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Consumer Purchasing Strategies and the Information in Retail Prices

GERARD J. TELLIS
Assistant Professor of Marketing
The University of Iowa
Iowa City, Iowa

This paper attempts to determine whether retail prices convey information on product quality. The study is motivated by many experimental studies that have suggested that consumers do make inferences about quality from price, and many market studies suggesting that such inferences would be misleading. This paper proposes a normative model of the consumer decision process under uncertainty, based on economic and decision theories. The model suggests that several consumer strategies may be optimal, depending on consumer and market characteristics. Application of the model to the ecological price-quality relationship indicates that prices communicate information on quality under certain conditions, and that consumers may use two rival strategies to exploit it.

Do retail prices convey information to consumers about product quality? In the last few decades, two traditions of research on the price-quality relationship have evolved fairly independently. One examined the empirical relationship between retail prices and quality levels, using a variety of measures, time periods, and product categories. The general conclusion from these studies was that the positive correlation between price and quality is weak and very variable (Tellis and Wernerfelt 1987). As a result, some authors have suggested that in the real world, price may not be a good indicator of quality (Gerstner 1985; Oxenfeldt 1950; Sutton and Riesz 1979). Another research stream, including about 40 experimental studies carried out over 30 years, sought to determine whether consumers

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infer quality from list price (e.g. Huber and McCann 1982; Lambert 1972; Tull, Boring, and Gonsior 1964). A review of these studies indicates that consumers do infer quality from price under certain circumstances (Monroe and Petroshius 1981).

The outcomes of these research streams raise two interesting questions: if the ecological relationship between price and quality is weak, why do consumers tend to infer quality from price in experimental situations? Alternatively, if consumers are prone to infer quality from price in the lab, what information can they glean from market prices?

The answer to these questions lies in understanding the heterogeneity among consumers and their shopping situations. Consumer inference is a complex phenomenon, one that depends on an interaction of consumer and market characteristics. Depending on the interplay of characteristics, several consumer strategies are possible. I identify four classes of "pure" consumer buying strategies: "informed," "high-price," "low-price," and "random." Two of these strategies exploit the information in market prices when quality is uncertain: the high-price (or inference) strategy describes the well known phenomenon of consumers buying the higher-priced brand with the expectation of higher quality; the low-price strategy describes the phenomenon of consumers buying the lower-priced brand with the expectation of minimizing certain loss. While the former phenomenon has been extensively studied in marketing, the importance of the latter phenomenon has only recently been realized following the work on behavioral decision theory, especially by Kahneman and Tversky (1979) and Thaler (1980, 1985).

This study suggests that the two strategies are related by similar market and consumer characteristics, and need to be analyzed together. It also suggests that markets are heterogeneous, with different consumer segments. Each of the four strategies above is best for a particular consumer segment. The inconsistency of findings across studies or across research paradigms may be due to our failure to recognize the heterogeneity of consumers and the variety of existing consumer strategies.

In this study a normative model of consumer choice behavior is defined, based on decision and economic theories in the literature. The model is then applied descriptively to the ecological price-quality relationship, in order to identify appropriate domains for these strategies. There are several benefits from a study of this type. First, the analysis can suggest what are efficient shopping strategies for consumers in the current retail environment. Such an approach can complement current research efforts focusing on normative managerial and public policy models. Second, the model can also be used by managers to develop appropriate price-quality

levels for specific consumer segments, especially those that are not now being served appropriately. Third, the theoretical model provides a broad framework for understanding consumer behavior under uncertainty. It could be validated in experimental situations, or by a meta-analysis of past experimental studies. It would thus be a useful addition to our knowledge in a field where authors have frequently called for theory development (Olson 1977; Monroe and Petroshius 1981).

This study deals with a world in which price is better known than quality. This may not be an uncommon situation, because price is a deterministic attribute with fixed values that consumers can ascertain relatively easily by scanning shelves or sales brochures, or by calling up to request them. On the other hand, quality is an inherently probabilistic attribute which consumers may find very difficult to ascertain by inspection. Moreover, even experience may not be a perfect guide to quality, because of frequent product changes, high consumer inertia, and consumers' limited search behavior (Newman 1977). Many if not most consumer purchases may therefore be made under some uncertainty about quality.

THEORY

Choice Strategies under Uncertainty

Product quality is defined as an attribute beneficial to all consumers. Freedom from defects, reliability, efficiency, safety, and purity of ingredients are some of its common dimensions. Quality is defined independently of price, and all consumers would prefer more of it to less. How would consumers choose products when price is known but quality is uncertain? Based on prior research (e.g. Cooper and Ross 1984; Tellis and Wernerfelt 1987) we may say that the strategy chosen, S_j, depends on the consumer's maximization of utility through trade-offs among three factors: the quality and price payoff from the jth strategy, Q_j, and P_j respectively, the utility of such quality and price, $U_q(Q_j)$ and $U_p(P_j)$, respectively, and the utility of obtaining information on price and quality for that strategy, $U_c(P_j,Q_j)$. Thus:

$$S_j = \text{Max}_j\,[U_q(Q_j),U_p(P_j),U_c(P_j,Q_j)], \qquad (1)$$

where $Q_j = E(Q_i/S_j)$ and $P_j = E(P_i/S_j)$ are the expected quality and price obtained by using S_j, from the market distribution of qualities (Q_i) and prices (P_i). I assume that $U_q(\cdot)$ is monotonically increasing and concave in Q; $U_p(\cdot) < 0$, and is monotonically decreasing in P; $U_c(\cdot) < 0$, is additively separable in P and Q, and is monotonically decreasing in the

number of P's and Q's information is obtained on. In this formulation the correlation between price and quality affects the expected values, Q_j and P_j, as shown subsequently, but not the search costs, $U_c(P_j,Q_j)$. The consumer makes a purchase only if the value of equation (1) is positive.

