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Steven M. Shugan,

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Editorial

Are Consumers Rational? Experimental Evidence?

Steven M. Shugan*

Warrington College of Business, University of Florida, 201 Bryan Hall, Box 117155, Gainesville, Florida 32611,
steven.shugan@cba.ufl.edu

Despite some misconceptions, consumer rationality is a property of the researcher rather than the consumer. Consumers become more rational as we are better able to predict their behavior or other important outcomes influenced by their behavior. Perfect rationality results when we achieve accurate predictions. Consequently, at least for many *Marketing Science* articles, consumers are becoming more rational as we find better ways to predict. However, some experimental consumer behavior articles find the opposite. The difference between experimental and statistical controls explains the divergence in conclusions. Experimental controls test rationality based on whether previously absent variables exhibit significant explanatory power holding known explanatory variables constant. Statistical controls test rationality based on the incremental explanatory power of previously absent variables after accounting for known explanatory variables. Moreover, experimental tests tend to isolate consumer behavior predictions while statistical tests check for sufficient accuracy to choose among different firm strategies. Both perspectives are correct but ask very different questions.

Key words: bounded rationality; experiments; predicted choice; consumption; consumer behavior; econometrics

1. Rationality

1.1. The Importance of Consumer Behavior to Marketing

Most marketing activities seek to influence markets involving interactions among suppliers, competitors, regulators, the courts, government agencies, and customers. Some research topics, including contingent contracts (Biyalogorsky and Gerstner 2004), auctions (e.g., Shugan 2005), and exploiting historic data bases for marketing interventions (Rust and Verhoef 2005), examine marketing issues applicable in both consumer and business-to-business settings. However, most academic studies in marketing focus exclusively on consumer markets (Ankers and Brennan 2002), perhaps because we are all consumers. Consequently, the study of how marketing activities influence consumer buying behavior is a central part of the discipline of marketing.

A clear and fundamental understanding of consumer behavior should help us more accurately predict consumer response to marketing interventions.

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*Steven M. Shugan is the Russell Berrie Foundation Eminent Scholar in Marketing.

Those predictions would certainly be instrumental, if not invaluable, for designing more effective marketing tactics and more profitable strategies. Understanding consumer behavior should allow both the identification of the critical variables influencing behavior and the nature of that influence. It should also reveal which variables have relatively little impact on behavior and which marketing activities, consequently, might be ineffective.

1.2. The Debate About Consumer Rationality

Given our great interest in consumer behavior, researchers in marketing sometimes find themselves entangled in debates about consumer behavior (e.g., see Firat et al. 1995, Howard and Sheth 1969). For example, one area of debate concerns consumer rationality. Sometimes, consumer rationality debates involve important implications for the effectiveness and implementation of numerous marketing activities. Many marketing activities, such as signaling, require highly rational consumers (Kirmani and Rao 2000). Other marketing activities, such as the construction of loyalty programs, might require irrational consumers (e.g., Taylor et al. 2004). Unfortunately, these debates about consumer behavior, despite their fascinating aspects, are sometimes distracting, confusing, and divert research efforts into directions with no apparent direct impact on marketing activities.

The manuscript review process reveals that some researchers summarily dismiss marketing models that

assume extreme consumer rationality, i.e., extreme forms of optimal behavior where consumers effortlessly ratiocinate through highly complex tasks with capacious memory. Other more moderate researchers suggest that marketing models should account for documented so-called departures from rationality found in experimental studies (e.g., Smith 2003). Some researchers, at the opposite extreme, summarily reject models that assume less than perfect rationality.

2. Some Definitions of Rationality

Before discussing the debate over rationality, perhaps we should define the term "rationality." As with other technical terms (e.g., utility, probability, product, optimization, equilibrium), the term "rationality" can convey different meanings in different disciplines. In fact, different meanings exist within the same discipline. Let us limit the following discussion to the meaning of rationality in the discipline of marketing and, possibly, some sister disciplines.

The everyday definition of "rationality" is "having the ability to reason." Technical definitions, in quest of precision, sometimes become far more complex and confusing. Confusion over the technical definitions of some technical terms often causes many unproductive debates about meaningless differences. Perhaps that confusion is, in part, deliberate. Researchers occasionally adopt less precise, simple everyday terms for their theories, both to better communicate the intended concept and to make assumptions appear more palatable. It seems far more reasonable to posit, for example, a normal distribution than to posit a Gaussian distribution for the ubiquitous error term. Similarly, it seems more defensible to assume that consumers are rational, rather than to assume that consumers are adept optimizers, with perfect foresight and knowledge of the firm's cost structure and never tire. In this sense, the usage of the term "rationality" is a marketing strategy for selling (i.e., making more palatable) a set of technical mathematical assumptions that are sufficient for building a theory of consumer behavior. Like other assumptions, the attractiveness of "rationality" assumptions (as approximations to some complex real-world situations) will depend on whether the subsequent theory is able to explain (i.e., predict) important observables.

