WHY DIFFERENCES IN BUYING TIME?
A Multivariate Approach

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by

Joseph W. Newman
Professor of Business Administration
University of Michigan

Richard Staelin
Assistant Professor of
 Industrial Administration
Carnegie-Mellon University

BACKGROUND OF THIS PAPER

ABSTRACT

New data on the duration of the purchase decision process for cars and major household appliances are analyzed by using two multivariate techniques (AID and MCA) in combination. The results emphasize the importance and complexity of interactions among variables and highlight the effects of previous experience in buying and using the product.

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This article presents new research findings which help explain marked differences observed in purchase decision times for new cars and major household appliances. It also describes the application to survey data of two multivariate techniques of analysis which gave rise to the findings.

The techniques, which have received minor attention in the marketing literature, were employed in successive steps as follows:

1. Automatic Interaction Detector (AID), a computer program which sequentially produces binary splits which minimize the within-group sum of squares for each independent variable /4/. It was used to (a) learn which of 36 selected factors were most useful for segmenting the sample of buyers on the basis of homogeneity of duration of the decision process, and (b) detect interaction between the independent variables. On the basis of AID output, several interaction terms were constructed.

2. Multiple Classification Analysis (MCA), a dummy variable computer program for examining the interrelationship between independent variables and a dependent variable within the context of an additive model /1/. MCA was used to (a) measure the effect of each independent variable (including interaction terms) on duration after adjusting for the effects of all other independent variables; (b) test for the statistical significance of each variable and for the combination of variables; and (c) determine how much of the variance of duration was explained by the model.

Prior to the use of the two techniques, more than 50 independent variables were screened by examining frequency tables. Each table represented a household characteristic, a condition under which the purchase was made, or activity in the decision process.

THE NEW DATA

The data analyzed were obtained in personal interviews in 652 households which had purchased one or more of the products of interest in 1967 or 1968 prior to the August, 1968, interviews. The respondents were randomly selected adults in a probability sample of 1,300 households of the U.S., excluding Alaska. Two hundred seventeen had brought new cars. Four hundred thirty-five others had bought one or more of the following: color television set, black and white television set, refrigerator or freezer, washing machine, kitchen stove or room air conditioner.

Each interview focused on only one product, its identity being determined by the priority indicated by the order in which the product was mentioned in the preceding paragraph. Only the sample of car buyers, therefore, was truly random. The other buyer samples were limited to households which had not purchased an item higher up on the priority scale. It is not known whether the decision times reported for each appliance subsample were the same as would have been obtained from all buyers of the appliance in question. The subsamples, however, were found to be similar on various demographic characteristics.

Purchase decision times have received minor research attention despite their importance for understanding buyer behavior and their implications for designing and scheduling promotional programs. Information on decision time for consumer durables previously reported in the marketing literature came from two inquires made in the early 1950's. One was a panel study by Ferber in 1951 in which 131 families in Decatur, Illinois, were interviewed about purchases and purchase plans for consumer durables, including clothing /2 /. The other was a national survey by Katona and Mueller in 1953 of 350 buyers of television sets, refrigerators, washing machines and stoves /3/. Neither study employed multivariate techniques in analysis.

Measuring Decision Time

Duration of the decision process refers to the time elapsing between the first conscious thoughts of buying a given product and its purchase. The concept is similar to that used by Ferber and by Katona and Mueller.

Estimates of decision time reported here are based on answers to these questions: "When did you buy it (a given product), which month and which year?" and "How long before actually buying a (name of product) did you people think or talk of buying it; was it a short time, or many months or what?" The respondents appeared able to quantify the time period reasonably well. Nevertheless, their answers should be regarded as approximations because of difficulties of recall. It is believed, however, that they are accurate enough to be useful information for management and to permit the categorization of households requisite to determining what factors seem to account for differences in decision time.

The decision times were found to vary widely. (See Table 1). About half of the buyers took two weeks or less while a third took six months or more. The distributions for cars and major household appliances were similar.

THE AID ANALYSIS

Analysis of two-way tables showed that the numbers of households with both long and short decision times were substantial regardless of how the sample was subdivided. The AID analysis was undertaken in an effort to go further in identifying the main influences on duration, including interactions between variables. The AID technique was selected because it is well suited to handling data on ordinal and nominal scales and because we, as researchers, were unable, a priori, to quantify the functional form of the relationships between the independent and dependent variables.

