Repositioning for Changing Preferences: The Case of Beef Versus Poultry

*Journal of Consumer Research*

September 1991

Anderson, Eugene W.; Shugan, Steven M.;
Vol. 18. No.2 pp. 219-233

**Abstract:**

It is demonstrated that a superior, high-share product (beef) could lose its relative position and sales as a result of a change in consumer preference for an attribute (convenience) on which the competition (poultry) was actually weaker. Multiple data sources are used to show this has happened for beef and poultry, rather than the alternative explanation of increased health awareness. The sources used include US Department of Agriculture (USDA) consumption data, a time series of new product introductions, and a sample of convenience beef and poultry products. Specifically, the problem is considered in the context of a 2-period, 2-firm, noncooperative, open-loop Nash equilibrium. The data support the hypothesis that increased demand for convenience contributed to poultry's success rather than the explanation that increased health awareness is solely responsible.
Repositioning for Changing Preferences: The Case of Beef versus Poultry

EUGENE W. ANDERSON
STEVEN M. SHUGAN*

We demonstrate that a superior, high-share product (beef) could lose its relative position and sales as a result of a change in consumer preference for an attribute (convenience) on which the competition (poultry) was actually weaker. We use multiple data sources to show this has happened for beef and poultry, rather than the alternative explanation of increased health awareness. These sources include United States Department of Agriculture (USDA) consumption data, a time series of new product introductions, and a sample of convenience beef and poultry products. The data support the hypothesis that increased demand for convenience contributed to poultry's success rather than the explanation that increased health awareness is solely responsible.

A change in the intensity of consumer preference for attributes such as speed, efficacy, health, or convenience can have an important influence on products and services that compete to fulfill the same consumer needs. For example, some products and services may not be able to respond as effectively to changes in consumer preferences. As a result, these products and services may lose market share and position. However, others may be particularly well suited to adapt to changing consumer needs and offer more or less of an attribute such as convenience or caffeine. In this article we present evidence concerning the impact of a shift in the intensity of consumer preference for a particular attribute—convenience—on competitive repositioning between beef and poultry products. We demonstrate analytically a case in which a market leader could be hurt by an increase in demand for an attribute on which it is superior to a competitor. Moreover, we consider evidence that suggests that a product—poultry—that was formerly considered weak on an attribute—convenience—appears to have benefited more from an increase in demand for that attribute than the market leader, beef.

This research should be interesting to consumer researchers for several reasons. First, we consider the subtle impact that a change in consumer behavior can have on the nature of product offerings and, ultimately, on a product's overall success. For example, beef products have been steadily losing share to poultry products for many years. We find evidence that this may be due to poultry's superior ability to reposition in response to increased consumer demand for convenience. However, poultry was once a far weaker product in terms of market share and beef was superior on the convenience attribute. How could a market leader actually be hurt by an increase in consumer preference for an attribute on which it is superior to the competition? One of our research goals is to understand when this could happen not only in the case of convenience in the meat industry, but with regard to changes in consumer preferences for other attributes in other product categories as well. Second, the notion that convenience plays an important role in this particular market brings into question the widespread belief that increased health awareness is solely responsible for beef's loss of share to poultry. To this end, we provide several empirical tests designed to discriminate between the implications of the widespread explanation that recent increases in health awareness are solely responsible for poultry's success and the alternative hypothesis that convenience is an important factor in poultry's success over the past 30 years. Third, convenience itself is an interesting and important topic as evidenced by the growing literature addressing the importance of time in consumer behavior (Bellante and Foster 1984; Bivens and Volker 1986; Bryant 1988; Feldman and Hornik 1981; Hornik 1981, 1982; Holbrook and Lehmann 1981; Sheth and Sheth 1969; Jacoby, Szybillo, and Berning 1976; Nickols and Fox 1983; Reilly 1982; Sheth 1989; Shimper 1982; Strober and Weinberg 1980; Weinberg and Winer 1983).

The article begins with a discussion of the relationship of our work to previous consumer research—along with...
a brief review of relevant research in the area of product competition. Briefly, we add to the growing discourse in consumer research concerned with convenience and time-oriented research. Moreover, by considering changing preferences, we account for the impact of important changes in consumer behavior on competitive repositioning. Determining the impact of significant aspects of individual consumer behavior should lead to more interesting implications for product strategy at the market level.

To determine how product competition might change in response to shifts in consumer demand for an attribute, we develop the analytical framework. The analytical framework contributes to our research in three important ways: by deriving a precise link between changes in consumer behavior and a product's market share and position, by providing a precise language for describing interrelationships among the conceptual factors affecting the level of an attribute competitors are willing to provide, and by leading us to explicit conditions under which a market leader might not adapt as well as a competitor to an increase in demand for an attribute on which it is superior to the competition.

The body of the article is devoted to relating our analytical findings to observable implications and proposing and testing several hypotheses using data gathered from secondary sources comprising both producer and consumer variables. The producer variables include output in the form of U.S. Department of Agriculture (USDA) per capita consumption of beef and poultry and a time series of new product introductions of high-convenience beef and poultry product. The consumer variables are taken from a sample of high-convenience beef and poultry products analyzed by the May 1988 Consumer Reports. The sample includes the following measures: observed retail price, judgments of quality by a panel of experts, and objective measures of fat content. The implications of the analytical framework with regard to these data suggest: (1) we should observe sales of convenient forms of both beef and poultry increasing and sales of low-convenience beef and poultry to be falling; (2) we should observe both beef and poultry adding new convenience products at an increasing rate and poultry should be adding products faster because of its greater ability to provide additional amounts of convenience; (3) we should test whether there is a price difference between convenient beef and poultry products to determine whether price is a possible confounding factor in the success of poultry relative to beef; (4) we should test for differences in the fat content of convenient beef and poultry products; and (5) we should observe convenient poultry products as higher in quality than convenient beef products because it is more difficult to adapt beef to high-convenience forms.