We can truncate the continuum represented by the above equation to identify four regions for four classes of choice strategies (j = i, s, r, a), each of which is applicable to particular situations. If $|U_c(P,Q)|$ is small relative to $\{U_q(Q),U_p(P)\}$, then the best strategy would be a full information strategy, S_i. In this case the consumer obtains all information on prices and qualities in the market and chooses the one that best satisfies him or her. On the other hand, if $|U_c(P.Q)|$ is high relative to $\{U_q(Q),U_p(P)\}$, then the consumer is best off using a random strategy, S_r, without incurring the high costs of collecting information on price and quality. In this case, the expected quality and price would be the average of the prevailing qualities and prices in the market. Formal models that support the rationality of a random purchase have been developed by Salop and Stiglitz (1977) and Varian (1980).

Generally however, price information is easy to obtain but information on quality is not. In this case, when $|U_c(P)|$ is negligible but $|U_c(Q)|$ is high, two more strategies become relevant. If the consumer also has a strong need for quality [$|U_c(P)|$ is negligible but $|U_c(Q)|$ is high relative to $\{U_q(Q),U_p(P)\}$], then the consumer could infer quality from price and buy the highest-priced brand available (high-price strategy, S_s). The consumer runs the risk of a bad buy while paying a premium, but if the correspondence between highest prices and quality is strong, the utility of the expected quality from this strategy, $U_q(Q_s)$, relative to the expected price, $U_p(P_s)$, may mean that this strategy has the best overall utility. So the correspondence between price and quality determines the quality payoff and hence the merit of this strategy. Experimental evidence seems to indicate that consumers do indeed use price to infer quality (Monroe and Petroshius 1981), while formal analysis (Cooper and Ross 1984; Tellis and Wernerfelt 1987) supports the rationality of such a choice under the conditions outlined above.

On the other hand, if the correspondence between high prices and qualities is weak, or the consumers' utility for quality is low, then the consumer could choose the lowest-priced product, with the expectation of no worse than the lowest quality, and the uncertainty of paying the least possible amount (a low-price strategy, S_a). Work by Kahneman and Tversky (1979) and Thaler (1980, 1985) indicates that consumers do tend to overweight certain events and under-weight opportunity costs (the certainty and endowment effects, respectively). In this case, the known attribute,

price, may become all-important relative to the unknown, quality, so that the decision process becomes primarily one of price minimization and consumers choose the lowest-priced product. While Equation 1 describes the multidimensionality of the consumer's strategy choice, a simplified though possibly helpful picture of the domain of these strategies is presented in Figure 1 in two dimensions.

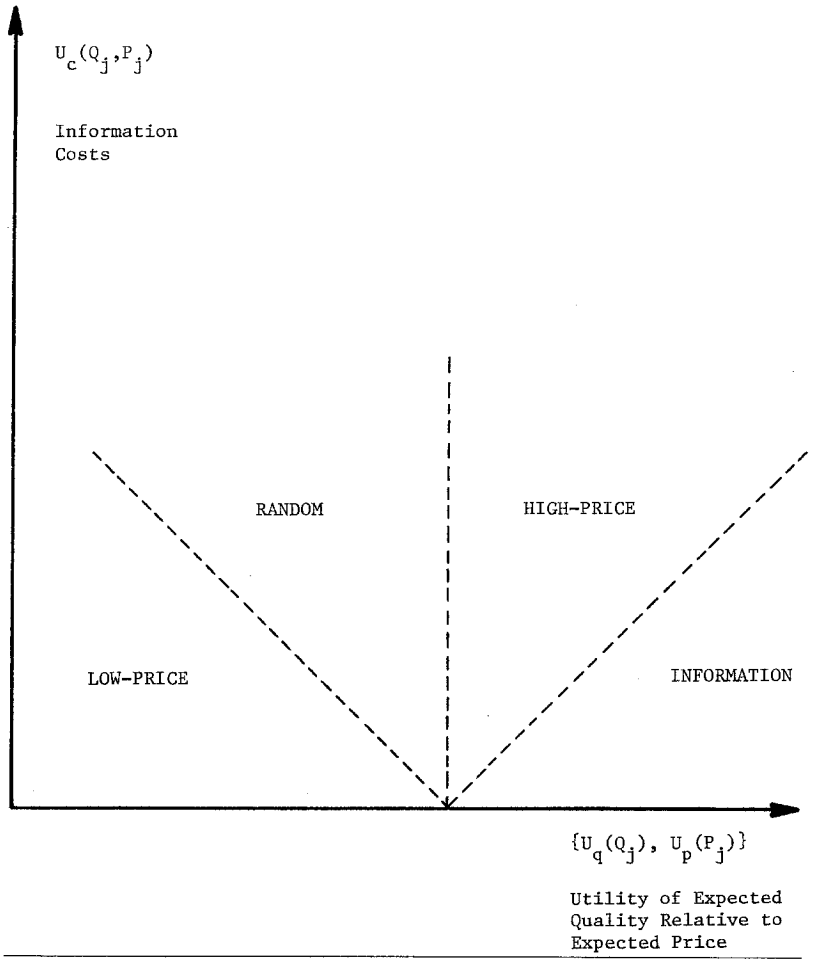
The four strategies described are "pure" or "degenerate" strategies that exist only when consumers are either fully informed on price and quality, fully informed only on price, or fully uninformed. If the distribution of brands and prices is such that consumers may be informed about only some brands in the market, then a series of "mixed" strategies become viable. Consumers randomly obtain information on some subset of brands and then adopt one of the pure strategies on these. The result is a mixed strategy that lies between a random strategy and one of the other three pure strategies. The mixture depends on the sample size relative to the number of brands in the market (as derived in Equations A2–A5 in the Appendix). If the sample size is less than two, then the strategy degenerates to a random strategy. If the sample size equals the number of brands in the market, then the strategy degenerates to one of the other three pure strategies. The number of brands sampled for information depends, itself, on such factors as purchase frequency, the number of brands stocked by stores, the relative location of stores, and the ease of obtaining information by phone or from shopping lists.

