Volume Title: Consumer Buying Intentions and Purchase Probability: An Experiment in Survey Design

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Volume Publisher: NBER

Volume ISBN: 0-87014-413-8

Volume URL: http://www.nber.org/books/just66-2

Publication Date: 1966

Chapter Title: Empirical Evidence

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Chapter URL: http://www.nber.org/chapters/c1535

Chapter pages in book: (p. 12 - 37)

accounted for by nonintenders (and in fact that all such purchases should be explainable by unforeseen changes in household circumstances); and (4) the cross-section correlation between purchase probability and actual purchases is higher than that between intentions to buy and actual purchases. Additional tests involving the influence of attitudes and expectations on purchases, holding either buying intentions or purchase probability constant, are discussed below.

6. EMPIRICAL EVIDENCE

I am aware of only three attempts to measure consumer purchase probabilities by means of surveys. One of these was an apparently unsuccessful experiment incorporated into a survey whose main focus was on consumer savings and asset holdings (Savings Study experiment).[13] The second was a pilot test predecessor of the experiment reported in this paper, and was conducted in November 1963 at the U. S. Bureau of the Census on a nonrandom sample of consumers from a Detroit suburb (Detroit experiment). The third study (QSI experiment), also conducted at the Census Bureau, was based on a random sample drawn from the 16,000-odd households included in the regular *Quarterly Survey of Intentions* in July 1964. All of these experiments use a forecast period of six months in which to contrast observed purchases with ex-ante purchase probability, although the QSI experiment will eventually have twelve months' purchase data as well.

Savings Experiment

The Savings Study experiment (97 households, high-income loading) suggests that the typical consumer can really distinguish only three classes of purchase probabilities, and seems to indicate that a probability survey does not provide any information not already obtained by the standard intentions surveys. This experiment, however, seems to me an intentions survey with a precoded response scale, not a survey of purchase probabilities. Respondents were not asked to indicate the probability that they would buy, but rather what kind of plans they had—certain, none, fifty-fifty, or anything in between. Specifically, they were asked whether they had any plans to buy a list of products between June and the end of the year, and then handed a flash card labeled "Plan-o-meter." The card contained a 10-through-0 scale with "certain" opposite 10, "fifty-fifty" opposite 5, and "no plans at all" opposite 0. Thus respondents lacking something called a "plan" would presumably have answered zero—defined as no plans at all—regardless of the level of their purchase probabilities.

The distribution of Savings Study experiment responses is trimodal, with peaks where the adjectives are provided. The proportion of zero responses ("no plans at all") seems to be about the same as what would typically be observed in a comparable sample for a buying intentions question with a six-month plan-

[13] R. Ferber and R. Piskie, "Subjective Probabilities and Buying Intentions," *Review of Economics and Statistics*, August 1965, pp. 322–5. Other experimental evidence using a precoded scale is discussed in Warren Bilkey, "A Physchological Approach to Consumer Behavior Analysis," *Journal of Marketing*, July 1953. Bilkey uses the principles of Lewinian vector psychology to set up a simple scale designed to measure both the respondents' "attraction toward" and "repulsion against" the attributes (including cost) of a specified product. The predictor variable is simply the algebraic difference between the two scale values. Bilkey's sample is quite small and nonrandom (less than 100 cases, mainly from a university staff). His results are hard to interpret, although they seem to indicate that further research along these lines is warranted.

ning periods. And dichotomous measures constructed from the scale responses (above or below a specified level) explain about as much of the variance in purchases as the entire scale. Thus the Savings Study experiment apparently obtained about the same kind and quality of information as an intentions survey (See Appendix Table A-1 for details of the Savings Study data.

Detroit Experiment

The Detroit experiment (192 households) was the first phase of an attempt to develop an experimental survey of subjective purchase probabilities.[14] Respondents were asked the following question: "During the next (6, 12, 24) months, that is, between now and next ———, what do you think the chances are that you or someone in the household will buy a ———?" Answers were to be given by selecting from a card containing an eleven-point probability scale (10 through 0) with descriptions for each scale value:

10	Absolutely certain to buy	10
9	Almost certain to buy	9
8	Much better than even chance	8
7	Somewhat better than even chance	7
6	Slightly better than even chance	6
5	About even chance (50-50)	5
4	Slightly less than even chance	4
3	Somewhat less than even chance	3
2	Much less than even chance	2
1	Almost no chance	1
0	Absolutely no chance	0

The distribution of responses in the Detroit sample is smoother than that obtained in the Savings Study experiment, but still shows the marked peak at 5 (described as a 50–50 chance) for all three time periods (Appendix Tables A-2, A-3, and A-4). The experiment appears to have been successful in increasing the proportion of nonzero-probability households over the proportion of intenders observed in the roughly contemporaneous *Quarterly Survey of Intentions*. Even though the Detroit group is not a random sample and would presumably have shown a higher proportion of intenders (or non-zero probabilities) than a random sample, the differences seem much too large to be attributed to the difference in sampling frame. Thus the Detroit experiment implies that a substantial number of households classified as nonintenders in a buying-plan survey will report that their probability of purchase is greater than zero.

The shape of the probability distributions in the Detroit experiment is worth comment. Many of them, especially those for probabilities covering a twenty-four-month period, are trimodal: peak frequencies appear at 0, 5, and 10, thus tending to reproduce the general pattern of results from the Savings Study experiment. It is easy to rationalize the peaks at 0 and 10; they suggest that the distribution has an inverse-*J* shape; most people have a zero probability of pur-

[14] This survey, as well as the QSI experiment, was designed by the Census Bureau in conjunction with the present author and other interested people. Operating responsibility for the survey rested with James Byrnes of the Census Bureau. Byrnes has reported detailed results of the Detroit pilot test in "An Experiment in the Measure of Consumer Intentions to Purchase," *1964 Proceedings of the Business and Economics Statistics Section*, American Statistical Association.

chase, and more are upward of 90 per cent certain they will buy than are 70 or 80 per cent certain. It is quite plausible to me that the true frequencies in the high-probability end of the scale would have this shape, since there must be a substantial number of households who purchase regularly at predetermined intervals. But I do not think it plausible that the true probabilities in the region around 0.5 are such that more households are really located at 0.5 than at either of the adjacent probabilities. The peak at 0.5 simply suggests that many households were unable to be very precise about the question, and chose the fifty-fifty value as a way of indicating that their prospects of buying were higher than zero but lower than one. If so, shifts in the true distribution among the classes ranging from 0.3 to 0.7—perhaps even from 0.2 to 0.8—would apparently not be reflected in the survey responses, which would continue to cluster at 0.5.

I would be inclined to argue (and evidence presented below supports this view) that the peak at 0.5 is basically due to the design of the scale from which respondents selected answers.[15] The descriptions accompanying the scale are all qualitative except for the reference to fifty-fifty chance opposite the 5 value. On either side of this value the scale points are symmetrically described in terms of degrees of better than (less than) an even chance. Most respondents apparently found these shadings of little help in selecting the most appropriate choice. In addition, there is evidence that interviewers occasionally suggested answers to respondents who seemed to be having difficulty in making a choice, and that in such cases the choice suggested by the interviewer was apt to be the fifty-fifty one.[16]

Purchase rates for automobiles in the Detroit experiment during the six months after the survey range from above 80 per cent for the highest probability class down to less than 10 per cent for the lowest one. The mean of the probability distribution is only moderately below the purchase rate (.17 compared to .22). These results are not inconsistent with the hypothesis that responses to the Detroit probability scale constitute unbiased estimates of the true ex-ante purchase probability in the sample.[17]

QSI Experiment

A full-scale experiment with a probability survey was conducted in July 1964. Since the object of the experiment was to determine whether or not a probability survey was superior to an intentions survey, it was decided to use identical households in a direct confrontation of the competitive survey design. Hence a random sample of some 800 households that had participated in the July 1964 Quarterly Survey of Intentions (QSI) were reinterviewed a few days

[15] This is not a criticism of the Census Bureau. I had the same degree of responsibility for the design of the Detroit scale as for the design of the one used in the QSI experiment.

[16] The fact that the experiment produced an objectively irrational peak at the 0.5 probability level does not necessarily preclude it from yielding a completely unbiased estimate of mean purchase probability. All that is necessary is that, among respondents selecting the fifty-fifty choice who "should have" selected a value above or below, the distribution of true probabilities be symmetrical about 0.5.

[17] One would of course expect the observed purchase rate in probability classes higher than the mean to be lower than ex-ante purchase probability, and in classes lower than the mean to be higher than ex-ante purchase probability, provided that the distribution of both unforeseen events and measurement error is random. Households reporting a probability of 1.0 can only be moved toward nonpurchase because of unforeseen events, and can only be misclassified upward because of measurement errors; households reporting probabilities of 0.0 can only be moved toward purchase because of unforeseen events, or misclassified downward because of measurement errors. Either event will result in regression bias.

later with the experimental probability survey.[18] These households were reinterviewed again in the latter part of January 1965 to obtain purchases and other relevant data. Reinterviewing after a few days' time is often done in Census Bureau surveys, but ordinarily the reinterview consists of the identical survey administered by supervisors as a check on the interviewing staff.

The QSI experimental design differs from that used in the Detroit pilot test only in that lessons learned from the latter could be applied in the former. In fact the survey designs are very similar. Both use a flash card with a probability scale ranging from 10 through 0, although QSI has a different (and presumably better) set of scale-point descriptions that are both qualitative and quantitative. The question asked was: "Taking everything into account, what are the prospects that some member of your family will buy a ——— sometime during the next ——— months; between now and next ——— ?"