The AID strategy is to divide the total sample into the most homogeneous groupings possible with respect to the dependent variable. The measure of homogeneity is the squared deviation from the mean (sum of squares). The smaller the sum of squares, the greater the homogeneity. The program operates sequentially. The splitting of the subsamples continues until the groups become too small, very homogeneous or until no remaining variable can explain a given amount of the variance (1% in this case). The AID program, therefore, provides a means of letting the data help to identify the key independent variables and indicate the functional form of the relationships.

Six time categories were used to represent the dependent variable of duration. Their midpoint values were 2, 6, 18, 36, 52 and 60 weeks. Thirty-six independent variables were chosen for the AID run after preliminary screening. (See Table 2) Although all of the levels of each variable are not given because of space limitations, definitions of variables found to be statistically most significant are indicated

in the AID tree which shows the segmentation which resulted from using the AID program. (See Figure 1) The average duration for all buyers was 18.01 weeks with a standard deviation of 20.05 weeks.

Satisfaction with Old Product

Satisfaction with the old product was the factor which produced the first split. Satisfied users averaged 14.18 weeks compared with 23.15 weeks for households which were not fully satisfied or which did not have regular use of that kind of product before.

Insight was gained by examining the intermediate AID output on amount of out-of-store information seeking. The latter was measured by an index based on the number of sources consulted and the number of types of information sought. Purchasers who were satisfied with their old product engaged in less information seeking (Index = 1.91) than did those who were not fully satisfied or did not have regular use of the product before (Index = 2.29). The difference was significant at the .05 level. In addition, the satisfied users were able to gather a certain amount of information in less time than the other groups of buyers. (See Figure 2) The findings indicate strong interaction between satisfaction with the old product and information seeking.

Product Purchased

Satisfied users split on the identity of the product bought. The split produced Group 6 (buyers of black and white television sets, washing machines and air conditioners) and Group 7 (buyers of cars, refrigerators, color television sets and stoves) which had average durations of 9.15 weeks and 16.60 weeks, respectively.

It can be argued that identity of product should not have been included in the analysis because it is a proxy for other more basic variables. A decision was made to include it in the first AID run, however, to see whether it would produce a split and if it did whether the car and appliance buyers would be placed in separate groups. They were not. Instead, we were confronted with the question of why buyers of black and white television sets, washing machines and air conditioners were placed in one group and buyers of cars, refrigerators, color television sets and stoves in another.

In a search for an explanation, the proportions of the sum of squares explained by each of the other variables were examined. The leading contender to product identity as a variable to be used for the split was condition of old product. Also, it was observed that the explanatory power of this variable was only about half as great after the product split as before, suggesting that product identity to a marked extent was a proxy for condition of old product.

Further examination produced evidence that products in Group 6 tend to be replaced later than those in Group 7, often after having reached physical obsolescence. Sixty-two per cent of the Group 6 products being replaced were broken at the time of the new purchase, compared with 19% for Group 7 products. Only 13% of the Group 6 products being replaced were less than five years old and 38% less than 10 years old. Corresponding figures for Group 7 were 39% and 70%, respectively.

Additional analysis indicated that urgency of purchase and cost of product contributed to the lower average purchase decision time for Group 6.

A second AID run was made using the same variables as in the first run except for product identity. Group 2 (satisfied users) splite on condition of old product as was expected. Average durations were 9.41 weeks for buyers whose old products were broken at the time of the new purchase and 16.57 weeks for buyers whose old products were still working.

Previous Buying Experience

Let us now return our attention to Group 7 in Figure 1. The next two splits of that group show that substantial prior exposure to the buying process for durable goods is associated with short decision times. The average household which had purchased either four or more white good items (refrigerator, freezer, washing machine or stove) or four or more cars in the last 10 years reported decision times of slightly more than nine weeks compared with about 20 weeks for households which lacked that much purchasing experience.

Plots of amounts of information seeking and duration of the decision process showed that experienced buyers engaged in considerable information seeking without increasing decision time.

Income

Household income had an insignificant effect on average decision time for the total sample. In the AID analysis, income did not appear until it was used for the fourth split of satisfied users. At that point, it divided the less experienced buyers into two groups: (1) those with household incomes from $3,000 to $15,000 who reported an average duration of 18.35 weeks, and (2) those with incomes under $3,000 or over $15,000 who reported an average duration of 30.05 weeks. The latter group included only 30 households. If financial pressure extended decision times, increases in income should be accompanied by decreases in decision time and they were not. The highest income households which lacked buying experience took more time than any other income group.