The above strategies also assume that consumers have no budgetary constraints within the range of available prices. If this does not hold, then in the case of the high-price strategy consumers would choose the kth highest-priced product, in conformity with their budget. The resultant strategy is also a mixed strategy, lying between the high-price and the low-price strategies. One example of this is the choice of a median-priced product, which some studies indicate is used by consumers faced with quality uncertainty (Monroe and Petroshius 1981).

The most important point here is that price could convey information on good deals in two ways. Through a high-price strategy, high price could indicate high quality. Through a low-price strategy, conversely, price could indicate products that are of low price but not necessarily low quality. Since consumers using these two strategies choose products on the basis of price alone, the expected quality essentially depends on the correspondence between market prices and qualities. This correspondence is thus the key external factor affecting quality payoffs and consumer purchasing strategies. While the correspondence between price and quality does not directly affect search costs, $U_c(P,Q)$, by making the high-price or

FIGURE 1

Domain of Strategies in Two Dimensions



Assumptions: 1. Price is better known than quality: $U_c(P) < U_c(Q)$. 2. On average, higher price is an indicator of higher quality.

low-price strategy particularly attractive, it could obviate the need for incurring the search costs of the full information strategy. Thus, analysis of what information consumers can use from retail prices depends primarily on an analysis of the quality and price payoffs associated with various strategies.

Derivation of Quality and Price Payoffs

Since quality is typically measured as a rank-order variable, all references to quality measures are in terms of ranks. The term "quality payoff" is the difference in quality obtained from any two strategies. To determine the benefit of using each strategy, we need to compare the expected quality from these strategies. For pure strategies (i.e. with no budgetary constraints), we need to compare the quality ranks of the most expensive brand (chosen from the high-price strategy), the best quality brand (chosen from the informed strategy), the least expensive brand (chosen on a low-price strategy), and the average quality brand (which would be the expected outcome of a random strategy). However, for mixed strategies, the statement of the payoff is more complex, because it involves comparisons among the expected payoffs of the high-price and low-price strategies, which are now dependent on the number of brands in the market and the consumer's sample size. The expected quality for each strategy is presented in the Appendix. That analysis indicates that the payoffs from the mixed strategies rapidly approach that of the pure strategies as the sample size, r, increases. This may be seen by differentiation of the payoff functions of the Appendix.

The derivation of the price payoffs may be obtained in the same way.

Hypotheses

H_1. We can test for the existence of three possible scenarios regarding the information conveyed by market prices. (1.1) Price conveys some information on quality, and the payoff from the high-price strategy exceeds that of the low-price strategy; since in this scenario there is a positive price-quality relation, it may be considered an efficient market. (1.2) Price conveys no information on quality, and there is no difference in the payoff between the high-price and low-price strategy; that is the null hypothesis, representing an inefficient market. (1.3) Price does convey information on quality, albeit of a perverse type, and the payoff of the low-price strategy exceeds that of the high-price strategy; this situation would represent a perverse market. The theoretical and empirical existence of such equilibria has been established by Tellis and Wernerfelt (1987).

H_2. If prices convey information on quality, then the quality payoffs of the high-price and low-price strategies are likely to be obverse to each other. This is because the better the correspondence between price and quality, the more likely it is that the most expensive product will be of the best quality, and the greater the payoff of the high-price strategy; for the same reason, as the correspondence between price and quality gets

stronger, the more likely it is that the cheapest product will be of lowest quality, and the smaller the payoff of the low-price strategy. As the correspondence between price and quality gets weaker, the reverse situation will hold.

