Empirical Analysis of Theory Based Models in Marketing - *A Comment on, "Structural Modeling in Marketing: Review and Assessment."*

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There has been a rapidly growing interest in structural models and the review paper by Chintagunta et al. (2005) is a timely contribution. The paper identifies the key issues and provides an excellent assessment. A contemporaneous paper by Erdem et al. (2005) also offers a critical examination on some of the issues. My comments will be in three areas: First, I shall selectively revisit some of the key issues in the paper and in doing so, hopefully, would shed additional insight on these issues. Second, I discuss some of the recent papers that build on established psychological consumer behaviors. Third, I offer a brief list of potentially significant substantive problems where structural models will be insightful.

1.a. Structural versus reduced form models.

At the outset, the review paper does an excellent job of discussing the structural versus reduced form models. In particular, it is worth reiterating that predictive validation is not a compelling benchmark for assessing the merit of structural models. The paper carefully, though cryptically, states the merit of reduced form models. Reduced form models have their place and will continue to be a vigorous part of research in the field. Reduced form models may identify unexpected empirical regularities that foster new theories. Since the work by Hauser and Shugan (1983), reaction to entry has been an issue of substantial interest. Contrary to expectations, Robinson (1988) and Bowman and Gatignon (1995) empirically show that the incumbent reacts only after a substantial time delay to entry. This unexpected and surprising result led to the theory work by

Kalra, Rajiv and Srinivasan (1998) that shows that delayed defensive reaction can arise in equilibrium. Also, a reduced form model can advance our knowledge when a structural model of the same issue may be too difficult. Ainslie and Rossi (1998) study similarities in choice behavior across categories in an essentially reduced form model. Yet the work remains as the best on that issue even after several years. A structural formulation of this problem is extremely complex. An insistence on such a model, in all likelihood, would have led to no advance in this area.

1.b. Partial equilibrium analysis .

A number of papers have established that it is important to account for consumers' price expectations. A partial list includes Gonul and Srinivasan (1996), Erdem, Imai and Keane (2003), and Sun, Neslin and Srinivasan (2003). All these models underscore that the estimates are biased when such expectations are not incorporated. A natural issue that arises is as to what the rational firm should do as the Stakelberg leader? Modeling the demand *and* the supply side is critical to answer this question. Yet, such a full equilibrium analysis has remained largely elusive in most cases. The resulting model complexity and lack of data availability have hindered progress in this area. There is a real risk that continued partial equilibrium analysis will lead to the same inference in different contexts.

1.c. Limited work on the dynamic supply side analysis.

The supply side structural models have been gaining significant attention. They include uncovering the nature of competition such as Bertrand or Stakelberg

(Kadiyali, Vilcassim and Chintagunta 1996) or the significance of vertical differentiation (Besanko, Dube and Gupta 2003). Recently, Zhu, Singh and Manuzak (2005) propose and estimate a structural model of entry across to investigate the determinants of cross-sectional differences in market structure in the retail discount store industry. Long run changes in location, quality, product offerings change the competitive marketplace. Estimating dynamic game-theoretic models is extremely complex and has hindered progress in this area. For example, Target, K-Mart and WalMart were competitive in the first fifteen years or so but diverge dramatically in their performance during the past fifteen years (Zhu, Singh and Manuzak, 2005). An examination of this dynamic competition that has resulted in vastly divergent outcomes for the firms will be a significant research contribution. Without further investigation of competitive dynamics, the supply side structural modeling will remain limited in its contribution.

2. Modeling psychological behavior in structural models.

Structural models of brand choice have typically assumed that consumers' brand evaluations remain stable (e.g. Erdem and Keane, 1996; Mehta, Rajiv and Srinivasan, 2003). Rubin and Wenzel (1996) show in an experimental setting that consumers' imperfect recall is an increasing and concave function of time lapsed since the time of encoding the information. Mehta, Rajiv and Srinivasan (2004) show that incorporating forgetting in a structural Bayesian learning models provides an explanation for inter-temporal

and cross-sectional variation in both habit persistence and state dependence in purchase behavior. The forgetting model substantially improves over a model based on perfect recall. Mullainathan (2002) proposes a structural model of forgetting to study the impact of the imperfect recall of past predictors of consumer's future income on the present consumption decision. He incorporates the psychological concepts of 'associativeness' and 'rehearsal' in his model and derives the result that the probability of a consumer perfectly recalling a past predictor is an exponential function of the time lapsed.

In yet another attempt, Mehta, Narasimhan and Chen (2005) examine the issue of confirmatory bias in a structural model. In their paper, the authors investigate the influence of effect of advertising. Given the partisan source, consumers are likely to treat advertising as tentative claims subject to verification by consumption. At the time of consumption, however, their behavior will be consistent with the well known confirmatory bias (Deighton 1984; Hoch and Ha 1986). In essence, they suggest and find empirical support that at the time of seeing the advertisement, the effect will be small but will be strongly reinforced upon consumption.

Most structural models on the demand side assume constant discounting by consumers. Lowenstein and Prelec (1992) and Laibson (1997) show evidence for a quasi-hyperbolic function. This is a fundamental issue that merits significant additional investigation. It may be interesting, for example, to estimate models with price expectations with such a discounting function. Since procrastination has been supported by such discounting, it may be useful to see if loyal or inert

consumers vary in their discounting pattern when compared to consumers who often switch.

3. Substantive issues that merit further investigation.

Information acquisition and interpretation is costly for consumers with limited cognitive resources. Search behavior with an explicit recognition of cost-benefit analysis is a ripe area for additional research. Mehta, Rajiv and Srinivasan (2003) show that price search is costly and as a result, consumers often consider a small number of alternatives. Interestingly, in-store displays and feature ads do not influence quality perceptions. Models of sequential search, particularly in the area of durable goods is an important and under researched topic.

A fair and compelling criticism of structural models is the assumption that consumers' have the ability to undertake daunting computational challenges. Consumers may often heuristics that may mimic the optimal conditions, quite closely. A heuristical approach to solving complex optimization problem has a long history in the field of operations research since the early work by Scarf (1960). Identifying consumer choice decision heuristics that may accomplish similar optimization will lend strong credence to structural models.

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