Taken together, the results of these tests suggest that health cannot be accepted as the sole explanation for the performance of poultry products relative to beef products. Furthermore, we try but fail to reject the hypothesis that convenience has played an important role in poultry's success. The final section summarizes our findings and discusses directions for future research. In brief, we believe that this article raises many important issues while at the same time providing evidence of the consequences of changes in consumer behavior. Future researchers might consider other important interactions between changes in consumer behavior and the ability of producers to adopt different product strategies.

**RELATIONSHIP TO PREVIOUS RESEARCH**

Convenience and Time-oriented Research

Convenience and increased demand for convenience are interesting and important areas for research (Downs 1961; Garretson and Mauser 1962; Kelly 1958; Niccosia 1966). Consumer research has long recognized the increasing importance of time to consumers (Howard and Sheth 1969), as well as the accompanying increase in preference for convenience products and services that save time. For example, Sheth (1989) presents evidence of increased emphasis on time-oriented concerns and product benefits among consumers. Moreover, interest in time- or convenience-oriented consumer behavior appears to be growing as evidenced by a widening variety of research. For example, Graham (1981, 1982), Hornik (1984), and Shimp (1982) address the issue of different perceptions of time and the value of time. They discuss how time usage can be perceived as either an investment or a cost. An investment in time may be valued positively (e.g., "time well spent"), as might be the case when preparing a meal on a special occasion.

However, it is more common to view the time and effort invested in consumption as costs. For example, the activities involved in meal preparation, such as cutting, boning, and cooking, are widely perceived as chores. In fact, several empirical studies, notably Cowles and Dietz (1956), Hall and Schroeder (1970), Nickols and Fox (1983), and Walker (1969), identify meal preparation as the most time consuming of household chores. If the tasks of meal preparation are viewed as costs, then we expect consumers to wish to minimize these costs and, as a result, maximize their satisfaction by achieving the benefits they seek as efficiently as possible. Hence, as the importance of time increases, so has the intensity of consumer preference for products that provide time savings or convenience to consumers (Sheth 1989).

According to the extensive review by Jacoby et al. (1976), consumer researchers, as well as many in sociology, economics, and psychology, find it useful to characterize time as a limited and scarce resource that a consumer must choose to commit among many different activities. In consumer research, recent studies employ this "time budget" approach. For example, Bivens and Volker (1986) measure the time and effort...
The focus of our research is on products that provide "value-added" convenience, such as frozen and microwave foods. Products which provide greater value-added convenience receive more processing or added services at the manufacturer level. Consequently, these products require less of a consumer's own time and effort relative to other products that might normally be employed in achieving the same final benefit (Reilly 1982). For example, a microwave beef dinner has many different services added to the raw ingredients and reduces both the time and effort required to produce a meal. By comparison, when preparing a meal from scratch, consumers must combine all the ingredients—vegetables, lettuce, meats, flour, fruit, milk, oil, butter, spices, and so forth—and incur the opportunity costs associated with expending the time and effort necessary to produce a meal—planning, cutting, boning, preparing, combining, and cooking. However, with a high-level convenience product such as a microwave dinner, many of the steps necessary to achieve the final benefit of a meal are performed by the producer.

Hence, the level of value-added convenience provided can be characterized both by the amount of service or processing a producer adds to a raw food product and by the corresponding reduction in the amount of individual time and effort that must be invested by the end user. From the producer's perspective, offering more convenience can be viewed as bundling extra services or adding levels of processing to the original raw materials. From the consumer's perspective, more convenience literally implies subcontracting out services, activities, and processing to a more efficient producer rather than invest individual time and effort to perform these steps at home. For example, the food-processing industry takes much of the labor of preparing meals out of consumers' kitchens by adding service to raw food-stuffs and offering convenience products at various stages of cutting, boning, preparation, cooking, freezing, and packaging. Each subsequent level of processing adds convenience above the previous level.

The above suggests a possible method for measuring the level of convenience provided by a product. If there are a finite number of tasks and activities that must be performed in order to enjoy a benefit, such as a meal, then the way in which these tasks are divided between producer processing and consumer labor relative to other products can be used to measure the level of convenience supplied by a product. Specifically, we can view the relative level of convenience as an increasing (decreasing) function of the number of tasks performed by a producer (consumer). Adding convenience requires adding more manufacturer processing or service. Less convenient products receive less processing. For example, cut-up parts receive more processing than whole fryers. Hence, cut-up parts provide marginally more convenience relative to whole fryers. In our empirical work, we show how the marginal amount of processing received can be used to categorize beef and
poultry products according to whether they provide relatively low, medium, or high levels of convenience.

**The Ability to Reposition When Preferences Change**

Convenience is also interesting because not all products and services can reposition as effectively in response to increased desire for convenience. For example, new products or services may arise to compete at performing old tasks, such as microwaves and jet air travel. In many cases, products cannot be replaced but must have more convenience added to their raw forms. A wide variety of products, particularly food products such as fruit juices, vegetables, and beef and poultry, have adapted convenience added to their raw forms. A wide variety of products, particularly food products such as fruit juices, vegetables, and beef and poultry, have adapted convenience added to their raw forms.