In the economics literature, rationality is usually associated with the sufficient conditions for the existence of a consumer utility function (e.g., Malinvaud 1972). Traditional economic theory implicitly defines consumer rationality in terms of expected utility maximization and a set of explicit axioms sufficient for utility functions to exist (Herstein and Milnor 1953). The econometrics literature defines rationality as utility maximization with an individual-specific additive error term (Lewbel 2001). Game-theoretic applications often define rationality as taking the best action,

given well-defined payoffs and rules of play (Bernheim 1984). Hence, rational consumers do what is best for them in a context where all players (consumers, manufacturers, retailers, etc.) have different incentives (e.g., see Alba et al. 1997 for a discussion of conflicting incentives in interactive home shopping). Lipman (1991) defines rationality as choosing the best procedure for deciding. Of course, other disciplines have other definitions, including the idea that rationality is merely normal behavior.

3. The "Best-Action" Definition

Most *Marketing Science* applications are consistent with the "taking-the-best-action" definition of rationality. This definition implies that rationality is necessarily a function of the model (or theory) being proposed or tested because the best action depends on the postulated world of the model (e.g., parameters, decisions variables, relationships, measures).

For example, when proposing a model of search and consideration sets, Mehta et al. (2003) state that "consumer rationality implies that consumers will engage in price search to reduce [price] uncertainty." Acquisti and Varian (2005) define consumer awareness of firm incentives to lower future prices as one property of rationality. Zwick et al. (2003) define optimal search behavior and the size of the consumer consideration set as properties of rationality. Akçura et al. (2004) define consumer learning as one property of rationality. Kalra et al. (1998) define consumer skepticism of manufacturer quality claims (i.e., without supporting evidence) as one property of rationality. Xie and Shugan (2001) argue consumer skepticism about service provider claims regarding future spot prices (i.e., that are not consistent with future spot profit maximization), ala Coase (1972), as one property of rationality. A variety of other factors might also produce other definitions for rationality (e.g., dynamics, uncertainty, the preferences of others, cultural pressures, etc.).

In sum, a rational consumer takes the best action within the world of the model. Given that the different models employ different decisions variables, different exogenous factors, different situations, and exhibit different properties, the precise meaning of the term "rationality" varies from model to model.

3.1. Why the Best-Action Assumption Is Really A Weak Assumption

The assumption that consumers will take the best action (within the world of the model) is often an extremely powerful assumption because it allows extraordinary consistency across and within myriad models that might appear completely unrelated. Hence, we can link diverse models related to advertising budgets, promotions, advertising copy, shopping

behavior, and so on with this high-level assumption. We also get consistency between models of very different phenomena (e.g., borrowing behavior and marriage).

At first, this might seem like a strong assumption. It is not. In virtually all situations, we could introduce ad hoc factors or arbitrarily modify the payoff function to make any outcome appear best. We might, for example, allow consumers to consider the perceived fairness of the outcome, imagined legal constraints, perceived risks of litigation, social acceptability, possible reputation effects, regret, intuition, and so on. A consumer might pay a higher price than necessary as a form of charity or a subsidy to help a valued firm stave off bankruptcy. A consumer might choose a lower-quality alternative as a means of experimentation (i.e., information gathering). A consumer might want to signal modesty in a social setting. Some consumers might deliberately try to make their own behavior unpredictable (as part of a more general strategy). Of course, some modifications might appear to resemble ad hoc ruses attempting to explain the irrational.

This is not to say that all actions are reasonable. Not all models are reasonable approximations of any conceivable real-world setting or real-world decision. This is only an argument that assuming that consumers take the best action is not as strong an assumption as it appears to be. The critical assumption, as argued later, is whether the model itself (i.e., the entire package of assumptions and conditions) provides a sufficient approximation of real-world settings. Moreover, outcomes might remain rational despite violations of the rationality assumptions (e.g., see Mandler 2005).

3.2. Why Best Is Really Best

Before arguing that model prediction is the key to testing rationality, we should concede that assuming that consumers do take the best action is still an assumption that warrants justification. Here are several justifications.