Certain, practically certain (99 in 100)	10
Almost sure (9 in 10)	9
Very probable (8 in 10)	8
Probable (7 in 10)	7
Good possibility (6 in 10)	6
Fairly good possibility (5 in 10)	5
Fair possibility (4 in 10)	4
Some possibility (3 in 10)	3
Slight possibility (2 in 10)	2
Very slight possibility (1 in 10)	1
No chance, almost no chance (1 in 100)	0

The QSI experiment also collected data on attitudes and expectations, and the questions attempt to distinguish degrees of optimism or pessimism about both personal financial prospects and general economic conditions. The QSI probability questions were preceded by a more detailed introduction designed to educate respondents about use of the scale. Also, respondents were given some "practice" on the scale, using a set of questions for which substantive content was of less interest. Finally, fewer prospective purchase periods were included for household durables and appliances. All these changes were based on preliminary analysis of the Detroit results; the QSI experimental format was set before any purchase data from the Detroit experiment became available for analysis. Appendix B contains the complete QSI experimental survey schedule.

The scale changes are the most important ones and, as the data will show, were at least partly successful in doing what they were designed to do. It was felt that the peak in responses observed at the 0.5 scale point in the Detroit experiment may have been an avoidable accident of scale design—specifically, it may have been caused by the presence of a quantitative fifty-fifty choice, all other adjacent choices being qualitative. Hence the adjectives used to describe the scale were changed to give the 50–50 choice the same degree of "visibility" as adjacent ones. Second, the upper and lower limits on the Detroit scale may have been technically unsatisfactory, in that there is literally almost nothing for which the prospects can accurately be described as "absolutely certain" or

[18] Due to nonresponse and failure to follow up, about 20 per cent of the original sample were not reinterviewed a few days later, as indicated in the text, but three months later, when the next regular QSI was conducted. These late-responding households have been excluded from the subsequent analysis.

"absolutely no chance." Concretely, some of the differences between respondents marking 9 as opposed to 10 (almost certain vs. absolutely certain) or 1 as opposed to 0 (almost no chance vs. absolutely no chance) may have been a reflection of differences in the tastes and sophistication of respondents rather than of substantive differences in their purchase probabilities. Finally, quantitative explanations were provided for each of the scale points in order to make perfectly clear (to respondents inclined to look at the numbers) the precise intended meaning of the scale points and descriptive adjectives.

Hypotheses to Be Tested. The QSI experiment was designed to test a number of quite specific hypotheses. The first, and most important, is that a survey of explicit purchase probabilities will provide a more efficient measure of future purchases than a survey of intentions to buy. A similar but stronger hypothesis is that, in a cross-classification of observed purchase rates by responses to a probability survey and an intentions survey, purchase rates would vary systematically among probability classes, holding buying-intentions class constant, but would vary only at random among buying-intentions classes, holding probability class constant. The hypothesis implies, of course, that there will be off-diagonal entries, since otherwise the two classifications would be identical.

In addition to both a probability scale and an intentions classification, the QSI experiment contains data on several kinds of household expectations and attitudes—the ones found to be of most use in previous studies—as well as some data on the incidence of unforeseen events. I have shown previously that expectations and attitudes expressed concurrently with buying intentions are largely redundant to intentions for the explanation of purchases, while intervening (unforeseen) events are not.[19] That is, introducing a buying intentions variable into the regression of purchases on what may be called initial-data variables (those reported concurrently with intentions) and intervening variables (those unforeseen or imperfectly foreseen at the survey date) will reduce or eliminate the influence of initial-data variables but have no impact on intervening ones. I also hypothesized that the only reason that the intentions variable did not completely eliminate the influence of initial-data variables on purchases was that intentions were a mediocre proxy for purchase probability, and that a good measure of probability would in fact completely eliminate the influence of initial-data variables. Since the QSI experiment contains both buying intention and purchase probability data as well as several initial-data and several intervening variables, all these hypotheses can be subjected to rigorous empirical tests.

The tests described above all relate to comparisons of a probability survey with an intentions survey. One can also test for bias between the probability survey and observed purchase rates. If the survey provides an unbiased estimate of the distribution of true purchase probabilities, the mean of the distribution will equal the observed purchase rate, provided that unforeseen events do not have a systematic influence on purchases.[20]

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[19] *Anticipations and Purchases*, Ch. 7.

[20] During the period of observation in the QSI experiment, there should have been a difference between mean probability and the observed automobile purchase rate because of the influence on supply of the strike during the fourth quarter of 1964. Thus if the survey had provided unbiased estimates of true ex-ante probabilities, the observed purchase rate for automobiles should have been lower than the mean purchase probability.

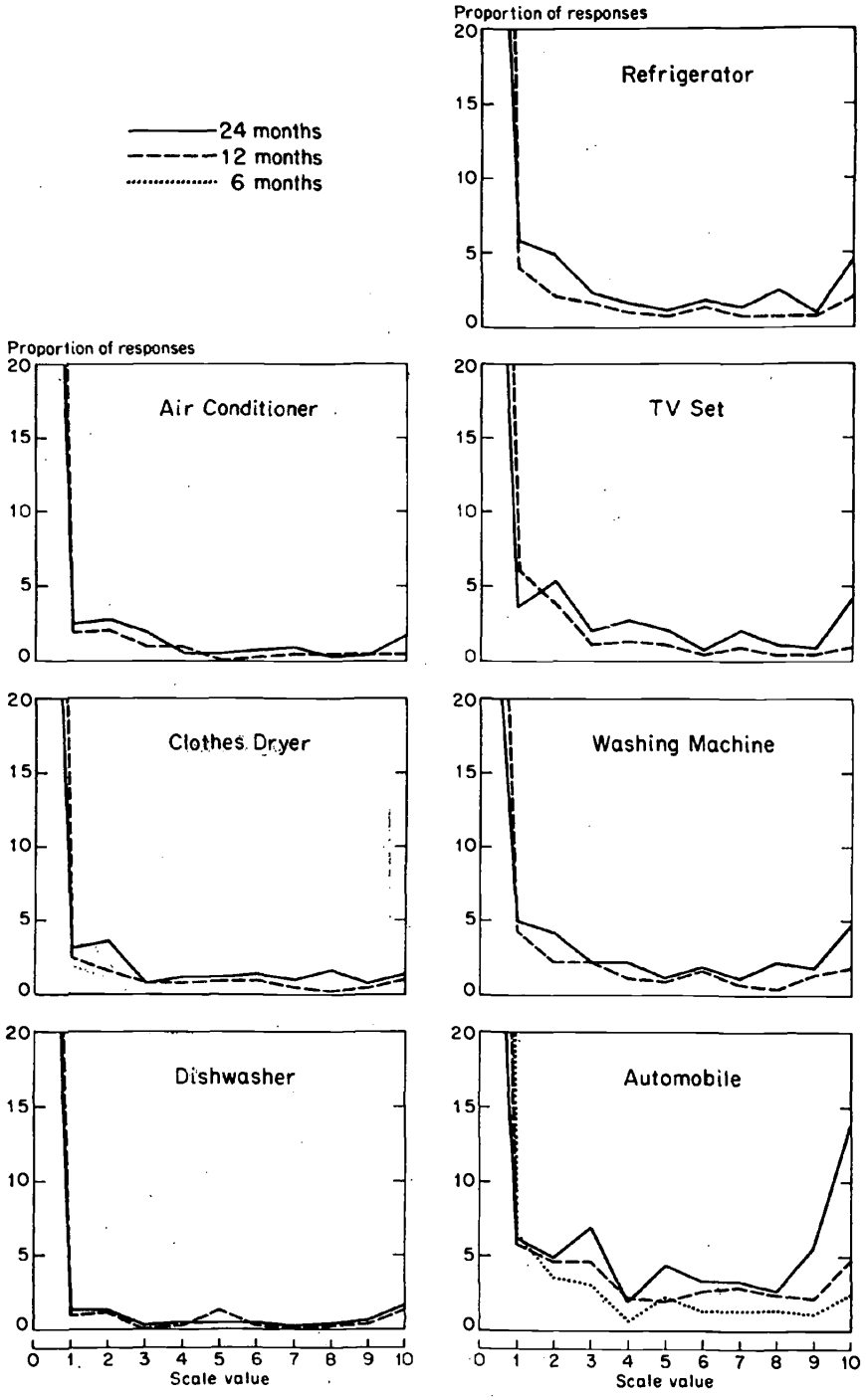

FIG. 2. Distribution of probability responses to QSI Experimental Survey, specified durables and time periods.

Source: Appendix Table 7.

