Louis L. Wilde*
California Institute of Technology

The Economics of Consumer Information Acquisition

This paper surveys recent theoretical work by economists on consumer information aquisition. Both models of individual behavior and models of market equilibrium are discussed. These models are used to illustrate the point that there are significant advantages to greater collaboration between economists and consumer researchers.

I. Introduction

Traditionally economists and consumer researchers have studied consumer behavior, especially under imperfect information, without paying a great deal of attention to one another. This is likely due to differences both in purpose and technique. Consumer researchers are generally concerned with individual choice, while economists focus on market outcomes. Even when economists propose detailed models of individual behavior, they tend to use these models to deduce propositions concerning overall market structure. Furthermore, consumer researchers draw data from both surveys and experiments, sources which economists distrust. This paper surveys recent theoretical work on consumer information acquisition, primarily by economists, arguing that consumer researchers and economists have much to learn from each other.

There are two reasons for concentrating on theory. First, comprehensive surveys by James Bettman (1977) and Joseph Newman (1977) deal with the empirical literature. Second, and significantly, accompanying the recent attention afforded consumer information acquisition

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by economists and consumer researchers has been an increased public awareness of the potential problems associated with imperfect information in product markets. This has resulted in a substantial demand for intervention.[1] However, without a well-developed theoretical understanding of consumer behavior under imperfect information it is difficult to know when and where to intervene. For example, in the hearings on the original "Truth in Lending" bill, Senator Paul Douglas asserted that a competitive outcome will obtain in a market even if only 10% of the consumers are "cost conscious."[2] Unfortunately, there is no literature, at least of which I am aware, that supports such a claim.

Proper intervention requires a thorough knowledge of both individual consumer behavior and market structure. Recent work by economists has shown that market outcomes are very sensitive to consumer information acquisition strategies. Yet the economics literature has little to say about actual consumer behavior. In contrast, the existing consumer research literature focuses on the individual consumer and can be a great resource to the economist interested in markets characterized by imperfect information.

Consumer researchers can benefit from economists as well. One of the most striking aspects of the consumer research literature is its lack of a unifying theoretical base. For example, Hansen (1972) discusses 28 different models of consumer behavior. To describe this state of affairs as bewildering is certainly an understatement. However, economic methodology has the potential to solve part of the problem. Section II of this paper, in which I discuss several recent models of individual consumer behavior, is offered as evidence supporting this claim.

Section III is devoted to market models. These models aggregate individual consumer behavior and, by including firms explicitly, attempt to characterize the nature of market equilibrium under imperfect information. Economists are interested in such models for several reasons. For one, they hold promise of providing a microeconomic foundation for the study of macroeconomic problems such as inflation and unemployment. But more importantly (at least for present purposes) they explain a wide variety of microeconomic phenomena, examples of which can be found in symposia on the economics of information in the November 1976 *Quarterly Journal of Economics* and the October 1977 *Review of Economic Studies*.[3]

1. For examples see Day's (1976) list of "recent or prospective" (as of the second quarter of 1975) information disclosure requirements.

2. Quoted in the *Report of the National Commission on Consumer Finance, Consumer Credit in the United States* (1972), p. 176.

3. See Rothschild's survey (1973) for an excellent discussion of the motivation for studying market models under imperfect information and a critique of early contributions to the literature.

II. Individual Behavior

The fundamental articles in the economics literature on consumer information acquisition are those of Stigler (1961, 1962) and Nelson (1970, 1974, 1975). While this work is well known, it will be useful to review briefly the underlying assumptions and predictions of the basic models proposed by these authors.

Stigler (1961) analyzes the behavior of an imperfectly informed consumer interested in purchasing a homogenous good. In his model only price varies across firms; once a consumer samples a firm, all the relevant information about that firm's product is summarized by its price offer. Price dispersion is (initially) taken as given, and the consumer is assumed to know the distribution of prices. Since search is a costly activity, the consumer must select a strategy for acquiring information. Stigler suggests that the consumer set a fixed number of stores to visit, ex ante, and then buy from the store offering the lowest price of those sampled. The optimal number of stores to visit is determined by the usual cost-benefit calculus.[4]

Based on this model, Stigler derives a number of hypotheses. For example, besides noting the obvious inverse relationship between the cost of search and the optimal amount of search, he predicts that either a greater dispersion of prices or a greater expenditure on the commodity will lead to more search.