1. Most consumers would prefer to make the best decision *ceteris paribus*.
2. The best action is often unambiguous (at least, if the model is properly specified) and, hence, this assumption is directly testable—unlike assumptions that are less precise about which action will be taken.
3. Possible ambiguity related to the best action alerts us of possible problems with the model's specification or formulation.
4. Given that firms seek to maximize expected profits, assuming consumer maximization creates a sense of symmetry and consistency in the model formation.
5. Rather than requiring predictions for all consumers, many marketing decisions need only consider

marginal consumers (i.e., only those few consumers who will change their purchase decisions—to buy or not—when we adopt a different marketing strategy). Hence, only marginal consumers need do what is best.

6. We are more interested in the eventual outcome rather than in blips along the way (although, the blips are also interesting). Equilibria, for example, represent our targeted outcomes.

7. We would expect that learning and experience would lead consumers toward the best actions.

8. When trying to persuade consumers, the conservative assumption might be that we face the arduous task of persuading very astute consumers rather than the relatively easier task of fooling naïve ones.

3.3. A Practical Definition of Rationality

Rather than quibbling with either the theoretical meaning of rationality or the particular rationality assumptions in any particular model, we should instead focus our concern on whether the rationality assumptions are sufficient to approximate the situation being modeled. The key test is whether the model can accurately predict outcomes in that situation, at least, better than could be done without the model.

Another way of looking at assumptions is that the assumptions provide sufficient conditions when the model's conclusions are justified. That viewpoint is true for every type of model (e.g., normative, descriptive, statistical, behavioral, aggregate, disaggregate, etc.). The question is not whether the modeling assumptions are each good approximations for every situation or even most situations; the question is whether the model's results are applicable in a sufficient number of situations so that the contribution justifies publication and application of the model. We hope that the conditions are sufficiently good approximations so that the model can accurately predict in a sufficient number of real-world situations.

4. Testing Whether Consumers are Rational

4.1. Rationality as a Model Property

Inaccurate model predictions do not necessarily imply that reality is complex or unpredictable. High levels of uncertainty (in some situations) might only reflect an inadequate state of the art in modeling. As modeling technology improves, we expect that reality will appear simpler and more predictable. For example, navigation on the high seas was once onerous, but global positioning systems technology now allows accurate predictions and, consequently, easier navigation.

A similar argument is possible for consumer rationality. Consumers appear rational in situations in

which our models can predict their behavior. Consequently, consumers in well-studied choice situations appear to exhibit high degrees of rationality because we have accurate models for these familiar situations. In other less-studied situations, consumers might appear irrational because our extant models are unable to accurately predict outcomes. In this sense, rationality is a property of our models and not a property of the consumer.

The concept of a subjective probability is analogous. The world is in some true state. For example, we might wonder whether the true box office of a movie is \$1 million, \$10 million, or \$100 million. However, there is some true box office. It is likely that time will reveal that true box office. In fact, we might know that true box office, but rather than using that information, we might predict it from other information to validate a model. A better model is better at predicting outcomes (i.e., explaining variance) than other models. However, the uncertainty in the outcomes (i.e., the variance) is a feature of the model and not reality. Reality consists of true states (which may or may not be known when predictions are made) while probabilities represent the researcher's uncertainty about the true states. There are no correct probabilities, but there are correct predictions. Subjective probability reflects the researcher's uncertainty. Similarly, irrationality reflects the researcher's inability to predict behavior.

Most marketing models (perhaps all) should be tested on their predictions. Usually, predictions are made for qualitative or quantitative observations that are not used in the formulation, estimation, or calibration of the model. Hence, a model should be capable of making predictions that we would be unable to make without the model.

4.2. What Is Being Predicted

The prior argument suggests how we should test the rationality assumptions of a model. Given that consumer rationality assumptions are just a few of the many assumptions that comprise a model, it would be unproductive to test each assumption in isolation.

Consider a road map that is a model of a geographic terrain. A particular map might show all the major highways but fail to show the location of hotels. The map model represents a simplification and approximation of the real geography. It can't show every detail of reality, nor should it. It is difficult to evaluate, in isolation, whether ignoring lodging is a good or bad assumption. If the map is being used to navigate across the state, other assumptions in the map's construction may trump the inclusion of lodging. If, in contrast, the user wishes to find lodging, ignoring hotels is a fatal flaw in the model. We are unable to evaluate the assumption in isolation. This argument also implies that the quality of

an assumption depends on the intent of the model, as well as on the other modeling assumptions. We are unable to conclude, in isolation, that some models comprise more realistic behavioral assumptions than other models. A model for predicting industry sales, for example, might require different assumptions about consumer behavior than a model attempting to predict a particular consumer's reaction to a direct-mail solicitation.