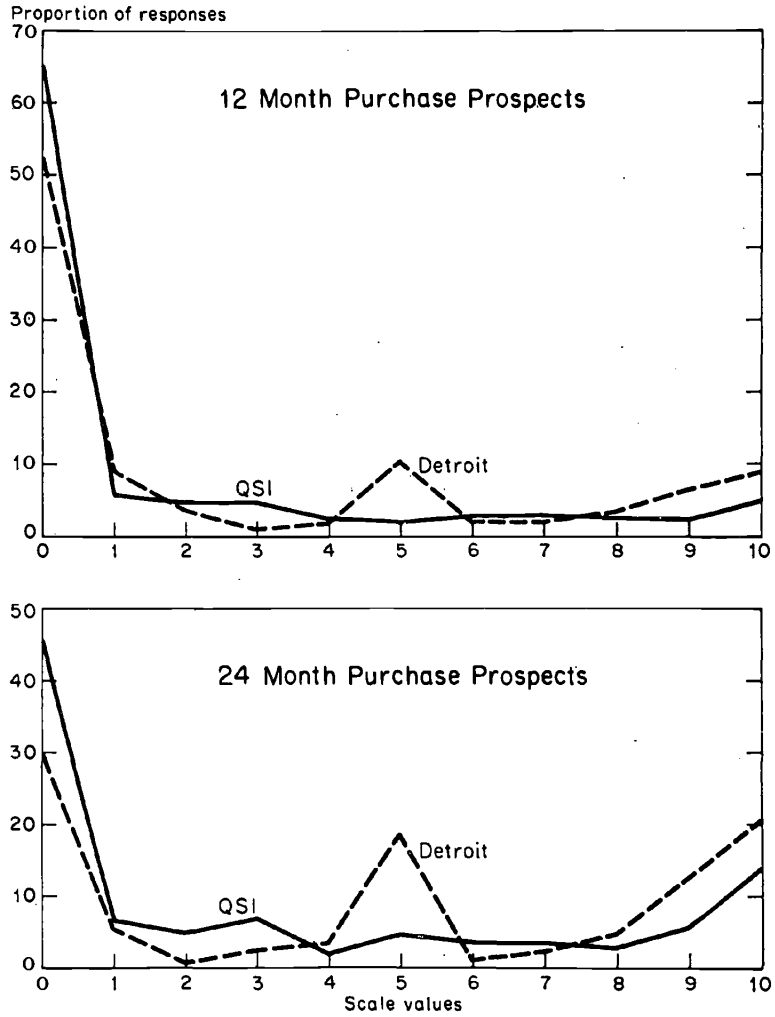

FIG. 3. Comparison of responses for automobile purchase prospects, Detroit scale and QSI scale.

Source: Appendix Tables A-3, A-4, and A-7.

Distribution of Purchase Probabilities. The evidence from the QSI experiment indicates that the distribution of purchase probabilities is shaped like an inverse J, with peaks at 0 and 1.0 and a trough in between (Figure 2). In contrast to both previous experiments, there is no indication of a peak at the scale midpoint of 0.5 (Figure 3); in fact, there is often a trough at this point, especially for the distribution of twenty-four-month probabilities. The data also suggest that the groups of households classified as intenders and nonintenders differ mainly with respect to the mean values of their probability distributions. Intenders have of course a higher mean than nonintenders and are apt to show a trough at a lower point on the probability distribution; other than that, the shapes of the two distributions seem to be much the same (Appendix Table A-8).

In effect, there seems to be a great deal of variation and overlap among households in the cutoff probability associated with a particular question about buying intentions. While some of the apparent variation is spurious because the two surveys were not taken at precisely the same point in time (and also because actual survey respondents were not necessarily identical even though the same household was reinterviewed), much of it is real.[21]

Bias in Means. Comparison of observed purchase rates with the means of the probability distributions obtained from the scale suggests that the probabilities estimated by respondents are, on average, lower than the true probabilities. Because of the strikes during October and November 1964 and the subsequent short supply of new vehicles, actual purchase rates for new automobiles should have been less than the mean of the probability distribution. But the mean was substantially lower than the purchase rate (.12 compared to .17).

For other durables, the results depend on how the probability-scale means are calculated. In the QSI experiment, it seems reasonable to view the scale responses as representing midpoints of intervals, i.e., a response of 9 covers probabilities ranging from 0.85 to 0.95, 8 ranges from 0.75 to 0.85, and so on. At the end points, the intervals are presumably smaller, ranging from .95 to 1.0 for a response of 10 and from 0.0 to 0.05 for a zero response. If zero responses are given a probability weight midway between 0.0 and the apparent lower end of the interval associated with a scale response of 1, i.e., if zero responses are assigned a weight of 0.025, the mean of the distribution probably exceeds the purchase rate. One cannot be certain because there is no six-month scale for household durables, but the mean for the twelve-month scale, computed as described above, is more than twice the observed six-month purchase rate for household durables. But if zero responses are assigned a value of 0.0, the mean of the twelve-month probability distribution is less than twice the observed six-month purchase rate. Since the probability distributions for these items are likely to be very highly skewed, I would expect the true mean of the zero-response group to be lower than the midpoint of the interval covered by the responses and possibly to be very close to 0.0.[22] This ambiguity does not arise in the case of automobiles because the mean of the six-month scale is less than the six-month purchase rate by either method of computation, and it should of course be higher because of the strike.

Intentions to Buy and Purchase Probability. The competitive survey designs—buying intentions and purchase probability—produce a markedly different distribution of responses. Tables 1 and 2 summarize the results of cross-classifying the two sets of data. Table 1 shows six- and twelve-month automobile buying intentions classified against purchase probability for six- twelve- and twenty-four-month periods; Table 2 contains similar data for a group of household durables and appliances. (Data for the individual household durables are shown

[21] Distribution of the responses into two groups—those where the same person was interviewed in both the regular QSI and the experimental probability survey, and those where a different person was interviewed—indicates that the patterns are much the same. The first group does show a little less scatter in the distribution of purchase probabilities among intenders, but not much less. Reinterviews where the same member of the household was present include about three of every four in the sample.

[22] A similar convention was not adopted for estimating mean values on the Detroit scale because of the way in which the extreme scale values were described. In the Detroit test, 10 meant "absolutely certain to buy" and zero meant "absolutely no chance." It is difficult to view these as being intervals rather than points, hence I take them as corresponding to probabilities of 1.0 and 0.0, respectively.

TABLE 1. CLASSIFICATION OF RESPONDENTS ACCORDING TO BUYING INTENTIONS SURVEY AND EXPERIMENTAL PROBABILITY SURVEY, JULY 1964: AUTOMOBILES

Probability Scale Value	Intentions to Buy Within Six Months							Intentions to Buy Within Twelve Months for Those with No Six-Month Intentions					
	Total	Definite	Probable	Maybe	Don't Know	N.A.	No	Total	Definite	Probable	Maybe	Don't Know	No
A. PURCHASE PROBABILITY WITHIN SIX MONTHS													
0	345	3	2	2	9	2	327	327	2	2	9	10	294
1	29	—	—	1	1	1	26	26	—	2	5	2	17
2	16	1	2	1	1	1	10	10	—	—	3	—	7
3	14	—	4	—	4	—	6	6	—	—	—	1	5
4	3	—	—	1	—	—	2	2	—	1	—	—	1
5	10	—	1	3	1	—	5	5	—	—	2	2	1
6	6	—	—	—	1	—	5	5	—	—	—	1	4
7	6	2	—	—	1	—	3	3	—	—	—	—	3
8	6	1	1	1	1	—	2	2	1	—	—	1	—
9	5	1	1	—	—	—	3	3	1	—	—	—	2
10	11	6	3	—	—	—	2	2	1	—	—	—	1
n.a.	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	451	14	14	9	19	4	391	391	5	5	19	27	335
Mean Scale value	.117	.66	.48	.34	.23	.09	.075	.075	.55	.12	.12	.13	.060
B. PURCHASE PROBABILITY WITHIN TWELVE MONTHS													
0	293	3	2	1	6	2	279	279	—	1	3	11	264
1	26	—	—	1	—	—	25	25	—	—	2	2	21
2	21	—	1	—	3	1	16	16	1	1	4	1	9
3	21	—	—	—	3	1	17	17	—	1	2	3	11
4	10	—	2	1	—	—	7	7	1	1	2	—	3
5	9	—	1	2	1	—	5	5	—	—	2	2	1
6	12	—	1	1	1	—	9	9	—	—	—	1	8
7	13	—	1	1	1	—	10	10	—	1	1	2	6
8	11	1	—	2	1	—	7	7	1	—	2	1	3
9	10	2	2	—	1	—	5	5	1	—	—	1	3
10	21	8	4	—	2	—	7	7	1	—	1	2	3
n.a.	4	—	—	—	—	—	4	4	—	—	—	1	3
Total	451	14	14	9	19	4	391	391	5	5	19	27	335
Mean Scale value	.19	.75	.61	.49	.37	.14	.13	.13	.66	.33	.36	.30	.10
C. PURCHASE PROBABILITY WITHIN TWENTY FOUR-MONTHS													
0	207	—	1	—	2	1	203	203	—	1	2	3	195
1	28	—	—	1	1	—	26	26	—	—	—	—	26
2	22	—	—	—	3	1	18	18	—	—	2	2	14
3	31	1	—	—	2	1	27	27	—	1	—	2	24
4	9	1	—	—	—	—	8	8	1	—	1	1	5
5	20	—	—	—	1	—	19	19	1	—	—	4	14
6	15	1	2	—	—	—	12	12	—	—	2	1	9
7	15	—	1	—	—	—	14	14	—	3	2	—	9
8	12	—	1	2	2	—	7	7	1	—	1	1	4
9	25	1	1	4	1	—	18	18	1	—	4	2	11
10	62	10	8	2	7	1	34	34	1	—	5	8	20
n.a.	5	—	—	—	—	—	5	5	—	—	—	1	4
Total	451	14	14	9	19	4	391	391	5	5	19	27	335
Mean Scale value	.33	.79	.82	.81	.59	.38	.28	.28	.72	.51	.67	.54	.21

Source: Basic data from QSI Experimental Survey, U. S. Bureau of the Census.

