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Journal of Business Research 55 (2002) 237–249

JOURNAL OF BUSINESS RESEARCH

The ability of ratings and choice conjoint to predict market shares A Monte Carlo simulation

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Accepted 4 January 2000

Abstract

We use a Monte Carlo simulation with many synthetic data sets to compare ratings and choice conjoint analysis in their ability to correctly predict market shares under varying market conditions. Our results provide guidance to researchers seeking to use conjoint analysis for managerial decisions. Our recommendations are quite different from the recommendations of prior researchers who compared conjoint methods using single empirical data sets. Our results indicate that one must, at least roughly, assess the degree of consumers' heterogeneity in preferences, product similarity in the marketplace, typical consumers' choice-rule (probabilistic or deterministic), and magnitude of error in measurement of utilities in order to make a prudent choice between ratings and choice conjoint analysis.

Keywords: Monte Carlo simulation; Market share; Conjoint

Conjoint analysis is perhaps the most widely applied method for modeling consumer preferences by marketing researchers (Wittink and Cattin, 1989; Wittink et al., 1994). The last 15 years of academic research have produced a plethora of new conjoint models and parameter estimation methods (for reviews of various methods see Green and Srinivasan, 1978, 1990). In fact, academic research in this area has been so prolific that many more models and techniques have been proposed by researchers than have been implemented by practitioners (Carroll and Green, 1995). The large number of methods that are available today may even confuse researchers who seek to apply conjoint analysis because many of the new methods have claimed superiority over existing methods. This has resulted in researchers calling for studies to systematically compare different methods and identify conditions under which one method outperforms other methods (Batsell and Louviere, 1991; Carroll and Green, 1995). This is the objective of our research.

A few recent studies have attempted comparisons among conjoint methods. Elrod et al. (1992) compared the predictive abilities of ratings (or individualized) conjoint and choice conjoint (or experimental choice) methods using data collected from student subjects about their preferences for hypothetical rental apartments. Oliphant et al. (1992) also compared the predictive abilities of ratings and choice conjoint methods using data from recreational vehicle owners about their preferences for a new emergency road service package to be offered by an insurance company. In both of these studies, researchers concluded that ratings and choice conjoint models performed equally well for their data sets. However, because of each study's reliance on a single data set, they were unable to systematically vary market conditions to explore whether one method might perform better than others under certain conditions. This led Carroll and Green (1995, p. 388) to conclude that:

> What appears to be lacking is convincing evidence of whether ... individualized conjoint, experimental

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0148-2963/02/$ – see front matter
PII: S0148-2963(00)00127-2

choice, and latent class models lead to different market share estimates, and if so, which is better under which conditions.

Vriens et al. (1996) reported a Monte Carlo simulation with synthetic data sets and compared nine different metric (ratings) conjoint methods using multiple comparison criteria including predictive accuracy. Due to the use of multiple simulated data sets, these researchers were able to vary conditions and investigate the superiority of one method over another under different conditions. They concluded that differences in the predictive accuracy among the nine conjoint methods were small. However, their study only included metric methods and ignored the recently developed choice-based conjoint method (Louviere, 1988a).

Thus, there is a gap in research about systematic comparison of market share predictions by ratings and choice conjoint methods under varying conditions. More importantly, little empirical evidence exists about conditions under which one of these methods recovers market shares better than the other. This research gap is critical because the ratings conjoint is the most widely used method by practitioners, and the choice conjoint represents one of the important new trends in conjoint applications (Carroll and Green, 1995). Therefore, it is important to understand whether the two methods lead to different market share predictions under varying market conditions so that users can make prudent choices to use one method vs. another, depending on the market conditions that characterize a conjoint application. Thus, our goal is to compare these two methods under a variety of market conditions and identify specific conditions under which one method may outperform the other. We achieve this goal by using a Monte Carlo simulation with multiple synthetic data sets to capture different marketplace conditions.

In what follows, we first briefly describe the two conjoint methods and review previous research that compared these two methods. Based on this review, we identify three market-related factors (consumers' heterogeneity in preferences, product similarity in the marketplace, and consumers' choice rule) and two model formulation-related factors (magnitude and correlation of errors) that have important effects on the relative performance of the two methods. Next, we describe the method of simulation used in this study based on the five factors mentioned above. This is followed by our discussion of the simulation results in which we compare the two conjoint methods in their abilities to predict market shares for the different populations. To preview our results, we find substantial differences in prediction accuracies of population market shares by the two conjoint methods under different combinations of the five factors. Finally, we discuss the implications of our results from both applied and theoretical perspectives.

1. Conjoint analysis methods

In their comprehensive review of conjoint analysis, Green and Srinivasan (1990) pointed out that although ratings conjoint analysis (using ordinary least-squares estimation for parameters at the individual level) appears to have dominated commercial applications, there has been increasing interest among academicians in the development of new methods. A popular new method pioneered by Louviere and Woodworth (1983) is choice conjoint analysis that usually estimates the parameters at the aggregate level. Louviere and his colleagues have repeatedly demonstrated the value of choice conjoint in both applied and theory testing (Louviere, 1988a,b; Horowitz and Louviere, 1990; Elrod et al., 1992).

As described next, there are a number of differences between ratings conjoint analysis and choice conjoint analysis including underlying models, assumptions about consumers' choice process, forms of data, and level of aggregation required for model estimation.

1.1. Ratings conjoint

Ratings conjoint is typically formulated using a general linear model in which desirability ratings of a set of product profiles are regressed against the dummy variables that constitute the characteristics of the product profiles. Usually, the regression coefficients are estimated separately for each subject. It is also possible to estimate the ratings conjoint at the aggregate level or separately for different segments (either defined a priori or simultaneously). We ignore these various segmentation conjoint models in this paper because these have been compared recently by Vriens et al. (1996). The regression model at the individual level is:

$$Y_j = \sum_{1} \beta_1 X_{j1} \quad (1)$$

In this model, Y_j is the desirability (utility) rating of an individual for the jth product profile, X_{j1} is the matrix of dummy variables reflecting the levels of the jth product profile on 1 attribute, and β_1 is the part-worth (utility weight) for the first attribute. Because this model formulation predicts desirability ratings for product profiles, choice simulators are needed to convert the predicted desirability ratings into market share estimates. It is assumed that the sample of subjects for which the desirability ratings are calculated is a random sample from the population of interest. Analysts may then estimate the relative shares of the products in the marketplace by computing the overall desirability (utility) of each product profile for each individual and by assuming some choice rule that translates the utilities of the product profiles into choices.

Two rules that are commonly used in choice simulators are "first-choice or maximum-utility" and "probabilistic choice" (Green and Krieger, 1988). When a "first-choice" rule is used in choice simulators, it is assumed that indivi-