H_3–H_6. The payoffs of the high-price strategy would be (3) higher for product categories with a higher price range, and (4) higher for durables than for nondurables. Conversely, the payoffs of the low-price strategy would be (5) lower for product categories with a higher price range, and (6) lower for durables than for nondurables. The reasons for these hypotheses follow.

Durables generally cost more and last for a longer period of time than nondurables. A good quality product would therefore pay dividends over a longer time period, in terms of lower maintenance or replacement costs. Accordingly, consumers would be better informed for durables and would better avoid low-quality, high-priced products, so that the correspondence between price and quality would be higher for durables (see Tellis and Wernerfelt 1987 for a proof and supporting evidence). As a result, the quality payoffs of the high-price strategy would be higher for durables, but the payoffs of the low-price strategy would be lower for these products.

When the range in prices is wide, the rewards of an information search would be large. Accordingly, more consumers would search and be informed in the case of products with a wide price range. That would eliminate low-quality, high-priced products, resulting in a better correspondence between price and quality (see Tellis and Wernerfelt 1987 for a proof and supporting evidence). As a result, the quality payoffs of a high-price strategy would be higher, and that for a low-price strategy would be lower, for merchandise categories with a greater range of prices for different brands.

EMPIRICAL EVIDENCE

Scope

This analysis seeks to determine to what extent the price system conveys information on objective quality, when consumers adopt certain simple choice strategies. It considers only the four pure strategies. (An analysis of the payoffs of the median strategy was also performed, but the payoffs of this strategy did not differ substantially from the random strategy, and in the interests of simplicity, these results are not presented). The study may be considered a descriptive analysis of the information in

retail prices, or a normative analysis of appropriate strategies for consumers given the market environment.

The price and quality data published by Consumers' Union (CU) in their *Consumers Guide* were used because of the objectivity, reliability, and validity of this source (Curry 1985; Curry and Faulds 1986; Thorelli and Thorelli 1977). Moreover, a survey confirmed what the widespread availability of *Consumer Reports* and the *Buying Guide* seems to indicate, that consumers consider these publications to be their most important sources of quality information, above *Good Housekeeping*, friends, relatives, salespersons, and endorsements (Curry 1985).

Some points regarding the data need clarification. Aside from the cases where CU's judges determine that quality ranks are inappropriate, CU also puts out tied ranks for brands that have been judged to be of equal quality. The distance between ranks is independent of the presence of ties (i.e., 1 is one rank better than 2, irrespective of the ties in 1). Prices presented by CU are the mean of either the quoted retail prices obtained from market surveys, or the retail prices paid by members, or the published list (retail) prices, in that order of preference, subject to data availability. With respect to list prices, while local discounting certainly exists, since this is likely to apply across brands it should not affect our main conclusions about the price-quality relationship. A limited test of the heterogeneity of the price-quality relationship over source of price data indicated no significant differences.

While errors in measuring price and quality may still weaken the observed relationships, that problem may not severely limit this study, which analyzes systematic variation in patterns across categories as predicted by the hypotheses above.

Data

The price and quality figures are from the most current entries of 156 product market evaluations published in the 1980–1983 issues of CU's *Buying Guide*. In this sample, 65 of the evaluated product markets involved retail prices paid by subscribers, 12 involved retail price quotations obtained from national surveys, 70 involved list prices, and the remaining 9 involved "approximate" retail prices, with the exact method unspecified. For nondurables, if package size varied, the cost for equivalent volume was used as price. Some of these product market evaluations could not be used in the analysis because of missing price information,

incomplete listing of products evaluated, or CU's failure to determine differences in quality.

Analysis

I first determined the price-quality pairs with the highest, average, and lowest price and highest and average quality in each of these 156 product markets, making the following adjustment for tied ranks: when n brands are tied for the same rank starting from the mth position, all of the brands in that tie are given the rank $(2m+n-1)/2$ as described by Kendall (1970). This applies for the first position, too. However, when n brands tie for the first position, the price assigned the "best" quality brand is the lowest of those n prices. While this is mathematically incorrect, it is reasonable in the light of consumer utility maximization.

I then calculated the price and quality payoffs of different strategies for each product market. In particular, I contrasted the payoffs of the high-price and low-price strategies against the random strategy. The latter can be considered the strategy of choice if there is no relationship between price and quality. For purposes of comparison, the payoff between the information and random strategy is also calculated. As a more direct test of the hypotheses, I also calculated the payoff between the high-price and low-price strategies.

Finally, to test the hypotheses, I determined if there are differences in the mean payoffs between pairs of strategies, across the whole sample of 156 product markets and across subsamples of these product markets, classified by product durability and price ranges. For this purpose, I used the t- and F-tests of means, as applicable. For ordinal data, analysis should be based on the median. However, since the comparison involves payoffs across strategies on the same ordinal scale, and these scales have a large

TABLE 1

Mean Quality Payoffs by Price Range: High-Price Strategy versus Low-Price Strategy

Extent of Price Range ($)	Mean Payoff	t-stat	N
.12	−.52	−.51	29
0.80	1.2	.74	31
21.70	1.5	1.5	30
96.60	4.1	3.7	28
349.60	7.2	3.5	28
Total	2.6	4.0	146

number of levels, we can treat the scales as interval. In any case, tests based on the median did not differ from those reported here.