Convenience is also interesting because not all products and services can reposition as effectively in response to increased desire for convenience. For example, new products or services may arise to compete at performing old tasks, such as microwaves and jet air travel. In many cases, products cannot be replaced but must have more convenience added to their raw forms. A wide variety of products, particularly food products such as fruit juices, vegetables, and beef and poultry, have adapted convenience added to their raw forms.

Hence, differences in the ability to reposition have powerful implications for product competition. However, although many issues related to product-quality competition have received wide attention in the literature, the effect of asymmetric repositioning ability is not explicitly addressed (Eliashberg and Chatterjee 1985). Hence, we add to the stream of research concerned with product-quality decisions by showing how asymmetric attribute production costs might affect competitive repositioning.

Recent research that examines the effect of production costs on product competition and product positioning includes Gavish, Horsky, and Srikanth (1983), Hauser and Shugan (1983), Hauser and Simmie (1981), and Shugan (1989). In particular, Shugan (1989) investigates the effect of production costs on competition in the context of product-assortment attribute. He considers the optimal level of product-line assortment in an ice cream market when firms face different fixed costs of providing assortment. Our present work builds on his research by considering the implications of competitors with different costs of increasing the level of an attribute.

We perceive a need for analytical and empirical understanding of how changes in consumer preferences can interact with the ability to reposition. This is particularly urgent in a world where change comes rapidly and the ability of firms to adapt to the competitive environment can be of critical importance. Moreover, we add to the growing literature on the importance of time in consumer behavior by examining the impact of increased intensity of preference for convenience on product offerings.

**ANALYTICAL FRAMEWORK**

In this section, our goal is to achieve a general understanding of when a product that is superior on an attribute might be hurt by an increase in preference for that attribute. To this end, we consider the problem in the context of a two-period, two-firm, noncooperative, open-loop Nash equilibrium (Friedman 1977). Briefly, we require the following to hold in developing our analytical framework: (1) the strategic variables for the firms are output and attribute levels, (2) production and repositioning costs are captured as a nonlinear function of any change in attribute levels, (3) the firms know each other's objectives and profit functions, (4) the firms choose a set of strategies and do not deviate from that decision, and (5) the market is stationary except that the intensity of preference for an attribute is allowed to increase deterministically between period 1 and period 2.

**Profit Function**

A general profit function for the product that is superior in period 1 is presented below. A symmetric expression exists for the profit function of the weak product. For ease of exposition, the subscripts, 1 and 2, refer to the incumbent market leader and the challenger in period 1, respectively.

\[
\Pi_i = \pi_i(Q_{it}, Q_{ct}, T_{it}, T_{ct}) + \rho \pi_{i2}(Q_{it}, Q_{ct}, T_{it}, T_{ct}) - \rho \alpha_i(T_{it}, T_{ct}).
\]

Hence, total profit for the incumbent, \(\Pi_i\), is the sum of profit in period 1, \(\pi_{i1}\), plus profit in period 2, \(\pi_{i2}\), minus the cost of repositioning the product, \(\alpha_i\). Period 2 profits and repositioning costs are adjusted by a discount parameter, \(\rho \in [0, 1]\). Profit in each period is a function of own and competitive attribute levels, \(Q_{it}\) and \(Q_{ct}\), as well as vectors of own and competitive attribute levels, \(T_{it}\) and \(T_{ct}\). However, the impact or importance of one of the attributes is assumed to increase in period 2 by a factor \(k\), \(k > 1\). Repositioning costs are captured as a function of the change in attribute levels from the previous period, resulting from their interaction in the last term of the equation.

The Appendix presents a useful specification of this problem. At the Nash equilibrium, both firms offer more of the attribute in both periods as revenue-related factors increase. For example, as the cost of repositioning increases, both firms offer less of the attribute in both periods. As the relative increase in demand for the attribute increases, both firms offer more of the attribute in both periods. This occurs even when the level of demand for the attribute in period one stays the same. Finally, as interest rates decrease, both firms offer more of the attribute in both periods. The remaining statics are straightforward and intuitive. We now examine our central question.

**Relative Quantity and Relative Convenience**

When could a market leader be hurt by an increase in demand for an attribute on which it was formerly superior to its closest competitor? In other words, when could a challenger reposition more effectively in re-
response to increased primary demand for an attribute? The following proposition outlines explicit conditions under which this could occur.

**Proposition.** There exist conditions under which a challenger would move from being a weak product in terms of the level of attribute \( j \), \( r_{i j}^* < r_{i i j}^* \), to the position of a superior product, \( r_{i i j}^* > r_{i j}^* \). Moreover, the challenger would move from being a lower-share product, \( Q_{i j}^* < Q_{i i j}^* \), to a higher-share position, \( Q_{i i j}^* > Q_{i j}^* \). Both products will reposition to offer more of the attribute, but the challenger will add more of the attribute at a faster rate.

**Proof.** The proof involves construction of situations in which the following are true:

1. The impact of attribute \( j \) on demand is higher in period 2, \( k > 1 \).
2. The marginal cost of repositioning and offering additional amounts of the attribute is higher for the incumbent than for the challenger.
3. The products are moderately competitive. Own effects on price are greater than competitive effects.
4. Interest rates are zero (\( p = 1 \)). If interest rates are higher (\( p < 1 \)), then the change in demand for the attribute, \( k \), must be correspondingly larger.
5. All other variables are equal across both firms.