Two aspects of Stigler's model have been criticized by economists. McCall (1965) and later Nelson (1970) observe that under Stigler's assumptions the appropriate decision rule is a sequential one. In this case the consumer samples firms one at a time, comparing each price offer to a hypothetical reservation price (calculated by comparing the marginal cost of more search to the marginal benefit as measured by the expected reduction in the final purchase price). The strategy is to buy from the first firm that offers a price which is lower than the reservation price. However, while it is certainly true that a sequential rule yields the minimum expected total cost of purchase (price plus search costs), it leads to essentially the same predictions as Stigler's fixed-sample-size rule; the empirical distinction between the two is meaningless, at least at the level of individual behavior.[5]

A second major criticism of Stigler's model is due to Rothschild (1973). In this famous survey, Rothschild pointed out that Stigler, McCall, and Nelson all model just one side of the market. As he put it, theirs are "partial partial-equilibrium" models, the rub being that the

4. See ibid. for a more complete summary and critique of Stigler's model.

5. This is not true at the market level. In fact, theoretically, market equilibria are very sensitive to assumptions made respecting consumers' information acquisition strategies. See the papers listed at the beginning of Sec. III for examples.

source of persistent price dispersion (which motivates search behavior) is never explained. This observation stimulated a good deal of research, and a number of models have appeared which derive nondegenerate equilibrium distributions of prices endogenously.[6]

Following Stigler, the next major contribution to the economics of consumer behavior under imperfect information was made by Phillip Nelson (1970). Nelson analyzes consumer behavior in markets characterized by joint distributions of price and quality. While this extension of the standard search model to multiattribute commodities is natural, it does not, by itself, change the qualitative results obtained by Stigler and McCall. If the utility associated with a particular price and quality combination can be costlessly ascertained once that pair has been drawn from the market distribution, then calculating an optimal fixed sample size is straightforward. Similarly, if a sequential rule is used in this case, then a reservation utility level is defined and the reservation price is replaced by a "reservation frontier" describing acceptable price and quality combinations.

The real power of Nelson's contribution rests with his observation that "information about quality differs from information about price because the former is usually more expensive to buy than the latter" (1970, p. 311). This implies that when quality is variable as well as price the consumer's information problem must include assessing the utility of goods. Nelson distinguishes two methods for making such assessments: *search*, which requires actual inspection prior to purchase, and *experience*, which requires buying and consuming the good in order to evaluate its utility. Goods are categorized as either search goods or experience goods depending on which technique is preferred.[7]

The work preceding Nelson is adequate for understanding consumer behavior with respect to search goods, but understanding consumer behavior with respect to experience goods requires a separate analysis. For them Nelson assumes "consumers either sample at random from among all brands or from among those brands in the price range the consumer deems appropriate for himself" (1970, p. 313). Hence the cost of experience is measured by the "loss in utility from consuming a brand at random rather than using the best brand one has already discovered" (1970, p. 314). Given this assumption, the standard cost-benefit calculus again yields the optimal investment in experience for either fixed-sample-size or sequential rules.

6. The papers listed at the beginning of Sec. III are good examples, but it should be noted that Stigler, while never developing such a model formally, did pay attention to the sources of price dispersion and the likely effects of imperfect information on market structure.

7. Darby and Karni (1973) define a third type of good, credence goods. The consumer cannot, by definition, evaluate the utility of these even after "consuming" them and must rely on outside sources for information. Examples include a surgeon's services and auto repairs.

Based loosely on his theoretical models, Nelson advanced and tested a number of hypotheses, mostly related to market structure. These will be discussed in more detail in the next section. The remainder of this section will be devoted to a critique and reformulation of Nelson's models of individual behavior.

Nelson focused on goods as entire packages of attributes rather than concentrating on the attributes themselves. But his definitions of search and experience can more naturally be applied to individual characteristics than goods. This is most evident in the case of experience goods. Since the utility of each option is evaluated by direct consumption for these goods, the good must actually be bought. So at least the purchase price is observed prior to consumption. But this cannot, by definition, affect the decision regarding which option to buy. Thus Nelson assumes that for experience goods consumers either sample at random or from some subset of prices which the consumer "deems appropriate." This assumption requires the further assumption that consumers either ignore price altogether or already have information regarding prices before they begin sampling. Neither of these assumptions seems justifiable, and certainly they would lead to different kinds of behavior. Moreover, other attributes besides price are generally observed prior to purchase, and the same problem arises with them. Fortunately, applying the concepts of search and experience to attributes instead of goods eliminates the difficulty altogether and permits a unified treatment of consumer behavior.[8] The following discussion will illustrate the usefulness of this simple modification of Nelson's model.[9]