RESULTS

Analysis of Quality Payoffs

Table 1 shows the mean payoffs of the high-price strategy versus the low-price strategy. These payoffs may be interpreted as the improvement in quality (ranks) obtained by using the high-price strategy instead of the low-price strategy. A positive sign means that the high-price strategy yields a better quality, while a negative sign means that the low-price strategy yields a better quality. The last row, Total, indicates that the quality payoff is significantly different from zero at the .01 level or better across all product markets. Thus we may reject the null hypothesis (1.2) that price conveys no information on quality. Similarly, we may also reject one alternative hypothesis (1.3), that the market may be perverse, with the payoff from the low-price strategy exceeding that of the high-price strategy. So, overall, choosing the highest-priced product does provide a better quality product than choosing the lowest-priced product, in support of Hypothesis 1.1.

However, Table 1 also shows a systematic difference in these results across widths of price range. When the range in prices is narrow, we get a perverse result, with the low-price strategy yielding a better quality payoff than the high-price strategy, but the difference is not significant at the .05 level. When the range in prices is wide, the results are more well-behaved, with the high-price strategy yielding a better payoff. These differences follow the pattern predicted by the third hypothesis: the wider range in prices leads to higher rewards for search, and motivates consumers to be better informed. This results in a closer relationship between price and quality, and the superiority of the high-price strategy. Table 2 presents a

TABLE 2

Mean Quality Payoffs by Product Durability: High-Price Strategy versus Low-Price Strategy

Product Type	Mean Payoff	t-stat	N
Nondurables	.42	.41	57
Durables	4.0	4.9	89
Total	2.6	4.0	146

TABLE 3

Mean Quality Payoffs by Price Range: Information, High-Price, and Low-Price Strategies versus Random Strategy

Extent of Price Range ($)	Information		High-Price		Low-Price		
	Payoff	t-stat	Payoff	t-stat	Payoff	t-stat	N
0.12	5.3	7.4	−.01	−.01	.51	.67	29
0.80	6.7	8.7	.21	.20	−.99	−1.1	31
21.70	4.4	7.7	1.1	1.2	−.43	−1.2	30
96.60	6.4	10.2	2.8	3.7	−1.3	−1.8	28
349.60	7.4	7.8	3.8	2.9	−3.4	−3.5	28
Total	6.2	18.2	1.5	3.4	−1.1	−3.1	146
(*F*, sig)[a]	(2.5, .1182)		(10.9, .0012)		(10.8, .0013)		

[a] The F-statistic is used to test the hypothesis that there is a linear trend in payoffs across categories. This is a more rigorous F-test than one merely for differences across categories.

similar analysis by product durability, confirming Hypothesis 1.1 for durables.

Tables 3 and 4 show the mean payoffs of the high-price, low-price, and information strategies compared to the random strategy. These payoffs may be interpreted as the improvement in quality from using any of these three strategies instead of the random strategy. Note that as the payoffs of the high-price strategy increase, those of the low-price strategy decrease. This result confirms our second hypothesis, that if prices convey informa-

TABLE 4

Mean Quality Payoffs by Product Durability: Information, High-Price, and Low-Price Strategies versus Random Strategy

	Information		High-Price		Low-Price		
Product Type	Payoff	t-stat	Payoff	t-stat	Payoff	t-stat	N
Nondurables	6.5	12.2	.02	.03	−.40	−.65	57
Durables	6.0	13.5	2.5	4.5	−1.5	−3.7	89
Total	6.2	18.2	1.5	3.4	−1.1	−3.1	146
(F, Sig)[a]	(.51, .4778)		(7.5, .0068)		(2.5, .1138)		

[a] The F-statistic is used to test the hypothesis that there is a linear trend in payoffs across categories. This is a more rigorous F-test than one merely for differences across categories.

tion on quality, then the payoffs of the high-price and low-price strategies are likely to be obverse to each other.

Table 3 reveals a pattern in the increase and decrease in these payoffs. The payoff of the high-price strategy keeps increasing with the range in prices for products in that class, the trend being significant at better than the .01 level (as determined by the F-test); conversely, the payoff of the low-price strategy keeps decreasing with the range in prices for products in that class, with the trend again significant at better than the .01 level. Both of these results are as predicted by Hypotheses 3 and 5, respectively, indicating that prices convey more information on quality in product classes where consumers are likely to be better informed due to the greater range in prices. Table 4 presents a similar analysis by product durability. Again, as predicted in Hypotheses 4 and 6, the payoff of the high-price strategy is higher for durables, in which case consumers are likely to be better informed; conversely, the payoffs of the low-price strategy are lower for durables. In this case the F-test indicates that the increasing trend in payoffs over categories is significant at the .01 level only for the high-price strategy.