TABLE 2. CLASSIFICATION OF RESPONDENTS ACCORDING TO BUYING INTENTIONS SURVEY AND EXPERIMENTAL PROBABILITY SURVEY, JULY 1964: HOUSEHOLD DURABLES

Probability Scale Value	Intentions to Buy Any of Six Household Durables[a] Within Six Months, Twelve-Month Purchase Probability							Intentions to Buy Any of Six Household Durables[a] Within Six Months, Twenty-Four Month Purchase Probability						
	Total	Definite	Probable	Maybe	Don't Know	N.A.	No	Total	Definite	Probable	Maybe	Don't Know	N.A.	No
0	2,377	2	7	13	12	34	2,309	2,174	2	4	11	6	31	2,120
1	87	—	1	—	2	1	83	95	—	1	1	3	2	88
2	57	—	—	1	2	1	53	99	—	—	1	2	1	95
3	29	—	2	2	1	—	24	41	—	1	1	—	—	39
4	23	—	—	2	1	1	19	38	—	1	2	3	1	31
5	22	1	2	2	3	1	13	28	1	1	—	2	—	24
6	21	—	2	1	2	—	16	30	—	1	—	3	1	25
7	14	1	2	2	—	—	9	29	—	2	1	1	—	25
8	11	1	2	—	—	—	8	36	—	2	1	1	1	31
9	17	—	2	1	1	1	12	24	1	1	2	1	1	18
10	30	6	3	—	3	—	18	80	7	9	4	4	1	55
n.a.	18	—	—	—	1	—	17	32	—	—	—	2	—	30
Total	2,706	11	23	24	28	39	2,581	2,706	11	23	24	28	39	2,581
Mean Scale value	.068	.72	.47	.24	.29	.08	.058	.108	.75	.64	.37	.40	.12	.095

Source: Basic data from QSI Experimental Survey, U. S. Bureau of the Census.

[a] The durables are air conditioners, clothes dryers, dishwashers, television sets, refrigerators, and washing machines.

in Appendix Table A-6.) Each table shows the complete distribution of responses, and the average of the probability scale values for each of the intentions-to-buy categories.[23] The latter are constructed on the assumption that probabilities are spread evenly over the interval associated with each scale value. Hence a response of five is assigned a probability of 0.5, and so on. Responses of ten and zero are viewed as having midpoints of .975 and .025 respectively, assumptions that are questionable for household durables as noted above.

Although responses to the alternative surveys are certainly correlated with each other, there is a great deal of scatter—off-diagonal entries, if you like.A few of the households reporting definite or probable intentions to buy within six months subsequently reported that they had a zero probability of purchasing.[24] A very substantial number of respondents reporting no intentions to buy reported a nonzero probability of purchase, as did most of those reporting "don't know."

Even without looking at purchase rates, the evidence looks favorable to the basic hypothesis underlying the experimental survey. The wide scatter of the probability responses within each of the several intender classifications means

[23] Some classifications could not be constructed because the relevant questions are not included on the survey; for example, a twelve-month intentions-to-buy question for household durables is not included on the regular QSI and the experimental survey did not ask about six-month purchase probabilities for these items, hence we can only classify six-month intentions against twelve- or twenty-four-month purchase probabilities.

[24] One or two of these cases are misleading since the household made a purchase during the brief period between the intentions survey and the probability survey. Other possibilities are that such cases represent either a change of mind, a different interviewer, a reporting error, or the rather whimsical interpretation of respondents for whom "intentions" contain a large element of wishful thinking (I definitely intend to buy if I possibly can), while probabilities tend to be relatively hardheaded judgments.

that the experiment will permit a test of the hypothesis that the probability responses are more accurate—at least we know they are different. More importantly, the probability data look quite reasonable: none of the intender classes have a mean probability of anything like 1.0, nonintenders have mean probabilities significantly higher than 0, and the estimates of mean probability for the various intender classes look much like the purchase rates typically observed for these same classes in studies of plan fulfillment.

Purchase Rates Among Intender and Probability Classes: Automobiles. Does the probability survey improve predictions of purchase rates among households, relative to an intentions survey? According to Tables 3 and 4, the answer is clearly yes for automobiles. These tables cross-classify respondents by in-

TABLE 3. PURCHASE RATES FOR AUTOMOBILES AMONG INTENDER CLASSES AND PROBABILITY CLASSES

Probability Scale Value	Intentions Class					
	Within Six Months		Within Twelve Months	No	Total	Unweighted Mean
	Definite, Probable	Maybe Don't Know				
A. SIX-MONTH PROBABILITY SCALE						
0	.25[4]	.20[10]	.21[24]	.08[262]	.10[300]	.19
1, 2, 3	.86[7]	.33[6]	.17[12]	.21[28]	.30[53]	.39
4, 5, 6	1.00[1]	.50[6]	.67[6]	.75[4]	.65[17]	.73
7, 8, 9	.20[5]	1.00[1]	.67[3]	.20[5]	.36[14]	.52
10	.44[9]	—	1.00[1]	1.00[1]	.55[11]	.81
Total	.50[26]	.35[23]	.30[46]	.11[300]	.17[395]	
Unweighted mean	.55	.51	.54	.45		
B. TWELVE-MONTH PROBABILITY SCALE						
0	.25[4]	.17[6]	.08[12]	.06[234]	.07[256]	.14
1, 2, 3	.00[1]	.17[6]	.18[11]	.21[39]	.19[67]	.14
4, 5, 6	1.00[4]	.60[5]	.20[10]	.31[13]	.41[32]	.53
7, 8, 9	.60[5]	.40[5]	.78[9]	.25[12]	.48[31]	.51
10	.42[12]	1.00[1]	.50[4]	1.00[2]	.53[19]	.73
Total	.50[26]	.35[23]	.30[46]	.11[300]	.17[395]	
Unweighted mean	.45	.47	.35	.37		
C. TWENTY-FOUR-MONTH PROBABILITY SCALE						
0	.00[1]	.00[1]	.00[6]	.05[172]	.04[180]	.01
1, 2, 3	—	.17[6]	.00[6]	.14[59]	.13[71]	.10
4, 5, 6	.25[4]	.00[1]	.50[8]	.10[29]	.19[42]	.21
7, 8, 9	.75[4]	.38[8]	.23[13]	.32[22]	.34[47]	.42
10	.53[17]	.57[7]	.54[13]	.33[22]	.47[55]	.49
Total	.50[26]	.35[23]	.30[46]	.11[300]	.17[395]	
Unweighted mean	.38	.22	.25	.19		

Source: Basic data from QSI Experimental Survey, U. S. Bureau of the Census.
Note: Small numbers above purchase rates show sample size.

TABLE 4. PURCHASE RATES FOR USED AUTOMOBILES AMONG INTENDER CLASSES AND PROBABILITY CLASSES

Probability Class	Intentions Class			
	Intenders and Don't Know	No	Total	Unweighted Mean
A. SIX-MONTH PROBABILITY SCALE				
0	$.17^{18}$	$.04^{205}$	$.05^{223}$	.11
1, 2, 3	$.45^{11}$	$.15^{13}$	$.29^{24}$	.30
4, 5, 6	$.50^{6}$	$.67^{3}$	$.56^{9}$	.59
7, 8, 9	$.50^{6}$	$.00^{1}$	$.43^{7}$	.25
10	$.75^{4}$	1.00^{1}	$.80^{5}$	.88
Total	$.38^{45}$	$.06^{223}$	$.12^{268}$	
Unweighted mean	.47	.37		
B. TWELVE-MONTH PROBABILITY SCALE				
0	$.00^{13}$	$.03^{194}$	$.03^{207}$	.02
1, 2, 3	$.28^{7}$	$.23^{17}$	$.25^{24}$	.26
4, 5, 6	$.50^{8}$	$.33^{6}$	$.43^{14}$	.42
7, 8, 9	$.60^{10}$	$.00^{4}$	$.43^{14}$	.30
10	$.71^{7}$	1.00^{2}	$.78^{9}$	.86
Total	$.38^{45}$	$.06^{223}$	$.12^{268}$	
Unweighted mean	.42	.32		
C. TWENTY-FOUR-MONTH PROBABILITY SCALE				
0	$.00^{8}$	$.03^{171}$	$.03^{179}$	.02
1, 2, 3	$.00^{5}$	$.09^{22}$	$.07^{27}$	.05
4, 5, 6	$.33^{6}$	$.09^{11}$	$.18^{17}$	.21
7, 8, 9	$.44^{9}$	$.30^{10}$	$.37^{19}$	.37
10	$.65^{17}$	$.33^{9}$	$.54^{26}$	.49
Total	$.38^{45}$	$.06^{223}$	$.12^{268}$	
Unweighted mean	.28	.17		

Source: Basic data from QSI Experimental Survey, U. S. Bureau of the Census.
Notes: Small numbers above purchase rates show sample size.

tender and probability groups, and indicate purchase rates for new and used cars combined (Table 3), and for used cars alone (Table 4). Purchase rates are computed for each cell and are shown in the body of the table; the superior figures indicate the number of cases in the cell.