Hence, increased demand for an attribute might actually result in the challenger's adding more of the attribute than the incumbent. Here, the challenger moves from being a relatively low-quality, low-share product to a higher-quality, high-share product. This shift or flip in competitive position occurs because the fixed cost of providing the attribute dominates at low levels of demand for the attribute. As demand for the attribute increases the difficulty of repositioning becomes the more important factor. We find this result interesting because an inferior product may catch, or even pass, a market leader on an attribute on which the leader was formerly superior.

This analysis demonstrates the importance of considering the interaction between changes in consumer behavior and the characteristics of producers in explaining observed competitive behavior. Furthermore, consumer preferences affect the attractiveness of both firms' products symmetrically. However, each firm's ability to adapt and provide additional amounts of the attribute is different. These conditions lead to new implications for the effect of changes in consumer behavior on competitive behavior.

**APPLICATION TO THE MEAT INDUSTRY**

We argue that, while health may be an important issue in the meat industry, poultry's success appears the result of repositioning more effectively in response to an older trend affecting a larger segment of consumers. After World War II, poultry was a less convenient, low-market-share product, that has since repositioned more effectively than beef to increased primary demand for convenience. Beef held a 3:1 share advantage and was already convenient. However, beef producers found it more costly to provide additional convenience. As a result, poultry and beef now possess market shares that are roughly equal.

We now turn our attention to determining whether the available evidence supports our hypothesis that the ability of these competitors to reposition in response to increased demand for convenience plays an important role in this market. In doing so, we must also consider the alternative explanation that beef's problems are solely attributable to increased health awareness, which we refer to as the health hypothesis. The hypothesis that convenience plays a major, additional role becomes the convenience hypothesis.

We have been unable to find a data source that provides both sales and prices for products offering different levels of convenience over the last 35–40 years. However, we have collected sufficient data on various aspects of this problem to allow us to relate our analytical findings to observable implications using data gathered from secondary sources comprising both producer and consumer variables. The producer variables include output in the form of USDA per capita consumption of beef and poultry and a time series of new product introductions of high-convenience beef and poultry product. The consumer variables are taken from a sample of high-convenience beef and poultry products analyzed by Consumer Reports (May 1988). The sample includes observed retail price, judgments of quality by a panel of experts, and objective measures of fat content.

There are several implications of the analytical framework. First, we should observe increasing sales of convenient forms of both beef and poultry and decreas...

---

1Price series for beef and poultry are available from the Bureau of Labor Statistics and USDA in two basic forms: for aggregate beef and poultry and for specific cuts of beef and poultry. It is straightforward to relate these price series to demand for low- and medium-convenience beef and poultry. Unfortunately, a consistent price series for high-convenience products is not readily available. However, it is worth mentioning that many empirical studies of the price-demand relationships in the meat industry have been conducted by both academics and government agencies. These studies examine aggregate beef consumption versus poultry consumption but do not control for the amount of processing. It is not surprising that this body of empirical work shows that price has a significant impact on sales. However, these studies often note an interesting departure in the explanatory power of price over time. For the last few decades, price alone consistently underestimates poultry sales and overestimates beef sales. Summarizing the conclusions of many of these studies, Thurman (1987) states that a plausible explanation for the increase in the demand for poultry in the 1960s, 1970s, and afterward is the introduction of value-added products. This suggests that the increased convenience of poultry products has played an important role and indicates that this role predates the increased health awareness of the late 1970s and early 1980s.
NOTE.—Test 1 contrasts the rate of high-convenience vs. low-convenience forms of both products under the convenience and health hypotheses. The health hypothesis suggests that poultry products should be increasing in sales and beef products should be decreasing in sales regardless of the level of convenience offered. The convenience hypothesis suggests that high-convenience forms of both products should be increasing in sales faster than low-convenience forms. In the left-hand graph, low-convenience products are represented by a dashed line and high-convenience products are represented by a solid line.

Our empirical work suffers from the internal validity problems associated with applied work using secondary data sources. For example, we have been unable to directly control for price in each test because of the unavailability of an appropriate price series for high-convenience products (price series for low- and medium-convenience products are readily available from the Bureau of Labor Statistics and the USDA). However, given the applied nature of our research we feel that it is appropriate to raise the importance of external validity relative to the importance of internal validity (Cook and Campbell 1979). By providing several tests using different data bases, any convergence of the results across tests in favor of one hypothesis or the other could be viewed as supportive. Hence, while none of the tests simultaneously and directly addresses all of the possible factors influencing beef and poultry, we have sought alternative methods to control for factors such as price and health. For example, test 1 controls for convenience by looking at beef and poultry sales at different levels of convenience, test 2 controls for increased health awareness by looking at beef and poultry new product introductions before and after 1980, and tests 3 and 4 examine whether there are differences in the price and health of beef and poultry products that could be confounding factors in tests 1 and 2.
For example, when making a meal from scratch a consumer may take the basic ingredients—vegetables, meats, fruit, flour, spices—and transform these raw materials into any dish he desires. However, because convenience products take some of the transformation steps out of a consumer’s hands, they necessarily reduce the latitude of control or freedom existing at the consumer level. Hence, customization must occur when adding convenience to a product category such as beef or poultry because the firm is taking over more steps of the meal-production process and must offer a larger number of different versions of the product to compensate for the diminished freedom of the consumer. This implies that a wider range of products must be offered at higher levels of convenience. For example, to sell the same amount of poultry in microwave form as in boneless or cut-up parts requires offering a wide number of product variants. As a consequence, the number of variants offered at each level of convenience should be indicative of how much convenience is being offered.