Assume a consumer desires to maintain a one unit per period flow of consumption of a good which is described by both price and quality. Let the market distribution of price and quality be $F(p,q)$ with density $f(p,q)$. Let the conditional distribution of quality, given price (based on F), be $G(q \mid p)$ with density $g(q \mid p)$. By paying a search cost, c, the consumer can draw an observation from F, but only the price of the good is revealed. Information about quality (prior to actual consumption) is provided by the conditional distribution of quality, given the observed price. After observing price, the consumer must decide whether to buy the good, consuming it and observing quality, or reject the good and draw another observation from F. If the good is purchased, then at the end of the good's lifetime (say T periods) the consumer faces another decision—whether to repurchase the good just consumed or return to the market and initiate a new round of search.

8. In "Advertising as Information" (1974) Nelson initially defined search and experience *qualities* instead of search and experience *goods*, but in his subsequent discussion did not make explicit use of the fact that goods generally are neither pure search goods nor pure experience goods.

9. This model is analyzed in detail in Wilde (1977*b*).

This decision will depend on the observed level of quality—if it is high the good will be repurchased and if it is low the good will be rejected in favor of renewed search.

In order to formalize this problem, assume there exists a function, $U(p,q)$, which gives the net utility to the consumer over the T-period lifetime of the good obtained by paying price p and consuming at quality level q. Naturally U is decreasing in p and increasing in q. Finally, assume that in addition to the actual cost of the good any repurchase involves some time and resource cost, say r, with $r \leq c$ (r and c are measured in the same units as U).

The optimal strategy for a consumer faced with this choice environment is derived using dynamic programming. Let $v(p)$ be the return from drawing an observation of p from F and then proceeding optimally. Let V be the expected value of v taken with respect to the marginal distribution of price. Then by the principle of optimality,

$$v(p) = -c + \max \{V,B(p)\}, \tag{1}$$

where $B(p)$ is the return to buying the good priced at p and then proceeding optimally. Equation (1) implicitly assumes search is timeless; as many observations as are desired can be drawn from F prior to purchase. Consumption, and hence experience, are not timeless. Let the discount rate on these activities be β, $0 < \beta < 1$. The $B(p)$ is defined by

$$B(p) = E[U(p,Q)] + \beta^T E(\max \{V,[U(p,Q) - r]/(1 - \beta^T)\}). \tag{2}$$

This expression incorporates the opportunity cost of experience in the first term and the possibility of renewing search if quality is low in the second term. Using G, (2) can be rewritten as

$$B(p) = E[U(p,Q)] + \beta^T\{VG[q^*(p) \mid p] + \int_{q^*(p)}^{\infty} [U(p,q) - r]/(1 - \beta^T)\, g(q \mid p)\, dq\}, \tag{3}$$

where $q^*(p)$ is that quality level which leaves the consumer indifferent between repurchase and search. That is, $q^*(p)$ is defined by

$$U[p,q^*(p)] - r = V(1 - \beta^T). \tag{4}$$

There are a number of questions one might ask of the solution to the functional equation (1). First, does it preserve the reservation price property? In other words, does there exist a unique price p^* such that when a price greater than p^* is drawn from F the good is rejected and when a price less than or equal to p^* is drawn the good is purchased? In general the answer to this question is negative. This is because no structure has been put on the joint distribution of price and quality. It

may be the case, for example, that high prices are signals of high quality, a relationship which, if strong enough, can make high price observations preferable to low. There is, however, a simple sufficient condition for the reservation price property to hold.

The reservation price is defined by $B(p^*) = V$. The reservation price property is equivalent to the existence of a unique solution to this equation with $B(p) \geq V$ for $p \leq p^*$ and $B(p) < V$ for $p > p^*$. Obviously, $\partial B(p)/\partial p < 0$ will yield such a result.[10] Using (3), it can be shown $\partial B(p)/\partial p < 0$ if the conditional distributions of utility, given price, are stochastically decreasing in p. That is, let $\Psi(\cdot \mid p)$ be the conditional distribution of utility given $P = p$, based on U and G. Then $\partial \Psi(w \mid p)/\partial p > 0$ for all w and p implies $\partial B(p)/\partial p < 0$.