A number of points stand out. First, it is clear that households classified as nonintenders have been successfully distributed into more homogeneous subgroups by the probability survey. About 11 per cent of all households classed as nonintenders actually purchased either a new or used car during the forecast period. But the purchase rates among zero-probability nonintenders are markedly lower, being 8, 6, and 5 per cent, respectively, for nonintenders reporting a zero probability of purchase during six, twelve, and twenty-four months. Viewed differently, of the 32 automobile purchases made by the 300 nonintenders in the sample, only 8 were made by the 180 nonintenders who also re-

ported a zero probability of purchase for all three periods; the remaining 24 were made by the 120 nonintenders who reported nonzero probabilities for one or more of the periods. Although data are not shown separately, it is also clear that households classified in the "don't know" category by an intentions survey have also been successfully reclassified by the probability survey.[25]

It is not so clear that the probability scale works as well among the straightforward intender classes—those who reported that they definitely, probably, or might buy. The six-month probability scale appears to have little or no relation to subsequent purchase rates among intenders, although the relationship is considerably closer for used automobiles than for new. While it can always be argued that the sample sizes are small, they were equally small for the "don't know" category. The twelve- and twenty-four-month probability scales show a more systematic relation to intender purchase rates than the six-month scale. Given the probable effect of the automobile strike on the purchase rates of households reporting high probabilities of buying within six months, I would judge that, among all households that would normally be defined as intenders (which excludes the "don't know" group), the probability classification shows about the same results as the intender classification,[26] and probably would have shown a closer association with purchase rates except for the strike. Over all, the unweighted means of the purchase rates for the various probability classes clearly indicates large and systematic variation in the expected direction.

On the other hand, the intentions classes do not generally appear to be effective discriminators within probability classes. Although it is often true that intenders with given probabilities have higher purchase rates than nonintenders reporting the same probability, this is not consistently the case, as can readily be seen from a comparison of the unweighted means of the purchase rates for the various intentions classes.

The statistical reliability of this evidence is hard to judge. Many of the cells have very few cases, and any test for statistical significance has elements of arbitrariness. One of the simplest tests is to estimate the rank correlation between purchase rates and probability class within each intender class, and between purchase rates and intender classes within each probability class, then to compute the proportion of the observed correlations that have positive signs to see if it differs significantly from one-half.

The results indicate that purchase rates are positively related to probability class, holding intentions class constant, with but a single exception; this proportion of plus signs would be observed about one time in 100 trials if the true pro-

[25] Households reporting that they "don't know" about their buying intentions behave more like intenders than nonintenders, a phenomenon noted previously by Mona E. Dingle, "A Quarterly Survey of Consumer Buying Intentions," *1960 Proceedings of the Business and Economic Statistics Section*, American Statistical Association. Those reporting that they definitely, probably, or may buy within twelve months show an actual purchase rate of 0.35; those reporting that they don't know about their six-month intentions show a purchase rate of 0.27; those reporting that they don't know about twelve-month intentions a purchase rate of 0.26, and nonintenders a purchase rate of 0.11.

[26] Neither classification provides especially good results for this particular period. For instance, the purchase rates among definite, probable, and maybe six-month intenders are not systematic at all, being respectively .42, .57, and .50; twelve-month intenders show a purchase rate of .35, as noted earlier. The six-month probability scale shows purchase rates that are somewhat less systematic than that, while both the twelve- and twenty-four-month scales yield more systematic differences in purchase rates. But for used automobiles the probability scale is about as good for intenders as for the other groups, and new-car purchase rates were subject to the exogenous disturbance of a major strike during the period of observation.

TABLE 5. PROPORTION OF AUTOMOBILE PURCHASES MADE BY SPECIFIED CATEGORIES OF HOUSEHOLDS

Classification of Households	Number of Purchases	Per Cent of Total
Intender groups		
Six-month definite plus probable	13	19%
Six-month definite, probable, maybe, don't know	21	31
Six- plus twelve-month intenders	25	37
Six- plus twelve-month intenders plus don't know	35	52
Probability groups		
Nonzero six-month probabilities	39	58
Nonzero twelve-month probabilities	49	73
Nonzero twenty-four-month probabilities	59	88
All groups	67	100

Source: Calculated from basic data and from Table 3, above.

portion in the universe were 0.5. In addition, almost half of the individual rank correlations are significant at the .05 level. In contrast, the proportion of intentions classes that show a positive relation to purchase rates, holding probability class constant, is not significantly different from one-half. More than a third of the rank correlations are negative, the observed proportion of positive signs would be observed about once in every ten trials, and none of the individual rank correlations are themselves significant at the 5 per cent level.[27]

Finally, it should be noted that the vast majority of purchases are made by households that report nonzero purchase probabilities. Table 5 indicates that the usual intender classification (definitely, probably, or might buy within either six or twelve months) accounts for little more than one-third of total purchases. The broadest possible intender classification—including all the above plus the "don't know" group—accounts for only about half the total purchases. But even for the six-month probability scale, more than half the total purchases are accounted for by households with nonzero responses, and households with nonzero responses on the twenty-four-month scale account for almost 90 per cent of all purchases during the period.

Purchase Rates Among Intender and Probability Classes: Household Durables. Too few intentions to buy any of the household durables were reported to permit separate analysis, hence the six items are grouped together. Even grouping in this way, the sample sizes are too small to permit meaningful analysis of the various intender subcategories. There is a further problem with aggregating across the six durables.

[27] An alternative test involves two-way analysis of variance on the cell means. After several fruitless attempts to locate an operational analysis of variance program that permitted unequal cell sizes, I decided to run two different analysis of variance tests that should provide upper and lower bounds to the true value. The first test assumes that all cells have but a single case and thus underestimates usable degrees of freedom; the second assumes that all cells have N/rc cases and thus overestimates usable degrees of freedom. The results indicate that the probability classes contain highly significant variations in purchase rates holding intentions class constant, and from observation we know that the variation is systematic. It is doubtful that intentions classes contain significant variations holding probability class constant. Thus both tests (sign of rank correlation and analysis of variance) reach the same conclusion.

TABLE 6. AVERAGE PURCHASE RATES WITHIN PROBABILITY CLASSES, SIX HOUSEHOLD DURABLES

Probability Class	Twelve-Month Probabilities	Twenty-Four-Month Probabilities
0	$.017^{2111}$	$.015^{1929}$
1, 2, 3	$.053^{150}$	$.034^{206}$
4, 5, 6	$.111^{63}$	$.045^{206}$
7, 8, 9	$.184^{38}$	$.084^{83}$
10	$.105^{19}$	$.215^{65}$
n.a.	$.231^{13}$	$.115^{26}$
Total	$.026^{2394}$	$.026^{2394}$

Source: Basic data from QSI Experimental Survey, U. S. Bureau of Census. See text for description of procedures.

Note: The durables included are air conditioners, refrigerators, washing machines, clothes dryers, television sets, and dishwashers. Superior numbers above purchase rates show sample size.

TABLE 7. PURCHASE RATES FOR ANY OF SIX HOUSEHOLD DURABLES AMONG INTENTIONS CLASSES AND PROBABILITY CLASSES

Probability Class, Sum of Six Items[b]	Intentions Class[a]			
	Some	None	Total	Unweighted Mean
A. TWELVE-MONTH PROBABILITY SCALE				
0	$.06^{16}$	$.09^{229}$	$.09^{245}$	.08
1, 2, 3	$.50^{4}$	$.12^{50}$	$.15^{54}$	.31
4, 5, 6	$.42^{12}$	$.12^{26}$	$.21^{38}$	.27
7, 8, 9	$.20^{10}$	$.14^{14}$	$.17^{24}$	.17
10–19	$.67^{9}$	$.24^{21}$	$.37^{30}$	.46
20 or more	$.40^{5}$	$.33^{3}$	$.38^{8}$	.37
Total	$.32^{56}$	$.11^{343}$	$.14^{399}$	
Unweighted Mean	.38	.17		
B. TWENTY-FOUR-MONTH PROBABILITY SCALE				
0	$.10^{10}$	$.07^{174}$	$.08^{184}$	.09
1, 2, 3	$.20^{5}$	$.11^{53}$	$.12^{58}$	.16
4, 5, 6	$.14^{7}$	$.03^{29}$	$.06^{36}$	.09
7, 8, 9	$.17^{6}$	$.13^{24}$	$.13^{30}$	.15
10–19	$.43^{14}$	$.22^{46}$	$.27^{60}$	.33
20 or more	$.57^{14}$	$.29^{17}$	$.42^{31}$	.43
Total	$.32^{56}$	$.11^{343}$	$.14^{399}$	
Unweighted Mean	.27	.14		

Source: Basic data from QSI Experimental Survey, U. S. Bureau of the Census. See text for description of procedures.

Note: Superior numbers above purchase rates show sample size.

[a] Intenders are defined as those who reported that they definitely, probably, or may buy within six months plus those who reported don't know.

[b] Sum of probability-scale responses for refrigerators, washing machines, clothes dryers, air conditioners, television sets, and dishwashers.

Two conceptually different kinds of purchase rates are shown in Tables 6 and 7. In the former, only probability classes are shown and the data measure only purchase rates for the identical items to which the probability response applies. That is, a household reporting that the probability of its buying, say, a washing machine was 9 in 10 (zero probabilities for all other items), and also reporting the purchase of a refrigerator (no purchases of any other item), would appear in Table 6 as a nonpurchaser of washing machines with an associated purchase probability of 0.9 and a purchaser of a refrigerator with an associated probability of 0.0. In Table 7, in contrast, purchase probabilities, buying intentions, and actual purchases are summed across the six household durables for each household. Thus the same household would show up as having a sum of purchase probabilities equal to 0.9 and having made one purchase. Households are also classified in that table as either having an intention to buy at least one of the six durables (or reporting don't know) or as having no reported intentions of any kind.