Analysis of Price Payoffs

The comparison of price and quality pairs obtained by various strategies shows how much more or less consumers would have to pay by adopting any of these strategies. Tables 5 and 6 present the price savings from using the high-price, low-price, or information strategy instead of the random strategy. Negative values indicate price premiums that consumers must

TABLE 5

Mean Price Payoffs by Price Range: Information, High-Price, and Low-Price Strategies versus Random Strategy

Extent of Price Range ($)	Information		High-Price		Low-Price		
	Payoff	t-stat	Payoff	t-stat	Payoff	t-stat	N
0.12	−.01	−.53	−.08	−7.8	.03	8.0	30
0.80	.06	.62	−.44	−7.1	.37	5.2	31
21.7	−1.0	−0.58	−12.2	−8.2	9.5	9.3	32
96.6	−11.7	−1.8	−54.7	−14.1	41.9	10.7	30
349.6	−53.4	−1.5	−213.5	−7.1	136.3	8.9	30
Total	−12.7	−1.8	−55.2	−6.3	37.0	7.1	153

pay. (These tables are analogous to Tables 3 and 4, but for price instead of quality). Notice that the high-price strategy, on the average, involves a premium over the random strategy for all product classes. The premium is significantly different from zero even when its absolute value is small. As we might expect, the convenience of obtaining a superior quality by merely buying the highest-priced product does not come without a price tag of its own. Going back to our choice model, the high-price strategy must appeal to consumers who certainly want superior quality, can easily obtain price information, have neither information nor time to resolve the uncertainty about quality, but have enough disposable income to buy the highest-priced product.

Conversely, Tables 5 and 6 indicate that, on the average, the low-price strategy results in price savings for all classes of products. This would be an ideal strategy for consumers who do not put much weight on quality, but for whom the marginal saving on price is important.

SUMMARY AND DISCUSSION

What information can consumers glean from market prices? This analysis indicates that there is no simple, single answer to the question. Markets are heterogeneous in the pattern of observed price-quality relationships. However, since consumers are also likely to differ in their search costs and their need for high quality and low prices, different purchasing strategies may maximize utility for different consumers. This was the thrust of the theoretical model; the empirical findings justify the contingent approach. The analysis leads to specific conclusions about the utility of the hypothesized strategies.

First, prices do convey information on quality, but the use of the high-price strategy may not always maximize consumers' utility. In particular, there seems to be no advantage to using such a strategy for nondurables or for product categories where the mean price range is less than about $42 (the cutoff point in the price range between the third and fourth catego-

TABLE 6

Mean Price Payoffs by Product Durability: Information, High-Price, and Low-Price Strategies versus Random Strategy

	Information		High-Price		Low-Price		
Product Type	Payoff	t-stat	Payoff	t-stat	Payoff	t-stat	N
Nondurables	−.00	−.11	−.28	−5.4	.16	5.6	58
Durables	−20.8	−1.8	−88.8	−6.8	59.5	8.0	95
Total	−12.7	−1.8	−55.2	−6.3	37.0	7.1	153

ries). In such markets, the high-price strategy does not provide a better quality than the random strategy, but does involve a significantly higher premium. For durables and products with a mean price range greater than $42, however, the high-price strategy does provide a significantly higher quality product, albeit at a premium. For consumers with high search costs, a high utility for quality, and a low utility for money, the high-price strategy should be appealing.

An interesting result of this study is its demonstration of the relevance and importance of the low-price strategy. Its appeal is probably more extensive than that of the high-price strategy, and is particularly strong in those circumstances where the latter fails. For example, in nondurables and those categories with a price range narrower than about $42, the low-price strategy when compared with the random strategy does not lead to a significant loss in quality, but involves a significant savings in price. Thus it outperforms the high-price strategy irrespective of the consumer's demand structure. For the remaining categories, while the low-price strategy does provide a lower quality product than the random strategy, the savings in price are substantial enough to make it attractive to consumers with a relatively lower utility for quality.

A third interesting result is the confirmation of the predicted differences in the payoff of these strategies across categories. In general, the high-price strategy has a higher payoff for durables and products with a wide price range; the low-price strategy shows the opposite trend. Even then, the dominance of the low-price strategy over the high-price strategy for nondurables and product classes with a narrow price range and the perverse price-quality relationship in the class with the lowest price range are surprising. The probable reason for it is that, for low-price range products, consumers are just not motivated to search and may be inclined to purchase randomly or by inference. Firms are likely to take advantage of such behavior by marketing more high-priced, low-quality products, leading to these results.

Research Implications

The results of this research have implications for two streams of related research. First, research on the price-quality relationship carried out over 30 years by researchers in marketing, economics, and consumer welfare has concluded that consumer information on quality may be inadequate (e.g. Geistfeld 1982; Oxenfeldt 1950; Maynes 1975; Maynes and Assum 1982; Riesz 1978, 1979; Thorelli and Thorelli 1977). Many of these researchers have called for better dissemination of information by firms, consumer groups, or public agencies. While better information dissemina-

tion should support the efficiency of the market, the proper reading of price signals can also do so. In particular, the purchase of the lowest-priced product by consumers uninformed on quality yields immediate price savings, obtains fairly good quality, and discourages premium pricing by firms attempting to exploit consumer ignorance. In this regard, the low-price strategy may be considered a form of risk-free "insurance" for uninformed consumers that limits the number of inefficient firms and reduces the probability of perverse markets.