Most of the following results hold qualitatively even in the absence of the reservation price property. But when the property does obtain, the optimal search strategy for the consumer in this model is a natural extension of the basic sequential search rule. Here the optimal strategy is defined by a real number p^* and a function $q^*(p)$ such that if

$$\begin{cases} p > p^*, \text{ the good is rejected; if} \\ p \leq p^*, \text{ the good is purchased and if} \end{cases}$$

$$\begin{cases} p < q^*(p), \text{ the good is rejected; if} \\ q \geq q^*(p), \text{ the good is repurchased.} \end{cases}$$

For the sake of discussion, continue to assume the reservation price property holds. Then $dp^*/dc > 0$ and $dq^*(p)/dc < 0$; when the direct cost of search rises, both higher prices and lower quality become acceptable. These are not surprising results, though. Of more interest is the relationship between acceptable price and acceptable quality. The following properties of the optimal strategy characterize this relationship.

1. To start, assume that c is very large, large enough to make all prices acceptable. Even then it is not necessarily the case that all quality levels are acceptable. In other words, if H is the marginal distribution of price, then $H(p^*) = 1$ does not imply $G[q^*(p) \mid p] = 0$ for all $p \leq p^*$. Thus, when search costs are high the good can "almost" be an experience good—the consumer ignores price, buys the first good sampled and uses experience to find an acceptable price-quality combination. However, the quality level which is acceptable is *not* independent of price.

2. Suppose c is somewhat smaller so that $0 < H(p^*) < 1$. Then $0 < G[q^*(p^*) \mid p^*] < 1$. This result implies that quality is *never* irrelevant when price matters. If it pays to set a reservation price which defines a nontrivial partition of the price set, then at the reservation price (and, because of continuity, in a neighborhood of it) it pays to reject some

10. Although $\partial B(p)/\partial p < 0$ implies p^* is unique, it may be infinite—all prices might be acceptable if search costs are high enough.

quality levels. It also is not necessarily true that $G[q^*(p) \mid p] > 0$ for all $p \leq p^*$; at very low prices it may pay to accept all quality levels rather than resample. In spite of this it remains true that there can never be pure search goods in this model, even when $c = 0$.

3. Next, suppose $c = 0 = r$; both search costs and repurchase costs are zero. In this case $H(p^*) = 0$; only the minimum price in the market is acceptable. Here, once again, $0 < G[q^*(p^*) \mid p^*] < 1$. This is the only case which yields pure experience goods. But it requires perfect information regarding prices.

4. Under two restrictive assumptions, it is possible to investigate the effects of changes in F. If utility is linear in price and quality, and if price and quality are distributed independently, then a mean preserving spread in prices increases net utility and decreases the reservation price. This implies an increase in the consumer's reliance on search relative to experience as a method for finding an acceptable good. With a mean preserving spread in quality, the reservation price rises but the effect on reservation quality levels is ambiguous. It appears most likely that both net expected utility and the consumer's relative reliance on experience increase.

5. It is also possible to study formally the effects of changes in T, the lifetime of the good. In order to do this, assume $U(p,q) = b(T)[u(q) - p]$ where $b(T) = \Sigma_{i=1}^{T} \beta^{i-1}$. This assumption compensates any increase in durability with an appropriate increase in price. Given it, an increase in T has two effects when $r > 0$. Since the opportunity to repurchase is postponed, the cost of consuming at a low quality level is increased. But at the same time the repurchase cost r is paid less often so that it is impossible to predict whether net utility rises or falls as T increases. In spite of this, it *is* possible to sign dp^*/dT. In particular, as long as $H[p^*(T)] > 0$, then $dp^*/dT < 0$, the reservation price falls as durability increases. Hence an increase in durability induces more search prior to the purchase of good.

Some of the results just reported require qualification (with respect to the formal specifications which yielded them, nor their empirical validity). For example, the nonexistence of search goods is partly due to the assumption that quality can never be observed except by actual consumption. A more general formulation would allow quality to be observed prior to purchase at some finite cost. Whether quality is then a search attribute or an experience attribute would be endogenous. Of course, if quality is a search attribute along with price, then the good becomes a search good in the sense Nelson uses that term. On the other hand, with price a search attribute and search costs nonzero, the good could never be an experience good.