It is evident from the data that the experimental survey was successful in distributing nonintending households into groups with systematically different purchase rates. However, the differentials among probability groups are not as large as for automobiles. Also in contrast to the automobile data, intenders consistently show higher purchase rates than non-intenders, given the probability class; hence both the intentions and probability classifications appear to be related to purchase behavior.

There are, however, a number of problems with the household durables data. First, a relatively large proportion of the durables analyzed here were purchased in conjunction with a change in residence. Although an attempt was made to follow movers in the reinterview, it is certain that some households known to have moved were not reinterviewed, and probable that a few others not reinterviewed had also moved. Since movers (some of whom were not in the reinterview sample) are known to have high levels of intentions, purchase probabilities and purchases, while non-movers who thought they might move (all of whom were in the reinterview sample) are known to have high levels of the first two but not purchases, the results will necessarily show bias—perhaps a considerable amount.

Second, we do not know how households that were thinking of buying one of several household durables would respond to the survey. If a household thinks there are eight chances in ten that it will buy some one of four durables, with the chances being the same for any of the four, the proper response is that the chance of buying any one item is two out of ten. But it is possible that many respondents in this position would select the answer eight out of ten for *each* of the four. In effect, the reported probabilities may not be additive across items. At present, about all that can be said is that the results for household durables appear to be less satisfactory than for automobiles, and it is not clear why this is so.

Multivariate Analysis. The difficulties of dealing with small cell sizes, as well as the advantages of being able to look at the entire distribution, are eliminated when we turn to regression analysis.

The variables are defined as follows:

Buying Intentions

B_{c-1}	Definitely expect to buy new or used car within 6 months = 1, otherwise 0
B_{c-2}	Probably will buy new or used car within 6 months = 1, otherwise 0
B_{c-3}	May buy new or used car within 6 months = 1, otherwise 0
B_{c-4}	Don't know about new- or used-car buying plans within 6 or 12 months = 1, otherwise 0
B_{c-5}	Definitely, probably, or may buy a new or used car within 12 months (no 6-month plans) = 1, otherwise 0
$B'_{c-1}, \cdots, B'_{c-5}$	Same as B_{c-1} through B_{c-5} above, except that only used-car intentions are included
B_{h-1}	Sum of definite intentions to buy any of six household durables within 6 months; maximum = 6, minimum = 0
B_{h-2}	Sum of probable, maybe, and don't know intentions to buy any of six household durables within 6 months; maximum = 6, minimum = 0

Purchase Probability

P_{c-6}	Probability of buying a new or used car within 6 months
P_{c-12}	Probability of buying a new or used car within 12 months
P_{c-24}	Probability of buying a new or used car within 24 months
$P'_{c-6}, \cdots, P'_{c-24}$	Probability of buying a used car within 6, . . . , 24 months (probability of buying a car minus the probability of buying a new car)
$P''_{c-6}, \cdots, P''_{c-24}$	Probability of buying a new car within 6, . . . , 24 months (= probability of buying a car multiplied by probability of buying new if a car is purchased)
ΔP_{c-6}, $\Delta P'_{c-6}$	Difference between 6- and 24-month probabilities of buying a car (used car); if $P_{c-24} - P_{c-6} \geqq 0.4$, $\Delta P_{c-6} = 1$, otherwise = 0
P_{h-12}	Sum of probabilities for purchasing any of six new household durables within 12 months (maximum = 6.0, minimum = 0.0)
P_{h-24}	Sum of probabilities for purchasing any of six new household durables within 24 months (maximum = 6.0, minimum = 0.0)
ΔP_{h-12}	Difference between 12- and 24-month sum of probabilities for six household durables; if $P_{h-24} - P_{h-24} \geqq 0.4$, $\Delta P_{h-12} = 1$, otherwise = 0

Purchases

A_n	Purchased new car = 1, otherwise 0
A_u	Purchased used car = 1, otherwise 0
A	Purchased new or used car = 1, otherwise 0
H	Sum of six new household durables purchased; 6 = maximum, 0 = minimum

Initial-Data Variables

J	Jobs easier or harder to get than a year ago? 5 = much easier, . . . , 1 = much harder
$\hat{J}$	Will jobs be easier or harder to get a year from now? 5 = much easier, . . . , 1 = much harder
$\hat{B}$	Will business be better or worse a year from now? 5 = much better, . . . , 1 = much worse
$\hat{Y}$	Will your income be higher or lower a year from now? 5 = much higher, . . . , 1 = much lower
$\hat{F}$	Will your financial situation be better or worse five years from now? 5 = much better, . . . , 1 = much worse
T	Is the present a good or bad time to buy? 5 = very good, . . . , 1 = very bad
Y	Family income level (00 dollars).

Intervening Variables

$Y+$	Unexpected income increase during forecast period = 1, otherwise 0
$Y-$	Unexpected income decrease during forecast period = 1, otherwise 0
X	Unexpected expenses during the forecast period = 1, otherwise 0
M	Changed residence during the forecast period = 1, otherwise 0

The regression analysis has three phases. The first tests the hypothesis that the probability variables can explain more of the variance in purchases than the buying intentions variable, and the stronger hypothesis that the intentions variable cannot explain any of the variance in puchases net of purchase probability. Tables 8 and 9 summarize the results. The second phase tests the hypothesis that the influence on purchases of variables reflecting the financial situation, expectations, or attitudes of the household (initial-data variables) is wholly subsumed in the probability variable and hence that initial-data variables have no net influence on purchases, along with the complementary hypothesis that the influence on purchases of variables reflecting unforeseen developments during the purchase period (intervening variables) is unaffected by the probability variables. A subsidiary hypothesis is that initial-data variables are less completely subsumed by buying intentions than by purchase probability because intentions are only a mediocre proxy for probability, hence that these variables will continue to show some relation to purchases net of intentions. As before, the influence of intervening variables on purchases should be unaffected by intentions (Table 10). The third phase of the analysis is an exploratory investigation rather than a test of hypotheses. Given the alternative probability variables, what is the best way of combining them so as to obtain the optimum relation to subsequent purchases? Table 11 summarizes these results. Finally, an exploratory investigation is conducted into the kind of variables that are important in explaining purchase probability (Table 12, below).

The data in Tables 8 and 9 clearly show that the probability variable explains significantly more of the variance in purchases of both automobiles and household durables than the buying intentions variable, although the margin of superiority is much greater for automobiles and especially for used automobiles. About twice as much of the variance in automobile purchases is explained by a simple linear combination of the probability variables as by a set of dummy variables reflecting the intentions classification; for the same type of comparison, the probability variables explain almost twice as much of the variance in purchases of household durables. In both cases the difference is statistically significant.

Not only does purchase probability explain significantly more of the variance among households in automobile purchase rates, but the evidence suggests that buying intentions make no net contribution to explained variance. Table 9 has the same intentions variables as Table 8; however, it uses a set of probability variables that explain about the same proportion of the variance in purchases but are less highly correlated with each other than those shown in Table 8. The best test of the hypothesis involves the joint F ratio for incremental explained variance. Treating the buying intentions classes as dummy (1, 0) variables, the joint F ratio for the regression of automobile purchases on intentions is 9.1 before probability is held constant. Net of the probability

TABLE 8. SUMMARY OF REGRESSION ANALYSIS: PURCHASES RELATED TO ALL BUYING INTENTIONS AND PURCHASE PROBABILITY VARIABLES

Dependent Variable	Regression Coefficients (Standard Errors) for Independent Variables								Constant	Adjusted R^2
	Purchase Probability			Buying Intentions						
	P_{6-c}	P_{c-12}	P_{c-24}	B_{c-1}	B_{c-2}	B_{c-3}	B_{c-4}	B_{c-5}		
Automobile Purchases, New or Used										
A	.031	.365**	.137	—	—	—	—	—	.060**	.179
	(.121)	(.130)	(.076)							
A	—	—	—	.305**	.460**	.388**	.151*	.236**	.112**	.093
				(.106)	(.099)	(.129)	(.062)	(.078)		
A	[a]	.366**	.106	−.034	.201*	.149	.026	.048	.058*	.182
		(.102)	(.077)	(.113)	(.101)	(.128)	(.062)	(.079)		
	Purchase Probability			Buying Intentions						
	P_{h-12}		P_{h-24}	B_{h-1}			B_{h-2}			
Household Durables Purchases										
H	.046[b]		.104*	—			—		.090**	.059
	(.067)		(.043)							
H	—		—	.353*			.144**		.129**	.034
				(.144)			(.045)			
H	.016		.102*	.277			.095*		.079**	.073
	(.067)		(.043)	(.143)			(.046)			

[a] Contribution to explained variance below program tolerance.

[b] P_{h-12} and P_{h-24} are highly correlated with each other; of the two, P_{h-24} is slightly more strongly correlated with *H*. For the simple correlations, the slopes are .178 and .129 for P_{h-12} and P_{h-24}, respectively.

*$=t>1.96$; **$=t>2.57$.

