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perhaps most—respondents the notion that the question is directed only to those prospective purchases that have received some detailed and explicit examination within the household's decision framework. To illustrate: while I have no present plans to take my wife and children on a vacation trip next summer, there is a high probability that I will do so. Assuming I take the question literally, if asked whether I "expect" to take a vacation trip, I would probably say yes; if asked whether I "intend" to, I would probably say that I don't know; if asked whether I "plan" to, I would say no; and if asked what the "chances are," I would pick a phrase like very good or a number like nine out of ten. It is evident that the numerical part of the last question provides the most useful information for anyone interested in forecasting the volume of vacation trips; all the other answers depend on idiosyncratic interpretations of adjectives, which not only must vary widely among households but also may vary according to how the question strikes the respondent at the time of the interview and how the interviewer asks the question.

What seems to me the most reasonable general interpretation is that plans or intentions to buy are a reflection of the respondent's estimate of the probability that the item will be purchased within the specified time period. Consumers reporting that they "intend to buy A within X months" can be thought of as saying that the probability of their purchasing A within X months is high enough so that some form of "yes" answer is more accurate than a "no" answer, given the particular question asked.[5] Thus consumers classified as nonintenders must comprise those who regard their purchase probability as too low, given the question, to warrant an affirmative response, or as too uncertain to warrant reporting the existence of a plan or a positive expectation. This interpretation implies that a good many respondents with purchase probabilities higher than zero will classify themselves as nonintenders.

4. THE LOGIC OF A PROBABILITY SURVEY

If we suppose that all households regard a specified question about buying intentions as having a cutoff (threshold)[6] probability of, say, C_i, and if the distribution of purchase probabilities is as shown in Figure 1-A, we would observe that a fraction p of the sample will report buying intentions and a fraction $1-p$ will be nonintenders. The p intenders will have a mean purchase probability of r, the $1-p$ nonintenders a mean probability of s, and the sample

[5] The literature in this field has been virtually unanimous in ignoring the probability nature of an intentions survey. Analysis of intentions data has been concerned with the fulfillment rate of buying plans, with the question of which responses (definitely, probably, may buy) to classify as a plan, and with the relation between failure to fulfill plans and other factors. Cf. the extensive discussion of anticipation surveys in *Consumer Survey Statistics*. Much of my own earlier work in this field (e.g., *Consumer Expectations, Plans, and Purchases*) exhibits this frame of reference.

A few scattered references in the literature suggest awareness of the probability character of intentions surveys, although none of these analyze the implications for survey design. For example, Tobin ("Predictive Value of Consumer Intentions and Attitudes") notes the threshold nature of affirmative responses to intentions questions. Maynes, in the *1962 Proceedings of the Business and Economic Statistics Section* of the American Statistical Association, comments on the necessity for more precise measures of intentions. And my own remarks on papers given by Katona-Mueller and Dingle in the *1960 Proceedings of the American Statistical Association* foreshadow the line of thought in this paper.

[6] The term is used by Tobin ("Predictive Value of Consumer Intentions and Attitudes") for much the same purpose.

as a whole a mean of x.[7] If the cutoff probability associated with a specified question varies among households, as it probably does, we would observe that the probability distributions for intenders and non-intenders overlapped to some extent, as in Figure 1B; if p and $1-p$ have the same values as before, it follows that r will be smaller and s larger than in Figure 1A.[8]

If it is true that intenders are simply households with purchase probabilities higher than some minimum level and nonintenders those with probabilities lower than the minimum, a number of implications follow. First, it becomes clear that the best predictor of the population purchase rate will be mean purchase probability in the population, not the proportion of intenders. Thus the proportion of intenders may not provide an accurate measure of the prospective purchase rate even under the best of circumstances (no sampling error, no unforeseen events, and so on), since there is no reason to suppose that p, the proportion of intenders, and x', mean purchase probability in the population, will be perfectly correlated. Second, it follows that a survey of intentions actually obscures the variable that we really want to measure: if responses to intentions questions rest on a comparison of the respondents' purchase probability with the probability threshold implied by the question, respondents are being asked to make two difficult judgments when the first (actual probability) is the only one of any real use.[9] And if respondents are capable of judging the difference between actual and threshold probability, they should *a fortiori* be able to provide reasonably good estimates of the former.