Even though the model outlined above is an advance over the existing search literature, it still has some shortcomings when viewed from a consumer research perspective. First, it abstracts from many aspects

of consumer information acquisition on which consumer researchers focus. These include the distinction between internal and external search, problems associated with the sources and types of information consumers seek and the patterns of information acquisition they use (e.g., brand vs. attribute processing), the effects of time pressure, and the role of processing costs. However, many of these considerations can be incorporated into the above model implicitly by suitable redefinitions of product quality and search costs. Second, in this model the consumer is assumed to be a very sophisticated processor of information. Some would argue that such a model is irrelevant since consumers generally use rules of thumb when confronted with imperfect information. This may be true, but the model is still useful since it can be viewed as a step toward developing a theory of "optimal" rules of thumb.

That consumers might rationally choose a rule of thumb was proposed some time ago by March and Simon (1958). However, they never pursued the possibility in any detail, and it remains a potentially rich area of research.

Behavioralists have identified many rules of thumb which apply to choice among multiattribute alternatives, but it is beyond the scope of this paper to survey them in any detail.[11] Therefore, as an illustrative example I will focus on the well-known conjunctive rule. This rule has two components, a set of cutoff levels which are associated with individual attributes and an ordering for inspection of attributes. The strategy is to inspect attributes in the specified order, rejecting an alternative if *any* attribute is unacceptable. The point I intend to make is that neither the cutoff levels nor the ordering should (or need) be taken as exogenous.[12]

The intuitive argument supporting this claim is simple. Consider a consumer inspecting elements from a set of brands, each of which is described by n attributes. The consumer uses a rule of thumb (in particular, the conjunctive) because inspection costs make instantaneous and perfect evaluation impossible. Let the cost of inspecting attribute i be $c_i \geq 0$, and assume the consumer already has in mind a set of cutoff levels. Then in what order should the attributes be inspected? The answer to this question depends on the consumer's subjective estimate of the distribution of the various attributes. This is because given such an estimate the consumer can predict (based on the preset cutoff levels) the probability that any specific attribute will or will not be acceptable. Hence the probability that inspection of the ith attribute will lead to rejecting an alternative can be calculated. Let this probability be ρ_i, $i = 1, 2, \ldots, n$. Suppose that ρ_i is very near one for

11. See Wright (1975) for a taxonomy of the most commonly studied rules of thumb.
12. This argument is adopted from Wilde (1977*c*).

some attribute; that is, suppose the ith attribute is very unlikely to be acceptable. Then one would expect that attribute to be inspected early in the optimal ordering since this minimizes the expected total cost of deciding whether to accept or reject an alternative. The only force which counters this tendency for early inspection of attributes with high values of ρ_i is differential inspection costs; if c_i is extremely large then it may pay to postpone inspection of attribute i even if ρ_i is near one. In fact, if one defines $R(i) = c_i/\rho_i$, then the optimal strategy is to inspect attributes in increasing order of $R(i)$.

Of course, the consumer is ultimately interested in maximizing utility net of search costs. The ordering condition derived above is one necessary condition stemming from this maximization process. Other necessary conditions are associated with the optimal cutoff levels. These are more complicated to derive and they involve somewhat unusual cost-benefit calculations, but combined with the ordering condition they yield a useful characterization of the optimal conjunctive strategy. For example, it turns out that "important" attributes tend to be observed early in the optimal ordering even if they are costly to observe; that is, the cutoff levels on such attributes are set high enough to keep $R(i)$ relatively small even if c_i is relatively large. One can also consider the effects of changes in the consumer's subjective estimate of the distribution of levels of the attributes. If a mean-preserving spread in the marginal distribution of attribute i raises ρ_i more than $\rho_j, j \neq$ i, for example, then attribute i tends to be observed earlier in the optimal ordering.

Results such as these are important because they demonstrate the possibility of building a rigorous theoretical basis for the study of consumer behavior under imperfect information. Moreover, they suggest that economics may provide a unifying methodology for such a construction. However, the use of this methodology to date, by economists, has not been without its own problems.

As suggested in the Introduction, economists tend to focus on market outcomes. As a result, they sometimes make assumptions concerning individual behavior which are at odds with empirical evidence, especially as assembled by consumer researchers. The next section of this paper will discuss two market models and attempt to illustrate this point in more detail.