TABLE 9. SUMMARY OF REGRESSION ANALYSIS: SELECTED PURCHASE PROBABILITY AND BUYING INTENTION VARIABLES RELATED TO PURCHASES OF AUTOMOBILES AND HOUSEHOLD DURABLES

Dependent Variable	Regression Coefficients and F Ratios									Constant	Adjusted R^2
	Probability Variables			Intentions Variables							
A. NEW AND USED AUTOMOBILES											
	P_{c-6}	ΔP_{c-6}	F Ratio	B_{c-1}	B_{c-2}	B_{c-3}	B_{c-3}	B_{c-5}	F Ratio		
A	.534**	.220**	*43.1*	—	—	—	—	—	—	.059**	.174
A	—	—	—	.305**	.460**	.388**	.151*	.236**	*9.1*	.112**	.093
A	.475**	.193**	*20.0*	−.021	.173	.126	.041	.070	*0.8*	.057**	.173
B. USED AUTOMOBILES											
	P'_{c-6}	$\Delta P'_{c-6}$	F Ratio	B'_{c-1}	B'_{c-2}	B'_{c-3}	B'_{c-4}	B'_{c-5}	F Ratio		
A_u	.640**	.187**	*44.7*	—	—	—	—	—	—	.048**	.180
A_u	—	—	—	.417**	.317**	.417**	.060	.280**	*6.9*	.083**	.069
A_u	.630**	.176**	*25.8*	.018	−.041	.064	−.008	.109	*0.4*	.048**	.173
C. HOUSEHOLD DURABLES											
	P_{h-12}	ΔP_{h-12}	F Ratio			B_{h-1}	B_{h-2}		F Ratio		
H	.160**	.071	*11.7*			—	—		—	.097**	.051
H	—	—	—			.353**	.144**		*8.0*	.128**	.034
H	.125**	.077	*7.7*			.301**	.095*		*4.1*	.084**	.065

Source: Estimated from basic data, QSI Experimental Survey, U. S. Bureau of the Census.
Note: * = $t > 1.96$, ** = $t > 2.57$.

TABLE 10. SUMMARY OF REGRESSION ANALYSIS: PURCHASES RELATED TO INITIAL-DATA VARIABLES, INTERVENING VARIABLES, PURCHASE PROBABILITY, AND BUYING INTENTIONS

Joint F Ratios for Groups of Independent Variables				
Initial Data[a]	Intervening[b]	Purchase Probability[c]	Buying Intentions[d]	R^2
Automobile Purchases Dependent				
1.3	—	—	—	.013
—	1.9	—	—	.019
0.1	1.6	42.6	—	.206
0.6	1.4	—	7.9	.122
Household Durables Purchases Dependent				
5.1	—	—	—	.061
—	1.8	—	—	.018
3.8	1.5	7.3	—	.110
4.5	1.7	—	6.2	.106

Source: Basic data from QSI Experimental Survey, U. S. Bureau of the Census.

[a] For automobile purchases, variables are J, $\hat{Y}$, $\hat{F}$, and T; Y is also used in equations with household durables purchases dependent.

[b] Variables used are $Y+$, $Y-$, X, and M.

[c] Variables used are P_{c-12} and ΔP_{c-6} with automobiles dependent, P_{h-12} and ΔP_{h-12} with household durables purchases dependent.

[d] Variables used are $B_{c-1}, \cdots, B_{c-5}$ with automobiles dependent, B_{h-1} and B_{h-2} with household durables dependent.

TABLE 11. SUMMARY OF REGRESSION ANALYSIS: PURCHASES RELATED TO ALTERNATIVE MEASURES OF PURCHASE PROBABILITY

Dependent Variable	Regression Coefficients (Standard Errors) for Independent Variables[a]								F Ratio	R^2
	P_{c-6}	P_{c-12}	P_{c-24}	ΔP_{c-6}	P_{c-15}	P_{h-12}	P_{h-24}	ΔP_{h-12}		
A	.534**	—	—	—	—	—	—	—	49.8	.112
	(.076)	—	—	—	—	—	—	—	—	—
A	—	.526**	—	—	—	—	—	—	86.1	.178
	—	(.057)	—	—	—	—	—	—	—	—
A	—	—	.379**	—	—	—	—	—	70.6	.151
	—	—	(.045)	—	—	—	—	—	—	—
A	.031	.365**	.137*	—	—	—	—	—	26.1	.185
	(.121)	(.130)	(.076)	—	—	—	—	—	—	—
A	.534**	—	—	.220**	—	—	—	—	43.1	.178
	(.073)	—	—	(.039)	—	—	—	—	—	—
A	—	—	—	—	.548**	—	—	—	81.9	.171
	—	—	—	—	(.060)	—	—	—	—	—
H	—	—	—	—	—	.178**	—	—	21.1	.050
	—	—	—	—	—	(.039)	—	—	—	—
H	—	—	—	—	—	—	.129**	—	26.7	.063
	—	—	—	—	—	—	(.025)	—	—	—
H	—	—	—	—	—	.046	.104*	—	13.6	.064
	—	—	—	—	—	(.067)	(.043)	—	—	—
H	—	—	—	—	—	.160**	—	.071	11.7	.056
	—	—	—	—	—	(.041)	—	(.048)	—	—

Source: Basic data from QSI Experimental Survey, U. S. Bureau of the Census.

[a] Variables as defined in text; P_{c-15} is a simple unweighted average of P_{c-6} and P_{c-24}.

* $= t > 1.96$; ** $= t > 2.57$.

TABLE 12. SUMMARY OF REGRESSION RESULTS: RELATION BETWEEN INITIAL-DATA VARIABLES, PURCHASES, AND PURCHASE PROBABILITY

Dependent Variable	Net Regression Coefficients (Standard Errors) for Independent Variables							
	J	$\hat{J}$	$\hat{B}$	$\hat{Y}$	$\hat{F}$	T	Y	$\bar{R}^2$
A	.014 (.019)	−.040* (.019)	−.004 (.022)	.021 (.027)	.032 (.022)	.012 (.016)	.0002 (.0004)	.030
H	.029 (.020)	−.007 (.020)	.004 (.024)	.019 (.029)	.012 (.023)	−.013 (.017)	.0018** (.0004)	.044
P_{c-6}	−.023* (.012)	.002 (.012)	−.003 (.014)	.010 (.016)	.029* (.013)	.016 (.010)	.0005* (.0002)	.041
P_{c-12}	−.013 (.014)	[a]	.015 (.017)	.020 (.021)	.046* (.017)	.007 (.012)	.0011** (.0003)	.072
P_{c-24}	[a]	−.029 (.017)	.023 (.021)	.064* (.026)	.078** (.021)	.014 (.014)	.0015** (.0004)	.148
P_{h-12}	−.012 (.024)	.011 (.024)	.043 (.029)	.133** (.035)	.054 (.028)	.030 (.020)	.0011* (.0005)	.112
P_{h-24}	−.010 (.035)	[a]	.032 (.042)	.226** (.053)	.116** (.042)	.062* (.031)	.0020** (.0008)	.150

Source: Basic data from QSI Experimental Survey, U.S. Bureau of the Census.
[a] F ratio below tolerance of regression program.
* $= t > 1.96$; ** $= t > 2.57$.

variables, the F ratio falls to 0.8, indicating that the intentions variables are essentially random numbers. For used automobiles, the results are even more striking. Before purchase probability is held constant, the F ratio is 6.9; net of probability, it falls to 0.4, and two of the five regression coefficients for intentions become negative numbers.

A similar calculation for household durables yields comparable though not so strong conclusions. Before probability is held constant, the F ratio for buying intentions is 8.0; net of probability it falls to 4.1, significant at the .05 level but no longer at the .01 level. In all cases, the F ratios for probability variables are significant at the .01 level both before and after buying intentions are held constant.

All these tests confirm the results obtained earlier. They show that the purchase probability variable completely dominates the buying intentions variable in the explanation of automobile purchases. This is especially so for used automobiles, where the test is more meaningful because there were no supply problems during the forecast period. The probability variables are significantly more closely related to purchases of household durables than are the intentions variables, but they do not completely dominate.

It should be noted that neither purchase probability nor intentions to buy can be expected to explain more than a relatively small fraction of the total variance among households in purchases of durables. The variable to be explained in these regressions is inherently dichotomous—purchase or nonpurchase of a particular durable. It is obviously not possible to "explain" all of the variance in a dichotomous dependent variable with an independent variable that takes the form of a continuous scale. This would be true even if the scale,

on average, provided a wholly accurate estimate of purchase rates in any group of households; that is, if the mean values of the scale responses in any group were always precisely equal to purchase rates. Thus the observed correlations cannot be matched against the standard that perfect cross-section predictions require an R^2 of unity. If the probability scale performed perfectly in these experiments and there were no intervening events, the observed correlation would still be far short of unity. In addition, of course, intervening events that are entirely idiosyncratic to particular households, and hence tend to average out over time for all households taken together, will produce a large amount of unexplained variance in any cross-section test. Since these factors have an influence on both the buying intentions and purchase probability regressions they will tend to reduce both correlations in absolute terms, but they ought not to affect the comparison between the two.

Testing of the second set of hypotheses yields less satisfactory results. As Table 10 shows, neither initial-data nor intervening variables show a strong relation to purchases before the probability and buying intentions variables are included in the regression. This is especially so for the relation between automobile purchases and initial-data variables. When purchase probability is added to the automobile regressions, the weak influence of initial-data variables is almost completely eliminated, but the somewhat stronger influence of intervening variables is also reduced substantially. And for the household durables regressions, the relatively strong influence of initial-data variables (mainly due to the effect of family income) is not reduced much by the inclusion of purchase probability, and the influence of intervening variables is reduced to almost the same extent.