Information Seeking

The lower branch of the tree diagram (Figure 1) represents households which either were not satisfied with their old product or did not have regular use of the same kind of product before (Group 3). Earlier it was noted that increases in information seeking activity were associated with longer decision times for this group.

It is not surprising, therefore, that the AID split of Group 3 was made on the amount of information seeking. The low information seekers (Group 4 with out-of-store information seeking index values of 0 to 1) had an average duration of 14.17 weeks compared with 27.00 weeks for the moderate to high information seekers (Group 5 with index values of 2 to 5).

Ability to Judge Product

The variable which best explained variance in purchase decision times for the low information seeking households (Group 4) was whether the respondent expressed confidence in his ability to judge the product. Those who said they could judge the product well (Group 9) had an average duration of 20.85 weeks compared with 7.14 weeks for those who said they had to put their trust in someone or some information (Group 8).

For the moderate to high information seekers (Group 5), duration was about the same across the scale of ability to judge the product.

The data do not provide an explanation for the difference just noted. Perhaps reported ability to judge the product reflected at least two kinds of behavior. The low information seekers who said they had to trust others may have trusted others not

only for information but for its evaluation as well. Such a delegation could result in short decision times. The trusting households which were moderate to high information seekers took more time than any other group. These households may have relied on others for information but assessed its credibility themselves, thereby extending decision time.

Stage in Life Cycle

Moderate to high information seekers split on stage in life cycle. One of the resulting groups (#16--composed entirely of households without children) had an average decision time of 17.70 weeks. That compared with 31.47 weeks for the other group (#17) in which 85% of the households had children. In three-fourths of the households with children, the head was under 45 years of age. The finding suggests that the presence or absence of young children may be a proxy for relevant product and buying experience. As families grow, needs change so that the family may be buying a car or appliance of a size and other characteristics which differ from those of the item last purchased. Awareness of changing family needs also may lead to more than average consideration of cars and appliances in advance of purchase.

THE MCA ANALYSIS

In addition to producing groups of households with widely different average decision times, the AID analysis pointed to interactions of variables. The AID output was used to construct three interaction terms which were included in the MCA analysis along with seven other independent variables which are identified in Table 3.

The number of variables was limited because the major purpose was to test the significance of the more interesting relationships suggested by the AID analysis and earlier studies. Another reason is that MCA is an analysis of variance technique. The F-tests of statistical significance used, therefore, rely not only on the amount of variance explained but also on the degrees of freedom used to estimate the coefficients.

The factors represented in each of the three interaction terms follow:

A. Level of satisfaction with old product
   Condition of old product
   Number of new cars and major appliances bought in last 10 years
   Income

B. Level of satisfaction with old product
   Amount of out-of-store information seeking
   Whether respondent said he could judge product well or had to trust others

C. Identity of product purchased
   Number of other major durables purchased in 1967 or 1968

Terms A and B above were included to reflect interaction detected in the AID analysis. (See Figure 1) Term C was included to test the significance of the experience of buying more than one major durable in a given time period.

On the basis of their unadjusted values, the three interaction terms and education and cost of product were found to be statistically significant at the .05 level. (See Table 3) In addition, stage in life cycle and sex of respondent were found to be significant at the .10 level.

After each factor was adjusted to remove the effects of the other factors included in the analysis, only the following were found to be statistically significant at the .05 level: Interaction Term A, Interaction Term B and race. Stage in life cycle was significant at the .10 level but none of the other factors met this criterion.

The model consisting of the three interaction terms and the seven other variables combined was found to be significant at the .05 level regardless of whether the adjusted or unadjusted values were used.

Coefficients for all levels of several factors for which interesting relationships were found appear in Table 4. MCA is a dummy regression program which uses the restriction that the weighted sum of the coefficients for each factor equals zero. A coefficient is viewed as an estimate of the adjustment in weeks that should be made to the sample mean of 18.37 weeks to arrive at the mean duration for a given sub-sample. The adjustment is to remove the effects of all other independent variables included in the model.

Income and conditon of old product were included in Interaction Term A to test a hypothesis of interaction between them. Such interaction, however, was not observed in our data, at least not for persons who were satisfied with their old product.