III. Market Outcomes

While economists have recently paid some attention to individual consumer behavior under imperfect information, a substantial effort has also been devoted to characterizing market organization when agents are imperfectly informed. Product market models include Butters (1977), Salop and Stiglitz (1977), and Wilde and Schwartz (1979). Labor market models include Mortensen (1976) and Wilde (1977*a*). The liter-

ature represented by these papers arose, at least indirectly, in response to Rothschild's critique of early search models. The common thread is a (nondegenerate) equilibrium distribution of prices or wages which emerges endogenously from the interaction of agents in the market—the equilibria involve distributions of wages or prices against which workers or consumers pursue optimal information acquisition strategies and firms maximize profits. Of course, the models all make a number of simplifying assumptions. A common one is that jobs and goods are homogeneous; quality variation plays no role in the analyses. Authors who do emphasize the role of product quality include Nelson (1974, 1975) and Schmalensee (1978).[13] The discussion in this section will focus on their work since it is closely related to the models of individual consumer behavior discussed in the last section.

Both Nelson and Schmalensee consider markets for goods with quality variation in which sellers can advertise. Using the distinction between search and experience goods introduced in his paper on consumer behavior, Nelson advances several propositions concerning various features of advertising. For example, he argues that advertising for search goods will provide direct information about the characteristics of a brand since such information can help the consumer assess the potential utility of the brand. Moreover, only valid claims will tend to be made since, with search goods, advertised claims can be checked prior to purchase. In contrast, there may be incentives for dishonest (or misleading) advertising for experience goods—exaggerated claims may induce trial purchases since the consumer cannot verify them prior to actual consumption of the good. The question is, Even though advertising for experience goods is not likely to provide the consumer with "hard" factual information, is there any *indirect* information that can be gleaned from advertising for experience goods?

Nelson claims that the most useful information that a consumer gets from advertising for experience goods is inferred from the fact of advertising itself. Because high-quality brands will obtain more repeat purchases than low-quality brands, producers of high-quality brands have more incentive to advertise than producers of low-quality brands. This generates a positive relationship between the level of advertising and product quality—the consumer can expect more heavily advertised brands to be better buys. But, since the only trustworthy information associated with advertising for experience goods is provided by the level of advertising, it is likely that advertising for experience goods will concentrate on enhancing the reputation of the brand.[14]

13. Satterthwaite (1979) provides an additional example.

14. There is a counterargument which says that producers of low-quality brands have more incentive to advertise than producers of high-quality brands because they need to maintain a flow of "new" customers (since they get few repeat purchases). The resolution of these counterincentives requires a formal specification of the model. Schmalensee's model, discussed below, attempts to provide such a specification.

While Nelson's analysis of advertising is interesting and suggestive, he does not provide a formal model of the complete market. Schmalensee's model does consider market interactions, although it does not formalize Nelson's model directly.

Developing a complete market model in which consumers pursue optimal information acquisition strategies and firms pursue optimal advertising strategies is a very ambitious task. Schmalensee makes a number of simplifying assumptions in order to keep his model tractable. First, he makes the very strong assumption that sellers optimize but buyers do not. Second, he makes the even stronger assumption that price is identical across firms with only quality varying. Finally, specific functional forms are used on both the supply and demand sides of the market.

Schmalensee considers a single market with N sellers and Q buyers. Each buyer demands precisely one unit of the good each period. The common price charged by all firms is P. Quality is described by parameters $\beta_i \geq 1$, $i = 1, \ldots, N$. These quality parameters effect buyer behavior in the following way. Suppose a consumer purchases brand j in period t. Then with probability $(1 - 1/\beta_j)$ the buyer will be satisfied with brand j and will buy it again in the next period. With probability $1/\beta_j$ the buyer will be dissatisfied and may switch to a different brand in the next period.[15]

The behavior of dissatisfied buyers is sensitive only to the advertising of firms. Let $A_i(t)$ be the expenditure on advertising by firm i in the period t, and $a_i(t)$ the conditional probability that a dissatisfied buyer in period t will switch to brand i in period $t + 1$. Schmalensee assumes that $a_i(t)$ is given by

$$a_i(t) = A_i^e(t) / \sum_{j=1}^{N} A_j^e(t), \tag{5}$$

where e is a nonnegative constant.[16] If $e = 0$, dissatisfied buyers ignore advertising completely. If $e < 1$, consumers respond positively to advertising but less than proportionately. If $e = 1$, dissatisfied buyers can be thought of as purchasing the first brand for which they see an advertisement. Finally, if $e > 1$, the most heavily advertised brand gets a disproportionately high share of the currently dissatisfied buyers.

15. In Schmalensee's model a single purchase gives less than complete information about the quality of the purchase. Hence the product must possess credence qualities in addition to experience qualities. See n. 7 above.

