratings of the submitted manuscripts.
- Authors from the United States and other authors enjoy the same benefit from applying SEM applications in their manuscripts.

IMPLICATIONS AND CONCLUSIONS

Although SEM today is less of a mystery to researchers in marketing than it was 20 years ago, the belief exists in some circles that authors should employ SEM whenever possible as a way of boosting the chance of publication. The results presented here do not support such a position. Rather, the results suggest that papers that include an SEM analysis tend to be better than the average paper but not necessarily or entirely due to the fact that SEM is being used. Papers using SEM also rate more highly on conceptual/theoretical development, research methodology, and even in writing quality.

This suggests that one potential side benefit of the growth of SEM is an ability to better organize one's thoughts about the phenomena of interest. A proper SEM application must also place great weight on measurement theory. A meaningful theoretical contribution depends greatly on a solid foundation of theoretically grounded measures. Although SEM has many applications, none is more important than its ability to provide evidence of construct validity or the lack thereof through a meaningful confirmatory factor analysis (CFA). Such tests mean that all measured items for all constructs are included in a single CFA test. Preferably, all reflective constructs would be represented by three or more measured items. Exploratory factor analysis (EFA) tools provide some evidence of validity, but EFA fails to provide the definitive test of measurement made possible by SEM applications of CFA. The process of assigning measures to constructs that must be performed in SEM is a meaningful theoretical exercise. Thus, SEM techniques provide evidence of the quality of measurement, and when the measures are good and show evidence of construct validity, SEM should also be the tool of choice to test theoretical relationships. This SEM model is developed simply by converting correlational relationships to structural paths, leaving the correspondence rules between constructs and measured items intact.

Moving beyond CFA, the structural model tests applied using SEM are likely to also be associated with greater attention to theory than some alternative techniques. As SEM has become more prominent, the literature has seen many more applications examining the extent to which sequences of relationships are moderated or mediated by other conditions or constructs. These are more complex theoretical arrangements than simple bivariate associations and, as such, may require more theoretical deliberation. Thus, the way a good SEM application forces the researcher to think about the problem at hand may be one explanation for the SEM advantage.

An alternative but less plausible explanation is simply that those researchers using SEM are either better on average than other researchers (as evidenced by the differences in ratings) or that a halo is attached to SEM papers so that reviewers naturally think a paper with an SEM application is superior. Perhaps in the early days of SEM when reviewers did not fully understand or were truly mystified by the technique, the halo factor may have been a more plausible explanation. Today, SEM is far less likely to mystify a reviewer. The fact that SEM

papers receive higher ratings on attributes not related directly to the SEM application is not likely due to a generalization by reviewers.

The fact that fit is not related to publication success is interesting. Perhaps it is simply because the data and relationships tested here do not provide an adequate test. For example, the reluctance to even submit an article for review with a low fit statistic, or modifications performed purely so an SEM model would achieve better fit, could not be examined. With more data than available here, perhaps a structural model could be developed that would more fully examine the fit–publication relationship. However, if fit truly is not related to the chance of rejection, an argument can be made that far too much attention is placed on meeting some exact fit standard such as CFI = 0.95. Authors chasing a specific fit standard are prone to oversimplify their models, and some of the most meaningful and interesting findings get left by the wayside in the effort to improve an index by 0.01 or 0.02ths a point. So, authors may want to concentrate more on having an interesting model with fit that is adequate for having some confidence in the results rather than sacrificing meaningfulness for fit. If fit is truly not as critical a factor to reviewers and editors as might be believed, such a move would not involve substantial risk. Reviewers today are also more likely to recognize a sliding standard for fit where simple models should be held to more strict standards than more complex models involving more variables and constructs.

New software improvements have made SEM more accessible to more researchers in marketing as well as other fields. As new users learn to apply the software, they also need to understand the basic principles of SEM in general to avoid misleading, incorrect, inappropriate, or sloppy procedures. More recently, authors sometimes submit results without ever reporting the overall fit including the model χ^2 and degrees of freedom. Essential pieces of information such as this that help an experienced reader better understand the model may well get left out simply because of the interface between an inexperienced user and the software. Software selection was not significantly associated with avoiding rejection, so any of the major players can be useful. But understanding the software is not a replacement for understanding the technique.

Marketing researchers have embraced SEM. CFA, in particular, presents a major breakthrough in establishing construct validity for conventional multiple item construct models. Given the ever-growing pressures to produce scholarly publications, the use of SEM will not soon fade away. Although SEM certainly has drawbacks and critics, SEM researchers should continue to be able to publish their research in scholarly marketing journals for the foreseeable future. Further, given the high proportion of published articles including an SEM application, marketing scholars need enough familiarity with this key multivariate data analysis tool so that they can read the scholarly research that uses this as the predominant hypothesis testing tool.

Marketing research practitioners are also increasingly becoming familiar with SEM. Many will have had a multivariate data analysis course that introduces the technique or even a course that featured SEM as the primary topic. Practitioners also are using SEM to develop explanatory models. Thus, to maintain their skills and be competitive as cutting-edge research vendors, they will need to include this important tool in their toolbox, if not now, in the near future.

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