The MCA results confirmed interaction between satisfaction with the old product and purchasing experience. Satisfied users who had bought four or more new cars and major appliances in the last 10 years took about eight weeks less on the average in the decision process than did those with less experience. Dissatisfied users or households which did not have regular use of the product before, however, had longer decision times if they had bought four or more major durables than if they had not. The difference was about nine weeks.

A diversity of behavior is evident in the data for Interaction Term B. For example, the average satisfied user of his old product who ranked high on out-of-store information seeking took about 26 weeks longer in the decision process than did the average purchaser who was dissatisfied with his old product or did not have regular use of that kind of product before, sought very little information, and said he could not judge the product well but had to trust others.

An increase from low to high information seeking activity was associated with an increase of about seven to eight weeks in average duration for both the satisfied and the dissatisfied users and those who did not have regular use of the product before. Average duration for buyers in the latter category who were very low information seekers varied greatly depending on reported ability to judge the product.

Findings relative to stage in life cycle were similar to those of the AID analysis.

While cost of product after adjustment for the effects of other variables did not prove to be statistically significant at the .10 level, its relationship to duration as evidenced by our data is interesting in view of Ferber's hypothesis that "the larger the size of the planned purchase, the longer the purchasing horizon is likely to be." /2/. The hypothesis received only limited support from our findings. The average purchase decision time for appliances increased by about six weeks as the cost rose from less than $100 to $500 or more. An increasing function was not observed for cars, however, and the average duration for cars was not longer than that for appliances.

CONCLUSIONS

The use of the AID and MCA techniques in combination contributed to understanding the wide differences in purchase decision times in several ways. Segments of the buying population with markedly different average times were identified; important interactions which otherwise might have gone unnoticed were detected and taken into account; and the effects of each factor were measured after adjusting for the effects of the other variables included in the analysis.

The analysis showed that the effects of variables often are neither additive nor linear, considerations which were handled by constructing interaction term. The complexity of relationships was apparent in the AID tree and the MCA coefficients. The latter reflected substantial differences in decision times among levels of variables, adding insight useful for sharpening hypotheses for future research.

Also indicative of the importance of interactions is the finding that the R^2 for the MCA analysis in which the interaction terms were used was .158 compared with .112 for a similar analysis in which the ingredient variables of the interaction terms were entered as separate entities. The low value of the R^2 is not unusual for consumer behavior studies. It reminds us that we currently are unable to predict behavior of individuals even though we are able to divide the population into groups which have widely different behavioral means.

Conventional demographic variables were of little help in explaining the differences. Instead, attention was directed to influences like condition of old product and whether the respondent felt he could judge the product well or had to trust others, and, more importantly, prior experience which affected both information seeking and decision time. The results thus add empirical support to the idea that product purchase and use are learning experiences on which many buyers capitalize to limit their search time.

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Table 1

DECISION TIMES FOR NEW CARS AND MAJOR APPLIANCES

	Per Cent of Buyers		
Decision Times	Cars	Appliances	Total Sample
Short Time (A week or 2)	45	51	49
A Few Weeks (3 weeks to 2 months)	10	7	8
A Few Months (2-6 months)	12	8	9
Many Months (6-12 months)	22	19	20
A Year or More	10	13	12
Not Ascertained	1	2	2
	100	100	100
Number of Cases	217	435	652

Table 2

INDEPENDENT VARIABLES USED IN AID ANALYSIS

1. Identity of product purchased

2. Cost of purchased product

3. Whether bought on credit or paid cash

4. Whether respondent said he could judge product well or had to rely on others

5. Source of information had most confidence in

6. Whether owned or had regular use of same type of product before

7. Level of satisfaction with old product

8. Condition of old product at time of new purchase

9. Age of old product

10. Whether repeated on brand

11. Number of brands considered at start of decision process

12. Whether used friends or neighbors as source of information

13. Whether used books, pamphlets, newspaper or magazine articles as source of information

14. Whether used newspaper or magazine advertisements

15. Whether watched TV commercials on product more carefully than a year earlier

16. Number of retail outlets visited

17. Amount of out-of-store information seeking

18. Urgency accompanying purchase

19. Number of major appliances bought in 1967 and in 1968 prior to August interview

20. Number of major appliances household intended to buy in next 12 months

21. Number of new cars bought by household in last 10 years

22. Number of refrigerators, freezers, stoves and washing machines bought in last 10 years

Table 2 con't.