Finally, an intentions survey obviously provides no information at all about the distribution of purchase probabilities among households below the cutoff, i.e., those who class themselves as nonintenders. As noted, these households account for the bulk of total purchases and of the time-series variance in pur-

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[7] The mathematics are quite straightforward: defining terms as above, designating the cutoff or threshold probability for the ith intentions question as C_i and purchase probability as Q, and taking total frequencies as equal to unity, we have

$$p = \int_{C_i}^{1} f(Q)\, dQ,$$

$$1 - p = \int_{0}^{C_i} f(Q)\, dQ,$$

$$r = \int_{C_i}^{1} Q \cdot f(Q)\ dQ \Big/ \int_{C_i}^{1} f(Q)\, dQ,$$

$$s = \int_{0}^{C_i} Q \cdot f(Q)\ dQ \Big/ \int_{0}^{C_i} f(Q)\, dQ, \text{ and}$$

$$x = \int_{0}^{1} Q \cdot f(Q)\ dQ \Big/ \int_{0}^{1} f(Q)\, dQ$$

See *Anticipations and Purchases*, especially Chapter 3 and Appendix.

[8] The time-series correlation between x and p can be shown to depend on the algebraic difference $\overline{R} - \overline{S}$ (the means of the random variables r and s), and on the variance of p (Okun, "Value of Anticipations Data"). As a consequence, the time-series correlation between x and p will tend to be lower if the cutoff probability varies among households.

[9] The argument suggests that a survey of explicit purchase probabilities may be easier for respondents to handle than an intentions survey, and there is some empirical evidence to suggest that this is the case. Census Bureau interviewers who have handled both types of surveys almost uniformly report that respondents seem to have less difficulty with the probability survey than with the intentions survey.

chase rates. Unless nonintenders' purchases are typically a consequence of unforeseen changes in circumstances, and hence nonintenders who subsequently purchase really had zero purchase probabilities at the time of the survey (which I find hard to believe), the inability of intentions surveys to measure changes in mean probability among nonintenders must be presumed to account in some part for the unimpressive forecasting record of these surveys.[10] Thus the most important potential gain from a survey of purchase probabilities is likely to be an estimate of the change over time in mean probability among nonintenders.

The objectives of a probability survey are, in principle, quite straightforward. An unbiased estimate of the future purchase rate is required, hence the survey should yield an estimate of mean probability which is on average equal to the observed purchase rate. While the distribution of probabilities is not known, there is a presumption that the true distribution is both continuous and relatively smooth—e.g., it would be surprising if there were sharp and irregular jumps from one probability level to the next. Whether a survey can be designed to yield unbiased estimates of the true distribution, or whether any operational survey will inevitably yield a mixture of true probabilities, wishful thinking, and unreasonably pessimistic appraisal, can only be determined empirically.[11]

Even if a survey of purchase probabilities yields an estimate of the true distribution of ex-ante probabilities, the mean of this distribution, while an unbiased estimate of the future purchase rate, will not necessarily constitute an accurate forecast. If important and unforeseen events occur during the forecast period, and if these events have a systematic rather than a random influence on behavior, a survey of purchase probabilities will not predict accurately by itself nor will any other ex-ante survey. The forecasting problem then becomes one of trying to construct a model which incorporates the prospective influence on purchase rates of presently unforeseen or imperfectly foreseen events, and the forecast becomes explicitly contingent on these events.

In sum, the evidence suggests that a survey of explicit purchase probabilities is worth serious investigation as a potentially superior source of information for predicting and explaining consumer purchase behavior. Although there may, and probably will, be biases in any measure of purchase probability obtained from surveys, there is neither empirical nor *a priori* evidence to suggest the direction or the extent of bias.

5. CRITERIA TO MEASURE THE GAIN IN ACCURACY

Before examining the evidence, it will be useful to set out the appropriate tests for determining whether or not a probability survey represents a significant improvement over an intentions survey. The only really conclusive test requires time-series evidence: Does a probability survey explain signifi-

[10] Most intentions surveys divide the high probability region of the distribution into several groups with more or less homogeneous purchase probabilities—definite intenders, probable intenders, and so forth. Thus changes in the mean value of the probability distribution above the nonintender cutoff point may be estimated with reasonable accuracy by changes in the proportion of definite, probable, and other intenders.

[11] By true probabilities I mean the probabilities that would be estimated by a highly qualified objective observer wholly familiar with all of the data relevant to the household's purchase decision. I view the probability judgments obtained from a household survey as estimates of these true probabilities.