Timothy F. Bresnahan
Stanford University

Comment on "Conjoint Analysis of Price Premiums for Hotel Amenities"

Introduction

This comment has two purposes. The first is explicit: an explanation of the Goldberg, Green, and Wind "preference reversal" finding in terms of perfectly rational but heterogeneous consumers. The second is implicit: an exposition of how economists' ways of modeling choice, particularly across individuals, could be useful in marketing research.[1]

Hybrid Categorical Conjoint Analysis: A Translation

Goldberg, Green, and Wind (GGW) elicited different kinds of information about hotel choice from their respondents and analyzed this information both separately and together. In phase 1 they presented lists of alternatives for a *single* feature of the hotel, as in my figure 1 (top). The respondent reports a first choice; in my example, respondents would say whether they were willing to pay \$10 extra for a large room, or even \$25 extra for a suite. Similarly in figure 1 (bottom), each respondent reports willingness to pay for a larger pool, or even poolside bar service. In the statistical part of phase 1, GGW estimate "part worths" for each of these items *across* persons. The canonical correlation procedure, crudely speaking, assigns a high part worth to those price-amenity pairs many respondents "most preferred" or few deemed "unacceptable."[2] This analysis uses only information from the single amenity at hand. In my example (see fig. 1), the inferences about room preference are drawn without using the pool data and vice versa.

The phase 1 single-amenity responses are later used to predict the

1. The relevant techniques have been recently surveyed in McFadden (1980).
2. Canonical correlation maximizes the correlation (across persons) between a linear function of the endogenous variables (here dummies for "most preferred" or "unacceptable") and a linear function of the exogenous variables (here dummies for "small room," "suite," etc.). In the GGW analysis, all of these variables are orthogonal dummies. Thus, the number of respondents who give each answer—"most preferred," "unacceptable," or "other"—for each alternative contains all of the information in the data.

(*Journal of Business*, 1984, vol. 57, no. 1, pt. 2)

0021-9398/84/5712-0026\$01.50.

Feature	Small Room	Large Room	Suite
Incremental Cost	$0	$10	$25

Feature	No Pool	Pool	Poolside Bar
Incremental Cost	$0	$5	$11

FIG. 1

travelers' choices among completely specified hotels. The first stage in this prediction is assigning to each feature of the hotel the value given it by the traveler. A traveler who most preferred the large room now gets a higher value of the utility function on complete hotels having large rooms, etc. These are the U_{i_j}'s of equation (3). These single-feature utilities are summed using one of the two weighting procedures described by GGW. This total net-of-price utility is then the predictor of choice among fully specified hotels.

In phase 3, respondents are asked to rank hotels with all features specified, including price. The fully specified hotels are priced so that each feature has the same incremental price as it did in phase 1. The direct rankings from phase 3 are then compared with the rankings predicted from the phase 1 responses. The "preference reversal" described by GGW comes about because the predicted rankings are insufficient to explain the actual ones. Total price has further explanatory power above and beyond the phase 1 prediction. This "reversal" is GGW's statistical evidence for the kind of irrationality suggested by Tversky's anecdote.

My difficulties with the preference-reversal conclusion stem primarily from the way GGW treat consumer heterogeneity. Unfortunately, the way tastes are assumed to be the same or to vary across individuals are buried in the statistical procedures. One can be easily ascertained: since "pool" responses are not used in estimating the part worths of "rooms," interfacet dependence has been assumed away. I shall have much to say about the dangers of this assumption in the next section. A second assumption is buried more deeply. When, we may ask, will a given feature have a large estimated part worth? The canonical correlation procedure will tend to assign it one when many respondents rate it "most preferred" or few rate it "completely unacceptable." The procedure then assigns the part worth for this feature as a U_{i_j} to all those

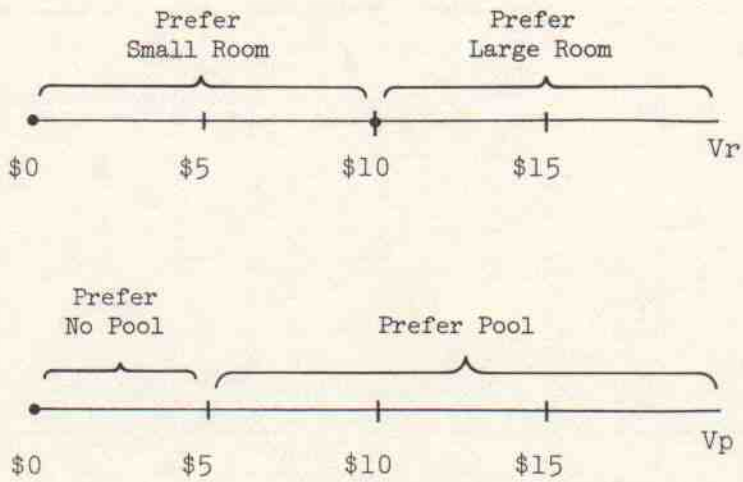

FIG. 2

who rated it most preferred. This, it seems to me, fundamentally confuses the intensity of preference by individuals with the extent to which individuals have the same tastes.

Preference Reversal: An Example with Rationality

A very simple example of heterogeneous consumers offers an alternative explanation of the "preference reversal" phenomenon. Suppose in phase 1 exactly half the consumers most preferred small rooms, half large (none suites), and half preferred to pay for the pool while half did not (none poolside bar). A moment's reflection reveals that these are insufficient data to predict a 50-50 split between the no pool/small room bundle and the pool/large room bundle. Yet, this is the GGW "test" of rationality.