23. Number of television sets bought in last 10 years

24. Number of new cars and major appliances bought in last 10 years

25. Age of head of household

26. Stage in life cycle of household

27. Occupation of head of household

28. Education of respondent

29. 1967 income of household

30. Household feels better or worse off than a year ago

31. Household expects to be better or worse off next year

32. Combination of household's feeling as to whether it was better or worse off than a year ago and whether it will be better or worse off next year

33. Opinion on whether it is a good time to buy major household products

34. Opinion on whether it is a good time to buy a car

35. Identity of household member who exercised major influence on purchase decision

36. Level of satisfaction with new product purchased

Table 3

STATISTICAL SIGNIFICANCE OF FACTORS IN MCA ANALYSIS

Factor	Significance Level for	
	Unadjusted Value	Adjusted Value
Interaction Term A*	$\alpha < .05$	$\alpha < .05$
Interaction Term B*	$\alpha < .05$	$\alpha < .05$
Interaction Term C*	$\alpha < .05$	NS
Education of respondent	$\alpha < .05$	NS
Sex of respondent	$.05 < \alpha < .10$	NS
Cost of product bought	$\alpha < .05$	NS
Stage in life cycle of household	$.05 < \alpha < .10$	$.05 < \alpha < .10$
Race	NS	$\alpha < .05$
Occupation	NS	NS

*See text for definition.

NS = not statistically significant at .10 level.

Total Sum of Squares	279,284
Explained Sum of Squares	68,899
Unexplained Sum of Squares	210,385
N	639
Mean	18.37 weeks
R^2	.158

Table 4

MCA COEFFICIENTS FOR SELECTED FACTORS

Factor	Level	Regression Coefficient*

Interaction Term A:

Satisfied with old product;
Old product broken at time
of new purchase:

Income < $5,000	-8.13
Income $5,000 - $9,999	-10.72
Income ≥ $10,000	-9.92

Satisfied with old product;
Old product working at time
of new purchase:

Number of new cars & major
appliances bought in last
10 years:

Four or more	-8.76
Less than four	-.93

Dissatisfied with old product or
did not have regular use of
product before:

Number of new cars & major
appliances bought in last
10 years:

Four or more	.09
Less than four	9.47

Interaction Term B:

Satisfied with old product;