The results of this study also complement the findings of over 40 experimental studies that consumers may use higher prices to infer higher quality. The results indicate that certain market conditions may support the use of such a strategy for certain consumer segments. It is probably the use of just these sorts of markets and consumers characteristics in experimental situations that has generated consumer inference. The theoretical model presented here may explain the divergence in the results of these experimental studies (Olson 1977). This study also emphasizes the inherently obverse relationship between the low-price and high-price strategies. The work of Kahneman and Tversky (1979) and Thaler (1980, 1985) supports the prevalence of risk-aversion, which can be linked to the low-price strategy. Future studies in the area may therefore benefit by designs that analyze these two phenomena concomitantly. The theoretical model may suggest the circumstances in which one strategy may prevail over the other.

We need to mention several caveats in this study, which also suggest areas of future research. Most importantly, the study is a descriptive analysis of retail conditions and a normative analysis of consumer behavior. Descriptive analyses of consumers' choice strategies, utility for quality, and cost of information would complement our understanding of what strategies consumers actually adopt, why they do so, and what their utility maximization decision rules are. At the same time, descriptive analyses of the validity of price and quality information published by Consumers Union would strengthen research in this area and probably throw more light on this problem. Another valuable line of research would be one investigating which types of firms are responsible for the asymmetry in the price-quality relationships, the reasons for it, and consequent methods of promoting the efficiency of the market.

A third worthwhile line of research would be to determine, by theoretical analysis or laboratory simulations, whether market prices could ever be perfect signals of product qualities. Grossman and Stiglitz (1976) have argued against this possibility in the stock market, and the same logic might hold for consumer markets. The reason is that, if price were a per-

fect signal of quality, then consumers need buy only by price and would have no motivation to inspect or search for superior quality. In that case, at least some firms would be motivated to cheat on quality, which would disturb the perfect relationship between price and quality!

APPENDIX 1
DERIVATION OF QUALITY PAYOFFS FOR VARIOUS STRATEGIES

The expected quality for the high-price (inference) strategy is given by:

$$E(Q_s) = \sum_{k=1}^{N} \{P(p_k) \cdot Q(p_k)\} \tag{A2}$$

where $P(p_k)$ is the probability of the kth highest-priced brand being chosen by the high-price strategy

p_k is the rank of the kth highest-priced brand (e.g., $p_k = 1$ for the highest price)

$Q(p_k)$ is the quality associated with the kth highest-priced brand

and
$$P(p_k) = \begin{cases} {}^{N-k}C_{r-1}/{}^{N}C_r, \text{ for } 1 \leq r \leq N \text{ and } N - r \geq k - 1 \\ 0, \text{ for } 1 \leq r \leq N \text{ and } N - r < k - 1 \end{cases} \tag{A3}$$

where N is the number of brands in the market and

r is the number of brands sampled by the consumer or consumer group.

The expected quality for the low-price strategy $E(Q_a)$ is given by

$$E(Q_a) = \sum_{k=1}^{N} \{P'(p_k) \cdot Q(p_k)\} \tag{A4}$$

where $P'(p_k)$ is the probability of the kth highest-priced brand being chosen in a low-price strategy

and
$$P'(p_k) = \begin{cases} {}^{k-1}C_{r-1}/{}^{N}C_r, \text{ for } 0 \leq r \leq N \text{ and } k \geq N \\ 0, \text{ for } 0 \leq r \leq N \text{ and } k < N. \end{cases} \tag{A5}$$

The expected quality for the random purchasing strategy is the average quality of all the brands in the market, and is given by:

$$E(Q_r) = \frac{1}{N} \sum_{k=1}^{N} Q(p_k) \tag{A6}$$

Proof for Equation A3

For $N - r \geq k - 1$ the probability, $P(p_k)$, of the kth highest-priced brand being selected by a consumer examining r brands, is the product of the number of ways, P_k in r, of the kth brand being in r, the number of ways, $P_{m<k \text{ in } r}$, of all other brands (m) in r being of lower rank, divided by the number of ways, P_r, that the sample can be chosen, i.e.:

$$P(p_k) = (P_{k \text{ in } r} \cdot P_{m<k \text{ in } r})/P_r \quad \text{(A7)}$$

Following basic probability rules:

$$P_{k \text{ in } r} = {}^{1}C_{1} \quad \text{(A8)}$$

$$P_{m<k \text{ in } r} = {}^{N-k}C_{r-1} \quad \text{(A9)}$$

$$P_r = {}^{N}C_r \quad \text{(A10)}$$

Substituting Equations A8, A9, and A10 in A7 gives us the result in Equation A3. When the *k*th rank is so high and the sample size is so large, such that the number of brands not sampled (N − r) is less than k − 1, then k will never be chosen and $P(p_k) = 0$.

Q.E.D.