Hence, the proper predictive test for rationality assumptions need not focus on consumer behavior. Those assumptions only indirectly impact the validity of the conclusions. For example, consider a model built to help select one of several new products for development. That decision might involve assumptions related to consumer reactions, development feasibility, supply chain issues, costs, competitive reactions, inventory requirements, and so on. Whether a naïve consumer rationality assumption is an adequate approximation for expected consumer behavior depends on whether replacing that assumption with a more complex or realistic assumption would change the selection decision. In general, the adequacy of the rationality assumption depends on whether the assumptions lead to the adoption of the wrong marketing strategy, rather than on whether the assumptions predict consumer behavior at some absolute level of accuracy. For example, the assumptions that consumers price shop at many or few outlets might each yield the same optimal marketing strategy when each assumption tends to yield the same prices across outlets.

Of course, the rationality assumption might be questionable if the model is unable to predict desired outcomes (e.g., profits, sales, market share) with sufficient accuracy to discriminate among strategies. Then, every assumption becomes suspect. Moreover, several assumptions could be flawed (i.e., bad approximations).

4.3. A Brief Comment on Prediction Versus Explanation

Although the technical terms "prediction" and "explanation" certainly vary in meaning, this discussion treats the words as almost synonymous. Usually, after observing some qualitative or quantitative observations, we propose a model or theory that explains those observations. We partially assess the validity of the theory or model by predicting different observations (qualitative or quantitative). In some cases, the researcher arbitrarily defines explained observations (e.g., based on a point in time in the dataset, based on previous research at the time of submission, and so on). However, this distinction is less relevant here.

4.4. Irrationality Is the Default Assumption

Authenticating irrationality is not necessarily our task. Our default assumption is that consumers are irrational, either because their behavior is inherently unpredictable or because we have not yet discovered how to predict it. The proof of rationality is straightforward but, perhaps, daunting. We need only create a model that accurately predicts (i.e., explains the variance) in consumer behavior. If we are able to predict consumer behavior as a function of the relevant variables in the situation of interest, we can conclude that consumers are rational (at least in that situation) and that our model accurately represents that rationality.

5. Conflicting Findings on Rationality

The prior reasoning suggests that consumers will appear to grow more rational over time as advances in model building technology ameliorate our ability to predict. For example, Wolfgang and Kannan (2005) discover how spatial multinomial models can better predict the spatial correlations among customer choices. Mittal et al. (2005) discover how customer satisfaction can better predict firm long-term financial performance. Divakar et al. (2005) discover how to better predict microlevel consumer behavior. Nair et al. (2005) discover how aggregate data can better predict purchase incidence, brand choice, and purchase quantities.

5.1. Are Consumers Becoming More Rational?

It seems clear that *Marketing Science* articles report increasing success at predicting consumer behavior—at least in purchasing situations. Moreover, many of these articles start with assumptions that are consistent with the strongest axiomatic representation of consumer preferences.

Consequently, consumers are becoming more rational because we are becoming better able to predict their behavior. This greater ability to predict behavioral response to marketing interventions is also occurring at a more disaggregate level (e.g., Rust and Verhoef 2005). Although we have as yet not achieved perfect rationality, because consumer choice is not yet perfectly predictable, we are getting closer to achieving that objective. It is also occurring with new forms of data including newsgroups (e.g., Godes and Mayzlin 2004) and click stream data (Montgomery et al. 2004). However, some experimental consumer behavior articles appear to find the opposite. These articles provide compelling demonstrations that influential variables are absent from extant models.

5.2. Explaining Severely Conflicting Findings on Rationality

It might appear surprising that such a large number of articles focusing on consumer behavior find

such a high level of irrationality (inconsistencies with typical extant rationality assumptions and the corresponding models) among consumers. These articles advocate inclusion of absent variables, including envy, relationships (Fournier 1998), framing, involvement (Zaichkowsky 1985), cognitive limitations, overchoice (Gourville and Soman 2005), social preferences, context effects, self-control, mental accounting, temptation, altruism, affective forecasting, bounded rationality (Arthur 1994, Simon 1981), fairness, the difficulty of the decision (Shugan 1980), and so on.

Moreover, many articles (e.g., Zeelenberg 1999) claim that consumers are becoming more irrational, at least in the sense that these articles are finding more violations of the most common rationality assumptions. Loewenstein (1999), for example, states: “Despite the blossoming of the utility concept and expanding appreciation for the diverse determinants of utility, the list of human motives that have been codified in utility functions, and hence incorporated into economic analyses, remains seriously incomplete.” Cohen and Dickens (2002) concede that behavioral studies have “been most successful in documenting failures of the rational-actor model (e.g., failures of expected-utility theory, irrational cooperation, and time-inconsistent preferences).”