Awareness of a possible link between cholesterol and heart disease increased dramatically in 1980 when the government created a furor in the industry and in the media by announcing dietary guidelines that advised consumers to cut back on beef. As shown in Figure 2, the health hypothesis predicts that, before this announcement, both poultry and beef should be adding new products at the same rate while, after the health announcement, poultry should be adding more new convenience products and beef should be adding fewer new convenience products because of the relative decline in the demand for beef. The convenience hypothesis predicts that both poultry and beef should be adding more convenience products at an increasing rate, both before and after the health announcement. However, according to our theoretical model, poultry should be adding more new introductions because of the lower repositioning costs enjoyed by poultry.

We estimate the trend for each category and check for a significant difference in the trend in the number of products after 1980. If the health hypothesis is in effect, then we expect to see a significant decrease in the trend for beef products and a significant increase in the trend for poultry products after 1980. If the convenience hypothesis holds, we should expect to see a positive overall trend for both beef and poultry. Moreover, poultry should be introducing new products at a greater rate.

**Test 3: Price Differences**

Are the prices of high-convenience forms of beef different from the prices of high-convenience poultry products? If the relative price of high-convenience poultry products is lower, then this could be a possible confounding factor because a price advantage for poultry might account for poultry’s increased share. Hence, for the null hypothesis of convenience to be supported, we expect to observe either no difference between the price of convenient beef and poultry products—or a higher price for poultry—because the explanation that convenience is an important factor is more attractive if poultry does not have an advantage in retail price. Alternatively, if there is a confounding price effect, then we expect a significant negative difference between the price of high-convenience poultry products and high-convenience beef products. Our null and alternative hypotheses can be summarized as follows:

\[ H_0 : \mu(\text{price})_{\text{poultry}} \geq \mu(\text{price})_{\text{beef}}, \]

\[ H_A : \mu(\text{price})_{\text{poultry}} < \mu(\text{price})_{\text{beef}}. \]
In Description of the Data (below), we perform an ANOVA test for the difference in average price per ounce within a sample of high-convenience beef and poultry products.

Test 4: Health Differences

Are poultry products healthier than beef products? The health hypothesis suggests that this is indeed the case and that it can account for the relative popularity of poultry products. However, high-convenience poultry products offer a wide variety of recipes that often include rich sauces, spices, as well as preservatives. Are the microwave and frozen meals that have poultry as their base meat healthier than products that use beef?

If the relative health content of convenient beef products is lower, then we expect to observe a significant negative difference between the fatty cholesterol content of convenient poultry and beef products, such as microwave dinners.³ Our null hypothesis of convenience and alternative hypothesis of health can be summarized as follows:

\[ H_0: \mu(\text{fat})_{\text{poultry}} \geq \mu(\text{fat})_{\text{beef}}, \]
\[ H_A: \mu(\text{fat})_{\text{poultry}} < \mu(\text{fat})_{\text{beef}}. \]

In Description of the Data (below), we perform an ANOVA test for the difference in average fat per ounce within a sample of high-convenience beef and poultry products.

Test 5: Quality Differences

Does poultry fare better in convenience forms than beef products? We argue that one reason that poultry was found to be less costly to reposition is that poultry adapts better to high-convenience forms. Poultry retains its flavor when microwaved or frozen, whereas beef has quality problems.

If it is relatively less costly to add convenience to poultry, then we expect to observe a significant positive difference between the overall quality of high-convenience poultry and beef products. Our null hypothesis of convenience and alternative hypothesis of price can be summarized as follows:

\[ H_0: \mu(\text{quality})_{\text{poultry}} \geq \mu(\text{quality})_{\text{beef}}, \]
\[ H_A: \mu(\text{quality})_{\text{poultry}} < \mu(\text{quality})_{\text{beef}}. \]

In Description of the Data (below), we perform an ANOVA test for the difference in average quality within a sample of high-convenience beef and poultry products.

---

³Saturated fat is the largest contributor to higher cholesterol levels according to U.S. Department of Health Education and Welfare, Office of the Assistant Secretary for Health, and the Surgeon General (1979). Reduced consumption of meats high in fat is recommended by National Institutes of Health (1985).
TABLE 1
CLASSIFICATION OF RELATIVE LEVELS OF CONVENIENCE

<table>
<thead>
<tr>
<th>Relative level</th>
<th>Consumer activities</th>
<th>Producer processing</th>
<th>Poultry products</th>
<th>Beef products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low convenience</td>
<td>Cutting</td>
<td>Butchering</td>
<td>Fryers</td>
<td>Roasts</td>
</tr>
<tr>
<td></td>
<td>Boning</td>
<td></td>
<td>Broilers</td>
<td>Round steak</td>
</tr>
<tr>
<td></td>
<td>Preparation</td>
<td></td>
<td></td>
<td>Ribs</td>
</tr>
<tr>
<td></td>
<td>Combining</td>
<td></td>
<td></td>
<td>Other primals</td>
</tr>
<tr>
<td></td>
<td>Cooking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium convenience</td>
<td>Preparation</td>
<td>Butchering</td>
<td>Cut-up parts</td>
<td>Ground</td>
</tr>
<tr>
<td></td>
<td>Combining</td>
<td></td>
<td></td>
<td>Cubed</td>
</tr>
<tr>
<td></td>
<td>Cooking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High convenience</td>
<td>Heating</td>
<td>Butchering</td>
<td>Frozen foods</td>
<td>Frozen foods</td>
</tr>
<tr>
<td></td>
<td>Reheating</td>
<td></td>
<td>Microwave dinners</td>
<td>Microwave dinners</td>
</tr>
</tbody>
</table>

NOTE.—The classification of products as high, medium, or low convenience is made in accordance with the amount of processing they have received from the producer. The distribution of meal preparation tasks between consumer activities and producer processing is shown to illustrate how marginal amounts of processing add convenience. The data on beef and poultry are derived from secondary sources made available by the USDA.

testing each of the issues containing a new product section and tallying the number of beef and poultry products listed. The resulting counts for both beef and poultry introductions are used to conduct test 2.