16. This is a Markov model with the transition probabilities a function of product quality. There is an extensive marketing literature dealing with such models (see, e.g., Massey, Montgomery, and Morrison 1970). An approach somewhat similar to Schmalensee's is due to Horsky (1977).

To close the market, it is assumed that the cost of production for a good with quality level β is the same for all firms and is given by

$$c(\beta) = P(1 - k/\beta^{\gamma}), \tag{6}$$

where $1 > k > 0$ and $\gamma \geq 0$. Here γ is a measure of the cost advantage of producing low-quality goods. Since it is natural that the unit cost of production be increasing in quality, $\gamma > 0$ is generally assumed to hold, although $\gamma = 0$ is a possibility.

For any given set of a_i and β_i, consumer behavior is described by a Markov chain. The probability that a consumer who purchases brand j in period t will switch to brand i in period $t + 1$ is given by

$$T_{ij} = (1 - 1/\beta_j)\delta_{ij} + a_i(t)(1/\beta_j), \tag{7}$$

where δ_{ij} is the Kroneker delta. For any initial set of market shares, this process will coverge to a unique vector of equilibrium market shares, say $(q_1, \ldots, q_N)$. If the $A_i(t)$ are fixed at A_i, these shares are given by

$$q_i = \beta_i A_i^{\gamma} / \sum_{j=1}^{N} \beta_j A_j^{\gamma} \tag{8}$$

Notice that if the A_i are all equal then better brands have higher equilibrium market shares since their customers are less likely to become dissatisfied. However, the A_i are in fact set in order to maximize expected profits. Given any set of advertising levels for firm i's rivals, and assuming enough buyers so that the vector of market shares evolves deterministically, expected profits for firm i are

$$V_i = m_i Q q_i(0) - A_i(0) + \sum_{t=1}^{\infty} D^t[m_i Q q_i(t) - A_i(t)] \tag{9}$$

where $m_i = P - c(\beta_i)$ is the unit markup, $q_i(0)$ is firm i's initial market share, $q_i(t)$ is firm i's market share in period t as generated by (7), and D is a discount factor. Focusing on the steady state, Schmalensee is able to derive a number of propositions concerning the relationship between market share, quality, and profits, and the underlying parameters β_i and γ.[17]

Most of the results are established for two special cases: $N = 2$ or $D = 1$. As one might expect, the key parameters in the model are e and γ. Surprisingly, though, it is the interaction of the two which is often crucial. For example, one of the strongest results obtained by Schmalensee is that if $N = 2$ or $D = 1$, then $\beta_i > \beta_j$ implies $q_i < q_j$ if and only if $e\gamma > 1$. Schmalensee describes this result in the following way:

17. Schmalensee's analysis of this model is much more extensive than one might think from reading my discussion of it. In fact, I will consider only two of the many propositions derived by Schmalensee. The interested reader should, of course, consult his paper for a more complete development.

> If dissatisfied buyers are sufficiently responsive to advertising spending, that is, if e is sufficiently large, low-quality brands will optimally advertise enough to more than overcome their rivals' greater ability to hold customers. The most surprising finding here is the positive interaction between e and γ; the cost advantage of low-quality sellers has a stronger positive impact on their equilibrium market shares the larger is e. [T]he more strongly buyers believe that relative advertising levels are a good guide to quality, . . . the more likely that low quality brands can exploit their cost advantages enough to receive the highest market shares. [1978, p. 494]

Schmalensee labels such an equilibrium, in which quality and market shares are inversely related, as perverse. He is able to show that in perverse equilibria (when $e\gamma > 1$) advertising levels are also inversely related to quality. More generally, if $N = 2$ or $D = 1$, and with $e > 0$, $\beta_i > \beta_j$ implies $A_i < A_j$ (*a*) if $e\gamma \geq 1$ and (*b*) only if $\gamma > 0$. Thus, a sophisticated buyer who tries to use advertising levels as a guide to quality will be misled in perverse equilibria.

The necessary condition associated with this last result, $\gamma > 0$, is interesting because it highlights one of the weaknesses of Schmalensee's model. In Nelson's model, the advertising of high-quality goods is more productive than the advertising of low-quality goods because repeat purchase probabilities are higher for them. The factor which offsets this in Schmalensee's model is the negative relation between quality and the profitability of an individual sale when $\gamma > 0$. But price is fixed in his model. There is no reason, in general, to believe that high-quality goods will have lower absolute markups than low-quality goods. If they do not, then Nelson's results must hold since the offsetting factor utilized by Schmalensee vanishes.