The apparent conflicts in these findings and the traditional assumptions in *Marketing Science* models sometimes cause debates between quantitative modelers who claim to have found high levels of consumer rationality (i.e., consistently with the model forecasts) and psychological researchers who tend to find high levels of irrationality (i.e., significant variance explained by absent or overlooked variables).

Despite appearances, there is little conflict between these two different research streams. Differences in research objectives and differences in research methods explain the differences in findings.

5.3. Experimental Controls Versus Statistical Controls

Most *Marketing Science* models focus on the amount of total variance explained by the model. Analytical models focus on whether qualitative outcomes are explained (i.e., occur when predicted). Statistical models focus on whether quantitative outcome variance is explained (i.e., the difference between observed and predicted outcomes). Normative models, calibrated from past data, focus on whether the models produce the best strategies. In each case, the question asked is whether the model makes an adequately accurate prediction to discriminate among possible marketing strategies.

For example, Hauser and Toubia (2005) find that the errors and biases associated with adaptive metric utility balance (prior metric responses by consumers

are used to construct hypothetical choices for each consumer, keeping similar choice probabilities within each choice set) combined to less than the order of magnitude of typical response errors.

Many consumer behavior models, however, use a different criterion. These models start with theories or hypotheses that consider factors not commonly recognized by past research. These factors might be completely absent from many extant analytical, statistical, and normative models.

These consumer behavior articles provide unambiguous evidence that these new factors explain (or predict) a significant amount of consumer behavior. The obvious conclusion is that excluding these factors ignores important aspects of consumer behavior—hence, extant models of behavior are wrong.

The key is that this experimental research asks a different question. This research employs experimental controls rather than statistical controls. Experimental controls test rationality based on whether previously absent variables exhibit significant explanatory power holding known explanatory variables constant. The question is whether there are still unexplored variables that can alone significantly influence consumer behavior or enhance our understanding of consumer behavior (i.e., having the ability to predict behavior).

Statistical controls test rationality from a different perspective. These controls ask whether the incremental explanatory power of previously absent variables is significant after accounting for known explanatory variables. Consequently, if known explanatory variables are sufficient to produce predictions (either qualitative or quantitative) that are adequate for determining the best marketing strategy, we would be satisfied with known explanatory variables. Moreover, in the quest for parsimony, stability, robustness, tractability, generality, and power, we would place greater value on models capable of isolating only the most critical variables that predict (i.e., explain the variance) in consumer behavior. With fewer variables, we are able to make more general predictions that are less dependent on factors that might be unknown in some situations.

Both the experimental approach and the statistical approach can yield remarkable insights. Both approaches can be extraordinarily useful, but they ask different questions, and each might be unable to answer the questions asked of the other.

5.4. A Brief Comment on Effect Size

Note that this discussion regarding controls differs from arguments regarding the transparent reporting of effect sizes in experimental inquiries (e.g., see Peterson et al. 1985). Effect sizes provide useful information about the absolute explanatory power of particular variables. However, as noted earlier,

effect sizes in experimental studies fail to consider the explanatory capabilities of variables held constant in the experiment. Although effect sizes do measure the total explanatory power of variables in experimental settings, while holding other variables constant, large effect sizes do not necessarily indicate large incremental explanatory power after including known explanatory variables.

Finally, the strength of the manipulation often determines the magnitude of the effect size. This could be problematic when the strength of the manipulation might not reflect the actual variance in real-world situations.

6. Conclusions

Despite some misconceptions, consumer rationality is a property of the researcher's model rather than the consumer. Consumer behavior appears more rational as researchers are better able to predict this behavior in more situations. Perfect rationality results when either consumer behavior is adequately predictable or when we can predict important outcomes influenced by consumer behavior. Consequently, at least for many *Marketing Science* articles, consumers are becoming more rational as new models more accurately predict consumer choice in more situations. However, some interesting experimental consumer behavior research finds the opposite. This research shows that extant models fail to consider critical variables that can explain significant variability in behavior.

The illusion of conflict is resolved by understanding the difference between experimental and statistical controls. This difference explains the apparent and dramatic divergence in the conclusions. Many articles in consumer behavior use experimental controls. Experimental controls test rationality based on whether previously absent variables exhibit significant explanatory power holding known explanatory variables constant. Hence, these articles ask whether previously unexplored variables have significant explanatory power alone. Many *Marketing Science* articles use statistical controls. Statistical controls test rationality based on the incremental explanatory power of absent variables after accounting for known explanatory variables. Statistical controls ask whether absent variables have significant explanatory power beyond what is explained by known explanatory variables. Both perspectives are correct, but they ask different questions.

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