In sum, where the probability variable performs well by itself (automobiles), it eliminates the influence of initial-data variables as predicted. However, that influence was negligible to begin with, and the probability variable substantially reduces the influence of intervening variables on purchases, contrary to prediction. Where the probability variable itself is only moderately strong in relation to purchases (household durables), it has only a moderate effect on the strong influence of initial-data variables, contrary to prediction, but also a lesser effect on the weak influence of intervening variables, consistent with the predicted results.

The alternative probability variables show some interesting relations to purchases (Table 11). Three probability measures were obtained for automobiles (for six-, twelve-, and twenty-four-month future periods), two for household durables (twelve- and twenty-four-month periods).[28] For automobiles, the strongest relation is between the twelve-month probability estimate and six-

[28] The rationale for asking about purchase probability over a twenty-four-month future period in an experiment using a six-month period over which to measure actual purchases is simply that probability responses relating to relatively distant future periods were expected to yield meaningful information about actual behavior in the near future. This expectation was based on analysis of buying intentions data. I have noted previously that the bulk of actual purchases during any time period are made by households that fail to report buying intentions of any kind. If one supposes that very few purchases are made by households that really have zero ex-ante purchase probabilities but experience wholly unforeseen changes in circumstances, and that for the most part households that purchase could have provided some ex-ante indication that their purchase probability was higher than zero, it becomes sensible to see whether nonzero responses can be extracted by stretching out the time period used in the survey. The evidence suggests that this procedure does obtain useful information from respondents, in that both twelve- and twenty-four-month probability estimates are significantly related to six-month purchase behavior net of the six-month probability estimate.

month purchases; the twenty-four-month probability estimate has a stronger relation to six-month purchases than does the six-month estimate. A six-month probability scale for household durables purchases was not even included in the experimental survey. It was thought likely that both the twelve- and twenty-four-month scales would be better, and three scales seemed excessive in view of interviewer experience with the Detroit pretest. The results vindicate this judgment, since the twenty-four-month scale is slightly more strongly associated with six-month purchases than is the twelve-month scale.

On balance, the evidence suggests that most respondents have a conservative bias in their responses to probability questions, or at least to the particular question used in the QSI experiment. In these data, if a household reports a zero probability of purchasing within six months but a nonzero probability of buying within twelve months (say, three chances in ten), the "true" probability of its buying within six months seems to be higher than zero. It is also likely in this case that the "true" probability of such a respondent buying within a year is higher than 0.3. In effect, households typically seem to underesestimate their purchase probabilities for any specified period of time, and tend to assign probabilities to given periods of time that "should" have been assigned to somewhat shorter periods.[29] To be sure, there are doubtless other biases as well in the probability responses. It may be, for example, that households assigning very high probabilities to short periods of time typically tend to overestimate; the evidence is not clear on this point. But the data clearly show that the opposite tendency exists.

The chief manifestation of the conservative bias is the tendency for those who "upgrade" their purchase probabilities to purchase at higher rates than other households during the six-month forecast period. That is, of two households reporting 0.3 for their six-month probability, with the first also reporting 0.3 for its twenty-four-month probability and the second reporting some number higher than 0.3, the second type of respondent, on average, will tend to have a higher six-month purchase rate than the first. The same general point is documented by the fact that a simple weighted average of the six- and twenty-four-month probability scales is more closely related to six-month purchases of automobiles than the six-month scale itself. The averaging process evidently tends to correct for the conservative bias.

I did not test all possible combinations of the probability variables to determine the formula that provides the best fit to actual purchases; there seems little to be gained by this kind of tinkering. One such test differentiates only between households that upgrade their six-month probabilities by at least 0.4, and all others. The data indicate that the six-month probabilities of "upgrading" households should be increased by between 0.2 and 0.3 to provide the best

[29] The evidence suggesting the hypothesis that there is a conservative bias in probability judgments cannot be explained solely by the presence of regression bias. The observed purchase rates of zero-probability households must exceed zero. These households can only be moved toward purchase by unexpected developments (negative purchases are not permitted), and misclassification can only result in an estimate of ex-ante purchase probability that is too low. But we are looking at differences in the purchase rates of groups of households reporting zero six-month probabilities, one of which has indicated that twelve-month probabilities are nonzero while the other has continued to report zero. I might also note in passing that the conservative bias seems to apply to households reporting six-month probabilities ranging all the way from 0.0 to 0.6.

fit to automobile purchases. They also show that the combination of six-month automobile purchase probabilities and this upgrading dummy variable explains as much variance as any other combination of probability variables.

The last question to be examined concerns the determinants of purchase probability itself. Only a limited amount of evidence is available: the QSI experiment contains data on job market conditions; short-term expectations about jobs, business conditions, and family income; long-term expectations about the respondent's financial situation; attitudes toward buying conditions;[30] and the level of family income. These include most of the variables that have shown a significant relation to buying intentions in previous cross-section studies. The most important cluster of variables for which no data are available consists of those which measure the stock of durables owned by the household. Although it is clear from my earlier *Anticipations and Purchases* that stock variables, especially those that measure the difference between desired and actual stock, are strongly related to both purchases and intentions to buy, it is equally clear that their influence on purchases is nil if buying intentions are held constant. *A fortiori*, therefore, the influence of stock variables on purchases was presumed to be adequately measured by the purchase probability variable, and hence stock variables were not included in the experiment.

Table 12 shows the results of regressing both the alternative probability measures and actual purchases on seven independent variables that were reported concurrently with probability. These are all initial-data variables in the terminology used above. Several points are of interest. First, the closest association is always found for the probability variable with the longest time horizon—twenty-four-months in this case. Second, the relationships are much weaker with respect to actual purchases than with respect to purchase probability. Third, only a small fraction of the variance in probability, and of course even less of the variance in actual purchases, can be attributed to the influence of the seven (initial-data) independent variables.

The fact that the independent variables tend to explain less of the variance in purchases than in probability is a consequence of two factors. The distribution of purchases among households will be influenced by unforeseen events (intervening variables), but the distribution of probabilities should not be so influenced; hence initial-data variables should be less strongly associated with ex-post purchases than with ex-ante probabilities. In addition, since purchases are measured over a six-month period, the distribution of the sample by frequency of purchases is basically dichotomous: in the great majority of cases a household either purchases one item or it purchases nothing. This is essentially a consequence of the length of the forecast period; if purchases had been measured over, say, a two-year period, the distribution would have been smoother because many more multiple purchases would have been observed. But for the six-

[30] Nearly all studies have shown that responses to a question about whether "the present is a good or bad time to buy cars and major appliances" is strongly related to buying intentions. As shown below, responses to this question were not strongly related to purchase probability in the QSI experiment. It is not clear why this is so, but I would conjecture that an inadvertent change in the wording of the question is responsible. Instead of asking whether "this is a good or bad time for you to buy cars and major appliances," the respondent was asked whether "this is a good or bad time for you to buy." These are not the same questions, and I am not sure how the typical respondent would interpret the question actually used.

month period, the independent variables tend to be more strongly associated with purchase probabilities than with purchases simply because the former are more smoothly distributed.

The reason that the independent variables are more closely related to twenty-four-month purchase probabilities than to probabilities for shorter periods of time can probably be attributed to the conservative bias discussed earlier. For the most part, this bias has the form that many respondents misclassify themselves in the distribution of six-month probabilities, putting themselves at zero when they "should" be elsewhere. Although the true six-month probabilities of some households are doubtless scaled less accurately by the twenty-four-month question than by the six-month one, the twenty-four-month one turns out empirically to be better on balance.

Finally, the results strengthen the earlier conclusion that purchase probabilities are apt to be a better time-series predictor of purchase rates than are buying intentions. The basic factors that exert a systematic influence on purchases are presumably actual and prospective changes in financial variables—especially the latter. All seven independent variables in Table 12 measure these kinds of changes either directly or indirectly, and the probability variable combines the influence of the underlying factors into a single number that reflects their relative importance to each household.[31]

The probability variable is much more strongly related to purchases than is any combination of the underlying financial variables because probability is not only affected by these systematic variables but also by a whole host of variables that are idiosyncratic to each household. But the systematic factors will be differently distributed over time, and will cause systematic changes in the distribution of probabilities and in subsequent purchase rates, while the purely idiosyncratic factors will be distributed at random (by definition) and hence will have no systematic influence on either the probability distribution or the subsequent purchase rate.

It turns out that the systematic factors in Table 12 are more closely related to the probability variables than to any of the buying intentions variables.[32] I infer that probability is likely to be a much better predictor of future purchase rates than buying intentions because it is much more strongly related to the underlying variables that actually determine purchase rates.

CONCLUDING REMARKS

One important question that cannot yet be answered concerns the role of disturbances in the relation betwen ex-post purchase behavior and ex-ante purchase probability. The evidence suggests that such disturbances were of little or no consequence during the period examined in this study. Households reporting disturbances of various kinds (intervening events, in the terminology used above) behaved in much the same way as other households. It may be that

[31] See *Anticipations and Purchases*, especially Ch. 5.

[32] There are of course a number of different buying intentions variables that might be used. I tried several combinations (definitely, probably, or may buy =1, all other households =0; any intention =1, all other households =0; definitely will buy =1, all other households =0; and definitely will buy =5, probably will buy =4, . . . , don't know =1, no =0), but none come close to explaining as much variance as the weakest of the three probability variables.