Finally, our third data source is the Consumers' Union publication, Consumer Reports. The May 1988 issue of Consumer Reports published data on price, serving size, and number of calories from fat for a sample of frozen foods. The sample consisted of 18 poultry entrees and 16 beef entrees. Sample selection was controlled to balance the number of beef and poultry dishes and to provide a representative cross-section of major manufacturers and types of entrees. These data are used to calculate price per ounce and fat per ounce in order to conduct empirical tests 3 and 4. The data also contained quality judgments for each of the entrees that can be used to conduct empirical test 5. A panel of judges provided a numerical rating, 0–100, to each entrée based on flavor and texture. The judges were trained by the Consumers' Union and instructed to keep freshly cooked beef and chicken in mind when evaluating each entrée. Hence, the numerical ratings reflect the judge's satisfaction with each product. In addition, the judges recorded sensory comments regarding their response to each dish (e.g., "chicken dry, tough and stringy, with gamy dark meat," and "beef chunks chewy, stringy, and fatty, with stale warmed-over flavor"). At least six judges sampled each product four times to account for variability from serving to serving of the same product that can occur as a result of uncontrollable factors, such as the product's age and storage history. To further ensure uniformity, conventional cooking methods—oven baked or boiled when appropriate—were used to heat the entrees. This process was expected to favor the beef products that generally do not microwave as well as the poultry products.

EMPIRICAL FINDINGS

Test 1: Sales Growth

Figure 3 presents the total sales of beef and poultry products sold in high-, medium-, and low-convenience forms. This plot indicates that the sales of both beef and poultry are increasing at the medium and high levels of convenience and that both categories are experiencing decreasing sales in their low-convenience form. We find this interesting because we expect that, if the health explanation tells the whole story in the meat industry,
then poultry should be experiencing increasing sales at the low level of convenience and beef should be experiencing decreasing sales at all three levels of convenience. Hence, Figure 3 suggests that we cannot accept that health hypothesis for this first test.

In Table 2, we present the results of a statistical test of the differences in the rate of growth of high-, medium-, and low-convenience products for both producers. The estimates were obtained through a GLS maximum likelihood procedure in order to obtain white-noise errors. The independent variables allow for separate estimates of the intercept for each level of convenience, $\alpha_L$, $\alpha_M$, and $\alpha_H$, as well as the slope estimate for the trend of low level of convenience sales, $\beta_L$. The estimated difference between the slope of low- and medium-convenience sales is $\Delta_M$, and the estimated difference between low- and high-convenience sales is $\Delta_H$.

The findings suggest that both categories are selling an increasingly large proportion of their products in high- and medium-convenience forms. The slope for low-level convenience sales, $\beta_L$, is negative and significant for both beef and poultry. Hence, the sales of low-convenience poultry are actually falling. This is consistent with the convenience hypothesis that predicts that both categories should be offering less product in low-convenience form. Moreover, there is a positive and significant difference between the slope of medium-versus low-convenience sales, $\Delta_M$, for both beef and poultry, indicating that both are experiencing growth in their more convenient forms. A similar result is found for the growth of high-convenience forms of both products, $\Delta_H$. Hence, the results in Table 2 suggest that we cannot accept the health hypothesis. However, the results are consistent with the implications of the convenience hypothesis.

A second important implication is that poultry should be increasing the proportion of product sold in high- and medium-convenience forms at a significantly faster rate than beef, because of poultry’s lower marginal cost of adding convenience. If we find evidence that this is the case, then we will have provided added support for the convenience hypothesis and our argument that poultry enjoys a lower marginal cost of adding convenience. The results of such a statistical test are presented in Table 3. The estimates were obtained by regressing low-, medium-, and high-convenience sales against the independent variables using the same estimation procedure as before. The independent variables allow for separate estimates of the intercept of beef and poultry at each level of convenience, $\alpha_B$, $\alpha_P$, as well as the slope estimate for the trend of beef sales, $\beta_B$, and the estimated difference between the slope of poultry and beef sales, $\Delta_P$, at each level of convenience.

The estimates show that there is a significant, negative difference in the sales trends between beef and poultry at the low level of convenience. This result suggests that the proportion of poultry sales in low-convenience form is falling faster than the proportion of beef sales in low-convenience form. At the medium and high levels of convenience, the estimates show that there is a significant, positive difference in the sales trends of beef and poultry. This suggests that the proportion of poultry sales at the medium and high levels of convenience is increasing faster than the proportion of sales at the medium and high levels of convenience for beef. Taken together, the results presented in Table 3 suggest that poultry is changing the mix of products it sells faster than beef and offering an increasingly greater proportion of convenient product forms. Hence, Table 3 presents further support for the convenience hypothesis.