Proof for Equations A2, A4, and A6

The expected quality of any strategy is the average of the quality of brands available, weighted by the probability of that particular brand being selected on its price rank. For the random purchasing strategy the probability of any brand being chosen is 1/N.

Q.E.D.

Proof for Equation A5

Let j equal the rank of the lowest-priced brand. Then $P'(p_k)$ can be obtained from Equation A7 in terms of j. Since j is the inverse order of k, $j = N - k + 1$.

Q.E.D.

An important point to note here is that the payoffs from the mixed strategies rapidly approach that of the pure strategies as the sample size r approaches N.

REFERENCES

Cooper, R., and T. W. Ross (1984), "Prices, Product Qualities and Asymmetric Information: The Competitive Case," *Review of Economic Studies,* **51,** 197–207.

Curry, David J. (1985), "Measuring Price and Quality Competition," *Journal of Marketing,* **49** (Spring), 106–117.

Curry, David J., and David J. Faulds (1986), "Indexing Product Quality: Some Issues, Theory and Results," *Journal of Consumer Research,* **13** (June), 134–145.

Geistfeld, Loren V. (1982), "The Price-Quality Relationship Revisited," *Journal of Consumer Affairs,* **16,** 334–346.

Gerstner, Eitan (1985), "Do Higher Prices Signal Higher Quality?" *Journal of Marketing Research,* **22**(May), 209–215.

Grossman, Sanford J., and Joseph E. Stiglitz (1976), "Information and Competitive Price Systems," *American Economic Association,* **66** (May), 246–253.

Huber, Joel, and John McCann (1982), "The Impact of Inferential Beliefs on Product Evaluations," *Journal of Marketing Research,* **19** (August), 324–333.

Kahneman, Daniel, and Amos Tversky (1979), "Prospect Theory: An Analysis of Decision under Risk," *Econometrica,* **47** (March), 263–291.

Kendall, M. G. (1970), *Rank Correlation Methods,* New York: Hafner.

Lambert, Zarrel V. (1972), "Price and Choice Behavior," *Journal of Marketing Research,* **9** (February), 33–40.

Maynes, E. Scott (1975), "The Concept and Measurement of Product Quality," in *Household Production and Consumption,* N. E. Terleckeys (ed.), New York: Columbia University Press, 529–560.

Maynes, E. Scott, and T. Assum (1982), "Informationally Imperfect Consumer Markets: Empirical Findings and Policy Implications," *Journal of Consumer Affairs,* **16,** 62–87.

Monroe, K. B., and S. M. Petroshius (1981), "Buyers' Perceptions of Price: An Update of the Evidence," in *Perspectives in Consumer Behavior,* Harold H. Harsajian and Thomas S. Robertson (eds.), Glenview, Illinois: Scott, Foresman, 43–55.

Newman, Joseph W. (1977), "Consumer External Search: Amount and Determinants," in *Consumer and Industrial Buying Behavior,* A. G. Woodside et al. (eds.), New York: North Holland, 79–94.

Olson, Jerry (1977), "Price as an Information Cue: Effects on Product Evaluations," in *Consumer and Industrial Buying Behavior,* A. G. Woodside, Jagdish N. Sheth, and Peter D. Bennett (eds.), New York: Elsevier North-Holland, 267–286.

Oxenfeldt, A. (1950), "Consumer Knowledge: Its Measurement and Extent," *Review of Economics and Statistics,* **32**(2), 300–314.

Riesz, Peter C. (1978), "Price versus Quality in the Marketplace," *Journal of Retailing,* **54**(4), 15–28.

———. (1979), "Price Quality Correlations for Packaged Food Products," *Journal of Consumer Affairs,* **3**(Winter), 236–247.

Salop, Steven, and Joseph Stiglitz (1977), "Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion," *Review of Economic Studies,* **49,** 493–510.

Sutton, Robert J., and Peter C. Riesz (1979), "The Effect of Product Visibility upon the Relationship between Price and Quality," *Zeitschrift für Verbraucherpolitik/Journal of Consumer Policy,* **3**(3), 145–150.

Tellis, Gerard, J. (1986), "Beyond the Many Faces of Price: An Integration of Pricing Strategies," *Journal of Marketing,* **50** (October), 146–160.

——— and Birger Wernerfelt (1987), "Competitive Price and Quality under Asymetric Information," *Marketing Science,* **3** (Summer), forthcoming.

Thaler, Richard (1980), "Toward a Positive Theory of Consumer Choice," *Journal of Economic Behavior and Organization,* **1,** 39–60.

———. (1985), "Mental Accounting and Consumer Choice," *Marketing Science,* **4,** (Summer), 199–214.

Thorelli, Hans B., and Sarah V. Thorelli (1977), *Consumer Information Systems and Consumer Policy,* Cambridge, Mass.: Ballinger.

Tull, D. S., R. A. Boring, and M. H. Gonsior (1964), "A Note on the Relationship of Price and Imputed Quality," *Journal of Business,* **37** (July), 205–210.

Varian, Hal (1980), "A Model of Sales," *American Economic Review,* **70** (September), 651–659.