One formal way to think of the data is as in figure 2. In the top half, we see the distribution of reservation prices for large rooms, V_r, and observe that 50% of the respondents have $V_r > \$10$. Similarly, 50% have $V_p > \$5$ and prefer the hotel with pool. To predict how these respondents will react to complete profiles, we need one further datum, the *joint* as well as marginal distribution of V_r and V_p.

In phase 3, the respondent will face a choice among the four possible hotels of figure 3. (The labels *N*, *R*, *J*, and *B* stand for *N*either, *R*oom, *P*ool, and *B*oth.) As in GGW, complete hotels get the sum of the prices of their individual features. The consumer's stage 1 responses completely predict preference between any pair except *N* and *B*. (Between, for example, *P* and *B*, only those who chose the large room in phase 1 will now prefer *B*.) So any new explanatory power for total price will come from the rankings of *N* and *B*. The complete choice behavior (phases 1 and 3) of all consumers is laid out in figure 4. Consumers to the right of the vertical line have $V_r > \$15$; they choose the large room in phase 1. Similarly, consumers above the horizontal line choose the pool in phase 1. The downward-sloping line is $V_p + V_r = 15$. Consum-

	N	R	P	B
Room	Small	Large	Small	Large
Pool	No	No	Yes	Yes
Price	$0	$10	$5	$15

FIG. 3

ers above and to the right of it choose *B* and *N* in phase 3, while consumers below and to the left choose *N* over *B*. The figure legend gives a complete guide to the labeled regions. To understand "preference reversal," consider the two pairs of regions, (II, III) and (V, VI). All consumers in regions II and III give the same phase 1 responses: they are willing to pay for the pool but not the large room. At phase 3 they differ. Only those in III take *B* over *N*. Similar results follow for (VI, V) with "pool" and "large room" reversed.

Now suppose that nearly all consumers have preferences that lie in II or VI. These consumers will be willing to pay for one amenity or the

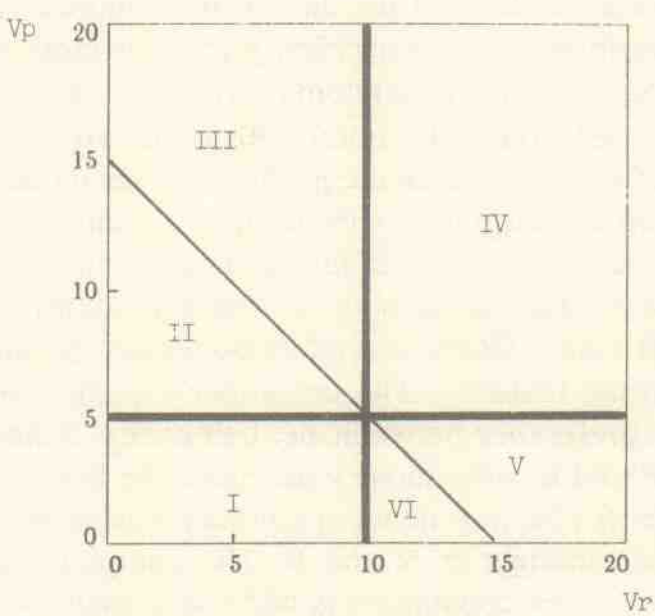

FIG. 4.—Phase 1: small room, I, II, III; large room, IV, V, VI: no pool, I, VI, V; yes pool, II, III, IV. Phase 3—preferences: *B* over *N*, IV, V, III; *N* over *B*, I, II, VI.

other at phase 1, but not for both at phase 3. Their phase 3 behavior will then occur to be entirely explained by the lower price of *N*. The phase 1 responses will have little predictive power. Thus, the "preference reversal" phenomenon is consistent with fully rational consumers, each of whom has additive preferences.

The example shows the relationship between the two general modeling concerns I raised in the last section: heterogeneity and interfacet dependence. At phase 1, GGW treat all of the facets independently. The essence of the example is that most of those who prefer a pool are unwilling to pay for the large room. This is a negative correlation of values of the two amenities across persons: positive correlations would lead to similar problems. Note that the correlations (across consumers) of valuations—heterogeneity—make interfacet dependence matter even though each consumer's preferences are additive.

It is natural at this juncture to question the empirical relevance of the example. Why should it be true that the heterogeneity takes the form of *negative* correlations? The answer lies in the limited time of business travelers.[3] It is perfectly rational to be willing to pay for a well-lit room or for a poorly lit lounge, but not for both. There is simply too little time in an evening for both reading and drinking. As a result, the population of hotelgoers is disparate, with many consumers willing to pay for some of the amenities and few willing to pay for all. This description of the distribution of tastes is empirically unverified. It does explain the data, however, and it is not obviously wrong.

Suggestions

For data like those gathered by GGW, changing to an explicit random-utility framework is not difficult. Because no feature of the choice problem varies in a continuous way, a complete description of the problem is provided by a large (though finite) list of choice probabilities. My preference would be to go with off-the-shelf statistical procedures such as the log-linear probability model. Texts like that by Bishop, Fienberg, and Holland (1975) extensively document the way to estimate the interaction terms suggested by the model in the last section. Modeling the interaction terms carefully is of more than abstract scientific interest. It is the interaction terms which are crucial to the strategic goals of the sponsoring firm.[4] Does the firm want to find a market niche? Emphasize the search for features some but not all consumers desire, as in the negative interaction effects of the last section. Does it want to solidify a position of market dominance?

3. Remarks by Richard Schmalensee clarified my understanding of these issues.
4. For a penetrating discussion of strategic issues, see Porter (1980).

Search instead for positive interaction terms, for that set of features that most consumers value.

References

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