The observation that price is fixed is, in a sense, a technical weakness. Other weaknesses, perhaps less obvious to economists, are associated with assumptions governing consumer behavior. In the absence of an assumption that consumers optimize, every attempt should be made to model consumer behavior in a way consistent with observed behavior. For a specific example, consider whether dissatisfied consumers do in fact act in accord with equation (5). More generally, I suspect that many consumer researchers would find the entire approach to advertising outlined in this section extremely ad hoc. But this is obviously one area in which economists can learn a great deal from consumer researchers.

IV. Conclusion

This brief survey only follows one line of recent work by economists on consumer information acquisition. Even this research is in its infancy,

however. For example, the theory of satisfactory choice and optimal rules of thumb is just beginning to be explored.

This paper also illustrates the advantages of greater collaboration between economists and consumer researchers. Economists need to take a closer look at multiattribute choice, focusing on the actual choice strategies used by consumers, while consumer researchers can benefit from the well-developed theoretical paradigms established by economists. Together, we should gain a fuller understanding of consumer information acquisition.

References

Bettman, J. 1979. *An Information Processing Theory of Consumer Choice*. Reading, Mass.: Addison-Wesley.

Butters, G. 1977. Equilibrium distributions of sales and advertising prices. *Review of Economic Studies* 44 (October): 465–92.

Darby, M., and Karni, E. 1973. Free competition and the optimal amount of fraud. *Journal of Law and Economics* 16 (April): 67–88.

Day, G. 1976. Assessing the effects of information disclosure requirements. *Journal of Marketing* 40 (April): 42–52.

Hansen, F. 1972. *Consumer Choice Behavior: A Cognitive Theory*. New York: Free Press.

Horsky, D. 1977. Market share response to advertising: an example of theory testing. *Journal of Marketing Research* 14:10–21.

McCall, J. 1965. The economics of information and optimal stopping rules. *Journal of Business* 38 (July): 300–317.

March, J., and Simon, H. 1958. *Organizations*. New York: Wiley, 1958.

Massey, W.; Montgomery, D.; and Morrison, D. 1970. *Stochastic Models of Buying Behavior*. Boston: M.I.T. Press.

Mortensen, D. 1976. Job matching under imperfect information. In O. Ashenfelter and J. Blum (eds.), *Evaluating the Labor Market Effects of Social Programs*. Princeton, N.J.: Princeton University Press.

Nelson, P. 1970. Information and consumer behavior. *Journal of Political Economy* 78 (March/April): 311–29.

Nelson, P. 1974. Advertising as information. *Journal of Political Economy* 81 (July/August): 729–54.

Nelson, P. 1975. The economic consequences of advertising. *Journal of Business* 48 (July): 213–41.

Newman, J. 1977. Consumer external search: amount and determinants. In A. G. Woodside et al. (eds.), *Consumer and Industrial Buying Behavior*.

Rothschild, M. 1973. Models of market organization with imperfect information: a survey. *Journal of Political Economy* 81 (December): 1283–1308.

Salop, S., and Stiglitz, J. 1977. Bargains and ripoffs: a model of monopolistically competitive price dispersion. *Review of Economic Studies* 44 (October): 492–510.

Satterthwaite, M. 1979. Consumer information, equilibrium industry price and the number of sellers. *Bell Journal of Economics* 10 (Autumn): 483–502.

Schmalensee, R. 1978. A model of advertising and product quality. *Journal of Political Economy* 86 (June): 485–504.

Stigler, G. 1961. The economics of information. *Journal of Political Economy* 69 (June): 213–25.

Stigler, G. 1962. Information in the labor market. *Journal of Political Economy* 70 (October): 94–105.

Wilde, L. 1977*a*. Labor market equilibrium under nonsequential search. *Journal of Economic Theory* 16 (December): 373–93.

Wilde, L. 1977*b*. On the formal theory of inspection and evaluation in product markets.

Caltech Social Science Working Paper no. 153, California Institute of Technology. Forthcoming in *Econometrica*.

Wilde, L. 1977*c*. Satisfactory choice and the optimal use of information. Mimeographed. Pasadena: California Institute of Technology.

Wilde, L., and Schwartz, A. 1979. Equilibrium comparison shopping. *Review of Economic Studies* 96 (July): 543–53.

Wright, P. 1975. Consumer choice strategies: simplifying versus optimizing. *Journal of Marketing Research* 12 (February): 60–67.