Very low to medium information
seeking

Very low to medium information seeking	.85
High information seeking	7.32

Table 4 cont'd

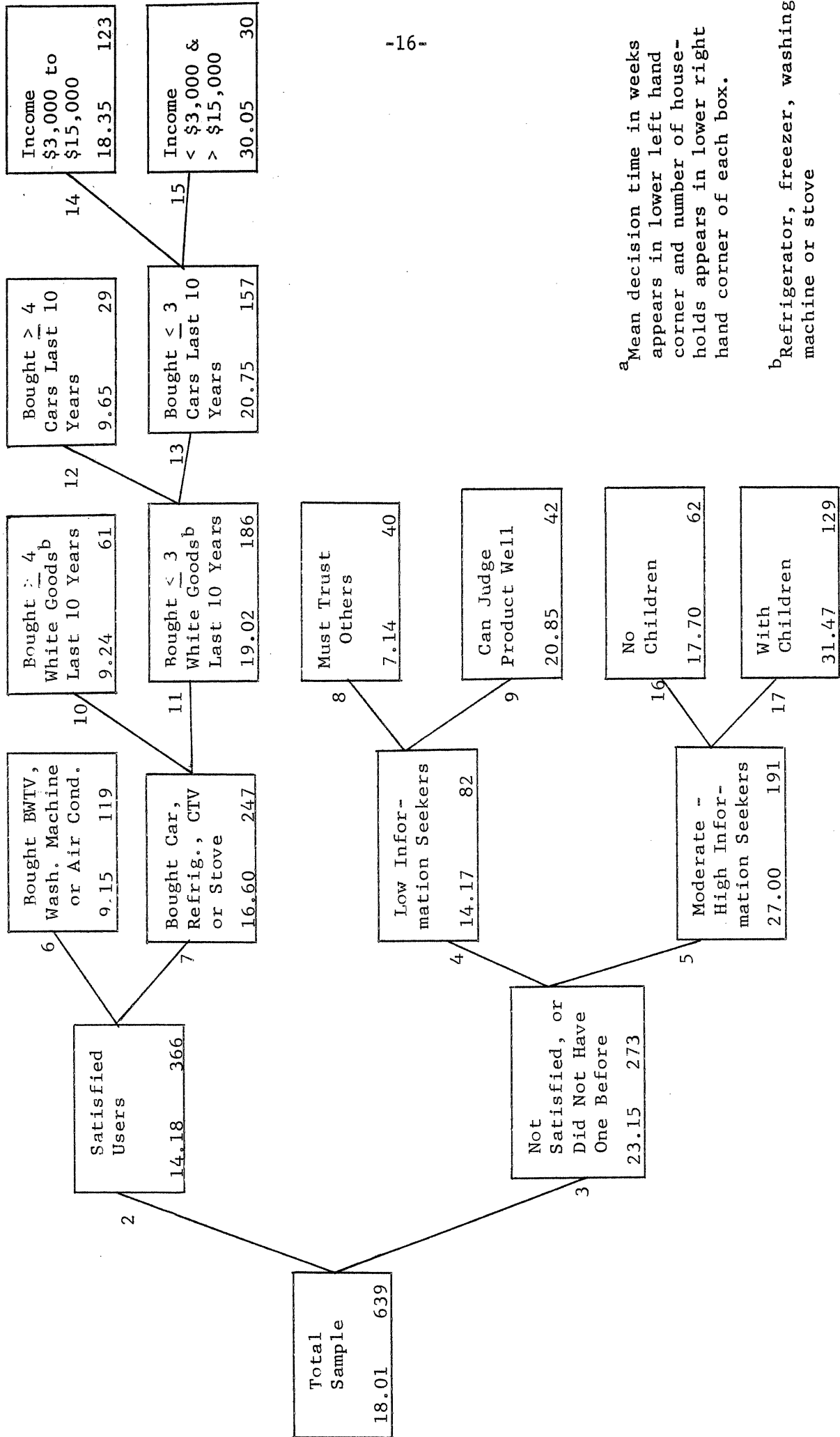| Factor	Level	Regression Coefficient
	Dissatisfied with old product or did not have regular use of product before:	
	Very low information seeking:	
	Could judge product well	-2.97
	Had to trust others	-19.15
	Low information seeking	-1.98
	Medium information seeking	2.90
	High information seeking	5.87
Stage in Life Cycle:		
	Household head under age 45:	
	Unmarried, no children	-3.45
	Married, no children	-2.42
	Married, youngest child < 6	1.71
	Married, youngest child ≥ 6	1.99
	Household head 45 or older:	
	Married, has children	-.99
	Married, no children, head not retired**	-5.40
	Married, no children, head retired**	1.54
	Unmarried no children, head not retired**	3.58
	Unmarried no children, head retired**	5.88

Table 4, Cont'd

Factor	Level	Regression Coefficient
Cost of Household Appliance:		
	< $100	-3.55
	$100 - $199	-1.64
	$200 - $299	-1.36
	$300 - $499	2.76
	≥ $500	2.83
Cost of New Car:		
	< $3,000	-.51
	$3,000 - $3,999	1.77
	≥ $4,000	-2.46

*MCA is a dummy regression computer program which uses the restriction that the weighted sum of the coefficients for each factor equals zero. A coefficient is viewed as an estimate of the adjustment to the sample mean that should be made to arrive at the mean duration in weeks of the decision process for a given sub-sample.

**Disabled persons and housewives 55 years and older were categorized as retired.

AID TREE FOR PURCHASE DECISION TIME[a]

Total Sample
18.01 639

2 — Satisfied Users
14.18 366

3 — Not Satisfied, or Did Not Have One Before
23.15 273

6 — Bought BWTV, Wash. Machine or Air Cond.
9.15 119

7 — Bought Car, Refrig., CTV or Stove
16.60 247

10 — Bought ≥ 4 White Goods[b] Last 10 Years
9.24 61

11 — Bought ≤ 3 White Goods[b] Last 10 Years
19.02 186

4 — Low Information Seekers
14.17 82

5 — Moderate – High Information Seekers
27.00 191

8 — Must Trust Others
7.14 40

9 — Can Judge Product Well
20.85 42

16 — No Children
17.70 62

17 — With Children
31.47 129

12 — Bought ≥ 4 Cars Last 10 Years
9.65 29

13 — Bought ≤ 3 Cars Last 10 Years
20.75 157

14 — Income $3,000 to $15,000
18.35 123

15 — Income < $3,000 & > $15,000
30.05 30

[a]Mean decision time in weeks appears in lower left hand corner and number of households appears in lower right hand corner of each box.