Test 2: Customization

A plot showing the number of beef and poultry introductions during the span of the sample is provided in Figure 4. It appears that annual introductions of poultry products are increasing over the span of the sample. Beef-product introductions are increasing slightly. Both beef and poultry introductions appear greater after 1980. Note also that the number of introductions in a category shifts from dominance by beef to poultry’s favor after 1965. This is consistent with the implications of our analytical framework.

We wish to determine the direction and significance of the trend in the number of new products for both
TABLE 3
ESTIMATED DIFFERENCE IN SALES RATES ACROSS CATEGORIES

<table>
<thead>
<tr>
<th>Level of convenience</th>
<th>(\hat{a}_B)</th>
<th>(\hat{a}_P)</th>
<th>(\hat{b}_B)</th>
<th>(\hat{b}_P)</th>
<th>(\hat{\phi})</th>
<th>(\hat{\theta})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low*</td>
<td>.913 (.012)</td>
<td>.899 (.018)</td>
<td>-.018 (.001)</td>
<td>-.010 (.001)</td>
<td>...</td>
<td>-.603 (.120)</td>
</tr>
<tr>
<td>Medium**</td>
<td>.038 (.009)</td>
<td>.023 (.011)</td>
<td>.010 (.001)</td>
<td>.067 (.001)</td>
<td>-.473 (.017)</td>
<td>.053 (.108)</td>
</tr>
<tr>
<td>High***</td>
<td>.048 (.007)</td>
<td>.047 (.010)</td>
<td>.008 (.001)</td>
<td>.003 (.001)</td>
<td>...</td>
<td>-.586 (.123)</td>
</tr>
</tbody>
</table>

NOTE.—The parameters for each level of convenience were estimated separately. The intercept term for each category within a level of convenience is represented by \(\hat{a}_i\), where the subscripts B and P refer to beef and poultry. The trend estimate for beef sales is denoted \(\hat{b}_B\). The difference in trends between poultry and beef sales is denoted \(\hat{b}_P\). Ordinary least squares estimates exhibited significant autocorrelation. Consequently, an ARMA (1, 1) error correction is used. The autoregressive and moving average terms are denoted \(\phi\) and \(\theta\), respectively. Span is 1962–1984. Standard errors are in parentheses.

Tests 3, 4, and 5

Table 5 presents the results of ANOVA analyses for tests 3, 4, and 5. The calculated F-tests indicate that we cannot reject the null hypotheses that the price and fat content of high-convenience poultry and beef products are the same. On the other hand, the data reject the null hypothesis that the perceived quality of poultry and beef entrées are the same.

The ANOVA for price per ounce indicates that the prices of convenience forms of beef and poultry are not significantly different, but there is a slight positive trend in poultry introductions and a slight negative trend in beef introductions. The results suggest that there is stronger support for the convenience hypothesis over the health hypothesis. Additionally, our argument that it has been easier to add convenience to poultry, which suggests that we should expect a stronger positive trend for poultry, appears to have been confirmed. In fact, estimation of these models omitting the dummy trend variable, \(N_t = a_t + B_t[\text{time trend}] + u_t\), yields a significant positive coefficient for poultry, \(\hat{b}_P\), and an insignificant positive coefficient for beef, \(\hat{b}_B\). Consequently, the overall results of test 2 add weight to the convenience hypothesis.
TABLE 4
RESULTS FROM ESTIMATION OF EQUATION 2

<table>
<thead>
<tr>
<th>Category</th>
<th>( \hat{\alpha} )</th>
<th>( \hat{\beta}_i )</th>
<th>( \hat{\delta}_i )</th>
<th>( R^2 )</th>
<th>Durbin-Watson statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>5.353</td>
<td>.016</td>
<td>.005</td>
<td>.005</td>
<td>1.930</td>
</tr>
<tr>
<td></td>
<td>(1.125)</td>
<td>(.079)</td>
<td>(.064)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poultry</td>
<td>3.989</td>
<td>.176</td>
<td>.144</td>
<td>.315</td>
<td>1.909</td>
</tr>
<tr>
<td></td>
<td>(1.763)</td>
<td>(.123)</td>
<td>(.101)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE.—The parameters for each category were estimated separately. The intercept term for each category is represented by \( \hat{\alpha} \). The trend estimate for the number of introductions over the entire sample is denoted \( \hat{\beta}_i \). The difference in trends between pre-1980 and post-1980 introductions is denoted \( \hat{\delta}_i \). Span is 1956-1984. Standard errors are in parentheses.

significantly different. This adds support to the convenience hypothesis because it indicates lack of a confounding price effect at the high-convenience level.

The calculated F-test for the ANOVA on the fat content of beef and poultry is particularly interesting because it indicates that we are unable to detect a difference between the cholesterol-laden fat content of high-convenience beef and poultry products. This does not support the health hypothesis and indicates a lack of a confounding effect by health at the high-convenience level.

The significant difference in the quality judgments of beef and poultry products supports our theoretical argument that it was less costly to reposition the poultry product because poultry adapts better to high-convenience forms and retains its flavor when microwaved or frozen, whereas beef has quality problems. Because this result indicates support for the hypothesis that the quality of high-convenience poultry products is significantly greater than the quality of high-convenience beef products, it also supports our assumption that it is relatively less costly to add convenience to poultry.