[b]Refrigerator, freezer, washing machine or stove

Figure 2

DECISION TIME AND INFORMATION SEEKING
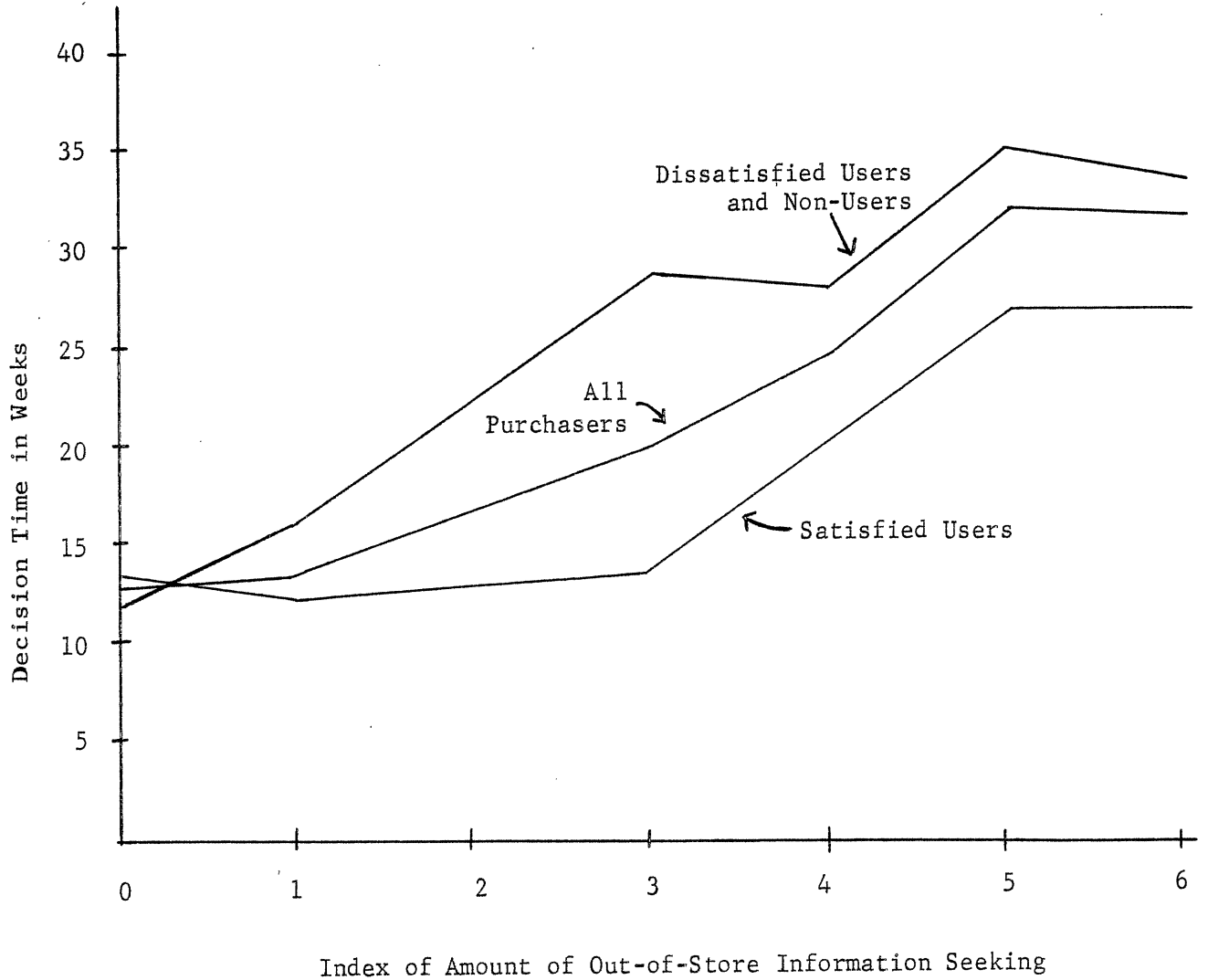
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