SUMMARY AND CONCLUSIONS
This article showed how a change in the intensity of consumer preference for an attribute such as convenience can influence competitive repositioning. We demonstrated that a superior, high-share product could lose its relative position and sales as a result of a change in consumer preferences for an attribute on which the competition was actually weaker. We illustrated one situation in which a product that was weaker on an attribute had a superior ability to reposition in response to changing preferences. Specifically, we found that the increased consumer need for convenience may be responsible for poultry producers' success in competing with beef producers. We presented several tests designed to discriminate between the observable implications of the convenience hypothesis and the expected implications of the health-awareness hypothesis. While not completely conclusive, the results of these tests are more than circumstantial. Overall, they suggest that health awareness cannot be accepted as the sole explanation for the performance of poultry products relative to beef products. This raises questions about beef producers' current strategy in responding to poultry's success. This article raises many other questions that we find interesting and important. For example, by providing evidence of the consequences of changes in consumer behavior for competitive repositioning, we hope future research considers other important interactions between changes in consumer behavior and the ability of producers to adapt different product strategies.

Future research addressing questions beyond the scope of this article might have both empirical and theoretical elements. Empirically, the next step might be to focus on other methods of measuring actual costs. Theoretically, future researchers could consider other important interactions between changes in consumer behavior and competing producers' abilities to adapt appropriate product strategies.

APPENDIX
We choose to pursue an open-loop strategy for our two-period, two-player, noncooperative, Nash equilibrium primarily for reasons of tractability. While an open-loop or nonfeedback approach does not allow for unplanned reactions, an open loop thus is not necessarily restrictive. Because there are no constraints placed on a firm's planning function, there is nothing to stop players from formulating and using strategies in which

### TABLE 5

<table>
<thead>
<tr>
<th>ANOVA RESULTS FOR PRICE, FAT, AND QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Price per ounce</td>
</tr>
<tr>
<td>Fat per ounce</td>
</tr>
<tr>
<td>Quality</td>
</tr>
</tbody>
</table>

NOTE.—The calculated F-statistics represent ANOVA results for each variable. The sample consists of 16 poultry products and 16 beef products.
the choice of strategy in each period depends on the observed choices of earlier periods. The equilibrium produced is a unique Nash equilibrium and no single firm can deviate from the strategies chosen and increase its discounted profit.

The Nash equilibrium strategies are obtained by differentiating both player's profit functions with respect to quantity and attribute levels for each period. For the two attribute case, we can reparametrize Equation 1—

as well as the symmetric expression for player c—as follows.

\[ \Pi_i = Q_{it}[\alpha_i - \beta_1 Q_{it} - \beta_2 Q_{et}] + I_1(\tau_{i11} - \omega \tau_{c11}) + I_2(\tau_{i12} - \omega \tau_{c12}) - c_i \tau_{i11} \Phi_{i11} - \tau_{i11} \Phi_{i12} \tau_{i11} + \rho Q_{i21}[\alpha_i - \beta_1 Q_{i21} - \beta_2 Q_{e2}] + kl(\tau_{i21} - \omega \tau_{c21}) + I_2(\tau_{i22} - \omega \tau_{c22}) - c_i \rho \tau_{i22} \Phi_{i12} + \rho \tau_{i22} \Phi_{i22} \tau_{i22} - \rho(\tau_{i22} - \tau_{i12}) \Lambda_i(\tau_{i12} - \tau_{i11}), \]

\[ Q_{it} = \text{quantity for producer } i \text{ at time } t; \]
\[ \tau_{ij} = \text{level of attribute } j \text{ for producer } i \text{ at time } t; \]
\[ \tau_{ilt} = \text{vector of attribute levels provided by producer } i \text{ at time } t; \]
\[ \Phi_{i1} = \text{matrix of absolute fixed-cost factors;} \]
\[ \Phi_{i2} = \text{matrix of diminishing returns fixed-cost factors;} \]
\[ \Lambda_i = \text{matrix of repositioning-cost factors;} \]
\[ I_i = \text{importance weight for the attribute;} \]
\[ k = \text{increase in importance of the attribute;} \]
\[ \omega = \text{impact of competitive attribute level on price;} \]
\[ \beta_1 = \text{impact of own quantity on price;} \]
\[ \beta_2 = \text{impact of competitive quantity on price;} \]
\[ c_i = \text{variable production costs; and} \]
\[ \rho = \text{a discount parameter.} \]

Taking derivatives with respect to quantities and attribute levels and solving the resulting twelve equations in terms of \( \tau_{i}, \) and \( \tau_{c}. \) yield a system of equations of the following form:

\[ D \tau = \mu. \quad (A2) \]

Where \( D \) is a matrix of coefficients from the first-order conditions, \( \tau^* = (\tau_{i11}, \tau_{i21}, \tau_{c12}, \tau_{c22}) \), and \( \mu \) is a matrix of constant factors from the first-order conditions. Provided \( D \) is positive definite, the system can be solved for \( \tau^*: \)

\[ \tau^* = D^{-1} \mu. \quad (A3) \]

The proposition and the conditions under which it holds were numerically confirmed with a computer experiment. The solution depicted in Equation A3 was evaluated through a simulation routine that allowed orthogonal manipulation of each of the exogenous variables listed in conjunction with Equation A1: \( \Phi_{i1}, \Phi_{i2}, \Lambda_i, I_i, k, \omega, \beta_1, \beta_2, c_i, \) and \( \rho. \) Each variable was allowed to take on a wide range of positive values in order to assess the robustness of the solution and the conditions under which the proposition holds. Care was taken to ensure that the first- and second-order conditions held for all values of the exogenous variables.

REFERENCES
